BAA

I & I News

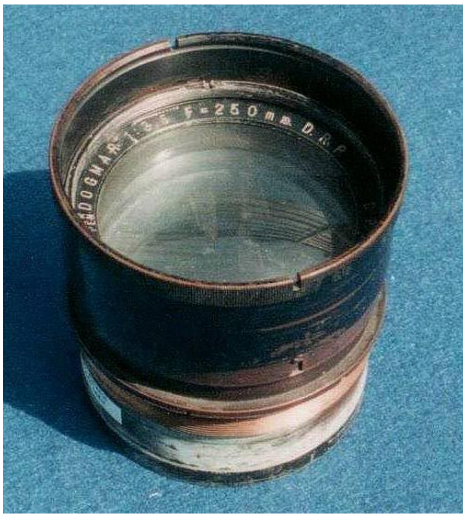
New Series No. 2 | Newsletter of the Instruments and Imaging Section | 27 October 2011

On 26 September the first number of the New Series of *I&I News* was sent to around 1,700 Members. Within 24 hours I received dozens of messages, and numerous e-mails arrived daily over the ensuing two weeks and more. The response to the first number of *Technical Tips*, resulting from an appeal for help concerning webcam drivers, was the same, and since the issue of these two publications I have received messages – and in several cases, articles and photographs – from Members in England, Wales, Scotland, Ireland, The Netherlands, France, Spain, Portugal, Italy, Bangladesh, Malaysia, Australia, New Zealand, Canada, and the USA. I thank all of you for your support. I have attempted to keep pace with correspondence, and I apologise to those of you to whom I have not yet replied personally.

These publications will be issued at irregular intervals, dependent on the availability of contributions, although several articles have been commissioned and others have been promised. As is well known by any publisher of periodicals, continuation is reliant on a constant supply of material.

This issue of *I&I News* includes articles on telescope-making, visual observing, simple imaging, spectroscopy, an instrument that was in use 800 years before the invention of the telescope, and a vintage item describing the fine art of micrometer-webbing. The first contribution, however, is by the Director of the Lunar Section – who also happens to be your new President.

Bob Marriott, *Director*



The 250-mm focus f/3.5 Dogmar lens by Goerz used by Edward H. Collinson for his pioneering work in meteor photography during the 1920s.

Lunar, planetary, and solar observing

Bill Leatherbarrow

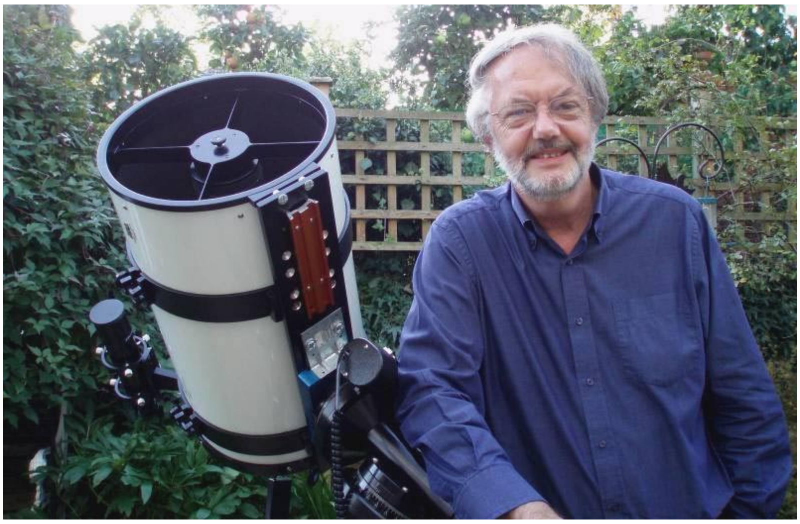
Since I first started in astronomy, all my observing has been done from urban, and therefore light-polluted, sites. That was a major factor (though not the only one) in my decision to concentrate on lunar and planetary observation. My observational work nowadays is concentrated on the study of the Moon, and specifically on the systematic examination of specific types of lunar formation under all angles of illumination. I also regularly observe the brighter planets and contribute to the work of the planetary Observing Sections. Although I still enjoy visual observation, I increasingly rely upon the higher resolution afforded by CCD imaging.

My main telescopes are a Celestron C9.25 SCT and a 12-inch Orion Optics Maksutov–Cassegrain. The latter incorporates a sub-aperture corrector in an open tube, which permits rapid cool-down of the system and largely avoids the problem of dewing of optical surfaces. The telescope has a fixed primary mirror, and the secondary is held in place by a rigid spider assembly, so that collimation rarely shifts. It is mounted on a Losmandy G-11 German equatorial.

For imaging I use an Imaging Source DMK21 mono camera. In addition, I use a Solarscope SV50 telescope for Hα imaging, and contribute the results to the Solar Section.

