The British Sundial Society

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BULLETIN

No 90.2 JUNE 1990

HONORARY OFFICIALS OF THE BRITISH SUNDIAL SOCIETY

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IN MEMORIAM

Dr Andrew Robertson Somerville

Members of the British Sundial Society were shocked to learn of the untimely death of the founding Chairman on June 26th 1990 at his home at Higher Poynton, Cheshire. It was especially poignant to the Council members who had attended a meeting at his home on 10th June, and also to those who attended the Annual Conference, 24/25 March, at Oxford, when he appeared in the best of health.

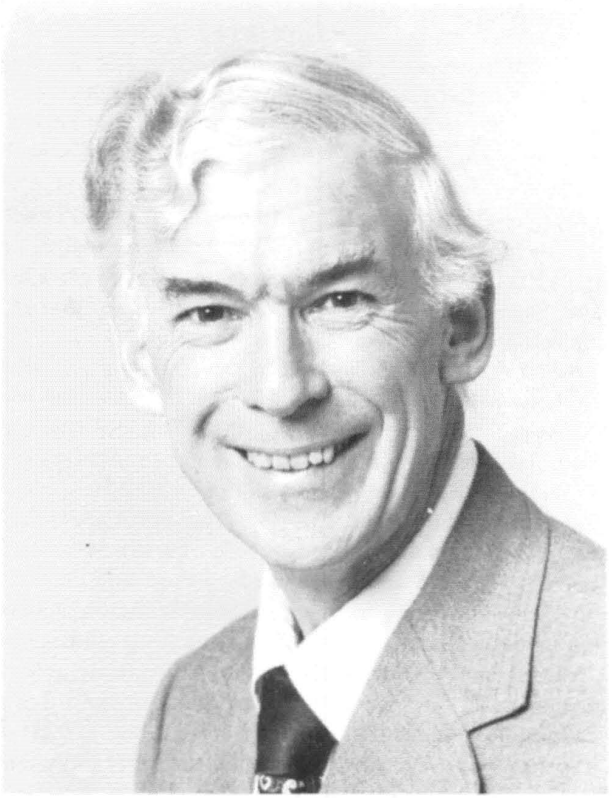
Andrew Somerville was born on 13th March 1923 at Paisley, Renfrewshire, Scotland. He received his basic education at Paisley Grammar School, from where he went on to commence studies in Organic Chemistry at the University of Glasgow in October 1939. A brilliant student, he graduated with BSc [Honours], being immediately directed to a Royal Ordnance Factory as a Supervisory Chemist to direct the processes designed to improve materials for the war effort. Following his release from this work, he returned to Glasgow University to complete his studies, graduating with a PhD in 1949. He followed this by spending the summer in Switzerland working with a specialist group in Zurich on particular aspects of the chemistry of aniline dyes - the subject of his research thesis. Here he further developed his passion for climbing, spending his spare time in the Alps, gaining a love of Switzerland and German with the local Swiss accent.

Following his award of PhD, he won a Rotary Club scholarship which enabled him to travel to the U.S.A. and work for a year at Cornell University, Upper New York State. On his return to England in 1950, Andrew joined Imperial Chemical Industries at the Butterworth Research Laboratories (later to become Akers Research Laboratories), at the Frythe, Old Welwyn, Hertfordshire. He commenced his most important work here on drugs related to cancer research and this became more and more oriented towards biochemistry as his research work progressed.

Here too he met his future wife, then Anne Stokes, who by a strange coincidence commenced working at the same laboratory on the same day as Andrew. She was on a "working holiday" from Adelaide, South Australia, but she remained in England to become Andrew's wife in 1952. Their new home was set up in Welwyn Garden City. Two children were born, Margaret in 1953, and Dugald in 1956.

In 1959 he was seconded for a period of two years to the McArdle Laboratory for Cancer Research at the University of Wisconsin, U.S.A. specifically to work with Professor Charles Heidelberger in skin cancer research; before returning to England to continue his work with I.C.I. Pharmaceuticals Division, Alderley Park, Cheshire. The Somerville family then settled into a new home at Higher Poynton. Andrew began his work on the biochemistry of neurological drugs and later on cardiovascular drugs, particularly Beta-blockers. This work was extended when Andrew and Anne spent a seven-months sabbatical in Italy in 1979, where Andrew worked with Professor Maseri at Pisa on Prinzmetal angina. This vacation intensified his love of travelling, of Italy and Italians, and wine and music.

By 1982 Andrew took early retirement to devote his



energies in the pursuit of his many hobbies, travelling [two trips to Australia], countryside activities and walking, making wine and music, and in the pursuit of sundials, particularly Scottish. In May 1989 he was the doyen founder of the British Sundial Society.

His other consuming passion was in the field of music. He had sung in choirs from his undergraduate days, whilst from his father, who played the violin, he inherited a great love of chamber music. But above all else, it was the human voice which held his affection, exemplified in his fondness for operatic works.

In his dealings with his fellow men, he was always considerate; as a friend he was a tower of strength, an anchor in a sea of trouble, someone who could be relied upon to give advice and support. As a teacher and expounder of knowledge, he had the ability to make difficult matters seem simple. He was meticulous in his research work, an excellent writer, and generous in his praise of the work of others. The British Sundial Society has suffered a great loss by his sudden and tragic death, his Chairmanship will be sorely missed.

The funeral service was held at Macclesfield Crematorium Chapel at 12.30 on Tuesday 3rd July 1990, attended by over one hundred mourners. A work was sung by the local choir which Andrew knew so well. The British Sundial Society was represented by Charles Aked, Christopher St J H Daniel, David and Lilli Young, and John Ward [in Britain on a visit from Australia].

The Council Members of the British Sundial Society, on behalf of all its members, express their deepest sympathies and condolences to Andrew's widow Anne, his daughter Margaret and his son Dugan in their sad bereavement.

David Young

DIALOGUE - NEWS ITEMS

DE ZONNEWIZERKRING

Although received before issue 90.1 of the BSS *Bulletin* went to print, it was not possible to include a review of the journal of the Dutch Society 90.1 issue number 38, January 1990, because space had run out. It opens with an advertisement for an IBM compatible computer program, at the price of 20 Dutch florins, in both Dutch and English versions. It will calculate all kinds of lines on flat surfaces, for suntime, analemmas, stellartime, Italian and Babylonian hours, azimuth, height of sun, mirror and bifilar dials. Payment by Eurocheque to : F. J. de Vries, F.F. Rooseveltlaan 96, 5625 PC Eindhoven, The Netherlands. See also page 4.

The second part of the article "Little Ship of Venice" is included and this is available in an English version from J. Krangten, Van Gorkumlaan 45, 55641 WN Eindhoven, The Netherlands. It is a very clear account of the most enigmatic dial produced, one which is often quoted, yet there are few examples extant and its use is often given wrongly in descriptions. A comprehensive mathematical analysis is demonstrated. It shows the great ingenuity of the medieval diallists in being able to produce such sophisticated designs without the aid of a computer. The English version has a few errors of translation, nevertheless it is very clear in its treatment and well worth acquiring by the keen diallist.

There is an account of a huge noon cannon with a bore of 10.5cm in southern Sweden, made by C.E. Littmann, instrument maker to the Royal Swedish Academy of Sciences. It is now fired every day from May to September, with the use of a match on cloudy days! A short article gives details of sundials in Turkey and Egypt, most of them on mosques. In another article by J. Schepman, a cut-out model of a multi-facetted sundial is included.

Van der Wyck gives an essay on the experience of diallists in the Southern hemisphere. M.J. Hagen writes on "The Analemma in Dilemma", which he rounds off with a mathematical analysis; plus another entitled "Tu, Tu Tuut", a series of little notes, mostly concerned with the time systems - UT, TDT, etc.

Book reviews cover a number of pages, three pages alone to *L'Ombra e il Tempo* by Trinchero, Moglia and Pavenello, reviewed by the present writer in *Antiquarian Horology,* Winter 1989, pages 426-427. His own little book *John Smith - Horological Dialogues* is reviewed, the main interest is the tables produced by Smith for the Equation of Time, the values quoted being much greater in variation than the actual figures. It is not known where Smith obtained his values, only Huygens and Flamsteed had published tables at that time. The catalogue of dials in Yugoslavia by Milutin Tadić is detailed, there seem to be over 200 medieval sundials still remaining. *Bulletin* 89.2 of the BSS is given a good airing, Dr. Somerville's "The Ancient Sundials of Scotland" in the *Proceedings of the Society of Antiquaries of Scotland* is covered, plus the October to December issues of *Antique Clocks,* and a number of other articles in journals.

The issue ends with an eight page article by M.J. Hagen on "Sundials in the Netherlands", with a number of illustrations. As with the BSS, the illustrations suffer from the mode of reproduction, limited by the amount of money available.

Altogether 56 pages of highly interesting information on the art of dialling in all its aspects, for which the contributors and editor of *De Zonnewizerkring* are to be congratulated.

The address of the Dutch Society is: SECRETARIAAT, F.D. Rooseveltlaan 96, 5625 PC EINDHOVEN, NETHERLANDS.

Their excellent journal is in the Dutch language with a few English summaries.

Issue No 90.2 has the usual collation of excellent articles. The sad news of the death of Dr. F.A.B. Ward, the first President of the British Sundial Society is reported. Three pages are devoted to a commentary on the sundial of Kaisers Augustus by I. Bauer. Dr. Hagen, who attended the BSS Conference at Oxford gives an excellent two-page account of this event. There is a description of a sundial in Portugal by Jan Kragten, and most interesting article on timekeeping in Nuremburg by De Rijk.

In the book review section Dr. Somerville's book *The Ancient Sundials of Scotland* derived from his article in the *Proceedings of the Antiquaries of Scotland* is discussed shortly (the contents of the article had been reviewed previously). Much space is devoted to the transcription of the first book of Orance Finé's *De Solaribus Horologiis et Quadrantibus Libri Quatuor* by Peter I. Drinkwater. Dr Hagen has also included an English version of his commentary, in which he ably analyzes the points raised by Finé's work. Another page is devoted to a discussion of the contents of the BSS *Bulletin* No 90.1, with mention of the grand old man of dialling - Mr. George Higgs and his 90th birthday. Other bulletins from other societies are commented upon, in particular *La Busca de Paper,* the Catalonian society newsletter. The dialling books in the library of the late Dr. J.G. van Cittert Eymers are listed, with a total of 76 titles. The last article is by Dr. Hagen on sundials in the province of Gronigen. Finally a list of the members of De Zonnewizerkring is given, a total of 153. Such a list in England, with the address of members included, would be unwise on security grounds.

The excellent coverage of British dialling activities, plus the generous comments on British literature in *De Zonnewizerkring* is much appreciated by the British Sundial Society.

ALTE UHREN (German text)

Issue No 1 of 1990 contains a paragraph on the formation of the British Sundial Society, together with a summary of the contents of *Bulletins* No's 89.1 and 89.2.

There is also a description of various sundials made by Professor Loske of Mexico which incorporate many original ideas and various materials. There are eight illustrations included.

Issue No 2 contains an article on the scientific instruments in the National Collection at Prague. Of the total of 1300 items, only 250 are exhibited. The illustrations include sundials, a nocturnal/sundial, a quadrant, etc. The standard of workmanship of these pieces appears to be first class, and the dials include unusual items like a pocket hemisperical dial, a book sundial and an adjustable equatorial dial.

With reference to the sundials of Professor Loske of Mexico mentioned in *Alte Uhren* issue No 1, 1990, an exhibition of his work is being held in the Horological Museum at Wuppertal from June 1990 onwards. It is hoped to repeat the exhibition in other European towns later. Descriptions of his work are now available in English, Spanish and German texts, the price is not known, his address is Professor Loske, Aptdo Postal 19-611, Mexico D.F. 03901, Mexico.

Reported by E.J. Tyler

METEOR

The monthly *Bulletin* of the Hungarian Astronomical Society, Vol 20, No 3, 1990 contains details of the new British Sundial Society reported by Mr. Lajos Bartha (pages 42-43). As "napóra" = sundial is the only Hungarian word the editor knows, he was glad of the English summary by Mr. Bartha.

LA BUSCA DE PAPER

The No. 4 issue of 1989 has taken on a new look with translations provided in both Spanish and English. This is important as it now allows the information to reach a far wider readership and credit is due to the Director who is financing this great improvement in the journal. The first main article is about the cataloguing of the sundials in Catalonia, included is a copy of the form to be provided so that the particulars of each dial may be noted precisely. We should, of course, be working towards an international system of recording, but this will have to wait until the time is more favourable. The second part of the article on the determination of the width of hourlines and other dimensions of sundials is included, an interesting discussion on an aspect usually taken for granted. There is a humorous account of a Friar Janot having a dream which is about sundials. From the data of the sundial indications one has to determine the present country in which it is set. A question is also set about the bibliographic reference: Explicatio horologi in Horto Lardini erecti anno 1669, Leodi, 1673, HALLUM. The answer to this lies in the article in this present BSS *Bulletin* - "A Brief Explication of a Pyramidical Dial".

CHAIRMAN'S NEWS

GEORGE HIGGS

Although those of us who have watched him heaving large stone sundials round his workshop in Kirkcudbright will find it hard to believe, George Higgs celebrated his 90th birthday in April. He was born with the century at Kirkbean, on the coast between Dumfries and Kirkcudbright, a birthplace he shares with John Paul Jones, and later moved with his family to Dundee. He trained as an electrical engineer at Dundee and Glasgow and eventually worked for Metro-Vick with whom he had a varied career involving railways in India, Africa and Brazil (where he met his wife), ending up as Chief Locomotive Designer at Trafford Park, Manchester. On retirement he moved back to Kirkcudbright. His house formerly belonged to one of the local artist colony and has a studio in the garden which has come in very handy for restoring sundials!

His interest in dialling started fairly late, but he soon became known locally as lecturer, dial constructor and restorer, and his friendship with the Head of the National Trust for Scotland's gardening school at Threave led him to volunteer to restore dials for the Trust. He has now completed quite a number of commissions for the Trust, including the big 52-face lectern dial at Culzean Castle and another lectern at Greenbank Gardens, Glasgow. Currently he is designing an analemmatic dial for Drum Castle in Aberdeenshire and setting up a number of dials for Lord Perth at Stobhall. His next-door neighbour in Kirkcudbright was the glass engraver David Gullan (now moved to Dumfries), and between them they have designed a very attractive glass dial, which can be hung on a window or mounted in a frame on the window sill; examples of these were on display at our Oxford meeting and a dozen or so, all individually designed, have now appeared in houses around Kirkcudbright and further afield!

George says that the secret of a long life is to keep busy and as he has enough work on hand for the next ten years, he has asked his actuary for an extension! Long may the commissions keep coming!

A.R. Somerville

THE NEW BULLETIN

Not exactly a new *Bulletin* but appearing in a new garb in the hope of improving its appearance, handling and wearing qualities. The first issues were produced as cheaply as possible since financial provision was not originally made for a journal when the Society was founded. Until the likely number of members was established and their needs identified, any possible publication was pure speculation on the part of the original Committee. However the quality of the material available, and the rapidly growing number of members, has made it imperative to provide the proceedings of new society in a better quality format. Some measure of the importance of the data is that all the copyright libraries have demanded copies of the *Bulletin,* whereas many similar publications are only taken by the two main copyright libraries.

The British Sundial Society Council hopes that the improvement in the quality of the *Bulletin* meets with the approval of members. Many members at the Annual General Meeting held at Oxford 24 March would have liked a super-glossy production and were prepared to pay the £25 subscription necessary to finance this, however the Council felt this would have been very difficult for some members to find, thus forcing out some of the real

enthusiasts, so a compromise of £12.50 was reached which just allows a substantial improvement in appearance and readability for a modest rise in subscription rate. More especially, although not so evident in this first improved issue, will be the inclusion of photographs, so if members can include these with their contributions (preferably black and white prints), it will be a major improvement. As we all know, one picture is worth a thousand words, except when it is a photocopied blur.

The Council hopes that this, whilst only a small step for members and a giant step for the Editor, is only the prelude to bigger and better things. If the membership continues to increase, it will reduce the *per capita* costs and the *Bulletin* may be issued four times a year instead of three.

Perhaps it ought to be made clear that the increased subscription rate is not entirely absorbed in the higher cost of printing, the amount of material included in this present issue is also greater than the earlier issues since the printed page carries more words than the former method. To carry the same amount of information would have required at least 40 pages of typescript and an increase of at least £2.00 a year to pay for it. So the increase is not as much as it would appear to be at first sight.

COMPUTER PROGRAM FOR DIAL CALCULATIONS

Mr Fer de Vries, of De Zonnewijzerkring, has prepared a very sophisticated program for calculating and drawing many types of sundial, which he has placed on sale to benefit the Dutch Society's funds. He has offered the right to distribute the program to the British Sundial Society for the benefit of its members and it will shortly be available from Mr Peter Scott, 38 Exford Drive, Breighmet, Bolton, Lancs BL2 6TB. Mr Scott is also going to add a complementary program of his own, both of which will run on IBM compatible systems, but the drawing function requires a graphic adaptor (CGA, or EGA/VGA with screen dump). It is available on a 3½ inch diskette or two 5¼ inch floppys, price £8. Enquiries direct to Peter Scott please, with stamped addressed envelope, for receipt of the program specification. Some members may prefer to wait until this is available for publication in the next *Bulletin,* the necessary details are not to hand at the moment.