My observing site is not ideal, and in order to gain maximum sky coverage I need to use the telescopes in both front and back gardens – so the luxury of a permanent observatory is not for me!

Sheffield w.leatherbarrow1@btinternet.com



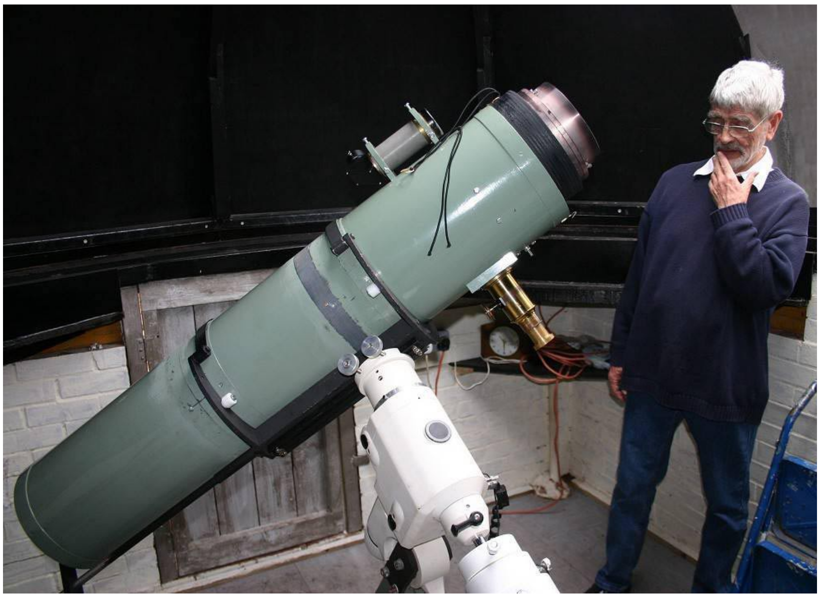
Some home-made telescopes

Len Clucas

The 8-inch f/6 reflector

It must have been 1944, when I was six years old, that some event in the sky (other than aerial warfare) was mentioned on the wireless. I asked my father if there were other worlds, and he had heard of Mars and Jupiter. That set me off – just the romantic sound of the names. Soon I was reading everything available about astronomy, and enjoying the pitch blackness of wartime skies over Newcastle to figure out the constellations. At about the age of ten I discovered that we lived only 1½ miles from the works of Sir Howard Grubb Parsons (the official and full name at that time), so I hurried round to look at the place. After I passed the 11-plus examination and went to a new school, the bus took me past the very doors of Grubb's four times a day, so I could often see, when the doors were open, progress on the latest instrument.

When in my last months at school the metalwork master suggested that as I was so interested in astronomy I should go to Grubb's and ask for an apprenticeship, I did so, and started there in September 1953. My first real telescope – an 8-inch f/8 – was made there. The mirror I ground and polished at home, and final figuring and testing was carried out at Grubb's. The metalwork I made at Grubb's and at home in the late 1960s. I acquired jointly, with my lifetime friend Martin McLelland, an 11-inch f/6 mirror by



The 6-inch f/15 folded refractor

The 12-inch f/5.5 reflector

David Sinden. I designed the telescope, and Martin made most of the metalwork – a fork and A-frame. Martin used it on and off for forty years, and in 2007 I converted the mount into an astrographic.

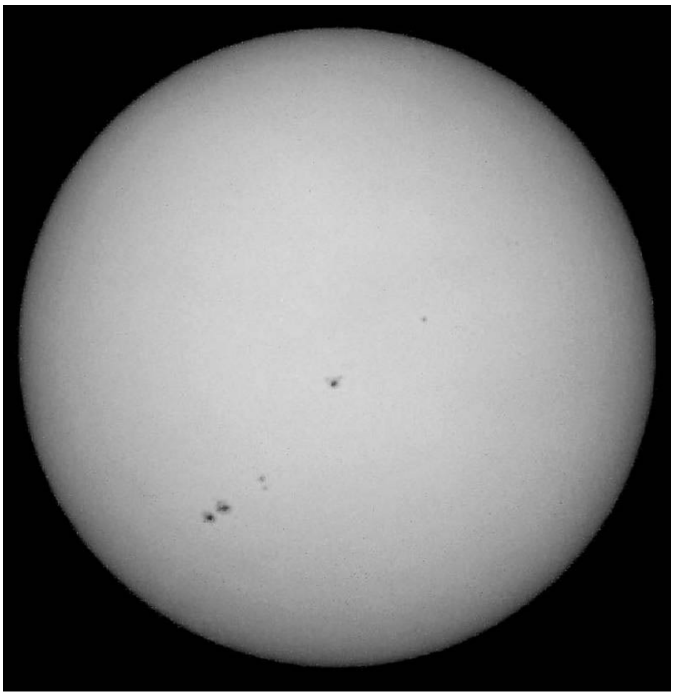
From the mid-1970s, for twenty-five years I made very little in the way of telescopes. When I started again, David Sinden – who had been Chief Optician at Grubb's for many years – had his optical works in Blaydon, and I used to call in each time I visited family in Newcastle (I then lived in York). From him I bought a 5¼-inch f/17 OG and a quartz flat, and made a folded refractor. I had seen a sketch, in H. C. King's *The History of the Telescope*, of Captain Ainslie's instrument, and I was very impressed with the result. The folded refractor was so good that I later bought a 6-inch f/15 OG from D&G Optics in America, with a 4-inch Zerodur flat from David. I am still using this instrument (above).

In 1996 David made me a 12-inch f/5.5 mirror which I incorporated in a complete telescope of the astrographic form (right), and I have used it for ten years. In the meantime I constructed an 8-inch f/6 Newtonian (top) with a front 9-inch-diameter plate to enclose the tube. Tube currents in this design are reduced, and this is evident in the performance.

The use of a big Newtonian on an EQ6 mount produces a problem of weight. By using a corrugated plastic drainage tube of 12-inch internal diameter I have been able to construct a 10-inch f/5.4 for use as a ‘goto’. The EQ6 is a nice mount; but on a tripod or post, the bottom of the telescope, if it is of reasonable length, fouls, so I have placed it in astrographic mode, as per the Bruce telescope.

I built my observatory in 2005. The ribs are band-sawed from 6 x 2-inch pine, in sections, lap-jointed and dowelled. The skin is marine ply (though not so marine), covered in 12-inch-wide flashband. The shutter hinges away from the dome. For my next project I have captured, by pure serendipity, a 16-inch mirror and flat from an old Dobsonian. These will be used with the mount currently occupied by the 12-inch.

Wooler, Northumberland len.clucas2@tiscali.co.uk



Low-tech imaging

John Wall

The accompanying image of the Sun was produced with a non-achromatic telescope that cost less than £100 to build, an appropriate solar filter, a Nikon Coolpix digital camera clamped behind a 50-mm Plossl eyepiece, and a little massaging with Adobe Photoshop, demonstrating what can be achieved with simple low-tech equipment.

Coventry wallporritt@madasafish.com

Seventy-five years of visual observing

Albert Jones

The 5-inch f/15 Calver reflector

As a child I was fascinated by the night sky, and later, around the end of the Depression of the 1930s, I left school and, free from swotting, found time for reading about astronomy. My first telescopes were made with simple lenses and cardboard tubes, and although they were crude they fostered my interest. My first proper telescope was a pre-owned 5-inch f/15 Calver reflector, with which I started serious observing of variable stars and comets, and it was with this instrument that I made my first estimates of Nova Puppis 1942 on 18 January 1943, and also recovered Comet Kopff at that apparition. Aperture fever led me to purchase an old 5.5-inch refractor, with which I found my first comet (1946h). Then I purchased an 8-inch mirror, and made a telescope with that. When I started observing for the Variable Star Section of the New Zealand Astronomical Society (later the Royal Astronomical Society of New Zealand), Frank Bateson told me that the New South Wales Branch of the BAA published the observations of their Variable Star Section, so I joined the Branch and also the parent body.

Wanting to be able to see fainter stars, I thought of buying a larger mirror of short focus for wide fields, but the question was where could I obtain an f/5 mirror. Very fortunate for me was that I was in contact by airmail with Dr Leslie Comrie, who had been born in New Zealand and who had made a name for himself in the UK in applied mathematics (especially in astronomy). He also gifted astronomy books to the Carter Observatory and to promising amateurs in New Zealand. I therefore wrote to him, asking about mirrors, and he replied that his friend James Hargreaves was a celebrated maker of short-focus mirrors, and that he had on hand a 12.5-inch blank of Hysil glass with which he could make an f/5 mirror. Dr Comrie offered to bring it to New Zealand, along with his luggage, when he came to visit family later in 1947, and for me to pay him then. After he arrived in New Zealand, the box was sent on to me in Timaru in January 1948. I then sent the £75 to Dr Comrie's account in the Auckland Trading Company – and with that money he sent food parcels to friends in England who had not had certain items during World War II. That arrangement had various advantages. Not only did it save me the hassle of applying in triplicate for an import license, and also for permission to send money overseas and arranging transport of the mirror from England, but recipients of Dr Comrie's parcels received longed-for foods.

I thought of calling the telescope Les, after Leslie Comrie; but he suggested the name Betty, after his wife, as she too had a perfect figure. Instead, I named it Lesbet, after both of them. Meanwhile, I designed the telescope and mounting ready for the optics. Having been infected with the aperture-fever virus I was anxious to be able to see fainter variables and comets, but a friend advised me not to rush the construction of the telescope otherwise I may never really finish the job.