A rather less elaborate program designed to run on a BBC model B, may be obtained by sending a formatted (40 or 80 track) 5¼ inch disk to Mr H C Parr, The Cottage, Romaldkirk, Barnard Castle, Co. Durham DL12 9EB. Please include a stamped addressed envelope for returning the disk. When space permits, Mr Parr's listing of his program will be published so that those who wish to enter the program on to their disc may do so.

THE BRITISH SUNDIAL SOCIETY

At a Council meeting following the AGM, Andrew Somerville was re-appointed Chairman, David Young Treasurer and Charles Aked Editor. The division of the secretarial work is still under discussion. Sub-groups were set up as follows:

Gordon Taylor (Five Firs, Cinderford Lane, Cowbeech, Hailsham, E. Sussex BN27 4HL. Tel: 0323 833255) will be responsible for sundial registration;

Jane Walker (31 Langdown Road, Little Sandhurst, Camberley, Surrey GU17 8QG. Tel: 0344 772569) will be responsible for education and publicity, with special emphasis on preparing projects to help school teachers cope with the new National Curriculum (attainment target 16, level 3), which lays down that pupils should:

know that the inclination of the sun in the sky changes during the year;

be able to measure time with a sundial.

We have already had many enquiries from teachers about this!

In addition, James Taylor (95 Howard's Lane, London SW15 6NZ. Tel: 081 788 5247) has agreed to co-ordinate the activities of members who are interested in applying computers to sundial calculations.

Members interested in any of these projects should get in touch with the appropriate person direct.

CONFERENCE AT OXFORD

I have been invited to sum up the weekend's proceedings - a task I view with some dismay since I have forgotten my pocket calculator!

Briefly I feel that we can evaluate the weekend by asking ourselves two questions (1) what have we learnt? and (2) what have we achieved? Personally I think we learnt a great deal from the excellent lectures given by Chris Daniels, Allan Mills and Andrew Somerville, as well as the fascinating tour of the sundials of Oxford and the visit to the Museum of the History of Science.

Our achievement of the successful formation of a national society coupled with a written constitution with little dissension and no acrimony is one of which we should be proud. The fact that we did not have to spend a great deal of time on the business was a great bonus, for it meant that there was ample opportunity for everybody to get to know everyone else and exchange ideas.

Since the subject was sundials, I feel that I could sum up even more appropriately by merely saying "a good TIME was had by all".

Reporter Gordon E Taylor

MEMBERSHIP

In general most members have paid their renewal subscriptions promptly and required no reminder, for which the Membership Secretary is grateful. New members have brought our total up to what it was at the time of the Oxford Conference, whilst three members have signified that they no longer wish to continue in membership. However there are about forty who joined the British Sundial Society in 1989 who have not yet paid their subscriptions. A separate reminder has been sent to these, but in view of the high cost of postage etc, no further notification or *Bulletins* will be sent, and they will be considered as no longer wishing to participate. There are insufficient funds to allow the cost of more than one notification, and it may well be that back numbers of the journal will not be available to those who rejoin later, the number now being printed is based on the present membership number.

LETTERS TO THE EDITOR

A GEOMETRIC PUZZLE

Some Digges at Mr Higgs by Mr F J de Vries of the Netherlands:

Bulletin 90.1 contained the dial of Thomas Digges, with a suggested construction and a method to calculate declining/reclining dials. Whilst the described method **is correct**. I would like to make some comments because the method can be simplified.

First I present the definitions for the method about to be described:

Inclination of the dial = i the zenith-distance of a gnomon placed on the dial; or the angle between the horizontal plane and the back of the dial-plane.

$0° = i = 180°$

Declination d of the dial = the azimuth which it faces. South = 0°, West = 90°, and so on.

$0° = d = 360°$ or $-180° = d = 180°$

The longitude correction is t_s

In Mr Higg's method the proposed dial is first translated from A to C, where it then faces West. This step is unnecessary because all the calculations can be done using triangle BAA[1]:

Given

side AB = 90°- ø
side AA′ = 90°- i
angle A = d

To calculate:

ø′ [new latitude]
d′ [new declination]
t_s [longitude correction]

cos (90- ø′) = cos (90°- ø). cos (90°- i) + sin (90°- ø).
sin (90°- i) cos d sin ø′ = sin ø. sin i + cos ø. cos i. cos d

So ø′ is known

sin (180°- d′)/sin 90°- ø) = sin d/sin (90°- ø′)
sin d′ = sin d. cos ø/cos ø′

So d′ is known

sin t_s/sin (90°- i) = sin d/sin (90°- ø′)
sin t_s = sin d. cos i/cos ø′

So t_s is known

But in my opinion it is much easier to translate the dial to a plane where it becomes a horizontal dial. The dial is therefore in the direction it is facing and the angle of the translation equals the angle of inclination i.

In this case only the new latitude ø′ and the longitude correction t_s have to be calculated, the new value for the declination is not required. Additionally the final calculation of a horizontal dial is easier than the calculation of a vertical dial, since we can use the formula; sin z = sin ø′. tan (t-t_s).

cos (90°- ø′) = cos (90°- ø). cos i + sin (90°- ø).
sin i. cos (180°-d)
sin ø′ = sin ø. cos i - cos ø. sin i. cos d

So ø′ is known

sin t_s/sin i = sin (180°- d)/sin (90°- ø′)
sin t_s = sin i. sin d′/cos ø′

So t_s is known

Another problem remains with the method, as well as my own, how to place the calculated dial on the plane at the original site when it is not known where the substyle or the meridian lies, for we only know a horizontal or vertical line in that plane. I calculate the angle b between the vertical line and the substyle using the formula:
sin b = cos ø. sin d/cos ø′.

With these remarks I hope to make a contribution to Gnomonics.

F J de Vries.

DIAGRAM 1

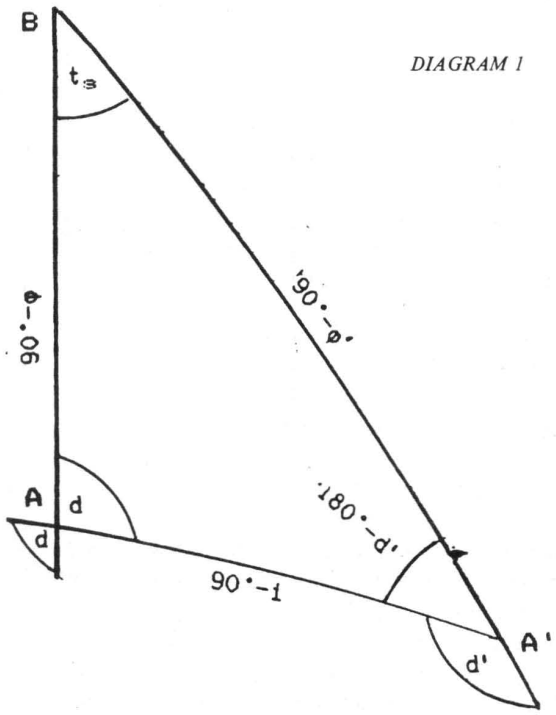
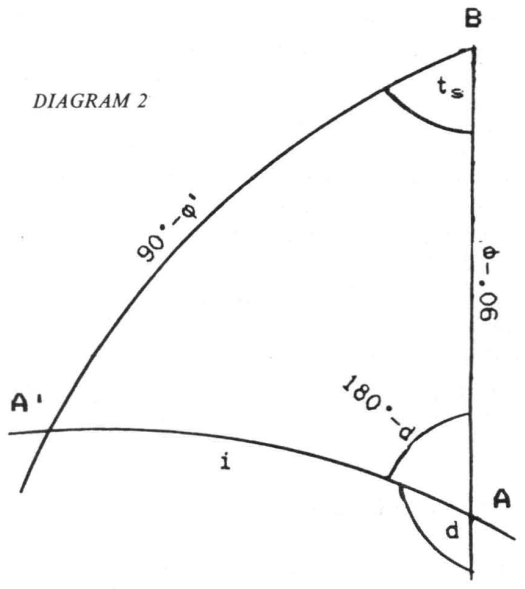


DIAGRAM 2



MR GEORGE HIGG'S REPLY:

Thank you for your letter dated 5th March. I was very pleased to receive it, although my first reaction was of dismay, fearing that you had found a serious error in my *Bulletin* contribution. Your first paragraph, however, reassured me.

Your "single shift" method with a "non-right angle" triangle is definitely simpler than my "two-shift" solution. Speaking metaphorically, I appear to have climbed over a stile instead of walking through the gate, under the mistaken belief that the gate was difficult to open!

My first encounter with the declining/reclining problem was in restoring Lady Henderson's (a fellow member of the Society) 300 year old 59 face polyhedral. At that time, 5 years ago, my only mathematical reference book (I'm no mathematician - only an engineer long since retired) confined its spherical geometry to the right-angled formulae.

The most interesting part of your letter was the second page. I had no idea how such simpler was the transfer to a horizontal aspect. I knew of that alternative and intended to investigate it when time permitted. I shall certainly use when the occasion arises.

In your letter you have had to hand-write the Greek characters not on your typewriter. On my copy, page 2, 124mm from the top, you have put "ø" following "cos i" instead of preceding it. At 141 mm from the top of Page 2 you should insert the divide sign (/) between "sin d" and "cos ø".

Once again many thanks for such an interesting and informative letter.

Yours sincerely, George Higgs

P.S. I suggest that if you agree, I write for the next *Bulletin* a statement pointing out how my calculations in *Bulletin* 90.1 can be considerably simplified by abandoning the right-angle constraint and by using the transfer to the horizonal method.

Editor's note: One can only admire Mr Higgs for his magnanimity and his acute percipience in respect of the slight omissions mentioned which, quite frankly, I overlooked at my first reading of Mr de Vries' contribution. I expect he will be notifying me in due course in respect of the errors I have made whilst editing the preceding text.

COMMENTS FROM READERS

"I very much enjoyed reading the latest *Bulletin*".

"The recent issue of the *Bulletin* was most impressive. I had no idea such material was available".

"My *Bulletin* has just come this morning and once again I have to congratulate you on a good mix of articles".

"The *Bulletin* alone is worth the subscription".

"I am sure I would enjoy the contents if only I could read the text". (A reference to the poor quality of some of the reproduction - caused by a fault in the photocopying. The matter is under review by the British Sundial Society Council, members will understand that the budget for publication is a very limited one).

"First I must congratulate you on the first two issues of the *Bulletin.* A tremendous effort...."

"I would however like to make some comments on the November copy of the *Bulletin*. I fear the quality of the writing in several of the articles leaves something to be desired. Overall there are several dozen grammatical errors; the commonest of these is where the correct mark would be a semi-colon or full stop, but the reverse also occurs in places. While this only occasionally obscures the meaning, such lapses tend to leave the reader underestimating the value and importance of the Society's voice....."

When an author insists on his work being reproduced exactly as he produces it, then it must go in warts and all; similarly, if it is prepared ready for printing, the editor is not going to retype it merely for the sake of correcting a few punctuation marks. We shall have to regard these minor blemishes in the text in the same light as the beauty spot upon the face of a beautiful lady. Authors are assured that the content is preferable to grammatical accuracy as far as the editor is concerned. Foreign authors in particular need not worry about the shortcomings of their Engish text, it will be transcribed into the mundane prose of correct English usage, as far as it is within the limited powers of the editor so to do. Great literature has never been written by great grammarians.

THE BRITISH SUNDIAL SOCIETY
OXFORD CONFERENCE HELD 24th/25th MARCH

About eighty members elected to attend the weekend Conference of the British Sundial Society held at Exeter College, Oxford. At least half of this number actually arrived the day before the meeting opened, with a number of visitors from the Continent, notably the founder of the Dutch Sundial Society, Dr M J Hagen; and Mr and Mrs Schwarzinger from Austria. Dr Holland and his wife travelled from Illinois, USA, unfortunately one member from Australia was prevented from coming at the last moment.

On arrival each participant was presented with a folder containing all the details of the programme, a specially produced pamphlet with the new logo describing the sundials at Oxford Colleges, a copy of a newly published English translation of the famous Book I of Oronce Finé's *De Solaribus Horologiis* ... and a pen inscribed "British Sundial Society".

Because the Society was only founded 5th May 1989 and was run by a provisional committee, almost two

hours of the first morning of the meeting was devoted to the adoption of the Society's Constitution and other administrative matters, plus a lively debate on the production of the Society's *Bulletin*. Most of the members present would have liked a more professional magazine but as the cost would have more than tripled the subscription, it was felt that this would have been out of the reach of many of the members and is a matter for the future. The subscription was raised to £12.50.

On the Saturday afternoon Oxford was surprised to see large parties going from college to college to view the dials. At one college the head porter only allowed the very large group in when reminded by a letter of authority. The colleges visited included St Edmund Hall, All Souls, Merton, Corpus Christi, Christchurch, Brasenose and Exeter, the main tour guide being Dr Philip Pattenden of Peterhouse College, Cambridge. It was he who described the complex Turnbull sundial at Corpus Christi to each group that visited the college, he was responsible for its restoration some years ago. As the rain poured down in the morning, the organizers were praying for fine weather in the afternoon, and these prayers were answered when the sun came forth to illuminate the sundials for the whole of the afternoon tour.

Earlier many of the participants had mounted an exhibition of sundials made by members, some marvellous sundial photographs, a particularly beautiful display of Austrian sundials being shown by Mr Schwarzinger, with a hologram of the Greenwich Observatory Dolphin sundial designed by Mr Christopher St J Daniel, and many individually designed and made sundials of all types. Rogers and Turner of Greenwich had a bookstall devoted to dialling works, some of great rarity; the Seven Dials Monument Charity was represented by its Chairman, Mr David Bieda. These were just some of the many facets of the exhibition.

In the evening there was a fascinating lecture on Stained Glass Window Dials by Christopher St J H Daniel, followed by a discussion of the dial survey of the British Isles being undertaken by the Society, and how best to computerize the data, plus the formation of sub-groups to deal with the specialized sections relating to gnomics, eg the use of computers in design, the preparation of educational material on dialling suitable to meet the requirements of the new educational programme for schools, which includes the use of sundials and an understanding of the sun's movements in the sky throughout the year.

The following day's programme included a thought provoking lecture by Dr Allan Mills of Leicester University Astronomical Department; and a visit to the Museum of the History of Science conducted by Mr F Maddison. The museum has one of the largest collections of portable sundials in the world, and one of the best collections of early dialling works extant. In the afternoon there was an engrossing lecture on the Symbolic Renaissance Sundials of Scotland by the Chairman Dr A R Somerville, who has made this subject his own, illustrated with truly splendid photographic slides. Mr Gordon Taylor, designer of the famous sundial at Hurstmonceux, drew the weekend meeting to a close for the members, praising the previous Committee members for their hard work in forming and running the new Society, and the work of Mrs Bowyer, the honorary auditor; Mrs Somerville, wife of the Chairman who had carried out much of the secretarial work; and Mrs Lilli Young, the wife of the Treasurer and Membership Secretary. The general concensus of opinion was that it was a most excellent meeting. The new Council, now larger by the inclusion of four new members, had further duties to perform and had a session to determine future policies and actions before leaving Exeter College.

The facilities at Exeter College were first class, the meals excellent, and the only real difficulty with Oxford is car parking, this was provided by the college at a nominal charge. Exeter college sundial is a disappointment, only half of it remains and is in shadow for most of the day. The fair city of Edinburgh is under consideration for the next Conference, in a years time. Some members have already placed their names on the list of attendees. Details of membership may be obtained from Mr David Young, 112 Whitehall Road, Chingford, London E4 6DW. The subscription rate is £12.50, the *BSS Bulletin* is issued three times a year.

Charles Aked

INVITATION

Suggestions for improving the *Bulletin,* comments [good and bad], letters and articles, are all welcomed by the Editor. For articles, black and white photographs have first choice and/or line diagrams. At present we have no facility for preparing art work although at least two members have volunteered their services should real difficulties arise.

Submissions of articles will be acknowledged on receipt. No firm date of publication can be given as there is already so much material in hand that even the Chairman has had one article removed at the last moment, and the review of his latest book from this issue; thus demonstrating the absolute impartiality of the publication process. The Editor's material is the first to be thrown out.

Those who find difficulty in expressing themselves in fluent phrases need not worry about grammatical perfection, or lack of style [no gnomonic pun intended], the Editor will do his best to impart any polish deemed desirable, all he needs is the receipt of the basic outline and accurate facts. This last is the most important requirement, all else is subsidiary. Furthermore the level of the material may be basic or esoteric, all is grist to the editor's gnomonic mill.

EARLY SUNDIALS IN ROYAL GARDENS

by A.R. Somerville

Information on early sundials in private gardens is hard to come by, as it is often buried in archives which have never been printed and the handwriting may be difficult to decipher. But records relating to Royal houses and gardens are better documented and a number of printed sources exist which make the task easier, for example, *The History of the King's Works,* published by HMSO in six volumes, which gives a detailed account of work in the Royal Houses of England for medieval times to 1851, and *The Accounts of the Masters of Works* which gives similar details for Scotland, although for a much more limited period. Records of dials are few but fortunately these volumes have excellent indexes which make them easier to trace. Earlier records for Scotland are printed in the accounts of the Lord High Treasurer and the Exchequer Rolls of Scotland (in Latin), though neither of these mentions sundials in the 16th century. The LCC *Survey of London* has many references to original documents, especially those relating to Whitehall.

WHITEHALL

The earliest reference to a sundial in *The History of the King's Works* (HKW) occurs in 1570 when a fountain was made for the Privy Garden in Whitehall Palace. This had two marble bowls and two brass columns and was surmounted by "a square dial with four sides". The brass columns and the "cocks" were gilded. Before this, however, Henry VIII's account books record payment for seven sundials for the Privy Orchard at Hampton Court in 1531 and 20 for the Privy Garden in 1534 (quoted in Strong's *Renaissance Gardens in England*). The latter were made by Brise Augustin of Westminster and cost 4s. 4d. each [22p] so they were probably ordinary brass horizontal dials.

A description of the Whitehall garden by Lupold von Wedel in 1584 includes "a nice fountain with a remarkable sundial, showing the time in 30 different ways", which seems a high number for what sounds like an ordinary pillar dial with four sides, so it is possible that he was referring to the "great dial" which must have been in existence at that time, though there is no reference to its original construction in HKW. This was described by the young Duke of Saxony in Jacobean times: "... in the middle of the garden is a great quadrangular stone, hollow in the middle and round like a baptismal font. One walks up four steps. On this stone are over 117 sun-circles, on which you can see the hours ... this Horologia was designed in the first place in Henry VIII's time by Joan Pieneto Episcopo Wintoniensi but later restored by the present King (James I) as the inscription records", "Joan Pieneto" is presumably John Ponet or Poynet, although he did not become Bishop of Winchester until 1551, four years after Henry VIII's death, but according to the *Dictionary of National Biography,* he was a man of wide learning, including astronomy and mathematics, and "for Henry VIII he made a curious dial of the same kind as that erected in 1538 in the first court of Queen's College". This possibly refers to a predecessor of the present wall dial of Queen's College, Cambridge; although the booklet about it by Shephard says that the first dial there was erected in 1642, Gunther's *Early Science in Cambridge* refers to an earlier one made in 1538. Ponet was "deprived" in 1553, on the accession of the Catholic Queen Mary, and had to flee the country, so the dial must have been made previously. He died in Strasbourg in 1556.

This is the "great stone dial" which was re-painted in 1595-6 by the Master Painter George Gower. The painter's specification claims (perhaps erroneously) 70 dials, but the main feature was a concave dial sunk in the top surface. His work is described as follows: "priming the Stone Diall in the Garden fower sundrie tymes over with fatt oile and twise with oile and leade and conteyning as followeth viz one greate hallowe Diall being painted and guilded with fine gould in divers parties as the howers planettes caracters ffingers pointes cloudes Lines and environed about twith the enteraunce of the xii signes and degrees into the xii monethes and at the corners the fower windows [winds?] and on the fower sides - in all conteyning lxx sundry dialls whereof thre great ones the cockes and points being all guilded with fine gould and all the Dialls garnished with Tabletts compartiments and sondrie verses written for the enriching of the same painted in oil Cullor as white lead vermillion, Bleu Bice - [a pigment made from coloured glass, ground very fine] Azure redd leade grene bize - masticott Spanish Browne Ivorye blacke etc". To protect these lavish ornaments the Master Carpenter, William Portington, constructed a frame with an ogival roof, presumably to save it from the weather when the court was not in residence. Another entry of 1581-2 in HKW says that Robert Adams joined with Humphrey Coole [Cole, the most famous instrument maker of his time] for "new making of the Dial in the Great Garden at Whitehall". This probably refers to the design and cutting of new copper gnomons, but it is not clear for which dial. The "great dial" was replaced in 1621-2 by Nicholas Stone (who also set up a sundial on a column at St James Palace during this period) to the design of Edmund Gunter (see *Bulletin* 89.1.17) and there is an account in 1632/3 to "Thomas Decritz, for painting, guilding and oyling the great Dyall in the privy Garden and fower little dialls there". In the same year there are payment to "John Marr, mathematician, for his paines and invention in making the greate Stone Dyall in the privy Garden at Whitehall" and to "Elias Allen for taking of the horrizon of the greate Dyall in the privy Garden and making xx new screw-pins to fasten it againe", so presumably further repairs had become necessary.

JOHN MARR

John Marr, or Mair (fl,1614-1647) was a Scotsman who served both James I and Charles I as compass maker, diallist and dial maker. According to Taylor's *Mathematical Practitioners of Tudor and Stuart England,* he was an excellent mathematician and geometrician. He was familiar with both Henry Briggs and Napier of Merchiston (the inventors of logarithms) and was present in 1614 at their first meeting in Edinburgh. When checking Gunter's dial he found that the magnetic variation had changed since Gunter had first set it up, and this observation led to the investigations of Henry Gellibrand which eventually established the "secular change" of the variation. He made many sundials for Charles I; in 1625-6 two new dials were installed at Nonsuch [palace] "on the the twoe Turrettes in the paved [inner] courte" which measured 6ft high by 4ft wide; the Serjeant Painter painted them white with black letters and vermilion lines.

In 1633-4 John Marr was again paid "for drawing of twoe greate Dyalls in the fountaine Courte ... and for new making the Styles of the said dyalles"; evidently a restoration of two 8ft square dials which had been "enriched with gold & bice" in 1606-7 and again in 1619-20 by the Sergeant Painter. Nonsuch had at least another two dials: one is described as having the 12 signes of the zodiac, pilasters on either side, a "semicircle on the topp and a freeze round about it, and the picture of tyme pictured in the middle". It was enriched in 1621-2 and in the same year another is mentioned in the inner court "containing 8 square yards and five feet"; it had a "compartment of stone on each side with a tri-angle on the topp and a face of death therein".

At St. James's Palace in 1629-30, Marr erected a "dial of Portland stone of viij cants [triangles or planes when the corners of a solid are cut off] wth a concave being xv inches over wth xvj plaine dyalls thereon and sundry necessary conclusions to be knowne by the shadow of the sonne uppon each of them".

The two large dials at Hampton Court have already been referred to (*Bulletin* 89.1.16) and one of these is described in great detail by Marr in Royal MS 17 A V, which as far as I know has never been printed and for which I hope to give a transcription at a later date. It was at least as complex as the Gunter dial and possibly more so. He was paid £100, which included "painting and guilding with fine gold and strewing with fine Bice". Other work by Marr included two painted dials made for Woodstock in 1632-3 and another dial for Whitehall, for which payment was made to "John Mare, Mathematician, for drawing divers Lynes wth the plannetts and points of the Compasse, fitting and setting up the Gnomon, and directing the painter for the making of the lettres of a Dyall vj foote square to be seene from the privy Lodgings". Walpole in his *Anecdotes of Painting* quotes a memorandum by the serjeant painter De Cretz referring to this dial; "for several times oyling and laying with fayre white a stone for a sundial opposite to some part of the king and queen's lodgings, the lines thereof being drawn in severall colours, the letters directing to the howers guilded with fine gould, whereon the number and figures specifying the planetary howers are inscribed; likewise certain letters drawn in black informing in what part of the compasse the sun at any time there shining shall be resident; the whole work being circumferenced with a frett painted in the manner of a stone one, the compleat measure of the whole being six foote". In the following year a "wainscott dial" was made to stand on the wall against the Queen's bedchamber.

John Marr was succeeded as Royal diallist by William Marr, probably a son or nephew, who, in 1665-6 received payment of £200 for "making the dial in the King's privy Garden at Whitehall". Presumably it had been neglected during Cromwell's time as three new gnomons had been cast for it in 1660 by Henry Phillips at a cost of 28s, and repairs were made by the masons in 1663 and again in 1688, when William Marre was paid for "new lineating" the dials, Streater for painting and Emmett for a new carved gnomon. Marr remarks that the work done was similar to that when he "made" the dial "in the late King's time", so that "making" need not mean more than "new lineating" and there is little doubt that this is still essentially Gunter's dial of 1622. The ultimate fate of this dial is not known. It appears in a drawing of 1670 and in another made between 1695 and 1698 (though both are on too small a scale to show detail - it appears only as an octagonal block of stone with a hollow in the middle and steps leading up to it on four sides, see fig. 1; and although there is a record that it escaped damage in the fire of 1698 which destroyed the whole palace, it is not shown on a drawing of 1741. The last record which may relate to it is in 1710 when "Mr William Allingham, mathematician in Canon Row, [London] demanded £500 to restore this dial, but his offer was refused".

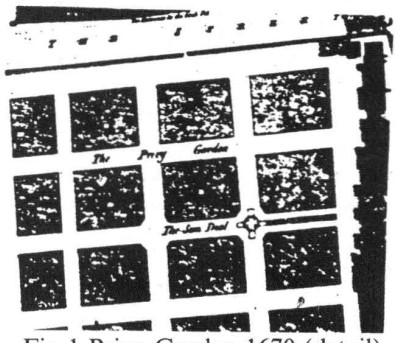


Fig 1 Privy Garden 1670 (detail)

FRANCIS HALL'S DIAL

The latter record, however, is more likely to refer to another, more spectacular but rather delicate, dial set up in the Privy Garden on 24th July 1669, by the Reverend Father Hall [Society of Jesus], also known as Linus or Line, Professor of Mathematics and Hebrew at Liége, who wrote a detailed account of it which was printed, with illustrations, in 1673. (But see the article "A Brief Explication ..." pages 19-25 of this issue, where William Leybourn writes as though the dial was removed by 1681). Francis Hall was born in London in 1595 and died

at Liége in 1675. He had a reputation for designing and constructing ingenious dials, but the one at Whitehall must surely have been his masterpiece, see fig. 3 in the article just mentioned. It contained many glass globes, one of which was filled with water and focussed the rays of the sun on a ring of metal numbers, so that a blind person could tell the time by feeling which number was the hottest! The dial was not covered in the winter and so was liable to damage by frost as well as being vulnerable to Noble vandals. In a letter of 26th June, 1675, it is recorded that "My Lord Rochester in a frolick after a rant did yesterday beat doune the dyill which stood in the midle of the Privie [Garden], which was esteemed the rarest in Europ. I doe not know if . . . it is by the fall beat in peices" (LCC Survey). About this time the works were in hand for the erection of the statue of Charles I at Charing Cross, and Andrew Marvell, asking the question:

What can be the Mistery why Charing Cross
This five months continues still blinded with board?

- rejects the suggestion that it might be for erection of a sundial, with an allusion to the above-mentioned incident:

For a Dial the place is too insecure
Since the privy garden could not it defend
And soe near to the Court they never will indure
Any monument how their time they misspend!
(LCC Survey)

After this the dial seems to have disappeared, though there is a doubtful reference to its remains being at Buckingham House. Some authors have assumed that is was Gunter's dial which was damaged by Lord Rochester, this seems most unlikely since it was of much durable construction; although Nicholas Stone's great-nephew, Charles Stoakes, wrote, sometime between 1669 and 1676 "the fine Diall now stands Ruin'd in the Privy Garden at Whitehall. The famous Mr Marr Erected the Lines" (*Notebook of Nicholas Stone*). We know that Charles II was in the habit of setting his watch by it (LCC Survey) and that, as we have seen above, it was restored again in 1688, so it was obviously well thought of and looked after. Aubrey, in his *Brief Lives*, refers to the dial made of glass spheres being broken all to pieces by Lord Rochester and others (LCC Survey), which seems to settle its identity.

OTHER DIALS

The fountain dial of 1570 is a more shadowy affair. A drawing of about 1555 by Anthonis Wyngaerde (illustrated in *The Renaissance Garden in England*) shows a great central fountain of conventional Italian Renaissance design with three or four bowls, whereas the entry of 1570 in HKW refers to the construction of a fountain with two bowls, two brass columns and a square dial; HKW also states that this fountain was still present in 1650 but had disappeared 20 years later. In 1614 there is a reference to "mending and sodeing (soldering) the fountain in the privy garden" and to removing it in 1661 (LCC Survey). The drawing of 1670 does not show either of these fountains. During modernisation of Whitehall in 1674-5, a new fountain was installed which is shown on the drawing of 1695-8, but there is no suggestion that it incorporated a sundial.

Other Royal dials were at Oatlands, Surrey; and Richmond. At Richmond in 1598-9 Leonard Fryer's work included painting "a greate diall in the utter [outer] court" 12ft wide and 14ft deep, "with grete Romaine letters in fyne gold with an ordnance of Jasper and stone woorke in oyle colours". Oatlands had two wall dials which were painted and gilded in 1619; one of them was 24ft in diameter and showed the planets and zodiacal signs, while in its outer "crest" or moulded frame, there was a "concave deciphering the fower quarters of the yeare with shippes hilles dales etc". Both dials had the letters "J.R.". In 1683 Henry Wynne, Master of the Clockmakers Company of London, supplied a brass double Horizontall dyal for Windsor Castle. This would have been a double dial of the Oughtred type and may be the same one which is now at Clarence House. Wynne also made an ordinary horizontal dial for Windsor which is still on the Terrace there.

The House of Commons evidently had a glass dial set in one of the windows, which was replaced in 1664 by the Master Glazier, but it was blown down in 1676-7 and had to be replaced again. The 14th century Clock Tower in New Palace Yard must have been in poor repair by 1706, because in that year the Treasury received a petition asking for "a good large sundial" to take the place of the demolished clock and bell which were stated to have been very necessary to Parliament . . . and all who had business there!

DIAL FASHIONS IN ENGLAND AND SCOTLAND

There are no sundials indexed in HKW before 1570 or after 1706, so it seems that the fashion for them, especially the elaborate stone types, was at its height in the time of James I and Charles I; and the frequent references to painting and gilding make it clear that not only the wall dials but also the multiple, free-standing, stone dials were decorated in bright colours, contrary to our present-day notions. These English dials were truly astronomical compendia which gave more information than just the local time. They showed the declination of the sun, which could be calibrated as the calendar date or the sign of the zodiac, the position of the sun in the heavens during the day and also during the year in relation to the constellations; they often had tables which enabled the dates of Easter and other festivals to be calculated as well as corrections for using as a moon dial and for reckoning the time of high tide etc. It is remarkable that at the same time in Scotland a very different style of dial was being developed. As I have discussed elsewhere *(The Ancient Sundials of Scotland)*, the Scottish multiple dials of this period show only local time and, occasionally, the sun's declination and they are made to characteristic shapes which are found nowhere else, either in England or Europe. The *Accounts of the Masters of Works*, however, have very few references to sundials; under Falkland Palace in 1539-41 there is an item ". . . for carriage of the orlage maid be Alexander Lindsay fra Kingorne to Falkland at the Kingis grace

command iiis", but this could have been a mechanical clock. Also at Falkland in 1628/9 "Item to Johne Patersone maissone for ane sone dyall and ane pillar to set it on and for gilting and cullouring of it and furnisching all materials thairto xxxiii lib vi s, viii d". Then at Holyrood Palace in 1633 there is a number of items relating to the famous dial made for Charles I's Coronation, including accounts for gilding and painting (though it appears that there may have been another dial here as well). But there are no references to dials at other Royal Palaces such as Stirling, Linlithgow or Edinburgh Castle, and apart from the Holyrood dial and a fragment of an obelisk dial at Stirling Castle, all the many Scottish multiple dials recorded today are in private, rather than Royal houses. No doubt the removal of the Court to London in 1603 had much to do with this and official interest in astronomy and navigation could account for the scientific character of the English dials, while the rise of Freemasonry and the continuing interest in symbolism in Scotland resulted in the very different fashion there. Yet in view of the increased communication between the two countries at this time, and the numbers of Scottish nobles who had houses in England, it seems surprising that there should be such a complete separation of dial styles. I live in hopes that our survey may yet turn up some Scottish types of monumental sundials in the backwoods of England!

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BRITISH SUNDIAL SOCIETY RECORD FORM TOPICS

Miscellaneous suggestions and queries by Robert B. Sylvester BSS Member No. 028

1. I feel the A4 size is ideal and would not wish it to be smaller.

2. Please can we standardise on the type of photograph? I still do not think colour prints are a good medium from the longevity, publication or lecture standpoint.

3. Should measurements be given in metric or Imperial? Metric is up-to-date but Imperial reflects the spirit of the age that most of these dials were constructed in.

4. Regret not knowing the gnomon angles. Do you require the correct gnomon angle for that latitude (which can be calculated) or the angle that the gnomon has actually been set at, should it deviate? Do we carry protractors?

5. How about printing a scale down a long side of the Record Form (like some knitting patterns) in case we misplace our rulers?

6. If colour prints predominate despite the virtues of transparencies, I could probably do the copy work from prints supplied to me as I have the apparatus and have standardised a method.

7. Many members must have transparencies but be unwilling to part with such originals. It may be helpful if the form was modified to record this fact and their availability if required. (Before the Society was formed, I was quite liberal in the number of photographs I took, hence I have been able to enclose several with the first batch of records).

Could the Record Form bear a box like this?:-

Photograph enclosed/can be loaned.
Type of photograph:

8. It may be handy if a standard letter could be produced by the Society asking for information about dials, to either be left or posted to an appropriate authority, eg. vicarages, town halls, stately homes. I append a suggested layout.