With Lesbet

Around that time, Frank Bateson was Director of the Jupiter Section as well as of the Variable Star Section of the RASNZ, and he urged me to make observations of Jupiter as well as variable stars; so the mounting was designed as an equatorial, with the intention of adding a motor drive in RA later. As I was already proficient at 'star-hopping' I did not need setting circles, because I already had available some war-surplus lenses with which I made up a 45-cm wide-angle finder for star-hopping and for observations of bright variables and comets. A larger object-glass of 78 mm was made into a bigger finder, which bridged the gap between the small finder and the 12.5-inch reflector. However, as soon as possible I did reach the stage where it was useable, and I then made a few alterations and improvements. After a while I found that I liked estimating the brightness of variable stars more than I liked observing Jupiter. Eventually, I concentrated on the former and so did not need the motor drive, and that project was never completed. You might therefore agree with the friend who advised me not to hurry the making of the telescope, because I never completed it.

I have said that it was made to look *through*, not to look *at*, and from February 1948 until May

2010 it enabled me to estimate the brightnesses of many variable stars and comets, as well as discovering one supernova and one comet (the first comet was found while star-hopping with the 5.5-inch refractor). In addition, I have had the fun of recovering some recurrent novae.

Sadly, my collaboration with Lesbet was halted in May 2010 when I broke my hip, and although I largely recovered from that and the stroke of 15 months earlier, I was worried that Lesbet would be too heavy and awkward for me to manage. Then, out of the blue came an e-mail from Alan Gilmore and Pam Kilmartin, of Mount John Observatory, inquiring if a lightweight modern Dobsonian might be easier for me to handle. Of course, I agreed, though not initially realizing that they were offering me one. My thoughts of the future of Lesbet were that only the optics were worth keeping and the remainder was merely junk. Alan, however, suggested offering it to the Nelson Provincial Museum, and in April 2011 it was taken to the archives storage building at Isel Park, Stoke, Nelson. I have gratefully accepted the Dobsonian as a loan while I can make good use of it.

From pencils to PCs

Over 60 years ago, when I started variable-star observing, after making an estimate I would enter in the log-book the name of the star, the time, and the estimate. Later, the Julian Date and decimal of the day would be added. Then the observations would be copied onto separate sheets for each star. At the end of the month the results were copied onto report

forms and posted to Frank Bateson, the Director of the New Zealand Astronomical Society's Variable Star Section that he formed away back in 1927. As I became more proficient in locating variable-star fields and making estimates of the magnitudes, on request to Frank he would supply me with more and more charts. When the number of stars under observation became much greater, the separate sheets for each star were dispensed with, and at the end of the month the estimates were taken from the log-book directly to the report forms so that the estimates of each star were together in chronological order. Then I started on the next star, then the next one, until all the observations had been sorted and written on reports forms – all written by hand, copies for my own archives being made using carbon paper. To do all the stars took days of turning pages of the log-book to find the next observation of each star.

After the RASNZ Conference in 1993, Gordon Hudson told me that a computer would be most useful for entering and retrieving data, so he urged me to apply for a K-T Grant to obtain one. It arrived in mid-March 1994, and with Ranald McIntosh's VSSOBS software installed, that started me on a steep learning curve to (a) learn how to use a computer, and (b) learn how to enter and retrieve data. As I was already a 'hunt and peck' typist with over 40 years' experience, all I had to do was learn the extra buttons on the keyboard – so that was one hurdle I did not need to surmount, though the other was getting the hang of the unfamiliar VSSOBS and other programmes.

For the first few days I thought the old way of handling the data was better, but soon I was becoming faster at entering data, and by the end of the month, all March estimates had been entered in the order that they had been written in the log-book. There was no longer a need to work out the Julian Date and decimal of the day, as Ranald's software took care of that automatically. In addition, the software had a facility for sorting the observations so that those for each star were together. So I followed instructions, the PC whirred and indicated 'Please Wait' for a few seconds, and then stopped. Surely the sorting cannot have been done in that short time? On checking I found that all was well, and

the estimates of each star had been collated in chronological order. Amazing! I was so pleasantly surprised.

To forward the data it was a simple matter of saving the data on a floppy disk and posting the disk to Ranald McIntosh, who had taken on the task of collecting observations on his computer. Meanwhile, besides forwarding observation to the Variable Star Section of the RASNZ, I was sending selected stars to overseas astronomers who requested data from me – mostly stars not on the VSS programme but which I had started observing for my own interests. Two years later I was urged to get connected to e-mail and the Internet. Grant Christie provided a modem, so from then on it was a simple matter of sending data away by e-mail – sometimes receiving thank-you messages the same day. One time after I had sent a monthly report to an astronomer in Mexico, he replied immediately, saying: 'Thank you for the data that you sent tomorrow.'

When Ranald McIntosh assumed the task of entering incoming observations in the VSS database, that must have taken a huge load off Frank Bateson's shoulders, and also the forwarding of data to the astronomers who contacted Frank and requested data.