9. Could we appeal for information about sundials via Diocesan Newsletters? I think many vicars would be sympathetic, and we may gain a few new members that way!

10. The Bulletin says that it hopes the Society can issue updates regularly to members participating in the survey, indicating what dials have been catalogued. I would find it interesting to see how many members had submitted a record on each dial. It would be helpful in enabling members to gauge if the dial had been researched adequately and one's efforts could then be directed elsewhere.

11. Could one of the more artistic members design a logo for the Society?

January 1990

16th CENTURY SUNDIALS FOUND DURING EXCAVATIONS IN HUNGARY
PRELIMINARY REPORT

In recent years, excavations in Hungarian fortresses, castles and cloisters have revealed several small bone/ivory pocket sundials. The majority of these are damaged or incomplete, but are generally still suitable for detailed gnomonical investigations. The kind of damage suffered indicates that they were thrown out as no longer useful, with one exception, which was hidden from the Turkish Army.

The chronicle of castle construction and expansion, as well as the Ottoman wars in Hungary, allows the elucidation of the dates as to when these sundials ceased to be used. This dating corresponds to the upper limit of the probable period of sundial construction. Only one of the excavated specimens has a date inscribed on it, and it is in accordance with these historical dates.

Of the bone sundials found, the only complete one from the Pogányzentpéter/West-Hungary monastery excavations has been described by Róbert Müller[1]. The Diósgyör finds (North-Hungary) are mentioned in Dr Ilona Czeglédi's book on the castle, with accompanying photographs[2]. Detailed gnomonic investigations, however, were only commenced by the author in the Spring of 1989, with permission of the museums and archaeologists involved. It was a fortunate circumstance that during my data processing, I received Dr Penelope Gouk's book - *The Ivory Sundials of Nuremburg*[3], This splendid catalogue and its descriptions includes a great deal of useful information and comparative data.

SUNDIAL FINDS IN HUNGARY

To my knowledge, the following sundials have been recovered from excavations up to the present:

BUDA/BUDAPEST, HISTORICAL MUSEUM

1. Ivory diptych dial or folded box sundial, with horizontal and vertical dial and compass. Size: folded - 24 x 25 x 10mm (0.94 x 1.02 x 0.4in). Leaf 1b, inside of cover, shows the date 1533. There is no other inscription or ornament. Found in the area of the Royal Castle. Inventory number 52.737.
2. Ivory plate, leaf 1 of diptych dial. Lower part missing. Size: 41 x 31 x 1.5mm (1.6 x 1.2 x 0.06in). Found in the area of the civic town by the Royal Castle. Inventory number 65,227 1-3.

DIOSGYOR NEAR MISKOLC, REGIONAL CASTLE

3. Complete ivory diptych dial with compass (lacking magnetic needle). Size: folded 29 x 33 x 8mm (1.14 x 1.3 x 0.3in). Recovered from debris of castle construction. Inventory number 65.8.1.
4. Truncated diptych dial, leaf 2 with modest ornamentation. Size: 31 x 43 x 6.5mm (1.22 x 1.7 x 0.25in). Inventory number 7332.
5. Elliptical truncated plate with horizontal dial and compass, magnetic needle missing. Perhaps diptych dial. Size: 46 x 36 x 7mm (1.8 x 1.4 x 0.3in). Very modest ornamentation. Inventory number 621251.

POGANYSZENPETER, SOMOGY COUNTY, RUINS OF PAULINE MONASTERY

6. Bone diptych dial with compass, (lacking magnetic needle but its corroded remnants could be seen when first recovered). Size: folded 21 x 23 x 8mm (0.8 x 0.9 x 0.3in). Found on top of an underground grain-storage vessel. Simple ornamentation. Inventory number 68.4.110. The only bone sundial which I could not investigate, since the official museum for this locality did not even reply to my request.

TATA, KOMAROM COUNTY, ROYAL CASTLE (In Kuny Domokos Museum)

7. Book-shaped bone diptych dial, truncated, leaf 2 only, base, exists with a hole for the compass. Size: 46 x 56 x 6.5mm (1.8 x 2.2 x 0.25in). Resembles a book when folded. No Inventory number known.
8. Trapeze-shaped bone plate with hour dial and compass hole. Magnetic needle missing. Size: length 76mm, width at top 44mm, at bottom 40mm, thickness 5mm (3 x 1.6 - 1.7 x 0.2in. Hole in the middle of circular dial. On the back of the plate is a larger, circular, depression.

INVESTIGATION OF BONE SUNDIALS

With the exception of the trapeze-shaped plate of Tata, the bone/ivory sundials recovered from different localities in Hungary resemble very closely the early 16th century sundials made in Nuremburg. However, there is only one perfectly indentical specimen, the second Buda example with cover plate. Similar, but of greater size are the specimens in the British Museum, London; Museum of the History of Science, Oxford; and the Metropolitan Museum of Art, New York. There is no ornamentation on the truncated Hungarian specimen. Penelope Gouk regards it is a very early specimen from Nuremburg[3]. It was made circa 1500.

The hour figures of the truncated vertical plate of Budapest, were cut into the bone by a steel tool. The figures are of strikingly modern shape. The larger sundials in the London and New York museums use Roman figures to mark the hours.

On the complete specimen in the British Museum, attachment points are visible into which the string gnomon was fixed. With measurements taken from the photographs, the position of the points are interpreted to serve for 48 degrees latitude. The hour line angles relative to 12 hours noon are relatively accurate on the vertical dial, significant deviation from the correct angle is found only at the 7am and 5pm lines. The lines for 11 and 13 hours are also slightly in error.

The Budapest vertical dial was made - judged from the angle of hour lines - for the latitude of 47 or 48 degrees. The hour line angle error is also maximum at 7am and 5pm, the deviation being -7° and -8° respectively.

The design of the vertical dials of the London, New York and Budapest sundials is very similar to the sundial plans designed by **Erhar Etzlaub** active between 1484-1532; and **George Hartman**, born 1489; both Nuremburg

mathematicians. In my opinion, the sundials were based on their drawings and implemented by an unknown compass-maker in Nuremburg.

The three box-shaped sundials, no 1 of Buda, no 3 of Diósgyör, and no 6 of Pogányszentpéter; are very similar in both size and shape. These sundials were probably made between 1520 and 1540, the Buda example in 1533; presumably in the same workshop but by different masters at different dates. None of the collections and catalogues known to me contain examples of such small Nuremburg sundials form this period [3] [4] and [6].

The string gnomon is set for the latitude of 48° for these three sundials. The angles for the hour divisions are rather inaccurate, resulting from the smaller size of the sundials. An error of one-tenth of a millimetre means degrees of angle in the direction of the hour line. In general, however, the vertical dials are less accurate than the horizontal dials.

On both dial-plates of the Pogányszentpéter sundial the hour marks are marked with Arabic figures. Gothic Arabic figures only occur on the horizontal dial plate of the Buda diptych dial. There are no figures on the Diósgyör sundial. The first two sundials show little ornamentation, small sun and star marks indented by a tool. Small stars only occur on the front of the vertical plate of the Diósgyör example.

The similarities and differences make me believe that the Buda and Pogányszentepter diptychs were made in Nuremburg. The simpler Diósgyör sundial, the largest of the three, may be a copy of the former, and was probably produced in an Hungarian workshop. This assumption is supported by the magnetic variation mark on the bottom of the compass hole solely on the Diósygör sundial. The engraved line inclines 9° to the East. This corresponds to the variation in Hungary around 1520-1530. At that time the Nuremburg masters did not indicate the magnetic variation on compasses[7].

The rectangular and oval-shaped truncated sundials (leaf 2) differ most significantly in style from the Nuremburg sundials. There is no elliptical, oval, ivory sundial of Nuremburg make known from the first third of the 16th century. The hours are marked by Gothic Arabic numbers. The error of the hour lines is considerable. The divisions of the oval sundial are the worst. Both of these sundials were probably made for the latitude 48-49°.

On the bottom of the compass hole in the rectangular plate, a carving indicating magnetic variation is visible, 5° East. For the oval sundial it cannot be determined unambiguously whether there was once a magnetic variation mark. On the basis of the locality of discovery and variation marking, these sundials could be made between 1530-1540. I think it probable that they were manufactured in Hungary and based on the Nuremburg example.

The book-shaped diptych dial of Tata seems to be a Nuremburg product. The divisions of the incomplete plate are similar to those of the Buda complete sundial. The hour lines are rather inaccurate, but correspond roughly to the latitude of 49°. The figures are Gothic style Arabic. Sundials of similar design are known from Nuremburg from the second half of the 16th century. The Tata sundial is an early representative of the Nuremburg 'book-shape' type.

The functional details of the trapeze shaped Tata dial-plate, (Tata no 8) are not known to me. It may be a fragment of a larger instrument. The scale is very inaccurate. Its design suggests a Nuremburg origin.

SUMMARY AND CONCLUSIONS

Some of the sundials found during Hungarian excavations were made in Nuremburg. The three sundials found in the Diósgyör castle may be of local manufacture. Near to the Diósgyör castle the ruins of a Pauline monastery were uncovered, and the bone-carving workshop may have been located there.

Nuremburg tradesmen had good links with Hungary and these contacts were probably maintained even after the Ottoman army conquered part of Hungary. The Nuremburg sundials may have been copied in the Hungarian workshops. In Buda and Vienna the angle of magnetic variation was indicated on compasses as early as the mid-15th century. Hungarian compass-makers placed this supplementary information on Nuremburg examples.

The Hungarian sundials clearly show that they were instruments meant for daily use and not merely decorative. The small and simple sundials could be relatively cheap and purchased by officials of lower ranks. The cultural demand is manifested in the large number of sundials recovered. It is of interest that the sundials until now have all been located, with one exception, in royal castles. These simple sundials were therefore probably used by the king's officials, scribes, soldiers, and so on.

ACKNOWLEDGEMENTS:

Mr Zoltán BENCZE, v, curator of the Medieval Department of the Budapest Historical Museum; Mrs Ilona CZEGLEDI Ph D, senior assistant in the Hungarian National Museum; Mrs Dr Sarolta SZATHMARI, Director of the National Centre of Museums in Hungary; as well as Mrs Penelope GOUK Ph D, Oxford; Mrs Anita McConnell Ph D, RICHS, London; Mr Dipl-Eng Joachi Schardin, Dresden; Mr David Thompson, London; and Professor Gerard L'E Turner Ph D, Oxford.

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3. Gouk, P. *The Ivory Sundials of Nuremburg 1500-1700.* Whipple Museum of the History of Science, Cambridge, 1988.
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6. Körber, H G, *Zur Geschichte de Konstruction von Sonnenuhren und Kompassen.* Veröffentlichung des Staatlichen Mathematisch-Physikalischen Salons, Dresden, Zwinger. Band 3, Berlin, 1965. (On the History and Construction of Sundials and Compasses, German text).
7. Bartha, L. "A mágnesa deklináció korai adatai a Kárpátmedencében", *Technikatörteneti Szemle,* XVI, 1986-87. Budapest, 1988. (Early data on magnetic variation in the Carpathian Basin, Review for the History of Technology, Volume XVI, 1986-87. Hungarian text with English summary).

Lajos Bartha,
Badapest Hungary

EDITOR'S NOTE:

Mr Bartha included some illustrations with his article but unfortunately they are not suitable for reproduction.

A UNIQUE GREEK SUNDIAL

by René R.-J. Rohr

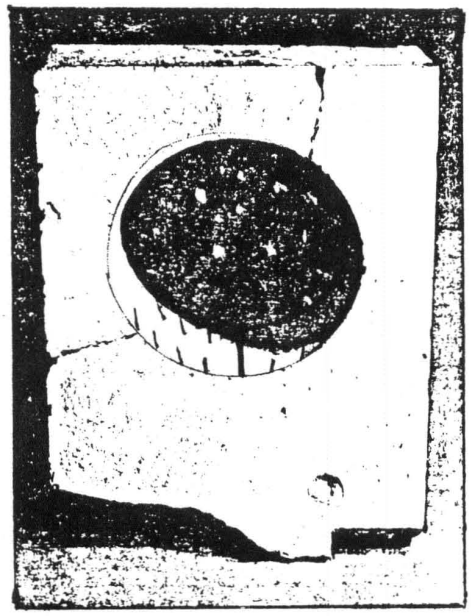
ABSTRACT: In the time of Alexander the Great, the Chaldean priest Berosus invented the *hemispherium* which in one form or another became for centuries, the best known sundial in classical antiquity. However, in 1975, a French team of archaeologists digging in Afghanistan brought to light a Greek sundial of almost the same era, but of so unexpected and mathematically correct a pattern that a new chapter seems to have opened up in the story of early gnomonics.

More often than not, in the story of Alexander the Great, the chapters dealing with the organization of the huge empire, the kinds of local government established and the Greek settlements and cities founded along the track of the campaigns are but little known to the average reader. A report published in 1976 by the French scientist Paul Bernard, leader of an archaelogical team[1] working in upper Afghanistan, affords a glimpse of what at least one of Alexander's cities in far-off Asia may possibly have looked like (Bernard 1976). The archaeological research was carried out near the Amu Dar'ya river, the ancient Oxus, of which parts now form the frontier between Afghanistan and the Turkistan region of the U.S.S.R. The site is in the region once known as Bactria, and by the time of Alexander's arrival there in 329 B.C., his heavily strained army was in urgent need of a rest. Alexander therefore remained there long enough to have a new city built, indeed long enough to marry Roxana, a Bactrian princess. The present name is Aï Khanoum.

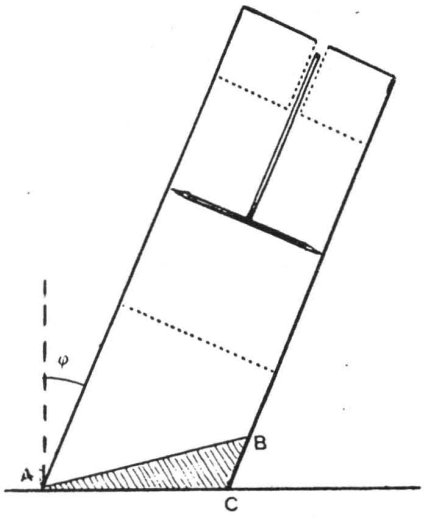
In years of patient digging, there gradually appeared the remains of a fine Greek city, rather important and containing the classical monuments of the time. It was as if a curtain were drawn aside, revealing a scene of Hellenic life and activity in far-off days. The discovery, in a part of what had been the gymnasium, of a sundial of the common *scaphe* type (having the shape of a hemispherical bowl) was not unexpected. Its form, a throne with front feet in the shape of lion paws, is familiar to archaeologists. However, in 1975 there came to light in one of the northern rooms of the same building (Bernard 1976, pp 299-302) a carved slab of limestone buried under heaps of calcareous rubble possibly intended to be fed to a nearby limekiln. It appeared to be another sundial, but of so astounding and unexpected a pattern that it must have taken the archaeologists some time to be sure of what they were examining. The fact is that ancient documents, written or carved, that refer to sundials are exceedingly scarce. The oldest and best known is a chapter in Vitruvius *De Architectura*[2] from the 1st century B.C. where thirteen different kinds of sundials then in use are listed by name. Of these, some remain unidentified today. Yet there is no certain evidence that one of the unidentified types listed by Vitruvius may correspond to the Aï Khanoum slab. We seem to have no alternative but to consider this find as a new, hitherto unknown, type of antique sundial of which, furthermore, only one specimen is preserved. Its present location is in one of the storehouses of the French archaeologists in Aï Khanoum, but it will be presented in due time to the National Museum in Kabul. The account presented here of this remarkable sundial follows closely the report given by Hanin (1976), although we consider in more detail its possible origin.

The dial consists of a slab of limestone, a parallelepiped 45 cm high by 35 cm wide and 15 cm thick. Passing perpendicular through its larger faces is a neatly cut cylindrical hole 22 cm in diameter (see figure 1), the inner surface of which is marked by two series of thirteen short lines, one series carved inwards from each of the larger faces of the slab. In each series, the seventh line, ie the one in the middle, is parallel to the axis of the cylinder with the seventh line of the two series joined as one single feature. All the other lines are slightly inclined to this middle line, with the inclination increasing the further the line is from the middle. The inclination of the lines in in opposite senses for the two series, when viewed from the corresponding faces of the slab. The question naturally arises of how this dial worked.

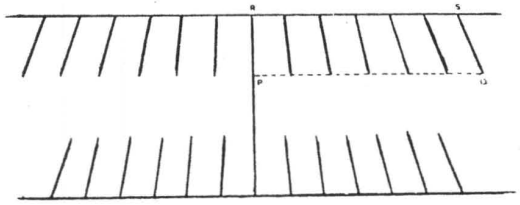
The two bases of the cylinder are circles. If their planes are set parallel to the equator, they will become equatorial sundials for which the axis of the cylinder, if made material by some iron or wooden rod, will serve as the gnomon. If the circles are then marked in increments of 15° from the lower middle line, the marks will indicate hours and the lowest mark, the middle line, will be the noon mark. A narrow hole was bored in the upper part of the slab (see figure 2) which held the iron rod that formerly supported the gnomon, The length of this gnomon must not have exceeded the thickness of the slab,



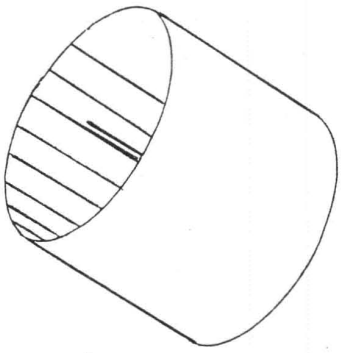
1. Front view of Aï Khanoum sundial.



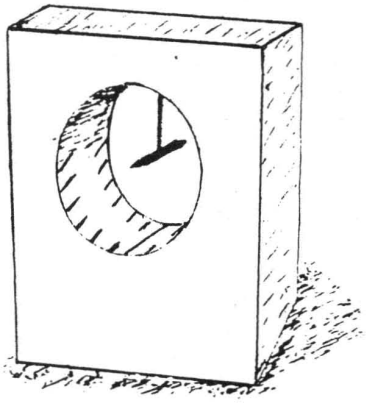
2. View of sundial when installed near Pattala, India. The hatched area was removed at Aï Khanoum. ø is the angle of the latitude where the dial is situated.



4. The hour lines delineated on the inner surface of the Aï Khanoum sundial after unrolling the cylinder. See text for the discussion on lines RS and PQ.



3. A modern equatorial dial similar in concept to the Aï Khanoum example but showing equal hours.



5. A sketch of the correctly mounted sundial.

GREEK SUNDIAL UNEARTHED AT AÏ KHANOUM, AFGHANISTAN

ie 15cm, and its tips should have lain in the planes of the slab faces.

Now suppose that the corresponding hour marks of the two circles had been joined by straight lines as in figure 3. The result would be a perfect modern equatorial sundial indicating "regular" hours, ie hours of equal length. But from early antiquity through to the Middle Ages the hours in common use were so-called "temporary" hours. The moments of sunrise and sunset separated the hours of the day from the hours of the night and there were twelve of each, their length never being the same on different days. The first hour of the day began at sunrise, it was noon at the sixth hour, and the last hour ended at sunset. Therefore the modern dial of figure 3 would have been of no use. During spring and summer the hours shown by an antique dial had to successively increase and then decrease in length, and during autumn and winter the change had to be reversed. The need to indicate temporary hours results in the inclined hour lines in the Aï Khanoum dial.

Since the day began and ended with the sun on the horizon, the corresponding hourlines had to be the intersection of the cylinder with the horizontal plane passing through the end of the gnomon being used as the indicator. The resulting curve lies in a plane but is elliptical, and as well, we shall have to remember, it is horizontal. The noon line, being the intersection of the meridianal plane passing through the axis of the cylinder with the cylinder's inner surface will be its lowest generating line. The intermediate hour lines will start from the hour marks around the circle at the face of the slab and will deviate, from being parallel to the noon line, in proportion to their respective distances from the noon line. The unrolled inner surface of the cylinder with the resulting hour lines is shown in figure 4. The two sets of hour lines correspond to the use of the two ends of the gnomon as the indicator.

On each day, no matter what the season, the tip of the shadow of the gnomon would move along a circle on the inner face of the cylinder; the plane of this circle would be parallel to the plane of the nearest face of the slab and would be at a distance from the slab face equal to $r \tan d$ where r is the radius of the cylinder and d is the declination of the sun. On the correctly completed and inclinded slab (figure 5) the upper end of the cylinder, and the upper end of the gnomon, would be used in spring and summer, whilst in autumn and winter the lower counterparts would be used. The temporary hours would be read using the tip of the shadow that was visible, by interpolation between the hour lines along the above-mentioned shadow circles for that day.

It must be remembered that on equinoctial days the hours marked on the outer circles would correspond (in duration) to those in use today. Therefore, in figure 4 let the line RS represent the length of half an equinoctial day, ie six of our present hours. The length of half a solstitial day indicated by the dial is then represented by PQ, and 6(PQ/RS) will then be, in modern hours, the hour angle t of the sun at the moment it crosses the horizon. In Alexander's time the solstitial declination of the sun was 23.9°, and if ø is the latitude at which the dial was meant to be used, then

$$\tan ø = (\cos t / \tan 23.9°).$$

Surprisingly enough, the resulting latitude is found to be about 23.5°, whereas Aï Khanoum, the place in which the dial was found, is at latitude 37°. This difference is too large to be ascribed to an error by the dialler whose work gives abundant proof of competence in other respects. On the other hand, the measurements used for this calculation were taken by archaeologists exercising the usual care of their profession. One is therefore led to consider the possibility that the sundial was not found at its place of origin.

A meticulous survey of the route followed by Alexander shows that in no place was a latitude of less than 25°N reached, and, moreover, that in ancient Pattala, the only point where he came so far south, the army had to undergo reorganization in view of its partial transportation westward by sea. It may be presumed the necessities of future communication must have given birth there to a seaport and another one of Alexander's cities. Pattala was located near the present-day city of Hyderabad, just north-east of Karachi, and here, one may assume, was the latitude in which the sundial was built to be used. The latitude deduced from the markings on the dial, that the Tropic of Cancer, is only slightly further south and corresponds to the latitude of the then island of Kutch in north-west India. (Whilst it is not unlikely that some Greek traders were scattered throughout Persia and parts of India before the time of Alexander, not being city dwellers they would have had little or no interest in dialling, and therefore should not be considered as possible constructors of the dial).

For correct operation of the dial, as we have noted, the main planes of the slab had to be parallel with the plane of the equator. Thus the extreme hour lines, which are horizontal, formed angles with these planes of the slab equal to the complement of the latitude. In Aï Khanoum this would have been 53°. In fact, as we have implied above, it is 66.5° - another way of looking at the discrepancy of 13.5° between the marking of the dial and its latitude of discovery. Now the horizontal base plane must also be carved at this same angle. However, it is actually found to be 53°, ie it is correct for the latitude of Aï Khanoum.

To explain this apparent contradiction in design, we may recall the well-known story of the transportation, during the first Punic War, of a Greek *scaphe* sundial from Sicilian Catania to Rome, where it took the people 99 years to become aware of the fact that the hours it showed were wrong! The difference in latitude between these two cities is almost the same as those postulated here in the case of the Aï Khanoum slab, an equatorial dial that must be set with its circles parallel to the equator. If the slab was constructed near Pattala and then later on, for reasons unknown, was taken far north to Aï Khanoum, its inclination would have to be increased by an angle equal to the difference in latitude. In figure 2, the base plane for its original correct inclination is indicated by AC. In Aï Khanoum, the increased inclination would have required the carving away of the hatched area ABC, with AB becoming the new base plane. So far all would have been well if the extreme hour lines had remained horizontal. But of course they had not. Since the slab was now more inclined by some 13.5°, the extreme hour lines were now out of their proper position by the same extent.

The hours indicated by the dial would have been correct on equinoctial days, but would have become more and more incorrect when the sun's declination approached the solstices. Possibly, as in Rome about the same time, nobody was aware of it!

Alexander's army reached the Indian Ocean near Pattala by 325 B.C., and this year may be looked upon as the earliest possible date for the making of the dial. About 145 B.C. ancient Aï Khanoum was destroyed by invading tribes from the northern steppes. Thus the contruction of the sundial must have taken place between 325 and 145 B.C.

The fact that at so early a date a polar dial had been invented is, in itself, of almost evolutionary importance in the history of ancient gnomonics. Apparently this new concept was subsequently not used again and remained forgotten for more than a millenium. But even more remarkable is the discovery of the means of having it correctly indicate temporary hours - an achievement next to the impossible! Perhaps, if it were known, the name of the dialler who designed the Aï Khanoum slab would appear in our texts as one of the great representatives of Greek thought in antiquity.

NOTES

1. Delégation archélogique française en Afghanistan, 12 avenue de Darulamman, Kart-i-Seh, Kabul, Afghanistan.
2. Book 9, Chapter 8.
3. The present article first appeared in *Journal of the Royal Astronomical Society of Canada,* Volume 74, No 5, 1980 under the title: "A Unique Greek Sundial Recently Discovered in Central Asia", pages 271-278.

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REMARKS

Although M Rohr makes no mention of it, the sundial appears to have been broken into at least two and possibly three parts, one crack takes its route directly through the hole on the top part which would have held the gnomon support. With such a large opening in the slab it would make the sundial unable to withstand the disruptive forces if thrown on the ground. There is also a part of the base which is lost and there appears an attempt at the right-hand corner of a deliberate chiselling away of part of the base.

Considering its novel function (for the period, and any time since), it is strange that there is no inscription on either of the faces of the sundial, there is total anonymity. One would have expected at least an indication of its function to be shown. Although not very large (approximately 18in x 14in x 6in), it would have been a weighty object to transport over such a large distance; evidently it was highly thought of to undertake such a task with the primitive transport facilities then available.

UNDERSTANDING THE LAMBERTIAN CIRCLES

In answer to the 'Distress Call' in the February 1990 issue of the *Bulletin*, I submit the enclosed Diagram and Explination following. On the Crossed Lines at right angles MAN and BAQ one first constructs an ordinary Analemmatic Dial, in this case for Latitude 52° North; represented by the Angle OAB. The usual Orthographic Construction determines D and H, the Foci of the required Ellipse of hour points and the Nodi for the projection of the tangent Scale of Solar Declination along FAG. The Solar Declinations are here indicated by the signs of the Zodiac (disposed on a Vesica, both for fun and to remind the reader that we are here dealing with a circle projected onto a straight line).

AE, equal to DC, determines the radius of the Minor Axis Circle, and the determination of the Elliptical Scale of Hour Points follows logically, as shown. When the instrument is finished and correctly orientated with M towards the North, with a vertical Gnomon free to move along FAG, it is ready for use, but lacks any logical means of establishing the times of Sunrise and Sunset, both on the Longest Day and at other Seasons of the Year. The 'Circles of Lambert' provide this Information. On the Longest Day the Gnomon stands at point F, the Maximum Solar Declination, when the Sun is on the Tropic of Cancer. Take therefore point F, along with the two Foci D and H, and find (either by Geometrical Construction or by trial and error), a point along the line AN upon which (as a centre) a Circle can be drawn whos circumference will pass exactly through points D, F, and H. This centre is marked by point L. The Circle drawn upon it passes through the Ellipse of Hour Points a little before the hour of 4 o'clock in the morning and a little after the hour of 8 o'clock at night: these being indeed the times of sunrise and sunset on the longest day at latitude 52° north.

To determine the times of sunrise and sunset on the shortest day, when the gnomon stands on point G, establish point aL and draw upon it a similar circle, which will cut the ellipse of hour points in the correct places. To determine the times of sunrise and sunset on any day in the year, simply draw a circle (upon a found centre lying along the line MAN, which will pass through that point on the tangent scale where the gnomon then stands, together with the two foci D and H, and that circle will always cut the scale of hour points in the correct places. Here I have drawn circles through the cusps of each of the zodiacal divisions, but circles can be drawn through any point on the declination scale. That is the utiliticity of the 'Circles of Lambert' at a particular latitude.

If, however, one draws **another** analemmatic dial, for a **different** latitude upon the same foci, as I have done for latitude 60° north (the angle OAB), then this dial will share the same solar declination scale, and the same 'Circles of Lambert' will determine the times of sunrise and sunset at this latitude also, as is made clear by the diagram. One set of circles serves every possible superimposed analemmatic dial which one might choose to add. There is no more to it than that!

Peter Drinkwater,

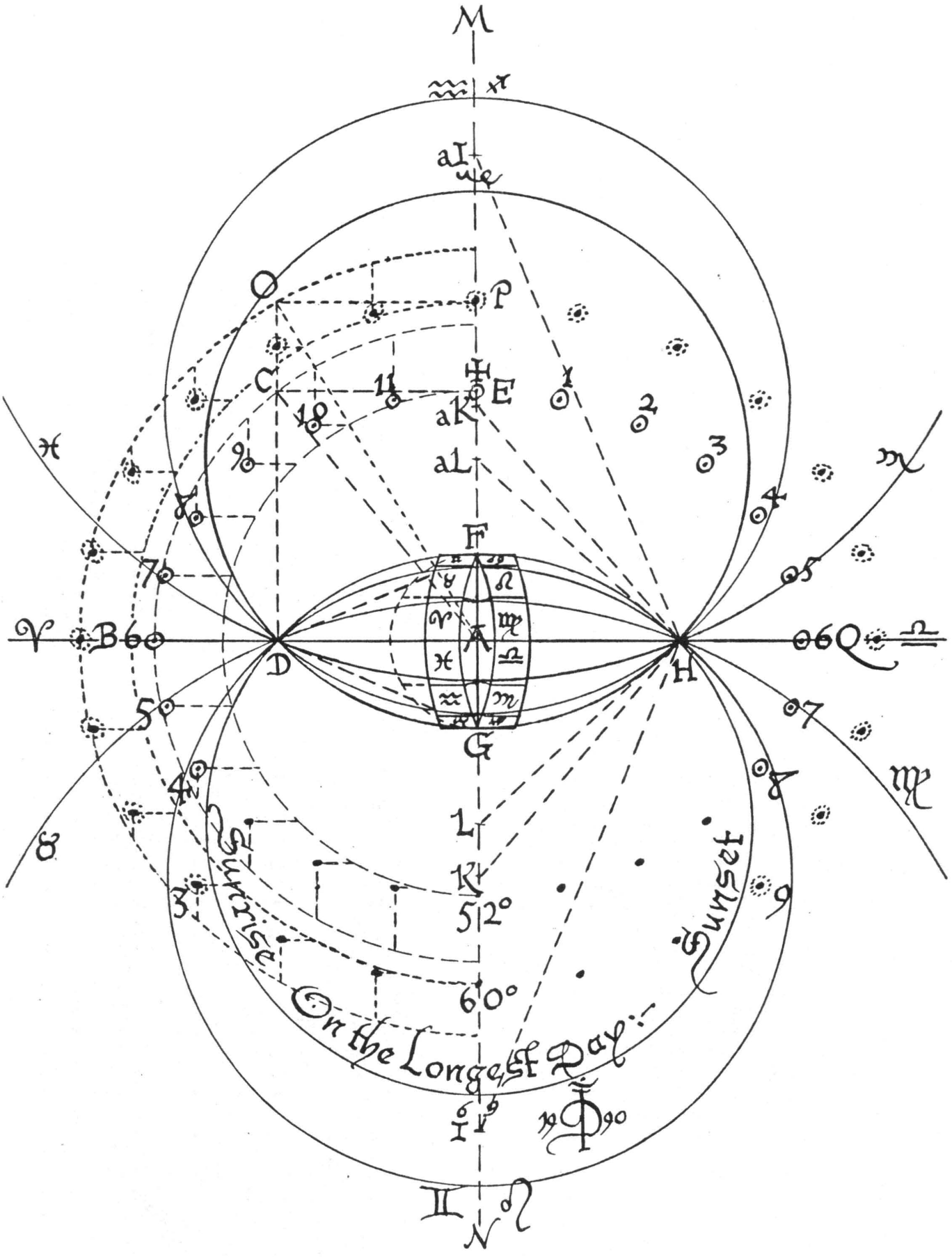

M
aI
O
P
C
E
aK
aL
F
D
H
G
L
K
Sunrise
Sunset
On the Longest Day
N

FIGURE 1 WILLIAM LEYBOURN AGED 64 YEARS, 1690.

DIALLING,

PLAIN, CONCAVE, CONVEX, PROJECTIVE, REFLECTIVE, REFRACTIVE.

SHEWING,

How to make all such *DIALS*, and to adorn them with all useful

FURNITURE

Relating to the

Course of the SUN;

PERFORMED

ARITHMETICALLY, GEOMETRICALLY, INSTRUMENTALLY and MECHANICALLY:

AND

Illustrated with SCULPTURES, Engraven in COPPER.

Comprised in XIV. Distinct TRACTATES, the Contents whereof follow next after the *Preface* to the *Reader*.

The SECOND EDITION Corrected, and two *New Tractates* added.

Collected, Methodised, and Published,

By *WILLIAM LEYBOURN.*

LONDON:

Printed by *J. Matthews*, for *Awnsham* and *John Churchill* at the *Black Swan* in *Pater-Noster-Row*, MDCC.