Having the use of the computer has also been of great benefit for observing comets within the range of my instruments. After World War II, announcements of comets were received by telegrams or letters from the Carter Observatory, and then ephemerides started arriving by air-letter from the BAA Comet Section. These days one can obtain such information by e-mail. Instead of having to trace or copy a chart and plot the comet path by hand, thanks to PC software this can now be done in a flash.

Back in the early days, when I wished to copy a chart I had to trace it onto tracing paper. Then I found out about Ilford Reflex paper – which was a messy process. After exposing the light-sensitive paper it had to be developed, fixed, washed, and dried to produce a negative reversed copy, and then the process had to be repeated to make a nice positive copy. Some time later I used the Kodak Verifax process, and although it still needed liquid developer it was much faster and not so messy. Later still, a 3M dry-copy machine was even simpler to use and faster, although the copies deteriorated with age. Some years later, photocopiers using plain paper became available. But now, if one has a scanner, a PC, and a printer they can be used to make copies. Modern technology is fantastic, and makes one wonder what new facilities may become available in the future.

Long ago, if I read about an interesting star and wished to see how it behaved I had to look through catalogues of stars, copy the positions of stars around the variable, plot them on graph paper, take a copy to the telescope, select suitable comparison stars, and hope to get reliable brightnesses for them later. Now, thanks to progress, there is software available for plotting star charts: just enter the position of the variable star, select the size of the region required, press 'Enter', and a second later the chart is displayed on the monitor. But that is not all, as the software can provide the required data on the comparison stars.

When I was starting to learn how to use a computer I could not believe that I would not need the typewriter again once I had got used to word processing; but I soon learned that that was true, as it is so easy to correct mistakes and to cut and paste sentences or paragraphs. Also, with the calculator on board I have forgotten how to use a slide rule or log and trig tables.

New astronomers are so fortunate that now there are better and easier ways of recording and forwarding data, and that they are able to obtain information by e-mail or the Internet, and produce charts and enlarge, reduce, or copy them, and I hope that some more amateurs will take up variable-star observing. Even after more than over 60 years I still get a thrill when I see dramatic changes in the brightness of stars, and the knowledge that the data are of value to science makes the effort even more worthwhile.

Although we can obtain weather forecasts via the radio and television, yet we still have to make the best use of what nature prepares for us – and that brings to mind 'The Astronomers' Lament':

Thirty days hath September,
April, June, and November.
All the rest have thirty-one
Without a blessed gleam of Sun.
If any of them had two and thirty,
They'd be just as wet and twice as dirty!

Nelson, New Zealand albert.jones@slingshot.co.nz

Addendum by the Director. Albert joined the Association on 30 May 1945. He is now 91 years of age, and is still observing. He has never counted his observations of variable stars, but several years ago they numbered more than 500,000. His achievements, awards, and honours are as follows:

1945 New Zealand Astronomical Society: first recipient of the Murray Geddes Memorial Prize
1946 Discovered comet 1946h Jones
1947 Astronomical Society of the Pacific: Donohue Comet Medal
1949 Donovan Astronomical Trust, Sydney: Donovan Medal and Prize, for Comet 1946h
1956 University of Otago: Mechaelis Gold Medal and Prize
1960 Royal Astronomical Society: Jackson–Gwilt Medal and Gift
1964 One of the first four Fellows of the RASNZ
1968 BAA: Merlin Medal and Gift, for comet observing
1973 Astronomical Society of the Pacific: Comet Medal
1987 Co-discoverer of SN1987A in the Large Magellanic Cloud
OBE, for Services to Astronomy
Nelson City Council: Certificate of Achievement
1997 AAVSO Observers: Director's Award, presented at Sion, Switzerland
1998 City of Nelson: Certificate of Appreciation in recognition of his contribution to Nelson in the field of science and education
BAA: Steavenson Award, for an outstanding contribution to observational astronomy
Astronomical Society of the Pacific: Amateur Achievement Award
Royal Society of New Zealand: Bronze Medal, for important contributions to variable star and cometary astronomy over more than 50 years
2000 Co-discoverer of comet Utsunomiya–Jones
2001 AAVSO: Variable Star Observer Award, for contributions to the AAVSO International Database
Smithsonian Astrophysical Observatory: Edgar Wilson Award (with Utsunomiya)
2004 Victoria University of Wellington: Honorary DSc
2005 RASNZ: Murray Geddes Prize (jointly with Carolyn Jones)
2008 AAVSO: Merit Award number 41
Minor Planet 3152 named Jones by the discoverers, Alan Gilmore and Pam Kilmartin

Leslie Comrie (1893–1950) was Director of the Computing Section 1920–22, and F. J. Hargreaves (1891–1970) was Director of the Photographic Section 1926–37 and President 1942–44.

An Anglo-Saxon dial in Northampton

Bob Marriott

The Church of the Holy Sepulchre in Northampton was established by the Norman earl Simon de Senlis around the year 1100, as a commemoration of the Crusade of 1096–99, and is the largest of only four round churches in England. It stands on a site previously occupied by a Saxon church built in the early ninth century, and its fabric contains several examples of stones plainly marked with Anglo-Saxon chevron tooling, as distinct from the diagonal axeing characteristic of Norman stonework. One of these stones is incised with a small circle or dial, a little over five inches in diameter, with divisions, and with a central hole for a style or gnomon. In its original position, before the Conquest, it would have been set vertically on the south face of the church; but now, in the Norman church, it is built into the inside of the south porch next to the top of the door, facing north, and rotated through 90 degrees.

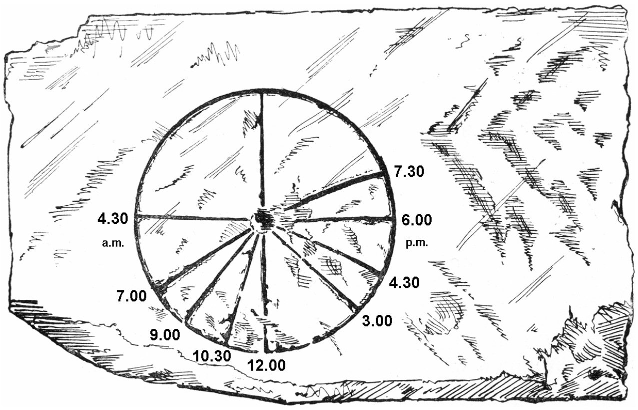
In the seventh century, Pope Sabinianus (604–606) ordered that dials be placed on churches to mark the canonical day hours, and he is also attributed with the introduction of the ringing of bells at those hours. For the secular division of day and night the Angles and Saxons used a system of eight 'tides', beginning at 4.30 am – Morgen, Daeg-mael, Mid-daeg, Ofanverth dagr, Mid-aften, Ondverth nott, Mid-niht, and Ofanverth nott – whereas the Holy Sepulchre dial is inscribed with canonical hours:

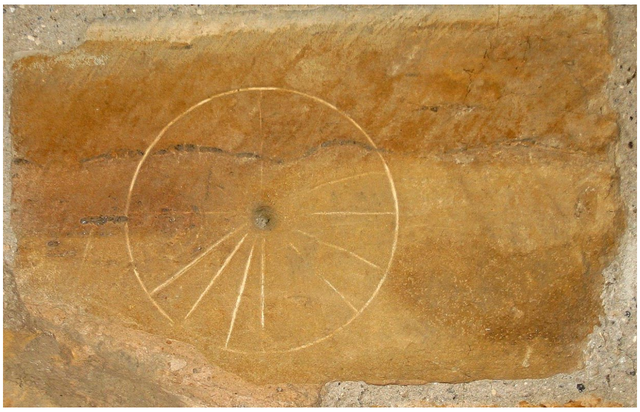
4.30 am	The hour of rising
7.00 am	Prime, the first service of the day
9.00 am	Terce, with special prayers
10.30 am	High mass on festivals and Sundays
12.00 noon	Sext, the mid-day service
3.00 pm	Nones, the afternoon office
4.30 pm	Vespers, the evening office
6.00 pm	Vespers in summer
7.30 pm	Compline, the last office of the day

The divisions of tides, hours, day, and night were flexible, as they were dependent on the length of daylight as linked to the seasons, thereby marking events rather than specific times.

Built into the same section of the fabric, but on the outside, facing south, at about the same height and of about the same size, is another dial, severely eroded. This mass dial, encircled by twenty-four tiny holes, is based on the duodecimal rather than the octaval system, and dates from the Norman or mediaeval period.

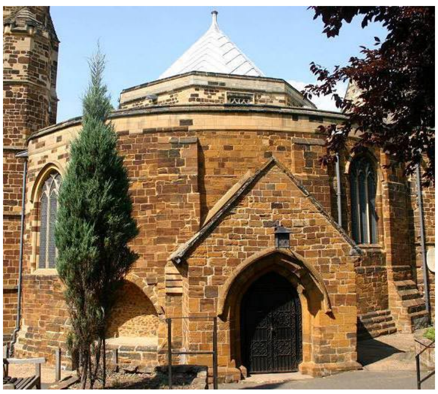
There are many examples of Anglo-Saxon dials around the country. Some of them are decorative and prominent, while others are easily overlooked. The dial in the Church of the Holy Sepulchre was sculpted almost 1,200 years ago, around the time of Alfred the Great. The church of which it once formed a part was destroyed during the Danish invasions before the Conquest, it became part of the fabric of the new Norman church, and for centuries it has not been met by sunlight. And yet it links astronomy, mathematics, horology, ecclesiology, and ethnology – a small and inconspicuous remnant of a culture in which daily life was dependent on religious offices, the seasons, and the flexibility of time.