FIG 2 TITLE PAGE OF WILLIAM LEYBOURN'S 1700 EDITION

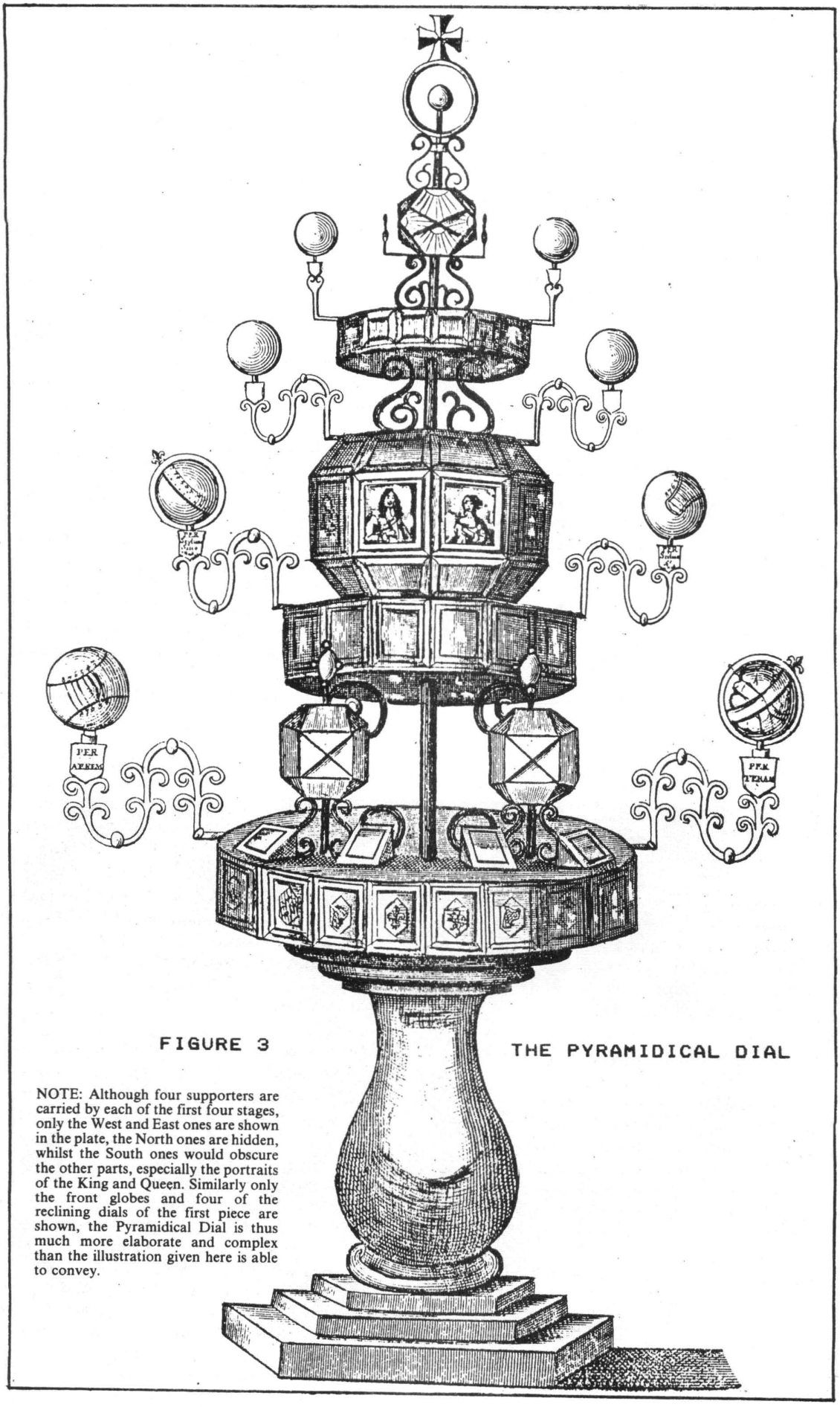


FIGURE 3 THE PYRAMIDICAL DIAL

NOTE: Although four supporters are carried by each of the first four stages, only the West and East ones are shown in the plate, the North ones are hidden, whilst the South ones would obscure the other parts, especially the portraits of the King and Queen. Similarly only the front globes and four of the reclining dials of the first piece are shown, the Pyramidical Dial is thus much more elaborate and complex than the illustration given here is able to convey.

A BRIEF EXPLICATION OF A PYRAMIDICAL DIAL,
which was set up in the KING'S MAJESTY'S Privy Garden at Whitehall, ANNO 1669.

The year 1660 was notable for the Declaration of Breda when Charles II set out his terms for the Restoration of the English Monarchy, General Monk having entered London and declared for Free Parliament, the notorious Long Parliament dissolved itself after calling a Convention. The Convention Parliament invited Charles to return to England and he was restored to the English throne, Samuel Pepys began his celebrated 'Diary', which was never meant to become public property. In contrast, the year 1669, when Pepy's Diary entries ended, the outstanding events included the last meeting of the Hanseatic League, Candia capitulated to the Turks after a twenty-one year siege, and freedom of worship in India was rejected. The anchor escapement for clocks also made its first appearance, however there seemed to be little to celebrate when a new sundial was set up in the King's Privy Garden in Whitehall. The optimism of its designer seems to have been unbounded, for the previous history of sundials in the same garden was of maltreatment, damage and decay into final oblivion. Two previous sundials weighing over five tons had been savaged beyond repair and, as will be seen from the following description by William Leybourn in his *Dialling*...., Second Edition, London, 1681, the sundial of 1669 was doomed before it was set in place. In his preface Leybourn states that what he has written is only an extract of what the maker of the sundial wrote in explanation and of the use of the various dials on it. A portrait of William Leybourn is given in Fig 1.

The designer, rather than maker, was the Reverend Francis Hall who wrote a treatise in Latin - *Explicatio Horologii in horto regio Londoni erecti in Anglia anno 1669 erecti, in quo plurima horologiorium sciatericorum genera contintur per Franciscum Hallum,* published Liège, 1673. An English translation appeared there also in 1673, with the title of *An Explication of the Diall set up in the King's Garden at London July 24th 1669.* Francis Hall was known as Father Linus and was Professor of Mathematics at Liège.

Leybourn's supplement, beginning on page 183, has the most useful addition of a facing full page plate illustrating the pyramidical sundial, see Fig 3. A single glance at this shows the impracticality of such a design for standing in English weather throughout the seasons. This figure is to be used in conjunction with Leybourn's account which now follows. The text has been transcribed into modern English for the convenience of the reader.

A General Description of the Several Parts, of which the Pyramid (or Body) is composed

This Dial standing on a pillar or pedestal of stone, consists chiefly of six parts or pieces, one less than another, and placed one above the other in the form of a pyramid, as in the Figure 3.

Of the First Piece

The first and largest of these six pieces, is a round table of about 40 inches in diameter, and some 8 or 9 inches in thickness. The edge whereof is cut into 20 equal planes, which being made hollow like so many boxes of an inch deep, are covered each of them with a clear polished glass; and on the inside of each glass is described a dial; whereof some of them show the hour according to the ancient or *Jew's* manner of counting the hours: others according to the way of counting used by astronomer: and lastly others show what hour it is according to our usual and ordinary way of counting the hour used in most parts of Europe. These twenty dials thus described on the edge of this table or first piece, are all vertical declining dials; whose style or gnomon is either a lion's paw, or unicorn's horn, or such-like, relating to His Majesty's Arms and painted on the bottom of the box.

Moreover upon the upper part of this table, are placed eight reclining dials, all made hollow, and covered with polished glass like the former, but differ chiefly in this; that they only show the usual hour in different ways; one of them showing the hour by the shade of the style falling upon the hour-lines, another by the shade of the hour-lines falling upon the style, a third without any shade either of hour-lines or style, etc.

Upon this piece stand also four globes, cut into several panes: upon one of which globes are described several dials belonging to geography, on another, dials belonging to astronomy; the third, dials showing several things appertaining to astrology, as what planet reigns every hour, the horoscope, aspect of the sun with the stars, etc.

There are also belonging to this piece, and issuing out of the sides thereof to the East, West, North and South, four iron branches supporting each of them a glass bowl which show the hour in four different ways.

Of the Second Piece

The second piece of the pyramid is also a round table, almost like the former, but somewhat less, having only thirty inches in diameter. It stands upon the first, held up by four iron supporters. The edge or circumference of this table is cut into sixteen equal planes, all made hollow, and covered by glass, like those of the first table. But they differ from them in this, that here the dials are not described on the glass covers, but on the bottoms of the boxes. Neither do they show the hour but the different risings of the most remarkable stars, according to the three manner of risings observed by astronomers, viz cosmical, achronycal, and the heliacal rising. The style to these dials is a little star painted on the inside of the glass cover, the better to keep it from the weather.

Out of the sides of this piece issue out four branches towards the East, West, North and South, and carry on each of them a glass bowl to show the hour, like those of

the first piece, but in a different way. For one of them shows the hour by a style without a shadow, another shows it by a shadow without a style etc, whereas those of the first table show it by the four elements, fire, air, water, earth.

On the upper part of this table are placed eight reclining planes, four whereof are covered each of them by a plate of looking glass, which the hour lines, or style of the dial, being painted, are reflected upon the bottom inclining planes of the third piece, and there show the hour.

The other four all have dials upon them, which are to be seen, each of them, in a looking glass placed upon the said bottom inclining planes.

Of the Third Piece.

The third piece of the pyramidical dial, is a great hollow globe of about 24 inches in diameter, placed immediately without any supporter upon the second piece. The superficies of this globe is cut into twenty-six planes, two whereof being octagons, serve for top and bottom; the rest are divided into eight equal reclining planes, eight equal inclining planes, and eight equal vertical or upright planes. These planes are all made hollow like those of the first and second piece. The incliners are not covered with glass, but are left open that they may better receive and show the dials reflected from the second piece. Two of the eight upright planes looking towards the North, have no bottoms but are covered with clear glass, as serving only for windows to look into the globe and behold there the dials described on the globe, which are seen as well outside, the same as within. The other six have not only each of them a cover of clear polished glass, with a dial thereon, like those of the first piece, but have also a glass for their bottom, which glass is thinly painted over with white colour for the purpose of showing the hour lines, drawn on the cover, as well within the globe as outside. On the bottom glasses are drawn several pictures holding either a sceptre or a truncheon, or similar, the end of which points out the hour you look for.

Two also of the recliners looking towards the North have only a glass cover, serving as a window to look into the globe, the other six have a double glass like the former. Their dials are some drawn upon the cover, others upon the bottom, but all so contrived that the hour cannot be known by them except by looking within the globe.

Moreover, from the top of this globe issue four iron branches towards the four corners of the world, each of them carrying a glass bowl, proportionally less than those of the first and second pieces; on which bowl dials are described, but differing from the former, showing the hour according to the several ways of counting the hours. These bowls are painted on the inside with thick colour to keep out the light, except for a little space left clear, like a star, for the sun's beams to pass through and show the hour, and the place also where the hour lines are drawn, only painted on the outside thinly with white colour that the light passing through, the said star may be seen and show the hour.

Of the Fourth Piece.

The fourth piece standing on the aforesaid globe and held up by four iron supporters like those to which hold up the second piece but proportionately less, is also a round table of about 20 inches diameter and six inches thickness. The edge of this table is cut into 12 equal superficies, not plain as heretofore, but concave like so many semi-cylinders; on each of which is described a dial which shows the usual hour by the shade of a Fleur-de-Lys, fixed at the top of each semi-cylinder.

From the top of this table issue forth iron branches carrying each a glass bowl, just like those of the first, second and third pieces, although proportionally less. The dials described on these glass bowls differ from those of the third piece, not only because they show only the usual hour, but also because here the hour lines are all left clear for the sun's beams to pass through, that by so passing they may exhibit the like dial on the opposite side of the bowl; which side is for that purpose thinly painted over with white colour, that the said hours may be seen and show their hour by their passing over a little star, painted in the middle thereof.

On the Fifth Piece.

The fifth piece standing upon the fourth, and held up also by four iron supporters, is a globe of about four inches diameter, whose superficies is cut into fifteen planes, eight whereof are triangles equal and equilateral; the other six are equal squares. The dials described on these planes show only the usual hour by the shade of a Fleur-de-Lys fastened to the top or bottom of each plane.

Of the last or highest Piece.

The highest piece or top of the pyramid is a glass bowl of some seven inches diameter, standing on the foot of iron placed on the middle of the fifth piece. The North side of this bowl is thinly painted over with white colour, that the shade of a little golden ball placed in the middle of the bowl, may be seen to pass over the hour lines which are drawn on the said white colour, and note the hour. The bowl is included between two circles of gilded iron, with a cross at the top. And thus much concerning this *Pyramidical Dial* in general.

Continued on next page

THE DIAL DESCRIBED

1. Of the Twenty Vertical Dials described on the first Piece.

	Lion			Hour by the	Paw of the Lion
Four of	Harp with	Painted in	Jewish	shadow of the	Top of the Sceptre
those	a Sceptre	the bottom	Babylonian	Lines drawn	Top of the
Dials	Fleur de Lys	of the	Italian	upon the	Fleur-de-Lys
have a	Unicorn	Box and	Astronomical	Glass passing	Unicorn's Horn
	Lion also	show the	Common	over the	Lion's Paw

II. Of the Eight Reclining Dials standing upon the First Piece.

These four recliners which stand upon the South part,

		By the Style passing over the Hour Lines.
First		Both by the Shadow of the Hour Lines pass-
Second	Shows the	ing over the Style.
Third	Hours	By the shadow of the Style passing over the
Fourth		Hour Line, and the Hour Lines over the Style.
		Without shade either of Style or Hours.

Those four Recliners standing upon the North part,

First	You see the Hour Lines but no Style.
Second	You see the Style but no Hour Lines.
Third	You see neither Style nor Hour Lines.
Fourth	You see both Hours and Styles.

III. Of the four Glass Bowls which stand upon the First Piece.

These four Bowls show the Common Hours by four different ways: viz

	First		Fire	By applying your Finger to the Meridians.
The	Second	By	Water	By the Rays of the Sun passing through the Water.
	Third		Air	By two Objects in the Globe reposing in your Eye.
	Fourth		Earth	By a Terrestial Globe described upon the Bowl.

IV. Of the four great Globes standing on the First Piece.

Each globe consists of 32 planes, of which 20 are equilateral triangles, and 12 regular pentagons; the triangles are all planes, and some of the pentagons also, and the styles of these dials are sharp pointed irons perpendicularly erected.

Of these Dials described on the First Globe,

	It is time of Rising or 6 o'clock.
Some show in	It is time of Dining or Midday.
what part of	It is Supper time or 6 o'clock
the World	It is Midnight or 12 o'clock.
	The Sun is in the Zenith.

The dials upon the 20 triangles show what time it is in various other countries in the world.

Of the Dials drawn upon the Second Globe,

	The Azimuth or distance of the Sun from the South.
	The Almucantar or degrees of Altitude.
Some of	The Sun's Rising.
them show	The Sun's Setting.
	The Amplitude or distance of rising from the East or West.
	The Day of the Month, etc.

Of the Dials described upon the Third Globe.

This globe consists of 20 equilateral triangles, some of which are made hollow like cones, the rest left plain.

The Dials show by the *shadow* of the Style	What Constellation	Begins to Rise. Begins to Set. Begins to pass the Meridian. Is just East or West. Is in our Zenith. Will be just East or West at 8 at Night. Will be just South at 8 at Night.

Of the Dials upon the Fourth Globe.

This globe (as the former) consists of 20 equilateral triangles, and the dials described upon them,

Show by the Shadow of the Style	What Sign is ascending. What Sign is Culminating. What Sign is Descending. In which of the 12 Houses the Sun is. What Planet Reigneth any day of the Week. What fixed Stars are in Conjunction with the Sun. What Aspect the Sun has to fixed Stars.

V. Of the Dials on the edge of the Second Piece.

The dials described upon the edge of this second piece,

Show the	Cosmical Achronical Heliacal	Rising and Setting of the fixed Stars.

VI. Of the Eight Reflected Dials, placed on the top of the Second Table.

The dials made upon the top of this second table, being high and above the eye, are made by reflection of the dials drawn upon the inclining plane, the style being a fleur-de-lys painted on the looking-glass placed on the table, appears not, but only the shadow thereof appears, which being reflected upon the hour lines drawn on the bottom of the globe, shows the hour.

VII. Of the Four Dials supported by the Four Branches of the Second Piece.

These four dials are drawn upon four glass globes, of about five inches diameter and show the usual hour in several ways.

The first shows the hour by moving the style (which here is a fleur-de-lys fixed on a movable equator) to and fro until it casts a shadow upon the globe, so shall the equator rest upon the hour. The second shows the hour by observing where the part of the globe lit by the sun meets with the unlit part, for that will be the true hour. The third shows the hour by the shadow of a style perpendicularly erected upon the superficies of the globe. The fourth shows the hour by placing of your body so as to behold your face in the middle of a little convex looking-glass placed for that purpose in the South Pole of the bowl or globe, you will at the same time (if the sun shines) behold the picture thereof at the hour.

VIII. Of the Dials described on the great Globe, which stands on the Second Table.

This globe consists of 24 planes, 8 recliners, 8 vertical, and 8 inclining planes. For the dials upon them, six of the upright planes are made hollow and covered with glass, having dials drawn upon them. The bottoms are also covered with glass thinly painted over with white colour that the dials may be seen as well within as outside the globe; the two hollows towards the North being left open as windows to look into the globe. On the bottom glasses are drawn several pictures, as of the King, Queen, etc. In the King's picture the hour is shown by the hour lines passing over the top of the sceptre. In the Queen's, by the shadow passing over the centre of a flower in her hand; and the rest over several truncheons etc, held in their hands.

For the dials described upon the reclining and inclining planes, they are of like kind (by reflection) as those before described in the former globe.

IX. Of the Four Glass Bowls, supported by the Four Branches of the great Globe.

The four bowls are gilded over, except where the hour lines are drawn, which is thinly painted over with white colour with the result that the sun's rays passing through a little star, left clear on the top of the bowl and making the like star of light upon the hour lines, may be seen to note the hour. The hours are such as to show the hours according to the different nations.

X. Of the uppermost Piece of the Pyramid.

This fourth and uppermost piece, consisting of 12 concave semi-cylinders, and standing upon the great globe held up by four supporters like those of the second piece. Upon each of those semi-cylinders a dial is described, showing the usual hour by the light of the Sun penetrating through the hour lines and passing over a little star painted on the lower part of the bowl.

The fifth piece consisting of eight plane equilateral triangles and six equal squares held up by four supporters, have dials inscribed upon them, showing the hour by the shade of a fleur-de-lys.

The sixth and last piece is a great glass bowl, standing upon the fifth, supported by a foot of iron and encompassed with two iron circles. Which bowl also shows the hour by the shade of a little golden ball placed in the middle of the glass.

Thus I have given a brief account of this (now demolished) Dial which account and figure thereof together may give some light to the ingenious practitioner (with what is delivered in the foregoing paragraphs) to invent infinite varieties of this kind.

WILLIAM LEYBOURN.

SUNDIALLERS AT OXFORD

From any rim
of the green bowl of hills
holding the city
hear dreaming spires still
ringing out centuries
in their measured way
while screaming tyres
gain on each day
to the ticking of
hour bombs.
Now anachronism
and an aplomb
for recording history
and gnomonic science
bring 70 likeminds
in alliance
to discuss sundials
in Oxford halls.

Old bishops look down on us
from Exeter College walls;
their forebears read sundials
from 600 AD.
Distant shadows
of their gnomons, we
go perambulating
like the March sun
to read time
upon old sandstone
where dials glow
blue, silver, red
against the gold.
When sun's abed
we mark out hours
as wine glasses sink,
convivial diallers
telling time to talk.

Anne Born

In commemoration of the first conference of the BRITISH SUNDIAL SOCIETY, Oxford, March 1990.

BOOK REVIEW

L'Ombra e il Tempo, Orologi solari, Arte, Storia, Scienza, Specifica Regionale; il Piemonte, [Shadow and Time, Sundials, Art, History, Science, Specific Region - Piedmontel] Aldo Trinchero, Lando Moglia, and Giancarlo Pavanello, 448 pages, 323 drawings, 196 B & W photographs. Editore Vanel, Corso Vercelli 87/C, 10155 Torino, Italia, 1988, Price 140,000 Lira, about £70.

The three authors are members of the *Academia del Sole* founded in Italy in 1988, of which Signor Pavanello is the President.

The book is a pleasure to look at, its large format, beautifully printed on heavy paper, makes the text easily readable. It is bound in a luxurious red cover, and is embossed with gold, with an additional ornamentation of small gilt stars in bas-relief. The first 200 copies of the edition of 1200 were numbered and signed by the three authors.

Following the introduction there is a chronological survey in Chapter 1, followed by a list of curios. Chapter 2 contains mottoes, arranged according to the subject. Some seem to be very witty but the Torinese dialect causes difficulty, Chapter 3, pages 89-142, gives descriptions of about 30 large objects, such as Stonehenge, famous noon meridian lines of the world, and large sundials at various places.

Chapter 4 contains descriptions of all Piedmontese sundials, covering 100 pages, without illustrations but with maps of the area and towns, which should make it easy to locate them all. But I'm afraid that no tourist will want to carry this 2 kilogram bible in his shoulder bag. In most cases there is only a short note telling you that there is a sundial in a certain spot, without giving a detailed description. Is there perhaps a separate catalogue of these sundials? Chapter 5 deals with the measurement of time in general, including the calendar with some philosophical remarks in the margins.

And then in Chapter 6 the real gnomonics start. Everything comes up for discussion and there is not much lacking in this cornucopia of details. Geometrical as well as mathematical methods of construction are described. Little attention is given to the Equation of Time, and for the 8-shaped equation loop the erroneous name lemniscate is used. The derivation of the formulae is not always easy to follow, especially in the larger and more complicated formulas for inclining/declining dial faces; the derivation given by van der Wyck in *De Zonnewyzerkring* is not included. On page 290 is a small error in the formula tan (DL) but it is given correctly in equation 7.14 on page 382. One may simplify this expression by rewriting 7.15 as:

tan (DS) = sin (ø2), tan (DL) [tan s = sin v, tan t_s]

and passing on to page 383 to mention that North-West should be changed to North-South (see page 302).

The formulae on these pages are included in separate section in Chapter 7, together with a list of symbols, abbreviations, and many tables which serve as a finishing touch to this chapter, full of practical information. The presentation of the derivation of the formulae is a little over-simplified, step by step, with all decimals and a new line for each step, plus a complete list of all the 15 degrees hour angles on every page. It is one way of filling a chapter.

Chapter 8 comprises an illustrated glossary, followed by a bibliography with sources and an extensive index titled "Indice". Alas it is not an alphabetical index which is so necessary in a work of this size.

There are no colour illustrations, which I do not mind so much but it is a pity that the reproductions of the many black and white photographs are not very good, aggravated by the small dimensions. Some are the size of a large postage stamp and most are smaller than 6 x 9 cm, so that it is not easy to detect if something is printed laterally reversed, such as the rear of the Volpaia nocturnal in fig. 6-122. This seems to have been taken from the catalogue of *De Tijdmeting* (Exhibition - La Mesure de Temps, Brussels 1984), the description by Jan de Graeve has been reprinted almost literally and - a real pity, especially for an Italian book - no mention has been made of what was published in *De Zonnewyzerkring* 36.3 and 37.1.28: a, the nocturnal has an extra disk for the Italian hours, b, the small altitude measuring quadrant shows Italian hours!

Italian time however is the subject of an extensive description (better than in the previous book about South Tyrol, which made no reference to these hours at all). Not only are there sundials with Italian hour-lines, but this matter is also treated with historic references, for instance about edicts for the time that Piedmont was French territory. There are also old tables wherein, for the latitude of Turin, the Italian time is given at 12 o'clcok noon "French time".

There are minor errors such as on page 396 where fig. 7.26 shows "2 Dic" at point 2 instead of "12 Febr." and on page 397 "delta" is printed after "latitudine".

On page 360 I found one illustration, fig. 7-Vlb, the most elegant church sundial in the Netherlands, ie. the Oosthuizen example. The beautifully sawn out stylus which gives such a marvellous shadow pattern is not shown at its best in this picture. The ingeniously carved woodwork makes all lines and figures stand out in bas-relief on the dial. But the real rarity of this west dial is in the fact that there are two coordinate systems on the same dial; the equatorial with hour lines and declination curves, and the horizon system with azimuth lines and altitude curves, all painted in beautiful colours. The caption only states there is a threefold pattern. The illustration forms part of a treatise on the use of various materials, and this one from "Olanda", [Holland] shows the dial rests against the wall on a "supporto". Does this imply a console? for there is no console and the dial frame rests only on two bolts. At the top of page 349, under the heading "Quadranti indicanti Azimut e Altezza di Sole", not only should the modern example at Greenwich be mentioned, but also the Oosthuizen sundial. (The example at Greenwich is by Przypkowksi - see also pages 139, 140).

When reading this book one sometimes gains the impression that the authors wrote sections on the same subject without mutual consultation when some coordination would have been advisable. In three places there are short remarks about the large sundial of Hurstmonceux Observatory, designed by Gordon Taylor but nowhere is his name mentioned, no more than his article "Equiangular sundials" in *the Journal of the British Astronomical Association* 1975, 86, 1. On page 312

of the present book is a small drawing of this circular sundial, the caption of fig. 6-65 stating (if I am not mistaken) that the hour ring lies in the plane of the equator. But this is not so! The ring has the same inclination as the equatorial plane but inclines the other way and is a mirror-image of that plane. The explanation of these hybrid sundials is very summary, as is the treatment of other analemmatic dials, such as the ones by Parent, Foster and Lambert. And what I find lacking in these three different descriptions is the fact that none mentions the others, and these are not to be found in an index because none is provided. So one is fortunate to meet with a subject three times, and any connection is lacking.

Another example of the same subject in three different places without connecting comment is the noon-meridian of Rome in the church of Santa Maria degli Angeli, the meridian of Bianchine or Linea Clementina, which I happen to know quite well and which is treated in *Bulletin 89,2,16* [*De Zonnewyzerkring*]. Illustrations of it are given on pages 121-3, and also 258, 290, 326-327 and 362. There is no mention on page 121 of the other illustrations. From this I learnt the beautiful intarsia zodiac figures were carried out by Carlo Maratta.

The unit of length employed here, 20.3cm, is called the Tacca, and the number of Tacche corresponds with the values of the tangents, which I should have seen for myself except there is no mention of the term Tacca in Blanchini's book. This unit is present as a brass strip set in the marble floor. The table given on page 122 gives the tacche in decimals, eg 89.7 at the Equinox, but which gives an erroneous picture since there are only whole numbers set in the floor, with no decimal fractions. (In the table the value 911 is given at the bottom which should be 219, in the last column is one "Equinox" too many). Bianchini, on the other hand, gives much more exact values in his book; on page 34 for instance he writes these distances for 23 September 1702 at noon (3.75 hours before the Equinox) for the oval light spot: with penumbra 90420 and 88700, without penumbra 90370 and 88750, and these values may be used to calculate the zenith distance and also the declination 0°3′15″ Bor, at a distance of 29°51′50″ Virgo. It is stated that the northerly gnomon aperture (for the Polar star) was, alas, closed at the time of the renovation by Vanvetelli in 1749.

In fig, 23-20f are two Polish medallions of September 12, but details are not given. The next illustration, fig. 3-20g, shows ellipses which, for a period of 800 years gives the distance of the Pole Star to the Zenith at intervals of 25 years, but the caption states "con le posizioni millenarie ...". Does this mean there is a change every millenium? The same illustration is shown on page 362, 7-IX, without comment, merely to show the intarsia. Many illustrations are shown more than once as examples to show different points, but never with references leading the reader from one to any of the others.

On page 258 is the same meridian with the delimitation of the light spot, as it should be at the Equinox at noon on March 21. The words TERMINUS PASCHAE are written at the date of March 22. Therefore the text is not correct when it states the ellipse of March 21 indicates the Easter limit. Why too does the author not tell us that there is a second Easter limit at April 25, which may be found on page 326, fig. 6-88 with a short description on page 327.

Lack of space forces me to come to a halt. Notwithstanding some shortcomings, this is a very valuable book, in respect of which we offer the three authors our heartfelt compliments.

M. J. Hagen,
Translated by M. Hugenholtz

EDITOR'S NOTE:

Dr Hagen was the founder of the Netherlands Sundial Group in 1978 which has been so successful and which has published a great deal of useful information in its bulletin *De Zonnewyzerkring,* referred to in his review above. He has pointed out errors in the text of the book which the Editor of this *Bulletin* deemed inexpedient to mention in his own recent review published in *Antiquarian Horology,* Volume 18, No. 4, Winter 1989 issue; although Dr Hagen does corroborate many of the points made in that review. What it amounts to is that there are three separate accounts included which have not been drawn together by one versed in gnomonics before it was printed in its final form, since many of the errors would have been spotted by even a casual reader providing he was familiar with the Italian language. These slight errors and lack of cross-reference detract considerably from the value of the book as a reference work, and the non-inclusion of colour plates is inexcusable in a book of such size and cost, since colour plays such an important role in the attractiveness of sundials as an art form. Nevertheless the book is an important publication and should be in the library of anyone interested in gnomonics. A further note by Dr. Hagen lists a number of other errors, not included here because of pressure upon space.

BOOK REVIEW

Catalogue de l'horlogerie et instruments de précision [*du début du XVI- au milieu du XVII- siècle*] (Catalogue of clocks and precision instruments from the beginning of the XVI century to the middle of the XVII century). By Adolphe Chapiro, Chantal Meslin-Perrier, and Anthony Turner. Published by the Musée National de la Renaissance, Château d'Ecouen, Paris, 1989. Case bound with coloured book jacket, Price £35.

The first 84 pages of this book deals with clocks and watches, and upon which no comment will be made here. Page 85 is blank and for diallists the book commences on page 86 with section 2 - Cadrans solaires et nocturlabe. As this ends at page 103 after describing 12 dials and 1 nocturlabe, the title seems to promise more than the contents. In fact the book is a catalogue of the items, to be found under the above listing, conserved in the Château d'Ecouen musem, and not a general catalogue as might be misconstrued from a glance at the title. An excellent colour illustration of a chalice sundial is given on page 86, with a brief description given on pages 94/5.

The dials described are as follows:

1. Equinoctial dial in the form of a reliquary cross, Adrien Zeelst, 1573.

2. Universal horizontal sundial with string gnomon, Ultrich Schniep, 1582.
3. Ivory dyptich sundial, Hans Tröschel, Nuremberg, 1592.
4. Horizontal sundial in the form of a watch case bowl, Cherubino Sandolino, Italy, 1597.
5. Universal horizontal sundial with string gnomon, Alexius Schniep, Vienna, 16th century.
6. Combined equinoctial and horizontal sundial, anonymous, Flanders.
7. Chalice dial, previously mentioned, anonymous, German, end of XVI century.
8. Horizontal sundial in the form of a cross with string gnomon, anonymous, German, XVII century, gilt brass and ivory.
9. Multiple sundial, Pierre du Jardin, Paris, 1627.
10. Polychrome, ivory and gilt brass dyptich sundial, Hans Troschel the younger, Nuremberg, 1627.
11. Astronomical nécessaire, Casper Buschmann, Augsburg, 1628.
12. Horizontal sundial of octagonal form, with string gnomon, Pierre Norry, Gisors, 1644.
13. Sundial combined with nocturlabe, anonymous, French or German, gilt brass. [The dial has a very heavy appearance and has a Teutonic look.]

The next section has 9 pages devoted to astrolabes.

The outlines are brief, being catalogue descriptions of the items only. The single colour illustration is excellent, the black and white illustrations, as in all offset litho reproduction, lack contrast and clarity. For those whose interest lies solely in the sundial section, the book seems far too expensive for the contents, so the individual member must make up his/her own mind. This is particularly so as the text is in French alone, with no English captions. It might have been preferable to have had a soft cover version at a lower price since this type of book does not suffer a great deal of use normally, being used for occasional reference only. For those who have visited the collection, it forms a useful, if expensive, record of the horological contents. Since Anthony Turner is one of the book collaborators, one might have thought that brief notes in English would not have been too much to expect. If a book is to reach the international market, English translations are essential.

22nd February 1990

SOME DIALLING LITERATURE

The 19-page Index to the dialling contents of the complete run of the journal *Antiquarian Horology* has now been printed in the same manner as for the earlier *Bulletins*. Although there are few major articles on sundials to be found in this journal, especially in the earlier issues, the index is a useful addition to researchers. Many of the minor items listed will not be found in the indexes provided (some of which are pathetically inept) with the volumes of *Antiquarian Horology,* and these items require a great deal of effort to locate them by a page by page search. The index is available to members of the British Sundial Society at the cost price of photocopying and postage, £1.50 in card covers. The price to non-members is £2.50. Members' orders, quoting membership number, to Charles K Aked, 54 Swan Road, West Drayton, Middlesex UB7 7JZ. All other orders to be sent to the horological booksellers quoted in *Bulletin* 89.1. Please note that only 100 copies were printed.

There are a very few copies left of the four page booklet "The Sundials of Oxford Colleges" produced by Charles K Aked for the British Sundial Society Conference held at Oxford. It features all the sundials visited on the tour of 24th March 1990. A copy may be obtained from the Treasurer, Mr David Young, 112 Whitehall Road, Chingford, Essex E4 6DW, price £1.00 which includes postage and packing. This is not available from booksellers as there are so few left.

Mr P I Drinkwater has transcribed Book I of Oronce Finé's work *De Solaribus Horologiis* of 1560 from the original Latin into English, and it is now available as *A first Book of Solar Horology.* It is viii + 32 pages and contains all the original diagrams, some of which have been corrected by Mr Drinkwater for the first time in 430 years! There is a short biography of Oronce Finé by Charles K Aked. Orders to Mr Drinkwater at 56 Church Street, Shipston-on-Stour, Warwickshire; or to Charles K Aked. The price is £3.50, postage and packing free. It is essential work for every diallist's library although only of use as an example of the early dialling literature. Again a strictly limited edition which will not be reprinted. The other books in Finé's work may be published later.

The Chairman's book *The Ancient Sundials of Scotland* has just been published by Rogers Turner Books Ltd.

The first issue of *The Clockmaker* contains an article "Making Sundials" giving constructional details for a garden horizontal dial and also a very basic equatorial sundial (pages 23-24). It is only for absolute beginners but it does go into detail about setting out the horizontal dial. Price £1.95 ($4.00). Available from TEE Publishing, Edwards Centre, Regent Street, Hinckley, Leics., LE10 0BB.