The Anglo-Saxon dial

The Norman or mediaeval mass dial



On wiring astronomical instruments

Anyone who has replaced the webs in a micrometer (such as myself) will know that the process requires a great deal of patience, and is accompanied by severe frustration. The following paper was produced by G. D. Hirst, a Member of the Association's New South Wales Branch, and was published in *J. Brit. Astron. Assoc.*, **18** (1), 40, November 1907. More than a century has passed, but the technique and results remain the same – as do the sentiments expressed.

I wish to claim your attention for a few minutes while I give you a method of procedure which I have adopted successfully for wiring astronomical instruments, and which, if followed, will, I think, remove many difficulties which I have succeeded in conquering, though not without much tribulation and drawing largely on my stock of patience. I have thought it likely that a few practical hints would be welcome to such of you as may at some future time find it necessary to replace the webs in a theodolite, transit instrument, or micrometer. We have a past master in the art among us in the person of Mr Esdaile, but we may not always be where we can avail ourselves of his services, and there is moreover a certain satisfaction in knowing that, should occasion demand it, we are independent of outside help. The tools we shall require are few, and can be obtained at a trifling cost. They are: a small coil of iron wire; a bottle of spirit varnish; a bottle of gold size; a few visiting cards (lady's size); a small camel's-hair brush; small sharp scissors; a wooden match, sharply pointed; and last, but not least, a spider in a good humour.

I am not an entomologist, so cannot give you a string of learned names of those spiders which are most suitable for our purpose. I know the name of only one, *viz*., the *Epiera Diadema*: this is the small green spider which used to be very common in the gardens about Sydney, but of late years they do not appear to be so plentiful. There are several varieties of black spider also which spin excellent webs for our purpose. The size of the spider is important: if too large, the web will be too coarse; if too small it will be so fine as to make it exceedingly difficult to handle, and so fragile that it would not stand any work. You may take it that any spider will do as to size that (with its legs tucked up) will cover a sixpence. Spiders do not take kindly to captivity, so the sooner you get one to spin after it is captured the better. They also appear to be pretty short-tempered, and after being poked about with a stick will sulkily refuse to spin.

I will now take it that we have got our spider in a box and that it is in an agreeable humour. Cut about 18 inches off your coil of wire, and twist and bend it into the form of Figure 1. Now smear a little of the gold size over the prongs, and hold it in one hand while you get the spider out of its box with a stick. Shake the spider off the end of the stick, and it will let itself drop at the end of its web; attach the web to one of the prongs, and wind slowly, shaking the spider down as you take up the web. About a dozen webs on one frame is enough, as it is better not to have them too close for convenience in removing them. If the spider seems willing to give more of its web, you can transfer it to another frame, and so have two or more of these in reserve. The reason why we have smeared the prongs with the gold size is to fix each web independently, for otherwise on removing one the others would slacken up. And this brings me to a very important part of my subject, *viz*., the proper tension of the web when it is fixed in the instrument. I think I am not far wrong when I say that this should represent the strain on the web caused by the weight of the spider. Nature is the best guide for this as in most things. If the web is stretched too tightly in our instrument the expansion and contraction caused by the variation of moisture in the air will most likely cause it to break at some future time, and if put in too slackly it sags and is, of course, useless. By adopting the method I have described we now have the web on the fork at the proper tension, and it only remains for us to transfer it, without altering that tension, to the instrument.

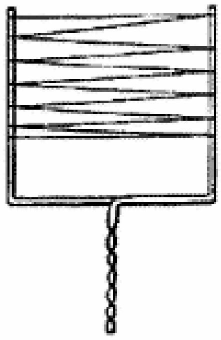


Figure 1

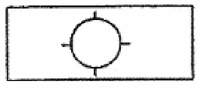


Figure 2

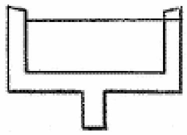


Figure 3

We will take the parallel position wire micrometer for our example, as this is the most difficult to make a satisfactory job. It must be taken all to pieces – and here a word of warning: do not get your screws mixed up, have a dozen empty pill boxes, and put each set of screws away by itself, labelling on the cover the part to which they belong. We will suppose we have now stripped our micrometer down to the frame which carries the position wire, and the fixed wire at right angles to it. On this frame – Figure 2 – there should be four small cuts as guides where to lay the fixed wires, and we will proceed to place our webs on them. First of all we must have some means of removing the webs from the wire frame on which they have been wound, so from our visiting card we will now cut a fork which will be wide enough to include the brass frame of the micrometer within it.

The ends of this fork – Figure 3 – we touch with the spirit varnish. Have your scissors ready, and gently bring the fork up underneath one of the webs on the wire frame until it just touches. Hold it there for a minute until the varnish has set, then snip the web off both sides and you have it ready to lay in position, it being still at the same tension as that at which it was wound off. Touch two of the opposite cuts on the micrometer frame with the thinnest possible film of the varnish, and lower the web down into position. The slight weight of the fork will keep it in position until the varnish has set. At the same time, the card is so light that the natural tension of the web is not appreciably altered. When the varnish is set, snip off the ends with the scissors. The same process is repeated with the perpendicular fixed wire, and we now proceed to the most difficult job of all, *viz*., the fixing of the moveable wire. This must be perfectly parallel with the fixed wire – and here is where the trouble comes in.

Having taken our web as before from the wire fork, we touch the two parts of the sliding frame where the cuts show the wire ought to be – one with a minute quantity of the spirit varnish, and the other with the gold size. The reason for using the gold size is that it sets much slower than the spirit varnish, and therefore gives us time to move one end of the wire should it not be parallel with the fixed wire. The sliding fame is now put into place, and with the pointed match we as delicately as possible move the end of the web held by the gold size until on examining the two webs with the magnifying glass they are seen to be parallel. This, as said before, is the most difficult part of the whole operation, and much patience is necessary, as, however carefully done, the point of the wood may drag the web away and break it, so that there is nothing for it but to try again. You will also have to be careful that in moving the web you do not alter the tension to any appreciable extent. I would strongly urge here that you should not be contented with 'near enough' as regards the parallelism of the wires. It is better to risk a breakdown than to stop short of as near perfection as possible.

I would emphasise also the necessity of using only the thinnest possible lick of varnish and gold size on the sliding frame, as the recess provided in it to take the wire is so shallow as only just to allow that wire to clear the fixed wire as it slides behind it, so if the fixing medium is too thick it will bring the two wires in contact, and there will be trouble. At the same time, the travelling wire must come as close as possible without touching, otherwise the two wires will not both be in focus at once.

We now have the micrometer webbed, and it is only necessary to put it together again. Only it has perhaps happened to some of you to take the kitchen clock to pieces, and after carefully cleaning wheels and springs, it was only necessary to put it together again; or you may have taken an equatorial to pieces, and it was only necessary to assemble the parts. Both these 'onlys' have happened to me, but the worst 'only' is, I think, the micrometer. The trouble is that much of the work has to be done over the delicate webs, and almost at the last moment (when everything has so far gone satisfactorily), a little screw may be dropped while getting it into its place – and then? Well, the only thing to do is to wipe the perspiration off your forehead, express your sentiments as briefly and in as well chosen language as you can, and go to work all over again.

A Hilger eyepiece spectroscope

Bob Marriott

Unlike a solar spectroscope, which requires an adjustable slit, a star spectroscope can be attached directly to the eyepiece. (Alternatively, a large objective prism can be mounted in front of the OG for mass spectroscopy.) Modern eyepiece spectroscopes are often equipped with a diffraction grating, but the model illustrated here contains a prism, and is equipped with three cylindrical lenses for different degrees of dispersion. A simple view of a spectrum with absorption lines is reward in itself; but with a little ingenuity such an instrument could be employed with a webcam or other form of electronic camera to produce video files and images that can be processed with software such as RSpec.

Adam Hilger (1839–1897) and his brother Otto (1850–1902) initially worked under J. B. L. Foucault at Lerebours and Secretan in Paris, and in 1870 moved to London to work for John Browning. Adam was later appointed foreman at Browning's works at 63 The Strand, and in 1875 he began his own business, specialising in spectroscopic instruments. He died in a bicycle accident in Brighton during the Easter holiday of 1897, and Otto, who in 1888 had been appointed to take charge of Lord Blythswood's physical laboratory in Renfrew – including the building of a diffraction grating ruling engine – returned to manage the business. The company is now a publishing house in Bristol.

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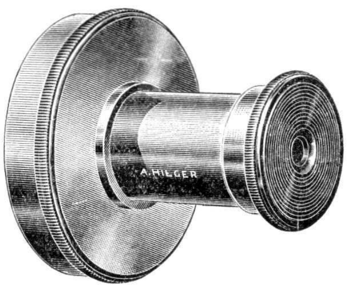

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The advertisement in the Association's *Journal*, 1907

A home-made 6-inch refractor

Kevin Bailey

During summer this year I managed to find time to build a 6-inch f/12 refractor. I had acquired a Fraunhofer-type achromatic lens – about $^1/_6$-wave – that needed refurbishment, though it took quite some time to clean the lens and the cell. Making the tube and the baffles was fairly straightforward, but positioning the three baffles inside the tube was very difficult. The instrument does not compare with my 10-inch Newtonian, but the definition is wonderful, and the focal ratio enables me to use my old Ramsden eyepieces to good effect – the ¼-inch producing about x320 magnification and a good field of view.

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