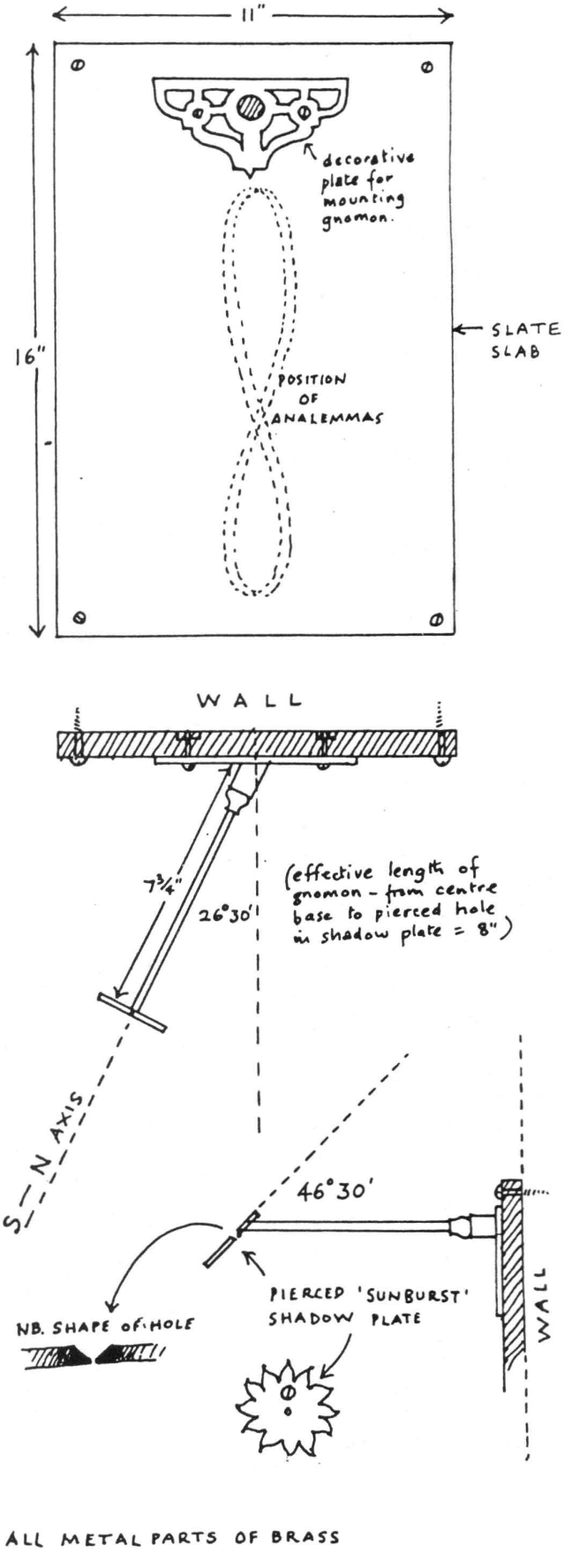
A DOUBLE ANALEMMATIC NOON MARK
by an empirical method

To calculate a dial, of whatever sort, then subsequently to observe the accuracy of one's calculations is one thing, but to mark out a dial by direct solar observation is another. The former method requires mathematical knowledge, ability as a draughtsman, and some constructional skill; the latter also requires constructional skill but also persistent attention over a long time and a degree of patience and fortitude, and it can only be done when the final dial incorporates the annual solar variation of the equation of time.

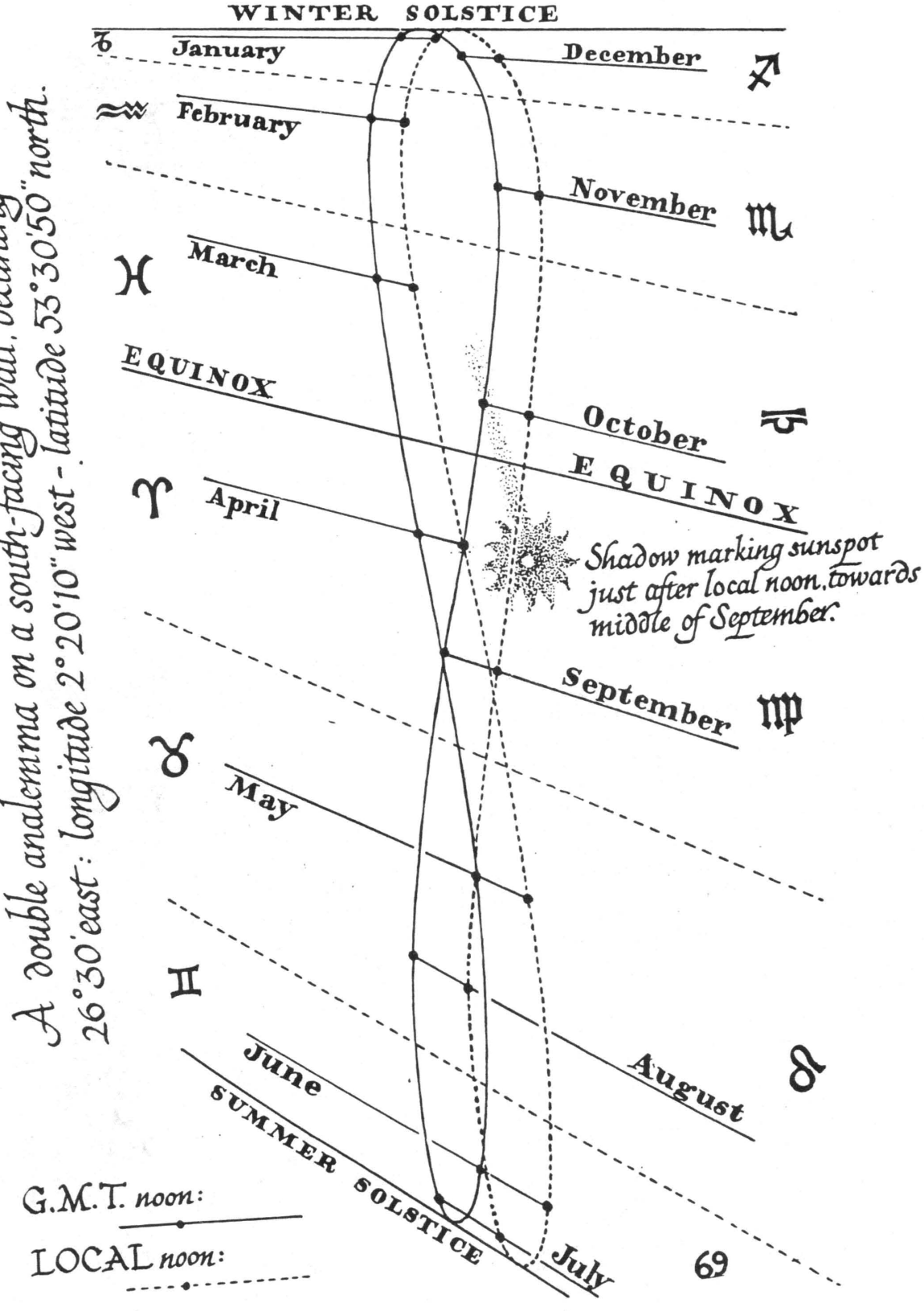
In the spring of 1986 I decided to set up a NOON MARK on the rear wall of my house (south-facing, declining 26° 30° east). A more or less evenly surfaced piece of slate 11 x 16in (280mm x 406mm) was screwed, in vertical format, to the wall at a height of about 7 feet, and a carefully engineered rod gnomon 8in (203mm) long attached, projecting horizontally from the centre of the top panel edge in line with the North-South meridian. At the top of the gnomon, a pierced 'sunburst' plate was fitted, tilted at an angle to provide the best average projection of the sun 'spot' through its hole, between the upper position of the winter solstice mark on the dial and the lower summer position. Although the gnomon could have been placed near the west edge of the dial instead of in the middle, its North-South orientation meant that the projected analemmas would appear in the centre of the dial, giving a pleasing symmetry on the East declining wall, its symmetry enhanced by some formal ornament of the bracket supporting the gnomon.

Daily, from April 1986 to April 1987, the position of the sunspot on the dial was plotted, exactly at noon, whenever conditions allowed. A log was kept of these observations, and it is remarkable that over a period of 365 days, the sun was shining **at noon** on 112 of those days (average of 1 in 3), even in the Manchester area where rainfall and clouds are not unknown, and also allowing for a number of days when observations were impossible because I was away from home. The marking out was done in fine wax crayon which would not wash off in the rain. Sometimes ten days or a fortnight would pass without an observation, to be followed by several days of uninterrupted sunshine (more or less!), though the number of times a patch of cloud would obstruct the sun exactly at noon was enough to try the patience of Job! Beginnings and ends of months were plotted, Zodiacal limits marked, the equinox and soltices clearly shown, and as the double, partly overlapping analemmas grew, the lines between the plotted points were smoothly joined with careful judgement in the lacunae.

Now, two years later, I have engraved the analemmas to make them permanent, and coloured them yellow for Greenwich Mean Time, red for local noon, to increase the clarity of the dial. The months, Zodiacal signs, equinox and solstices have been lettered in, and short brass pins mark the divisions between the months. A simple title **G.M.T. NOON/LOCAL NOON** (yellow and red respectively) explains the purpose of the dial. The double, overlapping analemmatic curves trace an attractive design and give visual indication of the progress of each day and the progression of the year.



Professor Alan Smith, Manchester,


WINTER SOLSTICE
January
December
February
November
March
EQUINOX
October
EQUINOX
April
Shadow marking sunspot just after local noon, towards middle of September.
September
May
August
June
SUMMER SOLSTICE
July
69
A double analemma on a south-facing wall, declining 26°30' east: longitude 2°20'10" west - latitude 53°30'50" north.
G.M.T. noon:
LOCAL noon:

WOOD'S CURIOSITIES OF CLOCKS AND WATCHES (1866)

With a title such as the above it is not to be expected that too much would be included in the way of sundials. However, commencing on page 5, before writing briefly on the mention of the sundial in the Bible, there is a short discussion which outlines the difficulties of the researcher when studying manuscripts written in the critical period of the introduction of the mechanical clock:

The general name of every instrument that in any way measured the motion of time was anciently horologium, and this name was used whether it referred to a sundial, clepsydra, sandglass or clock. (In fact the sand glass, which should be called a time-glass, seems to have appeared after the mechanical clock was invented about 1270). The etymon of the word clock is variously stated; thus we have the following:- Saxon, clugga, clucga; German, klocke; Armoric, cloch or clech; Irish, clog; Welsh, cloc; Belgic and Danish, kloke; Teutonic, glocke; French, cloche; Latin, glocio; Chinese, glog. It originally meant only a bell for striking a sound, and that signification it still retains in the French language. Clocks, even at so late a period as the reign of King James I, were often called horologes. Up to the fourteenth century the word clock was applied only to the bell which rung out the hour, or certain periods, determined by the sundial or sandglass (Chartres Cathedral the former, Barcelona and Perpignan the latter, for example). One writer says that there does not seem to be any passage which alludes to a clock (mechanical) by that name earlier than the thirteenth year of the reign of Henry VIII; but this is a mistake, for Dr Reginald Pecock, sometime Bishop of Chichester, in his work 'The Repressor of over-much Blaming of the Clergy,' written about 1449; distinctly mentions a clock. As an evidence of the truth of an argument based upon the fact that express mention is not made in Scripture of many things which are lawfully used in the service of God, he says: In al Holi Scripture it is not expressid bi bidding, counseiling, or witnessing, or bi eni ensaumbling of person ... that men schulde make and vse clockis forto knowe the houris of the dai and nygt; for thou in eeldist daies, and thou in Scripture mensioun is maad of orologis, schewing the houris of the dai and nygt bi schadew maad bi the sunne in a cercle, certis neuere saue in late daies was eny clock telling the houris of the dai and nygt by peise (weight) and bi stroke, and open it that nouwhere in Holi Scripture is expresse mensioun mad of eny suche". Lydgate, who was born about 1375 and died about 1461, says in his prologue to the 'Storye of Thebes', "I will myself be your orlogere tomorrow early". The bell of Wells Cathedral is to this day called the horologe.

One of the earliest means of marking the hours was the gnomon, or sundial, which was originally no more than a column that raised above the earth towards the sun, offered a substance, which by casting a shadow of varying position and length, denoted the various times of day. The earliest mention of sundial is in the second book of Kings, chapter xx, verse 11, "And Isaiah the prophet cried unto the Lord; and he brought the shadow ten degrees backward, by which it had gone down in the dial of Ahaz". The word dial is the same as that translated as degrees in the same verse; therefore this record must be received with caution, particularly because Ahaz was king of Judah from the year 741 to 725 B.C., and the invention of the sundial is generally attributed to Anaximander, about two hundred years later than this time.

From here Wood goes on to treat of clepsydrae which, of course, were originally devised to complement the sundial with its lack of indication in bad weather and during the night hours. Thus the water clock was termed *horologium hibernum* or winter clock; or *horolgium noturnum* - night clock, to distinguish these from sundials. Moving on to page 84 of his work, Wood quotes some of the passages from Shakespeare. These unfortunately have become trite as a result of being quoted so often and are included here merely to illustrate Wood's treatment in respect of dials.

As You Like It, Act III, Scene 7;
Jaques:
And then he drew a dial from his poke;
And, looking on it with lack-lustre eye,
Says, very wisely, 'It is ten-o'clock'.
And I did laugh, sans intermission, (without stopping)
An hour by his dial.

Wood unnecessarily mentions "This was probably a pocket sundial, which was an article not uncommon at the time when the play was written", he should have stated a portable sundial since pockets were not fitted to clothing then.

Henry IV, Act V, Scene 2;
Hotspur:
O! gentlemen, the time of life is short:
To spend that shortness basely were too long,
If life did ride upon a dial's point,
Still ending at the arrival of an hour.

Henry V, Act I, Scene 2:
Archbishop of Canterbury:
As many lines close in the dial's centre;
So many a thousand actions, once afoot,
End in one purpose.

Henry VI, Part III, Act II, Scene 5:
King Henry:
O God! methinks it were a happy life
To be no better than a homely swain; (a country youth)
To sit upon a hill, as I do now,
To carve out dials quaintly, point by point,
Thereby to see the minutes how they run ...

On page 302 is: "An oval silver watch by Dupont, à Castres, with engraved side, of birds and squirrels; engraved dial-plate with indexes to show the hour, days of the week and month, age of the moon, and constellation; inside the cover is fitted a sundial, with box for a compass". The compass was primarily for orientating the sundial but was useful to a traveller also. Dupont was working around 1650 and this watch was sold in the Bernal sale of 1855. Another entry is: "An oval by watch made by G Bernard, with open gilt-metal sides, silver back and front; inside the cover is a sundial without the gnomon; the dial-plate is engraved with cherub, birds, and dogs, and has a silver ring with numerals". This is probably Bénard of Paris, c.1600; there are two watches with sundials in the Metropolitan Museum of Art, New York, by F Bénard c.1600, and J Bénard c.1611, both of Paris. An oval watch with sundial by J Bénard is in the British Museum.

WORLD SUNDIAL DATA BANK

It is the intention of the Editor to publish details of sundials from various parts of the world so those with computer programming facilities may be able to collate these into one world listing. The following details have been edited by Mr Lajos Bartha from information compiled and reported by (1) Dipl.-Ing. Karl Schwarzinger, of Sistrane, Burgenland, Austria; and (2) Studienrat Arnold Zenkert of Potsdam, German Democratic Republic.

1. FIXED SUNDIALS IN AUSTRIA (Data to 28 Dec 1989)

DISTRICT	TOTAL	HIS	MOD	U/K	PHOTO
Burgenland	29	16	13	-	27
Kärnten	167	113	52	2	160
Niederösterreich	442	219	221	2	436
Oberöstrerreich	188	111	74	3	179
Salzburg	97	36	52	9	88
Steiermark	284	160	121	3	190
Tirol	410	215	191	4	398
Vorarlberg	45	17	28	-	43
Wien City (Vienna)	19	8	11	-	18
Grand Totals	1681	895	763	23	1541
South Tyrol in Italy	471	353	96	22	174

Key: HIS = Historical sundials/ before 1900; MOD = Modern sundials from 1901 to present; U/K = unknown date; PHOTO = Slides and prints.

(Before World War I South Tyrol was part of the Hapsburg Empire under the Austrian-Hungarian Monarchy).

2. FIXED SUNDIALS IN THE GERMAN DEMOCRATIC REPUBLIC (Data to 31 Dec 1989)

DISTRICT	TOTAL	SPEC	HIS	MED	VERT	EQU	ERR
Bezirk/Dresden	265	-	105	-	200	-	-
Rostock/Northern GDR	51	-	51	-	-	-	-
Neubrandenburg/NE GDR	35	-	35	-	-	-	-
Grand Totals	1374	22	541	124	892	194	109

Key: SPEC = Specially important sundial; HIS = Historical sundials/before 1900; MED = Medieval sundials; VERT = Vertical dial; EQU = Equatorial construction; ERR = erroneous construction. No mention of slides and prints. (Note: In the first line of 2, some dials are both historical and vertical, hence the total is not the sum of HIS and VERT).

Overseas members are invited to send in information about the sundials in their area/country. Some counties have been well documented, others have little listed information. The listing in the British Isles is patchy although there are extensive lists of scratch dials, and there is the work of Mrs Gatty in respect of the other types. There are quite a number of very well designed modern sundials in England and other parts of the British Isles, and whilst described in scattered articles, will not be gathered into a single listing until the British Sundial Society has collated the information received from participating members in the National Recording Scheme and placed this in a computer listing which is IBM compatible to allow easy exchange of data.

NOTES: