Making the Time the Ferries Run On

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2024

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Chapter 1. Introduction

This report is the result of research carried out by Emeritus Professor Norman Heckenberg as a Visiting Research Fellow at the Museum of Applied Arts and Sciences in Sydney starting in 2020. Norman and his friend Anthony Roberts have been researching the history of electric clock manufacturers in Australia for many years, starting with the Synchronome Electrical Company of Australasia in Brisbane [1,2] and leading on to Prouds Electric Clocks and Scientific Instruments in Sydney [3].

In 1913, Prouds, under the leadership of recently arrived English horologist Thomas Murday, began installation for the Sydney Harbour Trust (SHT) of a network of electric clocks at Circular Quay that were synchronised to the mean time clock at Sydney Observatory. We already knew a little about the system, but not how the synchronisation worked. It must have been one of the most advanced clock systems in the world at the time. The aim of the fellowship was to allow Norman to investigate the Observatory, its archives, and the Museum stores for any clues.

Prouds went on to install hundreds of tower clocks and clock systems, including in (Old) Parliament House in Canberra, and the operation continued until 1940 when Alan Crook Electrical (ACElec) took over that part of the business. Some of the tower clocks are still running, and we know that several collectors have Prouds and ACElec master clocks. See Appendix 1 for some more details.

Although the planned research activities were seriously disrupted by the COVID pandemic, they were eventually carried out, although in the main with disappointing results.

A physical inspection of the Observatory building guided by curator Andrew Jacob yielded no results. All the horological items from the Observatory were identified in the MAAS catalogue in March 2021 and examined at Castle Hill but nothing related to the synchronisation of the Circular Quay clocks was found. Contact was made with retired technician Carey Ward, who gave some useful tips for things to look at. Of course, his time at the Observatory was well after the relevant period, but it was good to rule out something that may have been missed.

Moving on to archival material, histories of the Observatory written by Harley Wood [4] and Pickett and Lomb [5] were found to contain no mention of the ferry clock system. Sydney Observatory Annual Reports kept at the Observatory did yield some interesting background but none could be found for the crucial years of 1913-15. It is unfortunate that the Observatory was short-staffed at that time. Then the Great War caused further disruption to everything.

A search was made of the surviving Observatory records at the State Archives (now NSW State Records Collection) in Kingswood.

It was hoped that the incoming and outgoing letters would be useful, but again there are gaps in the relevant timeframe. There are exchanges documented with Prouds over other matters, including electric clocks but, sadly, almost nothing about the ferry terminal. Most of these have been transcribed for this report, but some of the most interesting are readable only in parts.

Time was spent searching for Australian patents to follow up references by Prouds staff to patents they held. None were found. Two lapsed applications were identified by title but their contents could not be found.

A visit to the Telstra Museum in Bankstown elicited promises to search their archives for information on a similar installation at the telephone exchange at Sydney GPO. A 2024 search

of the database of the new National Communications Museum in Melbourne (that includes former Telstra material) found nothing.

Before this project started, Trove had provided many useful newspaper reports confirming thee existence of the system, but it was checked from time to time to see if anything new had turned up. Perhaps interestingly, although several reports announced that the system was being installed, no official opening was ever reported. Nor any outcry over poor performance, so the exact date of completion of the installation remains unknown.

Altogether, the results of the work are disappointing. However, it is an appropriate time to write down what we do know, and what we can surmise, and summarise what is known and what is not.

Around 1915 Sydney had the largest system of ferry transport in the world, operated by Sydney Ferries (on the water) and the Sydney Harbour Trust (the wharves). It was a time of rapid progress in many areas, and public timekeeping was one that was especially important in the context of public transport. Using electricity, multiple public-facing dials that required no winding could be driven to all show the same time. Central Railway Station already had such a system provided by the German company Wagner. There is also some evidence that The Synchronome Electrical Company of Australasia, based in Brisbane, had installed electric clocks at Circular Quay as early as 1906.

In 1912, retail jeweller William Proud set up Prouds Electric Clocks and Scientific Instruments with well known English electrical engineer/horologist Thomas John Murday (1865-1938) in charge of the workshop. More information on Prouds' activities is provided in Appendix 1, and in our article in the *Horological Journal* [3].

The second chapter of this report sets out what we know about their installation at Circular Quay and how the clocks there were controlled by a master clock that could be synchronised to the Mean Time clock at the Observatory. The third chapter provides an introduction to the history of electric clock synchronisation up to this time, while the fourth considers what can be said about the connection of the Observatory to the Circular Quay clock system.

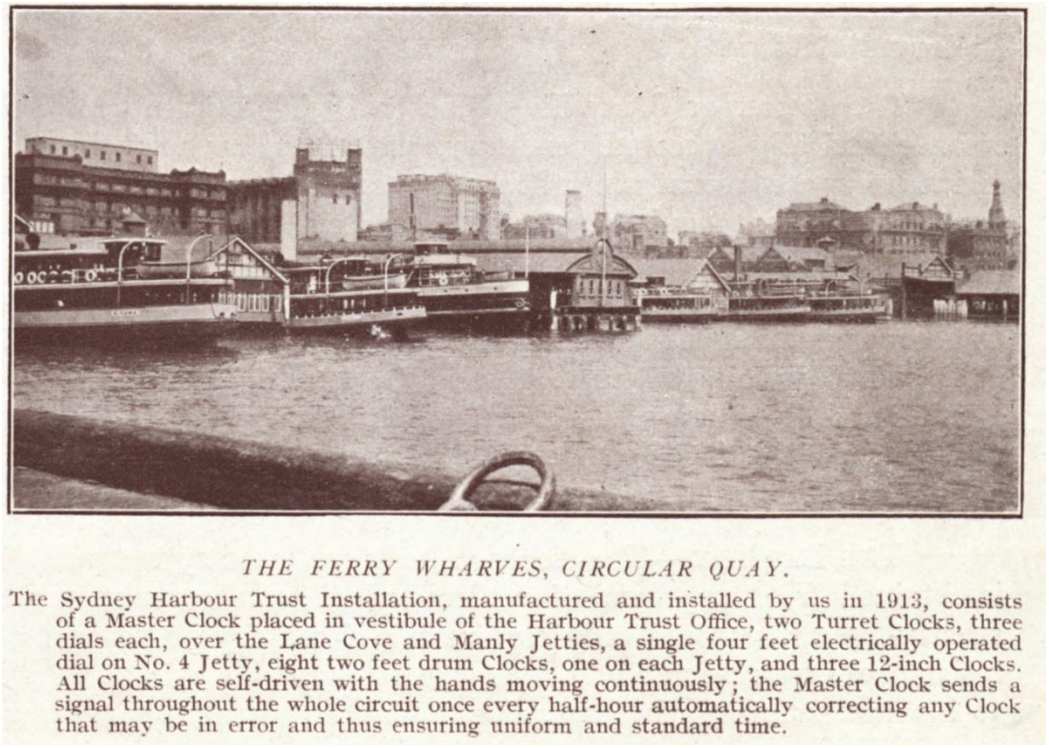
Appendix 2 provides transcripts and commentaries on relevant Observatory correspondence found, Appendix 3 contains a timeline of Observatory letters and relevant events, while Appendices 4-7 deal with new sources of information turned up during the project, which may interest the reader.

All newspaper reports cited in this work were accessed via Trove at the National Library of Australia. It is an invaluable resource.

I would like to thank the helpful staff of the MAAS, particularly Research Manager Deborah Lawler-Dormer and Curator of Astronomy Andrew Jacob for their coordination and friendly assistance during a hectic period that included the COVID 19 pandemic and the relocation of the Powerhouse collection to Castle Hill. Thanks also go to Dr James Nye and Prof. Edward Odell for advice on other electric clock systems. This project is part of ongoing research on Australian electric clock systems carried out with my friend and collaborator, Anthony Roberts, who also contributed ideas and discussions on this project. Finally, I would like to reiterate our gratitude to the Jackson and Taprell families for sharing family records and to Peter Taprell for the gift of a number of Murday relics collected by his father.

Chapter 2. Prouds installation at Circular Quay. (this background work was carried out in collaboration with Anthony Roberts)

Around 1913-15, Prouds installed an extensive system of electric clocks on the ferry wharves at Circular Quay and the nearby Harbour Trust building. As far as we know, nothing remains of the installation, and the wharves have been replaced many years ago. The installation was reported in newspapers and cited in advertising brochures as in Fig.1.



THE FERRY WHARVES, CIRCULAR QUAY.

The Sydney Harbour Trust Installation, manufactured and installed by us in 1913, consists of a Master Clock placed in vestibule of the Harbour Trust Office, two Turret Clocks, three dials each, over the Lane Cove and Manly Jetties, a single four feet electrically operated dial on No. 4 Jetty, eight two feet drum Clocks, one on each Jetty, and three 12-inch Clocks. All Clocks are self-driven with the hands moving continuously; the Master Clock sends a signal throughout the whole circuit once every half-hour automatically correcting any Clock that may be in error and thus ensuring uniform and standard time.

Fig.1. From the Prouds brochure ELECTRIC CLOCKS (c.1923). [6]

Fig.2. Ferry wharves are at right with one tower clock visible. The Harbour Trust building on the corner of George and Alfred Streets is near the centre, and the tower of the Observatory is visible on the horizon.(from a postcard)

Some of the special electric self-contained clocks made to the order of the Sydney Harbor Trust, and installed on the various Ferry Jetties, Circular Quay.

The complete installation consists of six single dial, 2 ft. diameter drum Clocks. 2 double dial, 2 ft. diameter drum Clocks, three smaller clocks as "starters". 2 turret movements, each driving three, 3 ft. and three 3 ft. 6 in. diameter dials, and one turret movement driving a four foot dial. Each clock is complete in itself and contains its own battery.

The hands all progress steadily, not in half minute jumps, as in the case of the ordinary type of electric clock.

A Master Regulator (also electric) fixed in the vestibule of the Harbor Trust Buildings transmits a synchronising current hourly throughout the system, correcting any slight error that may exist in any individual clock. This Regulator is itself electrically connected with the Mean Time Clock at the Observatory, so that the pendulums are swinging synchronously.

Fig. 3. A photograph and explanation sent by Prouds to Synchronome in Brisbane in 1916.

Note that the date of 1913 shown in Figure 1. is contradicted by other evidence discussed in Chapter 4.

Further details survive in a package sent to the Synchronome Electrical Co. of Australasia in Brisbane in 1916. As well as advertising leaflets it included an original photograph of the Quay clocks before installation and gave some details. (Fig.3)

From the photograph we can see that the turret clocks are the same as one that was installed in the School of Arts in Kingaroy, Qld in 1918 and is now on display in the Kingaroy Heritage Museum (Mosaic 2024/156). It has a heavy seconds pendulum impulsed periodically by a roller on an arm operated by an electromagnet. The impulses occur whenever the amplitude of swing decays to a minimum level, using a so-called 'Hipp toggle' switch. This electromechanical method of maintaining the oscillations is unique to Prouds, but it seems to work reliably and it was used in most of their master clocks right up until the end.

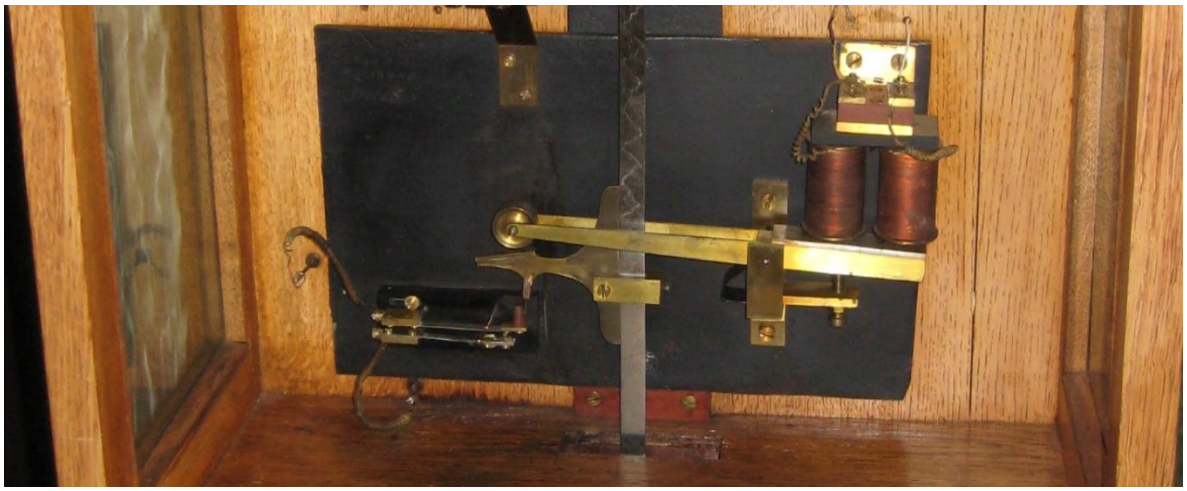


Fig. 4. Photograph of the impulse mechanism in the Kingaroy clock. A pair of solenoids attract the end of a lever upwards. This brings the roller down onto the sloping pallet attached to the pendulum, pushing it to the right. Below the pallet can be seen the Hipp toggle and contacts that switch the current to the solenoids.

The other clocks are much more mysterious. It is stated that the hands move continuously rather than every 30 or 60 sec, so they are not impulse dials as Prouds normally used in their (later) systems. The mechanisms used in Murday's domestic clocks would appear too delicate to drive 12" hands, but perhaps he may have used a compact electric pendulum clock like the one used to drive his recording microbarometer. It works on the same principle as the turret clock but has a shorter pendulum.

However, in a document dated 1996, Lawrence Taprell states (Appendix 6)

AS (sic) DOUBLE SIDED APPROX 3fT CLOCK WAS INSTALLED ON OF THE FERRY WHARFS. THE DRIVING MOVEMENT WAS DESIGNED BY T.J. MURDAY (MODIFIED BALANCE WHEEL TYPE)

SIMULAR TO CLOCKS MADE BY THE BRIGHTON CLOCK CO, ENGLAND TO THE MURDAY PATENT. (see Fig.5)

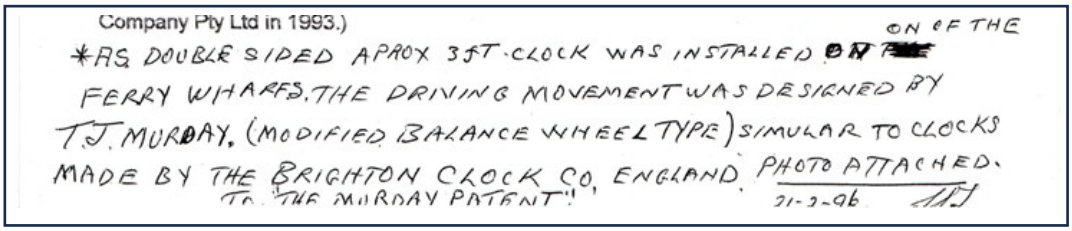

Company Pty Ltd in 1993.)
*AS DOUBLE SIDED APROX 3FT. CLOCK WAS INSTALLED ON ONE OF THE FERRY WHARFS. THE DRIVING MOVEMENT WAS DESIGNED BY T.J. MURDAY. (MODIFIED BALANCE WHEEL TYPE) SIMULAR TO CLOCKS MADE BY THE BRIGHTON CLOCK CO, ENGLAND. PHOTO ATTACHED.
TO THE MURDAY PATENT"
21-2-96

Fig .5 Reference to 3 foot dials at Circular Quay in notes made by Lawrence Taprell.

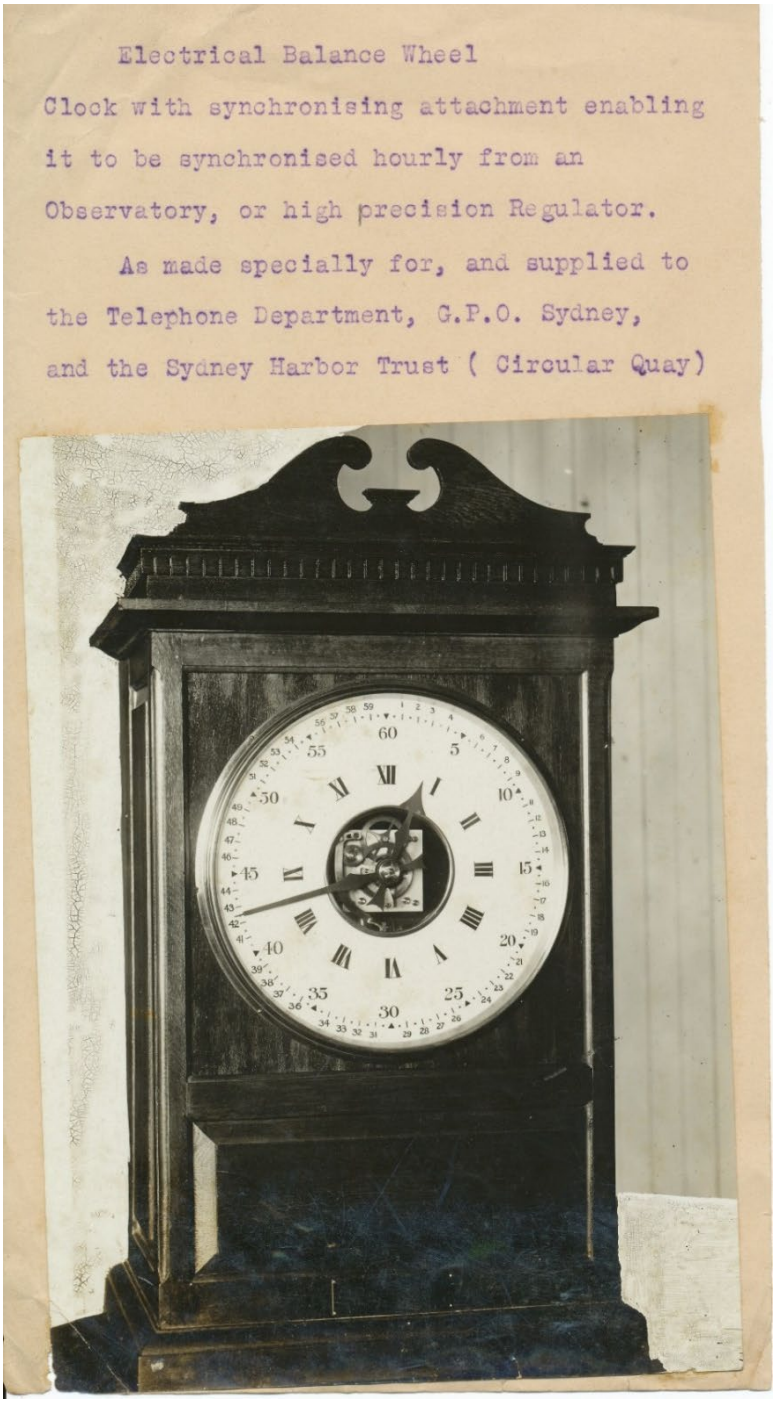


Fig.6 Another photograph sent to Brisbane in 1916. See Appendix 8.

It is certain that the shelf clocks in Fig.2 are balance wheel clocks (Fig.6). It is not clear if the 'starters' mentioned are these shelf clocks, or the three 12" dials mentioned in Fig.1. Nor is it clear what the term 'starter' means. One possibility is that the 'starters' are 'self-starters', meaning that they can be started using electrical pulses rather than having to be set in motion manually. This would be a great virtue for clocks hanging above a public thoroughfare.

The means used to automatically correct errors each hour or half hour can be glimpsed in the centre of the dial of one of them.

A square plate, the same as Murday used in his other balance wheel clocks, carries the 'motion works' that drive the hands. As well, a lever actuated by an electromagnet acts on a cam that forcibly moves the minute hand to the 6 or 12 o'clock position when an electrical current pulse is received each half hour. Murday had met such a system when working at the Standard Time Company in London ten years previously.

Figure 7. shows a close-up of the centre of the dial shown in Fig.6, with a hypothetical reconstruction of the lever system used to correct the position of the minute hand.

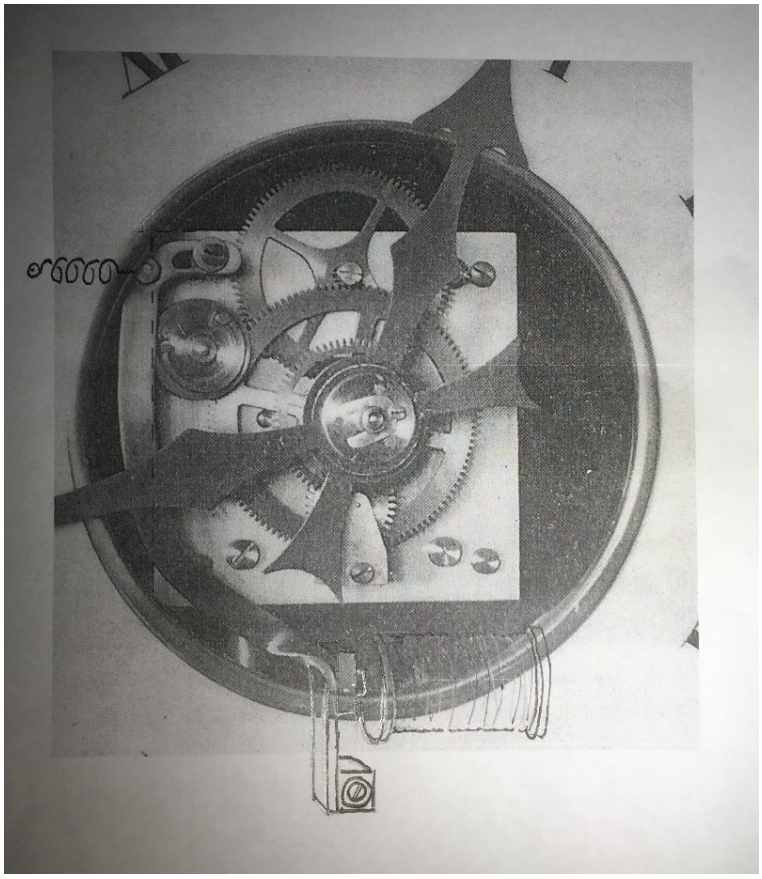
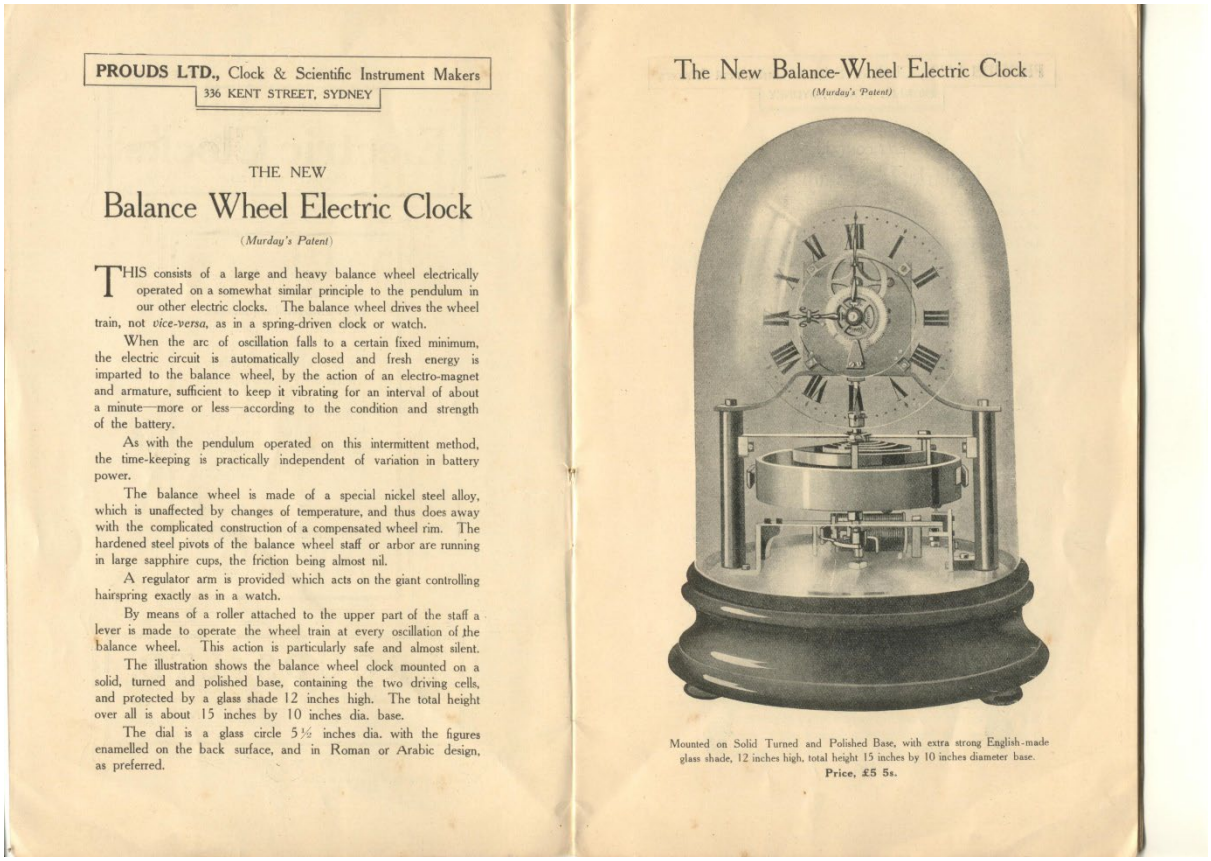


Fig.7. A close-up of the centre of the dial shown in Fig.6, with a hypothetical reconstruction of the lever system used to correct the position of the minute hand. When the solenoid is energised, the C-shaped lever moves to the right, pushing a part not visible into the gap between the two pins on the small disc, turning it if it is not in the correct position. A small wheel on the back of the disc is engaged with the minute wheel, so it and the hand move to the position they should have at that time.

Murday had invented a domestic horizontal balance wheel clock around 1910. [7] It was built and marketed by the Reason Manufacturing Co. in Brighton, England, and today examples are greatly prized by collectors. Prouds released a brochure [8] virtually identical to Reason's, advertising such a clock (fig. 8) and a range of half second pendulum clocks for domestic use. It is not entirely clear whether any were manufactured here, but there is some evidence to suggest that a few were made using imported parts.



PROUDS LTD., Clock & Scientific Instrument Makers
336 KENT STREET, SYDNEY

THE NEW
Balance Wheel Electric Clock
(Murday's Patent)

THIS consists of a large and heavy balance wheel electrically operated on a somewhat similar principle to the pendulum in our other electric clocks. The balance wheel drives the wheel train, not *vice-versa*, as in a spring-driven clock or watch.

When the arc of oscillation falls to a certain fixed minimum, the electric circuit is automatically closed and fresh energy is imparted to the balance wheel, by the action of an electro-magnet and armature, sufficient to keep it vibrating for an interval of about a minute—more or less—according to the condition and strength of the battery.

As with the pendulum operated on this intermittent method, the time-keeping is practically independent of variation in battery power.

The balance wheel is made of a special nickel steel alloy, which is unaffected by changes of temperature, and thus does away with the complicated construction of a compensated wheel rim. The hardened steel pivots of the balance wheel staff or arbor are running in large sapphire cups, the friction being almost nil.

A regulator arm is provided which acts on the giant controlling hairspring exactly as in a watch.

By means of a roller attached to the upper part of the staff a lever is made to operate the wheel train at every oscillation of the balance wheel. This action is particularly safe and almost silent.

The illustration shows the balance wheel clock mounted on a solid, turned and polished base, containing the two driving cells, and protected by a glass shade 12 inches high. The total height over all is about 15 inches by 10 inches dia. base.

The dial is a glass circle 5½ inches dia. with the figures enamelled on the back surface, and in Roman or Arabic design, as preferred.

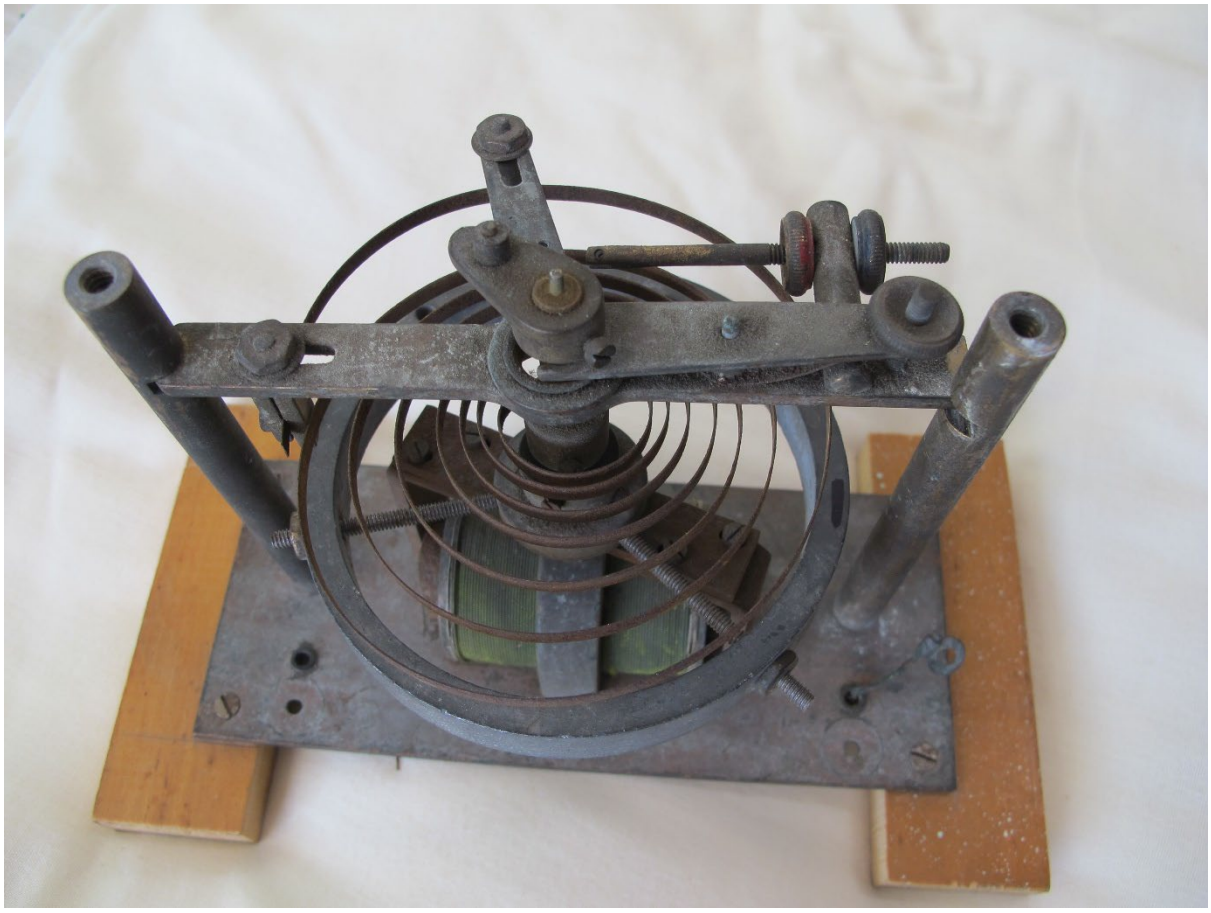
The New Balance-Wheel Electric Clock
(Murday's Patent)

Mounted on Solid Turned and Polished Base, with extra strong English-made glass shade, 12 inches high, total height 15 inches by 10 inches diameter base.
Price, £5 5s.

Fig. 8. From the Prouds brochure 'Electric Clocks'.[8] The contents of the brochure show domestic clocks and are very similar to a similar brochure from the Reason Manufacturing Co in Brighton.c1913?

Appendix 4 provides information about a distinctive form of horizontal balance wheel clock, perhaps a local model that has a much-simplified transfer lever arrangement that may have been developed for the Circular Quay clocks.

Although none of the clocks in Figure 2 have survived, part of a horizontal balance wheel clock of smaller size (Fig. 9) was found among material collected by the late Lawrence Taprell. It may well be a part of one of the balance wheel clocks. In detail it is quite different from the domestic clock shown in Fig. 8. The balance wheel is smaller and less decorative and the impulse is made by an electromagnet at the centre of the base acting on an iron yoke, rather than mechanically by an impulse arm actuated by a magnet. A few other examples have been seen in the UK and are referred to there as Mark 2 clocks.[9] The oscillation period is 3 sec rather than 4 as in the more common Mark 1 model. Such a clock could probably be started by applying 1sec pulses to the magnet, perhaps making it a 'starter'.



Indeed, if such a clock were supplied with strong 1 s current pulses it is highly likely that it could be made to fall into synchrony with them. However, we are told that Murday instead used the clocks free-running with hourly (or half-hourly) correction of the hands, probably because then they could continue to run even if control was lost.

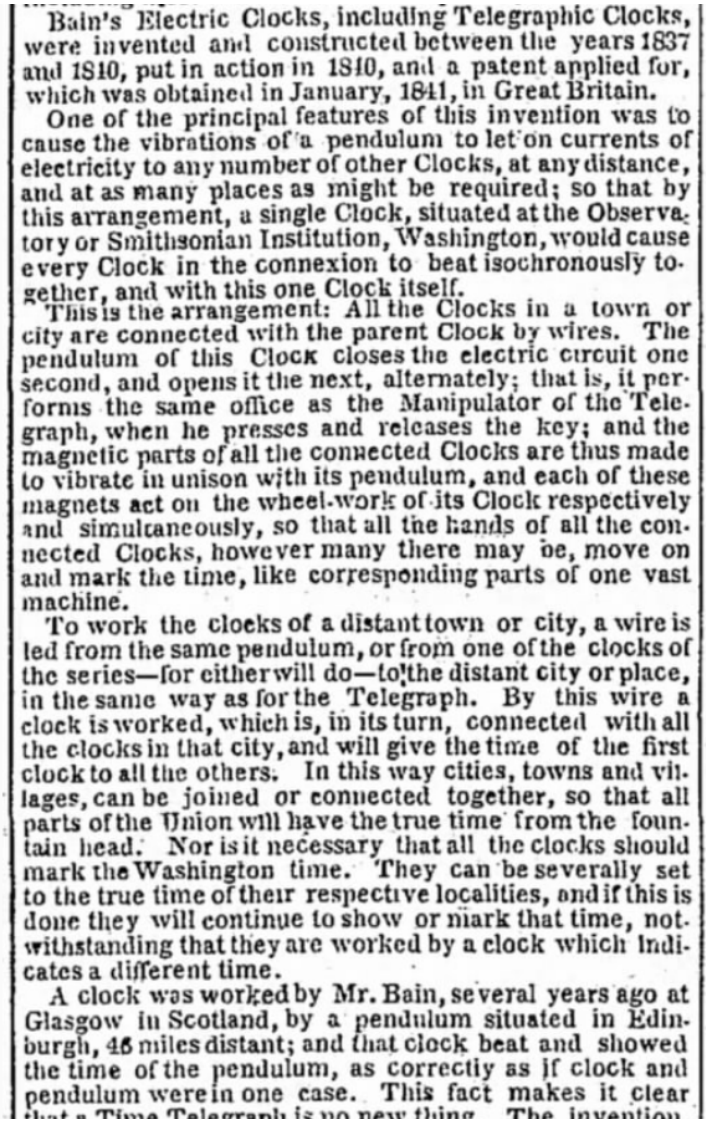
Finally, the wall clock in the middle of the picture is a seconds pendulum clock, probably the Master Regulator that transmits the hourly (or half hourly as per the brochure?) synchronising pulses to the rest of the clocks.

It is the statement that 'This Regulator is itself connected electrically with the Mean Time Clock at the Observatory, so that the pendulums are swinging synchronously' that prompted this research project. This synchronisation would have raised the accuracy of the master clock to another level altogether and is further discussed in Chapter 4. To help the explanation, Chapter 3 looks at the history of clock synchronisation up to the time of the Circular Quay installation.

Chapter 3. Synchronisation of Pendulum Clocks

"Synchronise watches", calls the Squadron Leader, meaning that all his pilots should set the hands on their watches to show the same time. But there is another meaning for the word 'synchronisation', in the context of pendulum clocks: that the pendulums of two independent clocks should swing in unison. What the hands on the dials show is something else, although if they were set to agree in the sense above, then the hands would continue to agree perfectly forever. This second meaning is what is of most interest in this project.

Already in 1665, Christiaan Huygens, inventor of the pendulum clock, noticed that two pendulum clocks mounted near to each other could sometimes spontaneously fall into a state where the two pendulums would swing in perfect unison until upset by some disturbance. Ever since, people have regarded this as a nuisance to be avoided or dreamed of making money from the phenomenon in one way or another. They learned that even small amounts of mechanical energy transmitted through the supporting structure or surroundings could cause it, and by minimising such transfers by mounting clocks on massive isolated supports, as in observatories, it could be avoided.



Bain's Electric Clocks, including Telegraphic Clocks, were invented and constructed between the years 1837 and 1840, put in action in 1840, and a patent applied for, which was obtained in January, 1841, in Great Britain.

One of the principal features of this invention was to cause the vibrations of a pendulum to let on currents of electricity to any number of other Clocks, at any distance, and at as many places as might be required; so that by this arrangement, a single Clock, situated at the Observatory or Smithsonian Institution, Washington, would cause every Clock in the connexion to beat isochronously together, and with this one Clock itself.

This is the arrangement: All the Clocks in a town or city are connected with the parent Clock by wires. The pendulum of this Clock closes the electric circuit one second, and opens it the next, alternately; that is, it performs the same office as the Manipulator of the Telegraph, when he presses and releases the key; and the magnetic parts of all the connected Clocks are thus made to vibrate in unison with its pendulum, and each of these magnets act on the wheel-work of its Clock respectively and simultaneously, so that all the hands of all the connected Clocks, however many there may be, move on and mark the time, like corresponding parts of one vast machine.

To work the clocks of a distant town or city, a wire is led from the same pendulum, or from one of the clocks of the series—for either will do—to the distant city or place, in the same way as for the Telegraph. By this wire a clock is worked, which is, in its turn, connected with all the clocks in that city, and will give the time of the first clock to all the others. In this way cities, towns and villages, can be joined or connected together, so that all parts of the Union will have the true time from the fountain head. Nor is it necessary that all the clocks should mark the Washington time. They can be severally set to the true time of their respective localities, and if this is done they will continue to show or mark that time, notwithstanding that they are worked by a clock which indicates a different time.

A clock was worked by Mr. Bain, several years ago at Glasgow in Scotland, by a pendulum situated in Edinburgh, 46 miles distant; and that clock beat and showed the time of the pendulum, as correctly as if clock and pendulum were in one case. This fact makes it clear that a Time Telegraph is no new thing. The invention

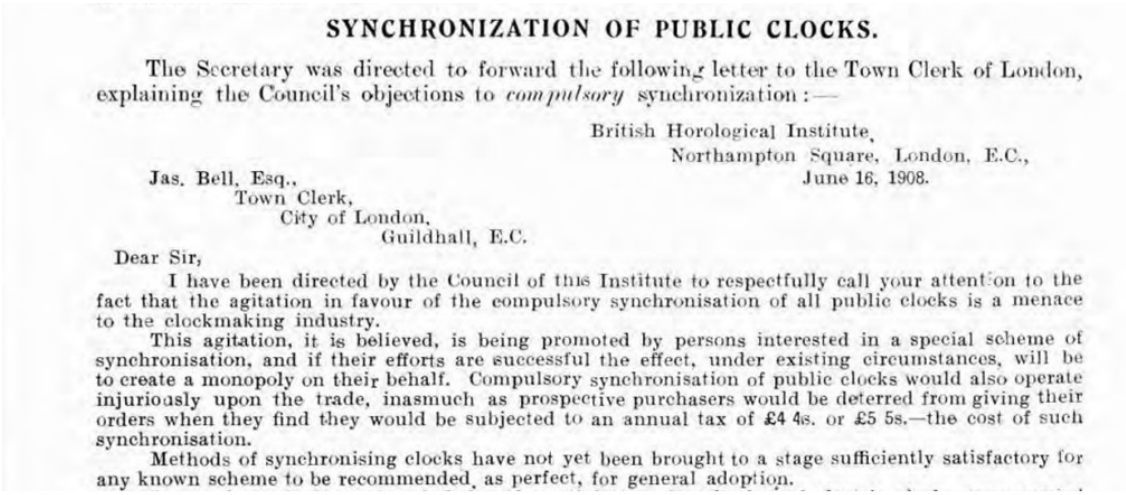
Exactly how it happens involves nonlinear physics that is highly case-specific [10], but the phenomenon often occurs in many different contexts whenever there are two oscillators running at nearly the same frequency.

The advent of electromagnets in the nineteenth century opened up a new avenue for transmitting energy between pendulums in a relatively controlled manner, and already in the early 1840s, the man credited with building the first viable electric clock, Alexander Bain, was able to demonstrate the synchronous swinging of pendulums in Edinburgh and Glasgow, 74 km away(Fig.10).

Fig.10. Excerpt from article in The Louisville Daily Courier. Louisville, Kentucky. 20 December 1848. p.2.

The further history of this area is clouded by the use of the term 'synchronise' at the end of the nineteenth century by a number of companies, such as the Standard Time Company of London (STC), and the Synchronome Company to refer to their more commercially successful systems which periodically corrected the time shown on clock dials, either hourly in the case of (STC) [12] or every 30 seconds for Synchronome systems[13]. 'Corrected' means bringing the dial into agreement with a standard clock that might just be a relatively accurate local clock (*e.g.* Synchronome) or even the Mean Time clock at Greenwich Observatory (*e.g.* STC). In these clocks, there is no implication that any pendulums are swinging in unison, and indeed, Synchronome dials have no pendulums, just a simple mechanism to move the hands which is powered by the pulses from the controlling pendulum clock.

Public annoyance at unreliable public clocks was being harnessed by these and other companies to call for compulsory synchronisation of clocks. Letters appeared in the *Times of London* and when those calls were effectively neutralised (Fig.11), it was still a strong selling point for new clocks. Similar agitation appeared in Sydney around the same time.



SYNCHRONIZATION OF PUBLIC CLOCKS.

The Secretary was directed to forward the following letter to the Town Clerk of London, explaining the Council's objections to *compulsory* synchronization:—

British Horological Institute,
Northampton Square, London, E.C.,
June 16, 1908.

Jas. Bell, Esq.,
Town Clerk,
City of London,
Guildhall, E.C.

Dear Sir,

I have been directed by the Council of this Institute to respectfully call your attention to the fact that the agitation in favour of the compulsory synchronisation of all public clocks is a menace to the clockmaking industry.

This agitation, it is believed, is being promoted by persons interested in a special scheme of synchronisation, and if their efforts are successful the effect, under existing circumstances, will be to create a monopoly on their behalf. Compulsory synchronisation of public clocks would also operate injuriously upon the trade, inasmuch as prospective purchasers would be deterred from giving their orders when they find they would be subjected to an annual tax of £4 4s. or £5 5s.—the cost of such synchronisation.

Methods of synchronising clocks have not yet been brought to a stage sufficiently satisfactory for any known scheme to be recommended, as perfect, for general adoption.

Fig.11. Part of a letter opposing compulsory synchronisation from the British Horological Institute. The Horological Journal July 1908, p193

Thomas Murday had worked at STC before coming to Australia and was also familiar with the Synchronome system. While at STC, he was granted a patent for 'Improvements in Synchronising Turret Clocks' [14] and would have been aware of the work of his colleague there, A. B. Weber, on an improved way of correcting the hands of remote clocks using hourly pulses[15]. In this system (Fig. 12), the minute arbor of an existing clock is retrofitted with a cam and a solenoid-operated lever that engages it. When an hourly pulse operates the lever, the minute hand is forced to the 12 o'clock position on the dial. Something very similar can be seen in one of the Circular Quay clocks.(see Fig. 7)

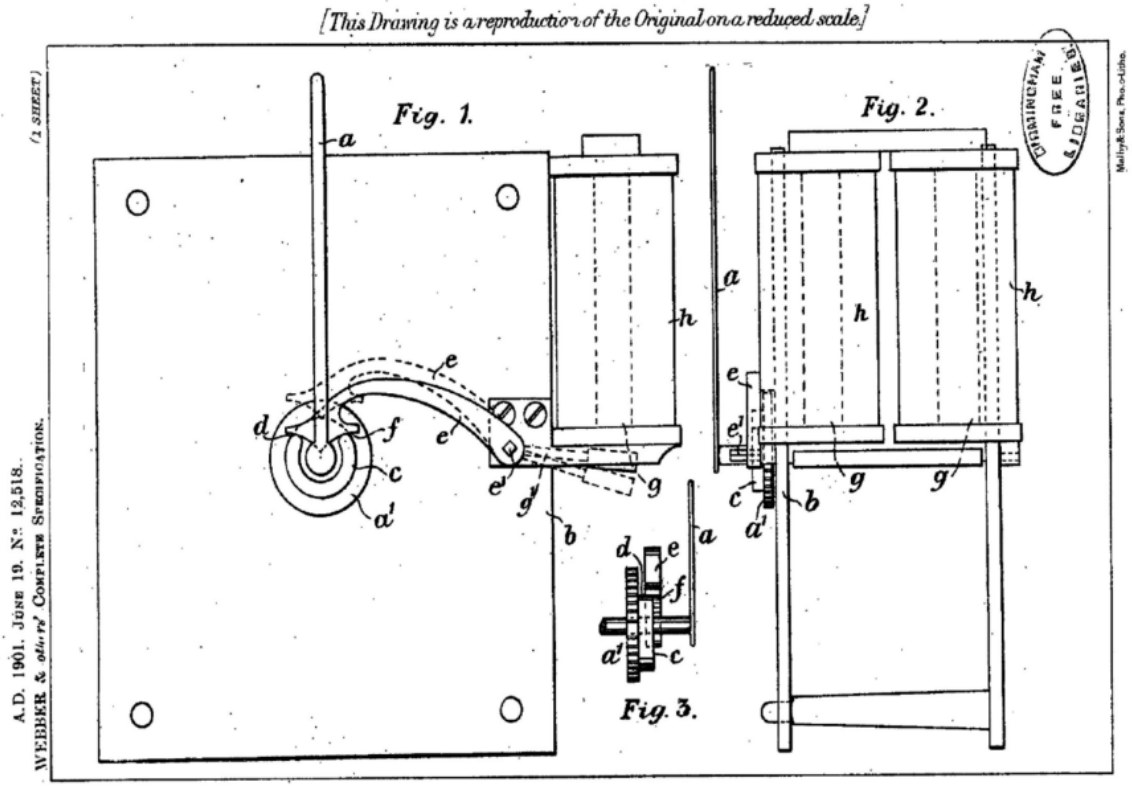
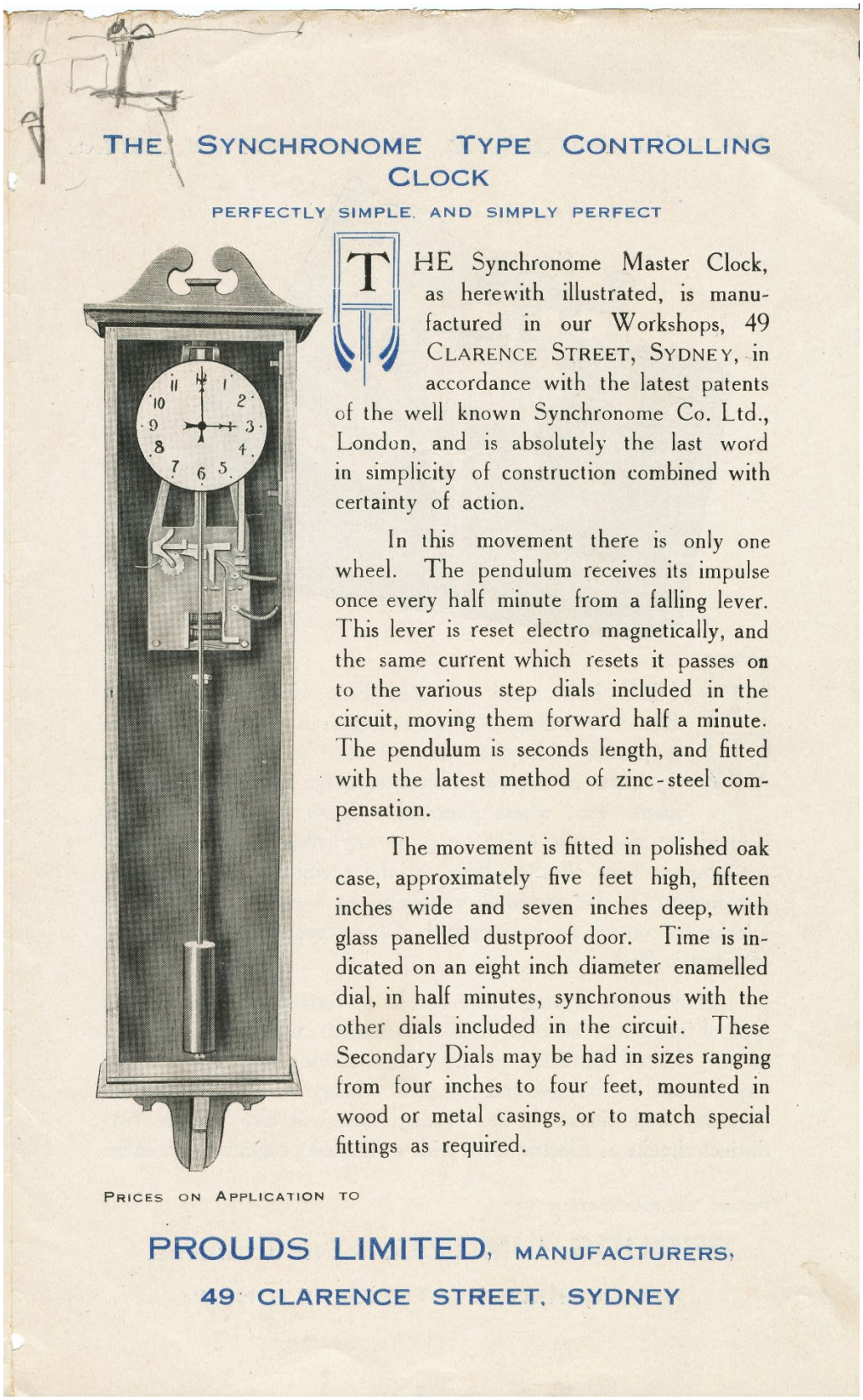


Fig.12. Diagram from specification of UK patent 12,518/1901, Webber and STC. 'Improvements in Apparatus for Synchronizing Clocks'

As for Synchronome, Murday must have been well aware of their work as he had a patent for a 'silent' half-minute impulse dial mechanism compatible with their system [16], and one of the first products advertised by Prouds was a modified Synchronome master clock (Fig.13). Evidence that he was on good terms with Synchronome founder Frank Hope-Jones comes from the latter's glowing citation in a talk given in 1900 [17].

Returning to the concept of synchronised pendulum swings discovered by Huyghens, and its extension using electrical coupling by Bain, a major step in this direction had been made by Robert Lewis Jones who was granted a patent in 1857 [18] for 'Improvements in Regulating Clocks by Electricity' (Fig. 14). Jones found that pulses from one clock could nudge a second one, even one that was independently powered, into synchronism. This would take less power from the first and would allow the second to continue working independently if the connection failed.



THE SYNCHRONOME TYPE CONTROLLING CLOCK

PERFECTLY SIMPLE, AND SIMPLY PERFECT

THE Synchronome Master Clock, as herewith illustrated, is manufactured in our Workshops, 49 CLARENCE STREET, SYDNEY, in accordance with the latest patents of the well known Synchronome Co. Ltd., London, and is absolutely the last word in simplicity of construction combined with certainty of action.

In this movement there is only one wheel. The pendulum receives its impulse once every half minute from a falling lever. This lever is reset electro magnetically, and the same current which resets it passes on to the various step dials included in the circuit, moving them forward half a minute. The pendulum is seconds length, and fitted with the latest method of zinc-steel compensation.

The movement is fitted in polished oak case, approximately five feet high, fifteen inches wide and seven inches deep, with glass panelled dustproof door. Time is indicated on an eight inch diameter enamelled dial, in half minutes, synchronous with the other dials included in the circuit. These Secondary Dials may be had in sizes ranging from four inches to four feet, mounted in wood or metal casings, or to match special fittings as required.

PRICES ON APPLICATION TO

PROUDS LIMITED, MANUFACTURERS,

49 CLARENCE STREET, SYDNEY

Fig. 13. A page from the Prouds brochure 'Electric Time Circuits', c.1916, showing their 'Murday Synchronome'.

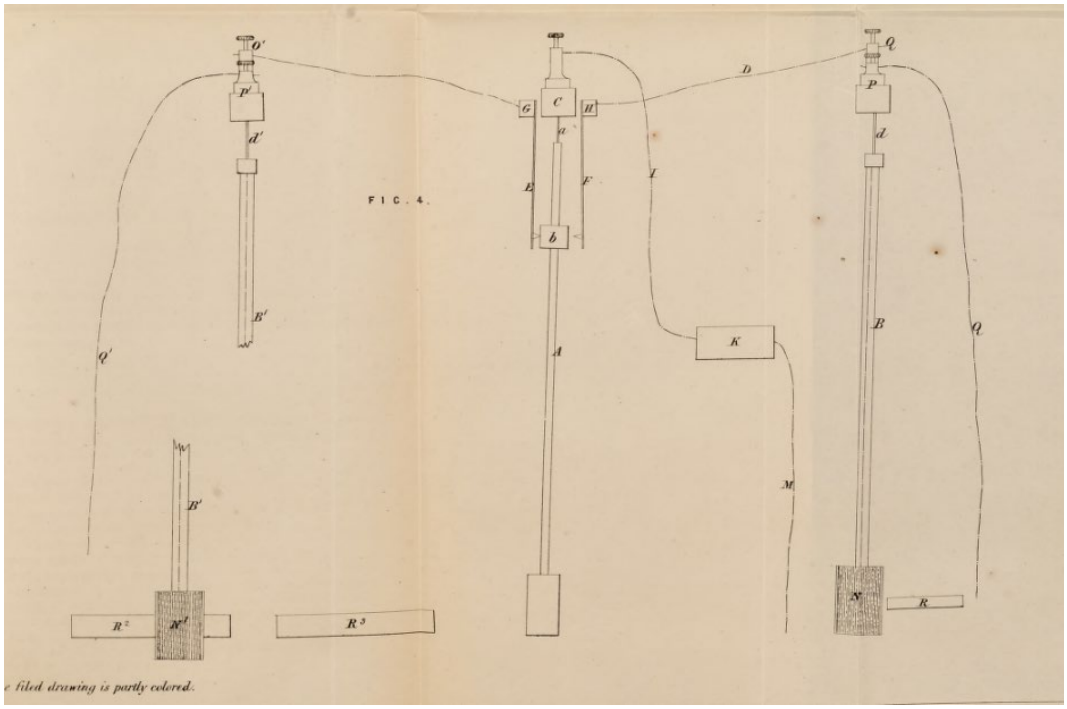
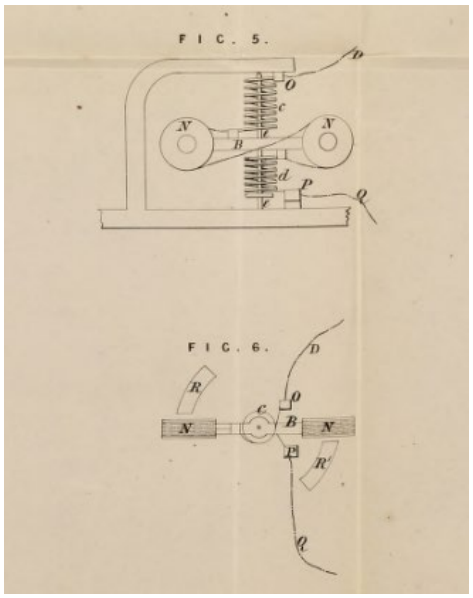


Fig.14. In the diagram excerpted from the patent specification, a central master clock is controlling another clock on each side. Each of these has a pendulum bob in the form of a flattened solenoid that swings over one or two permanent magnets. Contacts on the master clock switch current pulses through the solenoids, generating forces relative to the magnets. Things are arranged so that each synchronised pendulum is retarded or accelerated by the electromagnetic force according as it is leaving or approaching too soon or too late, maintaining the synchronicity of its swings.



Jones' patent also envisaged synchronising the oscillations of a balance wheel clock in a similar way. In the example given (Fig. 15), the balance wheel carries two coils that can interact with one or two permanent magnets when a current pulse flows.

Jones points out that the positions of the coils and magnets could be swapped if desired.

Fig.15. Another excerpt from Jones' 1857 patent specification diagram. It shows two views of a balance wheel fitted with coils and magnets.

Meanwhile, astronomers, who were the ultimate timekeepers in those days, were experimenting with new clocks, comparisons of clocks at different longitudes using telegraph and later wireless signals, and the idea of having a laboratory standard clock that controlled a 'slave' that did the hard work of automatically sending out the time to users.

A leader in this area was Charles Piazzi Smythe at Edinburgh Observatory who collaborated with F.J. Ritchie in the 1850s to set up the 'Edinburgh Ring' [19]. Based on the Jones system, in Edinburgh the Observatory controlled 'sympathetic ' spring-powered mechanical pendulum clocks, swing for swing, for the time ball and 1pm gun as well as the Post Office and other subscribers. In subsequent developments, electrically powered 'electrosympathetic clocks' eliminated the need for winding of the controlled clocks. Eventually the network expanded across Edinburgh and Glasgow and the system was sold overseas (Fig.16). A particularly interesting feature of the Ritchie network was the use of 'drop't second' contacts on each controlled clock that made it possible to monitor its operation remotely. Australian Government Astronomers W.E.Cooke, P.P.G.E. Baracchi and G.F. Dodwell would presumably have been aware of these developments.

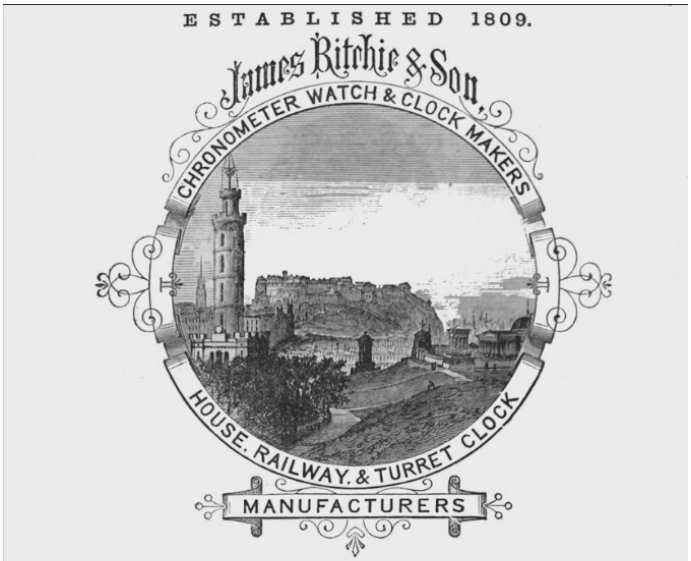


Fig. 16 Advertisement for Ritchie

These Australian astronomers were doing their own experiments too, as evidenced by letters exchanged between them, and purchases of electromagnets [Appendix 2], although no publications were found.

Several letters were found in the archives that refer to experiments Observatory staff were doing on pendulum synchronisation (see Appendix 2) and W.E. Cooke was discussing the subject with other astronomers well before the Circular Quay installation. In a letter (26/09/1912) to the Victorian Government Astronomer, Cooke asks about Baracchi's pendulum synchronisation experiments. In November of the same year, in a letter to Mr Dodwell, he gives details of how he has successfully synchronised pendulum clocks (see Appendix 2 for diagrams)

> *'I extend the pendulum & fix a soft iron armature, as shown. This swings over an elec. mag. at the extremity of its swing on one side, & a momentary current is sent into the e.m. each second from the master clock. Every other second would be theoretically correct, but every second is easier & comes to the same thing.*
> *The weight of the pendulum must of course be raised to allow for the extra attachment, & the*

clock rated to approx.. agreement with
the parent. The primary contact can
come from b_1b_2 in parallel with r_1r_2 (?????)
The Arrangement would then be:
A simple pendulum swinging freely in
a case, well mounted, & out of the way.
It issues a contact every second, the current from which
splits and works two electromagnets in
common. One of these is r_1r_2, which keeps
the pendulum swinging. The other controls
your slave-clock which may be anywhere
handy. I find that the control is
remarkably effective. There is an old
clock in the workshop, which has been
used for all sorts of purposes, probably
for the last 50 years. I rated it &
found it was losing 36^s per day – put
on the seconds-contact current from
our M.T. clock & it immediately was
synchronised. The idea then would
be to load up the slave clock with
any sort of contacts required, seconds
Minutes, 10" (for seismograph), hourly
etc, put on extra driving weight if
required, and let the pendulum below
control it. Strictly speaking the free
pendulum ought to be in an air-tight
case, & I believe one could be made
of wood (?) & glass by a good man, like
Baker, but anyhow one ought to get
a better rate than under present
conditions. Of course the seconds issued
by your slave clock would really be your standard'.

The work behind this letter must have been done at about the same time that Murday arrived in Sydney. The arrangement is reminiscent of that used by Ritchie and others. Murday must have used something similar.

One negative finding of this research is that Murday seems to have taken no part in, or been excluded from, these discussions. Neither his work, nor the connection to the Sydney Harbour Trust, are ever mentioned in Cooke's letters to his colleagues.

However, the time was ripe for the Circular Quay installation, a relatively cheap and maintenance-free (no winding) system of clocks that could be controlled to all show the same and correct time, and that could continue to run independently for a time if control

was lost. Murday used the term ‘synchronisation’ in both senses explained above: swing for swing synchronisation of his local master clock at the Harbour Trust offices with the Observatory mean time clock, and hourly correction of the public-facing dials all over the wharves.

With the Observatory connection working, the time shown on the SHT vestibule clock would have been identical with that shown at the Observatory and thus as exact as could be, and the clocks on the wharves would have been corrected hourly to bring them back into agreement in case of any small divergences.

A recent more general review of electric clock networking can be found in [20].

Chapter 4. Role of the Observatory in Time Distribution and Connection with Prouds and the Sydney Harbour trust.

The pre-installation photograph (fig. 3) includes a wall clock which is presumably the local master clock that was installed in the vestibule of the Sydney Harbour Trust Building and which sent out the hand-correction signals to the clocks at the wharves.

Something very similar is shown more clearly in a drawing (fig. 17) from the same bundle sent to Brisbane. Unfortunately, any covering letter explaining the contents of the bundle has not survived. The drawing appears to show a conventional Hipp toggle clock driving a dial with a seconds hand mechanically. In such a clock, the pendulum acts as a sort of electric motor driving the clockwork linked to the hands. When the amplitude of swing decays after maybe twenty swings, the 'toggle' is triggered, closing a switch that feeds current to an electromagnet that gives the pendulum a push. It is an exceptionally reliable system because if friction increases, the magnet just pushes the pendulum more frequently to keep it going.

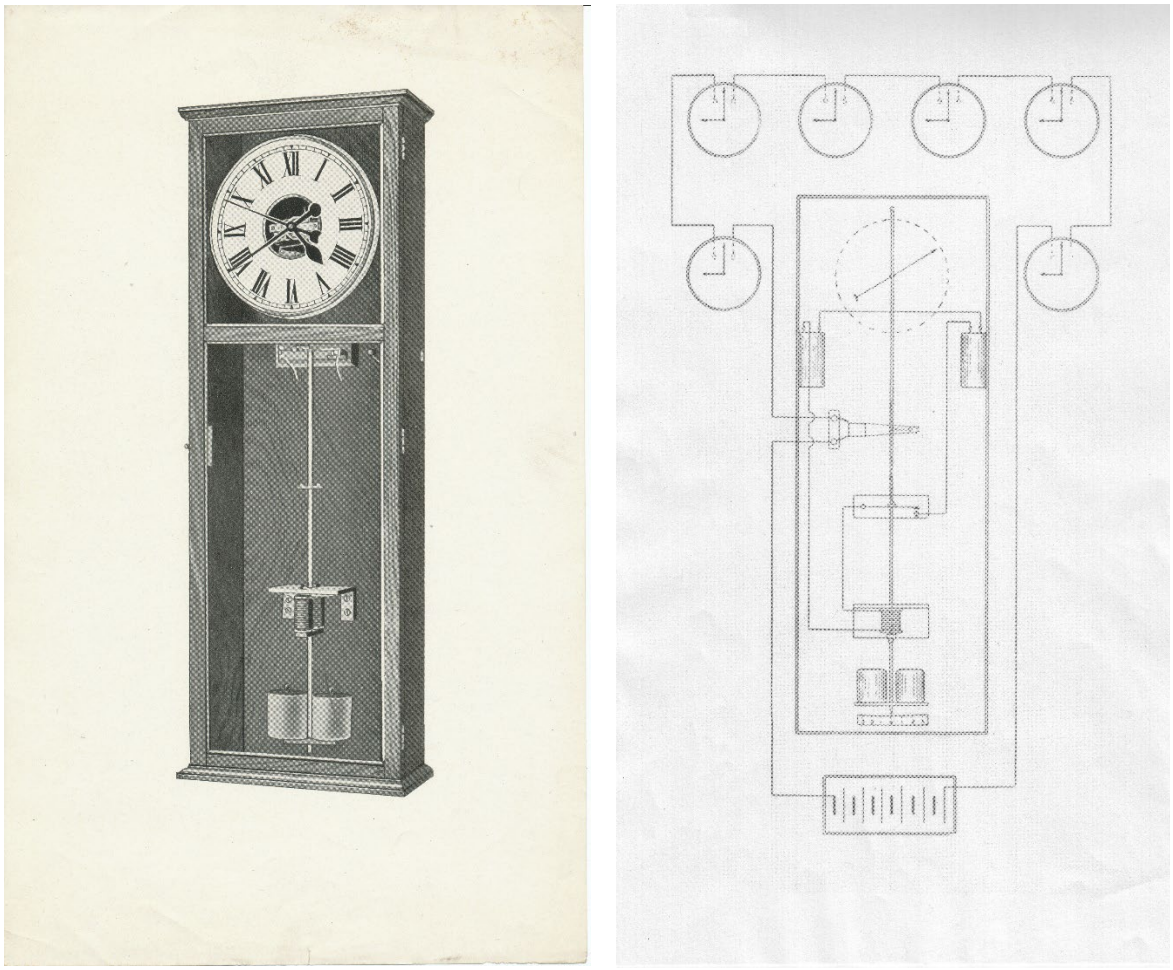


Fig. 17. Pictures sent to Brisbane in 1916. The wall clock looks very much like the one shown in Fig.3.

A second drawing is a circuit diagram showing contacts fitted to such a clock to produce one second current pulses from a second battery to drive a series of secondary dials. Both these images look like they have been prepared for publication, but we have not been able to find

them in print. It may have been for an advertising brochure that was not finished but it is just possible that the circuit diagram may have been part of a patent application. Another member of Murday's team, Arthur Franklin, claimed in a tender document some years later to be a holder of a patent for work done in Proud's workshop at that time. There is no evidence of a British Patent from this time. We have been able to establish that Murday made an application for an Australian patent in the week ending 8 October, 1913 for "An electrical device for timing, controlling, and indicating the duration of boxing contests, and the like" but it lapsed after a year. A second application by 'Prouds Ltd, nominee of the actual inventor' for "An improvement for telephone meter" was probably also from Murday, but it too lapsed. The boxing match timer was installed in several major stadiums. The telephone meter may be related to the special clock installed at the GPO (fig. 6) but the actual patent applications have not been archived.

The circuit diagram in Fig. 17 does not show how an hourly hand-setting pulse was generated, but this could easily have been done using a switch linked to the cannon pinion carrying the hour hand.

Another diagram shows essentially the same clock with a different dial arrangement (fig. 18) and a similar clock was exhibited in England in 1996. [9]

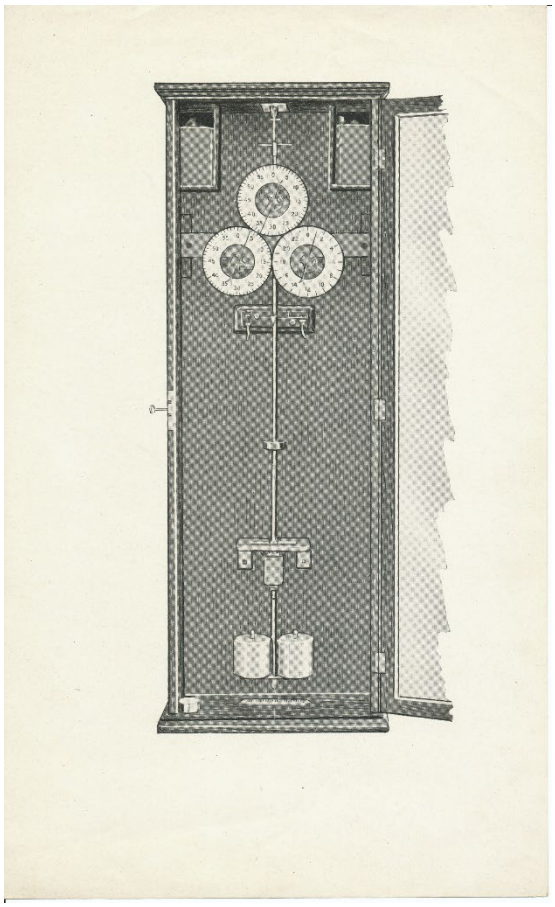


Fig. 18 Another dial arrangement

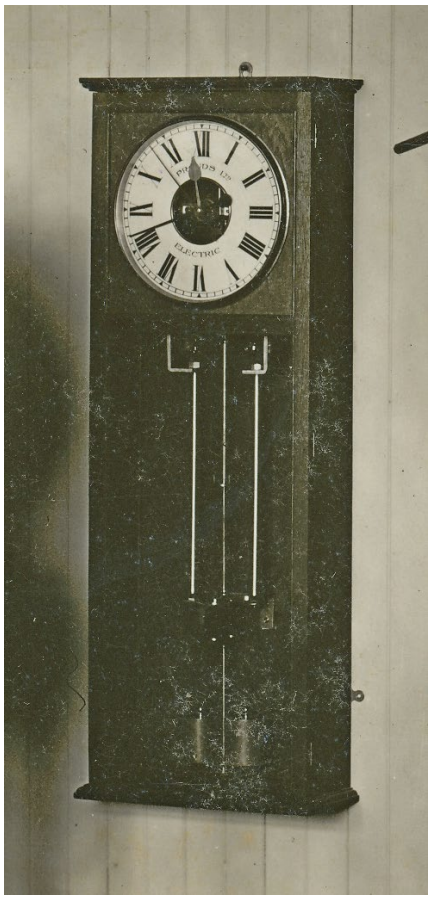


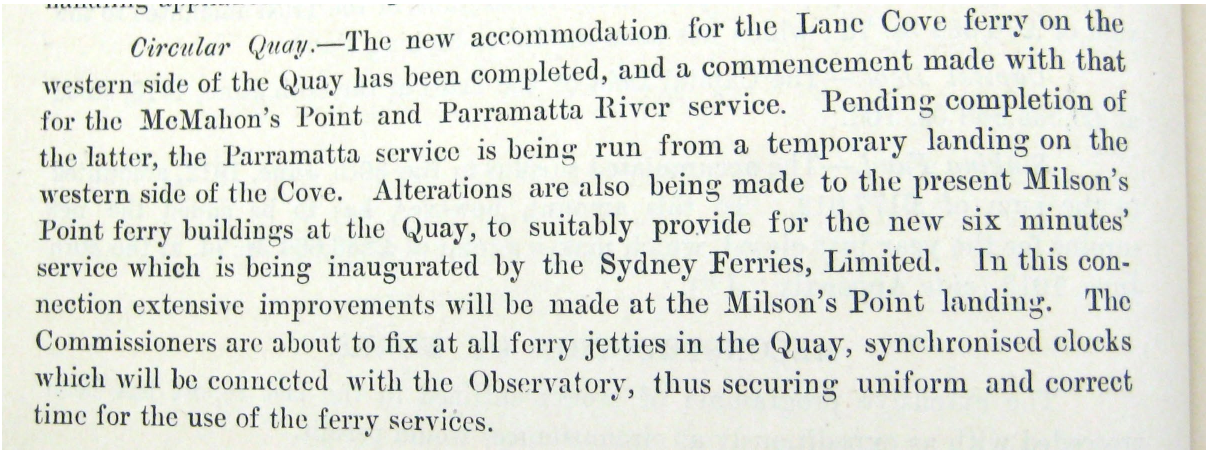
Fig.19 Sydney Harbour Trust Clock

Comparing these diagrams with the pre-installation photograph, reproduced in enlarged form as fig.19, we can note the presence there of metal rods descending on either side of the pendulum. These could easily have held electromagnets that acted on the pendulum when fed 1 sec pulses from the Observatory, nudging it into synchrony, as in the Ritchie system. Or perhaps they were levers that acted mechanically on the pendulum, actuated by solenoids at the top. Although that would at first seem an unlikely scenario, we know that Murday did like such an electromechanical impulse as he used it in the more common form of horizontal balance wheel clock and in his Prouds master clocks.

It is this clock that would have been synchronised 'swing for swing' with the Mean Time Clock at the Observatory. It was the aim of this project to find out more about the connection and the details of how it operated. Sadly, this has not proved possible. In view of that, the reader may be thinking, can we be sure that the connection even existed?

Evidence for the existence of the connection.

The Sydney Harbour trust certainly expected one, as stated in their 1913 annual report. (fig. 20), although no other references to the system were found in the SHT archive.



Circular Quay.—The new accommodation for the Lane Cove ferry on the western side of the Quay has been completed, and a commencement made with that for the McMahon's Point and Parramatta River service. Pending completion of the latter, the Parramatta service is being run from a temporary landing on the western side of the Cove. Alterations are also being made to the present Milson's Point ferry buildings at the Quay, to suitably provide for the new six minutes' service which is being inaugurated by the Sydney Ferries, Limited. In this connection extensive improvements will be made at the Milson's Point landing. The Commissioners are about to fix at all ferry jetties in the Quay, synchronised clocks which will be connected with the Observatory, thus securing uniform and correct time for the use of the ferry services.

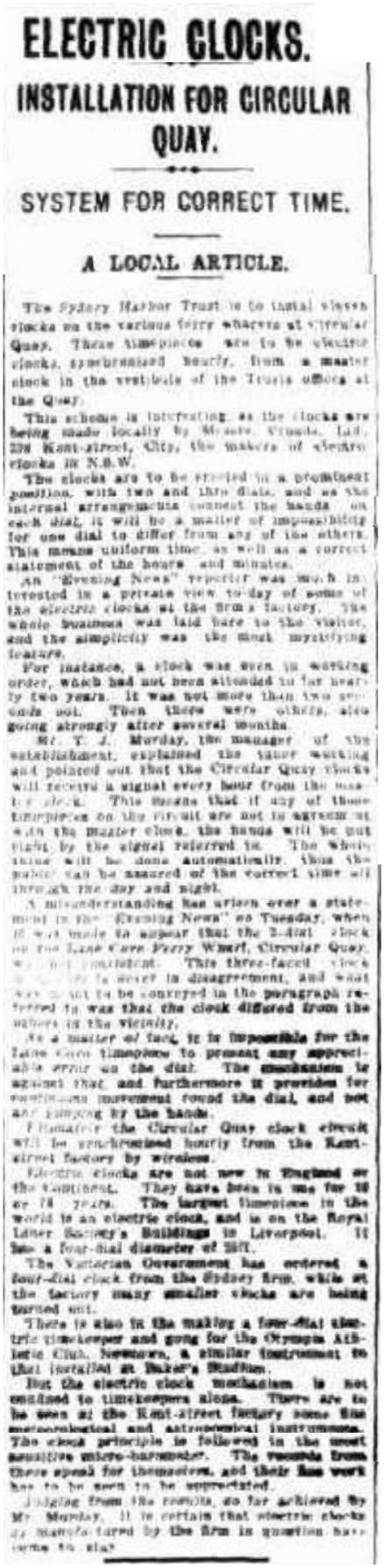
Fig. 20. The Sydney Harbour Trust Commissioners' Thirteenth Report for YE 30 June 1913

The news reached Wagga Wagga by October of that year (Worker, Thursday 2 October 1913, page 21 (5)) reporting:

> Clocks connected to the Observatory are to be fixed at all the ferry jetties at Circular Quay, Sydney, to secure correct and uniform time for all of the services.

It reached Sydney in December in a larger piece in the Sunday Times, (Sunday 28 December 1913, page 3) also based on the Commissioners' Report.

On the other hand, no mention of the Observatory was made in a more detailed article in the Evening News (Thursday 8 January 1914, page 9), instead, Murday is reported as stating 'Ultimately the Circular Quay clock circuit will be synchronised hourly from the Kent-street factory by wireless.' Figure 21 reproduces the article and provides a transcript.



ELECTRIC CLOCKS.

INSTALLATION FOR CIRCULAR QUAY.

SYSTEM FOR CORRECT TIME.

A LOCAL ARTICLE.

The Sydney Harbor Trust is to instal eleven clocks on the various ferry wharves at Circular Quay. These timepieces are to be electric clocks, synchronised hourly, from a master clock in the vestibule of the Trust's offices at the Quay.

This scheme is interesting as the clocks are being made locally by Messrs. Prouds, Ltd., 336 Kent-street, City, the makers of electric clocks in N.S.W.

The clocks are to be erected in a prominent position, with two and three dials, and as the internal arrangements connect the hands on each dial, it will be a matter of impossibility for one dial to differ from any of the others. This means uniform time, as well as a correct statement of the hours and minutes.

An "Evening News" reporter was much interested in a private view to-day of some of the electric clocks at the firm's factory. The whole business was laid bare to the visitor, and the simplicity was the most mystifying feature.

For instance, a clock was seen in working order, which had not been attended to for nearly two years. It was not more than two seconds out. Then there were others, also going strongly after several months.

Mr. T. J. Murday, the manager of the establishment, explained the inner working and pointed out that the Circular Quay clocks will receive a signal every hour from the master clock. This means that if any of those timepieces on the circuit are not in agreement with the master clock, the hands will be put right by the signal referred to. The whole thing will be done automatically, thus the public can be assured of the correct time all through the day and night.

A misunderstanding has arisen over a statement in the "Evening News" on Tuesday, when it was made to appear that the 3-dial clock on the Lane Cove Ferry Wharf, Circular Quay, was not consistent. This three-faced clock it appears is never in disagreement, and what was meant to be conveyed in the paragraph referred to was that the clock differed from the others in the vicinity.

As a matter of fact, it is impossible for the Lane Cove timepiece to present any appreciable error on the dial. The mechanism is against that, and furthermore it provides for continuous movement round the dial, and not any jumping by the hands.

Ultimately the Circular Quay clock circuit will be synchronised hourly from the Kent-street factory by wireless.

Electric clocks are not new in England or the Continent. They have been in use for 10 or 12 years. The largest timepiece in the world is an electric clock, and is on the Royal Liver Society's Buildings in Liverpool. It has a four-dial diameter of 25ft.

The Victorian Government has ordered a four-dial clock from the Sydney firm, while at the factory many smaller clocks are being turned out.

There is also in the making a four-dial electric timekeeper and gong for the Olympia Athletic Club, Newtown, a similar instrument to that installed at Baker's Stadium.

But the electric clock mechanism is not confined to timekeepers alone. There are to be seen at the Kent-street factory some fine meteorological and astronomical instruments. The clock principle is followed in the most sensitive micro-barometer. The records from these speak for themselves, and their fine work has to be seen to be appreciated.

Judging from the results so far achieved by Mr. Murday, it is certain that electric clocks as manufactured by the firm in question have come to stay.

ELECTRIC CLOCKS.

INSTALLATION FOR CIRCULAR QUAY, SYSTEM FOR CORRECT TIME. A LOCAL ARTICLE.

The Sydney Harbor Trust is to instal eleven clocks on the various ferry wharves at Circular Quay. These timepieces are to be electric clocks, synchronised hourly, from a master clock in the vestibule of the Trust's offices at the Quay. This scheme is interesting as the clocks are being made locally by Messrs. Prouds Ltd., 336 Kent-street, City, the makers of electric clocks in N.S.W, The clocks are to be erected in a prominent position, with two and three dials, and as the internal arrangements connect the hands on each dial, it will be a matter of impossibility for one dial to differ from any of the others. This means uniform time, as well as a correct statement of the hours and minutes. An "Evening News" reporter was much interested in a private view to-day of some of the electric clocks at the firm's factory. The whole business was laid bare to the visitor, and the simplicity was the most mystifying feature. For instance, a clock was seen in working order, which had not been attended to for nearly two years. It was not more than two seconds out. Then there were others, also going strongly after several months. Mr. T. J. Murday, the manager of the establishment, explained the inner working and pointed out that the Circular Quay clocks will receive a signal every hour from the master clock. This means that if any of those timepieces on the circuit are not in agreement with the master clock, the hands will be put right by the signal referred to. The whole thing will be done automatically, thus the public can be assured of the correct time all through the day and night. A misunderstanding has arisen over a statement in the "Evening News" on Tuesday, when it was made to appear that the 3-dial clock on the Lane Cove Ferry Wharf, Circular Quay, was not consistent. This three-faced clock it appears is never in disagreement, and what was meant to be conveyed in the paragraph referred to was that the clock differed from the others in the vicinity. As a matter of fact it is impossible for the Lane Cove timepiece to present any appreciable error on the dial. The mechanism is against that, and furthermore it provides for continuous movement round the dial, and not any jumping by the hands. Ultimately the

Circular Quay clock circuit will be synchronised hourly from the Kent-street factory by wireless. Electric clocks are not new in England or the Continent. They have been in use for 15 or 16 years. The largest timepiece in the world is an electric clock and is on the Royal Liver Society's Buildings in Liverpool. It has a four -dial diameter of 25ft. The Victorian Government has ordered a four-dial clock from the Sydney firm, while at the factory many smaller clocks are being turned out. There is also in the making a four-dial electric timekeeper and gong for the Olympia Athletic Club, Newtown, a similar instrument to that installed at Baker's Stadium. But the electric clock mechanism is not confined to timekeepers alone. There are to be seen at the Kent-street factory some fine meteorological and astronomical instruments.

The clock principle is followed in the most sensitive micro -barometer. The records from these speak for themselves, and their fine work has to be seen to be appreciated. Judging from the results so far achieved by Mr. Murday , it is certain that electric clocks as manufactured by the firm in question have come to stay.

Fig. 21. Evening News, Thursday 8 January 1914, page 9, image and transcript.

A reference was also made in a letter to the SMH in 1914 to a connection to the GPO (but it fails to mention the ferries) (fig. 22). The letter suggests that the installation was not yet complete.


this direction.

The enterprising manager of the Sydney Ferries is having a series of synchronised clocks installed at the Quay by Proud's, Limited, which are all locally manufactured, and include those wonderful clock-driving pendulums the inventions of a local scientist, Mr. Murday, whose micro-barometers have just been accepted for public exhibition by the Tourist Department.

A self-winding, synchronising clock is also shortly to be installed in the G.P.O., for the use of the telephone time-signallers. This will be connected with the Observatory.

Fig. 22. Excerpt from letter to SMH from Arthur Vogan 17/02/1914.

And, in a reply to another missive from Mr Vogan, W.E. Cooke resolutely avoids any mention of the (proposed) connection between the Observatory and the ferries expected by the SHT. (fig.23)

TO THE EDITOR OF THE HERALD.

Sir,—It is evident, from letters that have recently appeared in the "Herald," that the Sydney public requires a better system of time than at present in existence. This necessity forced itself upon my attention when I first assumed control of the Observatory, and I have been quietly working for an improvement ever since. It is quite obvious that every clock in the State ought to conform to one definite system, and it is equally obvious that that system shoud originate at the Observatory. Unfortunately, however, this institution has not yet a fixed place of abode, and is consequently not yet in a position to take any active steps. Much of the preliminary work has, however, been accomplished. My aim is to distribute absolutely correct time not only to Sydney, not only to New South Wales, but to every dweller in Australia, and every ship within Australian waters. For the latter portion of the scheme of course the co-operation of the other Australian Observatories and the Federal Government is required; but experiments in wireless time signalling are now being carried out by the Federal department for that purpose.

With respect to Sydney, arrangements for giving every telephone subscriber correct Observatory time at any moment of the day or night are nearly completed, and this alone will probably compel the owners of all public clocks to keep them accurate.

The actual mechanical control of clocks, public and private, is another matter altogether. This, I think, should be undertaken by those who have control of the wires, and probably the Post and Telegraph Department would do so if there was a sufficient demand. Failing this a system of control by wireless is feasible. Experiments in this direction are being commenced, and this may perhaps, if necessary, be undertaken by the Observatory, when it is properly installed in its new quarters at Wahroonga.

Finally, I wish to contradict an unfortunate misstatement in Mr. A. J. Vogan's letter in to-day's "Herald," headed "Behind the Times." The time ball is not "let go" by hand, but is still dropped mechanically, as it has always been, and may confidently be accepted as the most reliable time signal possible. The wireless installation at Pennant Hills does not affect us in the slightest.

I am, etc., W. E. COOKE,
Feb. 17. Government Astronomer.

Fig. 23. Letter from W.E. Cooke in SMH 18/02/1914

Later that year, A.W. Tournay-Hinde presented a lecture to the Engineering Association of NSW, where Murday gave some demonstrations and answered questions. A list of electric clock systems installed in Sydney included those at the Quay, described as ‘synchronised’, but making no mention of the Observatory (Appendix 5)

Although in 1912 Cooke stated that the only connection they have is to Messrs Hardy and Allerding, at the end of 1914, in a letter to Sydney University Registrar Barff, (Appendix 2) Cooke confirms that 1 sec pulses are available from the Observatory.

A week after the letter from Arthur Vogan, A.W. Tournay-Hinde (see Appendix 5) also weighed in.
On the 18/2/1914, W.E. Cooke responded with his perspective on public timekeeping (Fig. 23). He does not seem to be an enthusiast for Observatory control of public clocks.

SYDNEY TIME TO THE EDITOR OF THE HERALD.

Sir,-it is evident, from letters that have recently appeared in the "Herald," that the Sydney public requires a better system of time than at present in existence. This necessity forced itself upon my attention when I first assumed control of the Observatory, and I have been quietly working for an improvement ever since. It is quite obvious that every clock in the State ought to conform to one definite system, and it is equally obvious that that system shoud(sic) originate at the Observatory. Unfortunately, however, this institution has not yet a fixed place of abode, and is consequently not yet in a position to take any active steps. Much of the preliminary work has, however, been accomplished. My aim is to distribute absolutely correct time not only to Sydney, not only to New South Wales, but to every dweller in Australia, and every ship within Australian waters. For the latter portion of the scheme of course the cooperation of the other Australian Observatories and the Federal Government is required; but experiments in wireless time signalling are now being carried out by the Federal department for that purpose.

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accepted as the most reliable time signal possible. The wireless installation at Pennant Hills does not affect us in the slightest.

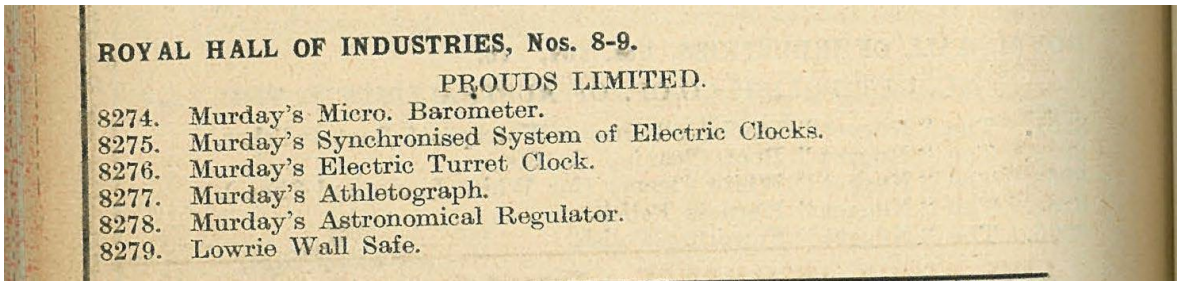
I am, etc., W. E. COOKE, Feb. 17. Government Astronomer.

The nature of the telephone service Cooke refers to here is revealed in an article in the SMH on 22 September 1914 (p.10)

CORRECT TIME TELEPHONIC FACILITIES.

The postal authorities intimate that the correct standard time regulated directly from the Observatory can now be obtained by any subscriber connected to exchanges in the Sydney metropolitan area at the cost of one halfpenny for each call. Time signals of two kinds will be furnished:
--(a) The time to within a half-minute (b) the exact time to within a second
Subscribers requiring standard time to within a half-minute should call the exchange and request "time please." They will then be connected to a telephonist who will furnish the standard time to within a half-minute by word of mouth.
Subscribers requiring the exact standard time to a second should call the exchange and request "exact time." They will then be connected to a telephonist who will connect the subscriber's telephone line to the time-signal service connected with the Observatory. No verbal statement will in this case be given, but the ticks of the standard clock at the Observatory will be transmitted through the telephone. It is presumed that all who require this exact time will know the time to the nearest minute, and will only be con-cerned with the exact seconds.
The "exact time" signal will be given by means of a series of short buzzes, one buzz being transmitted at each beat of the Observatory clock, that is, one buzz per second. The subscriber will hear a regular succession of buzzes from the first to the fifty-ninth second in each minute, but at the sixtieth sec-ond (i.e., the exact minute) the succession of buzzes will be broken, the buzz not being heard after the fifty-ninth second till the beat of the first second of the next minute.
The time-signal service will be available daily throughout the 24 hours.
The maximum duration of any one connection to the "exact time" service will be three minutes.

Prouds mounted an exhibit in the Hall of Industries at the 1914 Easter Show that included 'Murday's system of synchronised clocks', but this was probably just a master clock and impulse dial system. (fig. 24)



ROYAL HALL OF INDUSTRIES, Nos. 8-9.

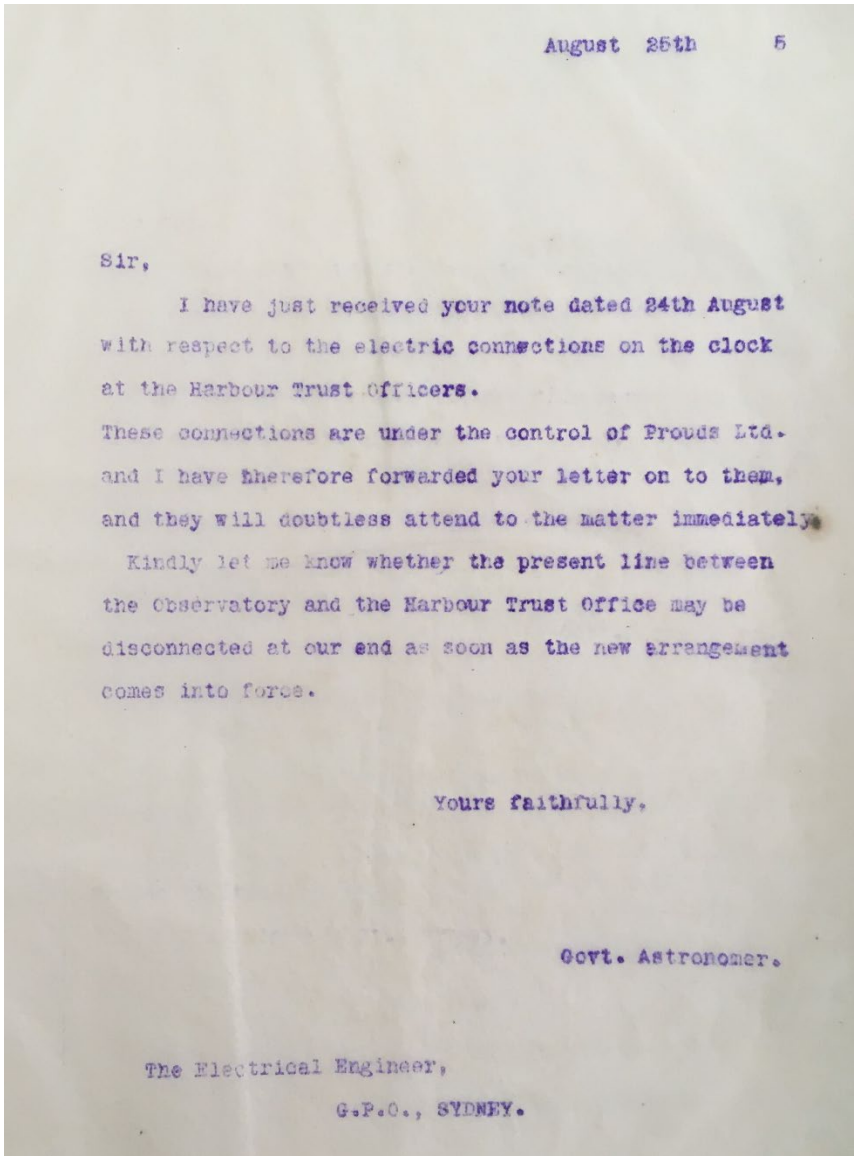
PROUDS LIMITED.

8274. Murday's Micro. Barometer.
8275. Murday's Synchronised System of Electric Clocks.
8276. Murday's Electric Turret Clock.
8277. Murday's Athletograph.
8278. Murday's Astronomical Regulator.
8279. Lowrie Wall Safe.

Fig. 24. Excerpt from the 1914 Royal Easter Show catalogue.

In a letter to the Sydney University Registrar (Appendix 2) on 27 November 1914, Cooke says that 1 sec pulses are now available from the Observatory by telephone that could be used to rate clocks at the University. Again, no suggestion of synchronisation or control.

Returning to the issue of the Observatory-Quay connection, in 1915 a letter to the Electrical Engineer at the GPO refers to 'the present line between the Observatory and the Harbour Trust Office' 'under the control of Prouds Ltd'.(Fig. 25)



August 25th 5

Sir,

I have just received your note dated 24th August with respect to the electric connections on the clock at the Harbour Trust Officers.

These connections are under the control of Prouds Ltd. and I have therefore forwarded your letter on to them, and they will doubtless attend to the matter immediately.

Kindly let me know whether the present line between the Observatory and the Harbour Trust Office may be disconnected at our end as soon as the new arrangement comes into force.

Yours faithfully,

Govt. Astronomer.

The Electrical Engineer,
G.P.O., SYDNEY.

Fig. 25 Letter referring to Observatory- SHT connection

The previous day, Cooke had written to Prouds (see Appendix 2) asking 'to have this connection made'. Both letters were evidently signed by Cooke.

Although this seems to be definite proof that such a connection existed, it also implies that it is about to be altered or removed very soon after the installation of the clocks at the Quay. Since the incoming letters have not survived, we can only speculate about what the 'new

arrangement' was. Probably, a direct line was considered by the PMG to be a violation of its rules, and they wanted the signals to go through the GPO for revenue purposes.

Lawrence Taprell commented that a similar system at the Customs House worked well for many years apart from times when PMG technicians removed connections they did not understand. (Appendix 6) Perhaps something relevant could be found in the archives of the PMG.

In January 1916, prompted by Prouds' display at a trade fair in the Sydney Town Hall, a long article headed 'CLOCK LIARS' (a favourite meme in those days) appeared in the Sun. It quotes Murday and mentions the 'synchronised' clocks at the Quay, but not the Observatory. It also mentions that 'the system of working the clocks is patented by Mr. Murday, of Proud's'. See fig.26

It was also in 1916 that a number of captioned photographs were sent by Prouds to A.G. Jackson, proprietor of the Synchronome Electrical Company of Australasia in Brisbane.

It contained various brochures and photographs mounted on roneoed sheets, including the Circular Quay clocks. (fig. 3)

One sheet gives prices. Although any covering letter has not survived, Prouds may have hoped that Jackson would buy some of their products for installation. The self-contained turret clock, the Athletograph and the Microbarometer don't have counterparts in the Synchronome range. (In fact, in 1917, Prouds installed a turret clock in Kingaroy, Queensland, and they must have dreaded having to make a maintenance call by steamship.)

However, some of the other products are directly competitive, and the miniature timeball in one photograph is a straight Synchronome UK product.[21] It is noteworthy that the line in the 'Electric Time Circuits' leaflet that states '…ours is the only ELECTRIC CLOCK FACTORY IN AUSTRALIA', has a cross against it in the margin, perhaps made by a disgruntled Jackson.

Although the photographs of the Quay clocks are from before the installation, the fact that they were sent in 1916 surely implies that the statements made in the text were still operative at that time, and therefore that:

> "A Master Regulator (also electric) fixed in the vestibule of the Harbor Trust Buildings transmits a synchronising current hourly throughout the system, correcting any slight error that may exist in any individual clock. This regulator is itself electrically connected with the Mean Time Clock at the Observatory, so that the pendulums are swinging synchronously.

CLOCK-LIARS

SYDNEY BEHIND THE TIMES

SYNCHRONISING SYSTEM

As a matter of interesting observation one day a man whose business took him journeying from the suburbs on one side of the city to those on the other checked the clock faces, exposed for the benefit of the public, with his watch. Two of the clocks were for the purpose of ensuring accurate tram running. Several were at ferry wharves. Some were private clocks ornamenting the towers of buildings, others were municipal clocks. He did not seek to set up the correctness of his watch against theirs. It was merely the basis to work out the variation in the clock times.

Naturally expecting variations he was grimly entertained when he found that not one of the clocks agreed. The total variation between slowest and fastest among 12 clocks intended to assist the public was 10 minutes. Ferry time and tram time and train time were characteristically different, and ferry time on one side of the water was not ferry time on the other. Yet trams are supposed to run a conjunctive time-table with boats and trains. "What liars!" he ejaculated amusedly to himself. With, as it happened, a watch running correctly, he could afford to be amused. But what about people who have no watch, or whose watch has stopped or lost or gained? What guidance is there for them?

Those who have a watch, and happen to be in view of the time ball on the tower of the Observatory when it drops at 1 p.m. each day, true to the tenth of a second by the astronomically-checked official time recorder there, are amply accommodated. Householders with telephones can obtain time signals through their receivers. But the great mass of people moving through the city to keep appointments, and who depend on the clock faces that affect to be their time guides for calculations about catching tram, train, or boat, sadly often find their confidence misplaced.

Yet in this busy modern world, where time is money—even more, sometimes happiness or sorrow, or life or death—there is growing among progressive communities the knowledge that the public clock plays a big part in the smooth and efficient working of the machinery of a community. In modern business places the various clocks keep the one regulated time. But, outside them, in Sydney, is chaos. In Melbourne and in Brisbane electrically synchronised clocks, working from a master clock, are installed for public service throughout the city areas, and even into the suburban districts. Seven miles out of Brisbane, the little railway station clock will display to the half-second the same time as the clock at the Central railway station or the Town Hall, or the up-to-date business place in the city.

True enough, the railway and tramway departments do use a synchronising system to a limited extent. But the extent is so limited that it serves no wide public convenience. Time regulation in the Railway Department is confined, for instance, to the Central railway station platforms and offices, and does not extend to suburban railway stations.

Interesting exhibits of master clocks for synchronising time purposes are on view at the Trade Fair at the Town Hall. There are two kinds of master clock—one that propels every half-minute the hands of clock faces connected with it, another that acts as a sort of guide and mentor to an independently operating clock. The latter merely intrudes its influence, as it were, every half-hour, when, if the hands of a subject clock have lagged behind, or have run too fast, they are corrected. The former are put forward as most suitable for clocks in the different offices of a big building working from a master clock in the same building. It is sufficient for that purpose that the clocks should exactly coincide in time, and should be right to half-a-second. But for the exacting requirements of transportation services, particularly railways, and in the case in which the synchronised system is spread through a city and its suburbs, it is claimed that the self-operated clock, supervised half-hourly by the master clock, is the better. Its hands work continuously, and show the time to a fraction of a second. And the fact that it operates independently ensures that there will be no stopping if there is a breakdown in the electric system through which the master clock works. Such an accident would mean only that until repairs were effected the subject clock would have lost the half-hourly guidance of the master clock.

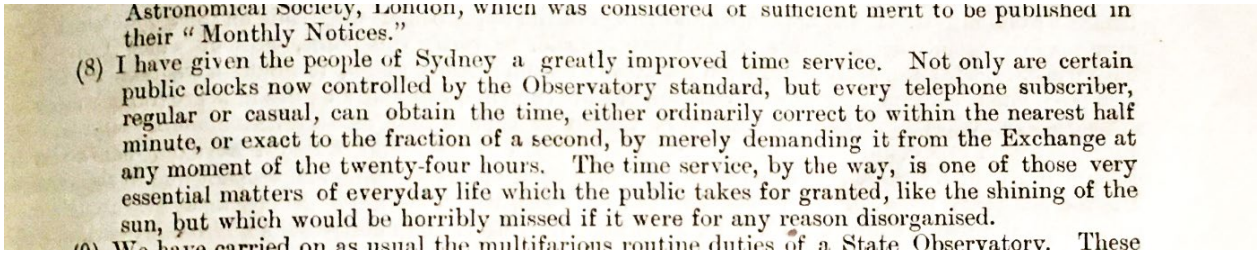
Synchronising installations have been placed in all the clock towers of the Quay ferries, in the Sun Newspaper, in the British Australasian Tobacco Co.'s big factory, where there are 22 dials, in the Public Works and the Registrar-General's Departments, in several big hotels, and various business places. An order has been received to instal the system and 70 dials and watchmen's tell-tale clocks in the new Commonwealth Bank.

Every part of these synchronising clocks, as well as of the electrical clocks and scientific instruments generally, is made by Australian workmen in the firm's factory in Lawson House, Clarence-street. Not only is that so, but also the systems of working the clocks are patented by Mr. Murday, of Proud's, who is an inventor of considerable repute in the scientific world. The utmost delicacy is required in making and fitting the mathematically fine parts of the instruments, and that this can be done by the Australian workman shows that properly taught and given the opportunity he need fear no competition with those in the larger world centres. It is Mr. Murday's express intention to hasten the day when the old spring-operated clock will become obsolete. The electric clock, he claims, runs with a time-keeping accuracy that the spring clock cannot approach. It does not require winding, but runs for a year or eighteen months without attention, and then requires only renewed dry cells, which cost merely a few shillings.

"If I had my way," he said emphatically, "I would have a municipal law that no clock should be shown in the public streets that was not accurate to one minute."

Fig.26. Article in Sun, 14 January, 1916.

In 1918, in response to a highly critical 1917 report from an Inquiry by the Public Service Board into the Observatory, Cooke compiled a long list of his achievements since his appointment. It included (fig 27) a statement that 'certain public clocks [are] now controlled by the Observatory Standard.' This must be a reference to the Circular Quay installation that he is *in extremis* prepared to take some credit for as well as the telephone service he championed.



Astronomical Society, London, which was considered of sufficient merit to be published in their "Monthly Notices."

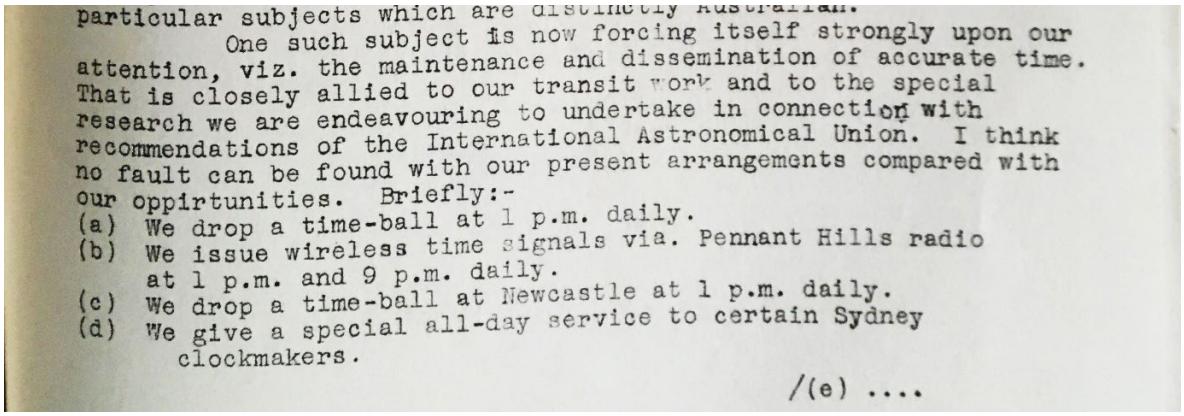
(8) I have given the people of Sydney a greatly improved time service. Not only are certain public clocks now controlled by the Observatory standard, but every telephone subscriber, regular or casual, can obtain the time, either ordinarily correct to within the nearest half minute, or exact to the fraction of a second, by merely demanding it from the Exchange at any moment of the twenty-four hours. The time service, by the way, is one of those very essential matters of everyday life which the public takes for granted, like the shining of the sun, but which would be horribly missed if it were for any reason disorganised.

(9) We have carried on as usual the multifarious routine duties of a State Observatory. These

Fig. 27 Excerpt from Cooke's reply to critical Public Service Board report

The Ninth Annual Report of the Government Astronomer to the Board of Visitors in 1924 includes a helpful summary of the time dissemination activities of the Observatory,(fig. 28) that includes

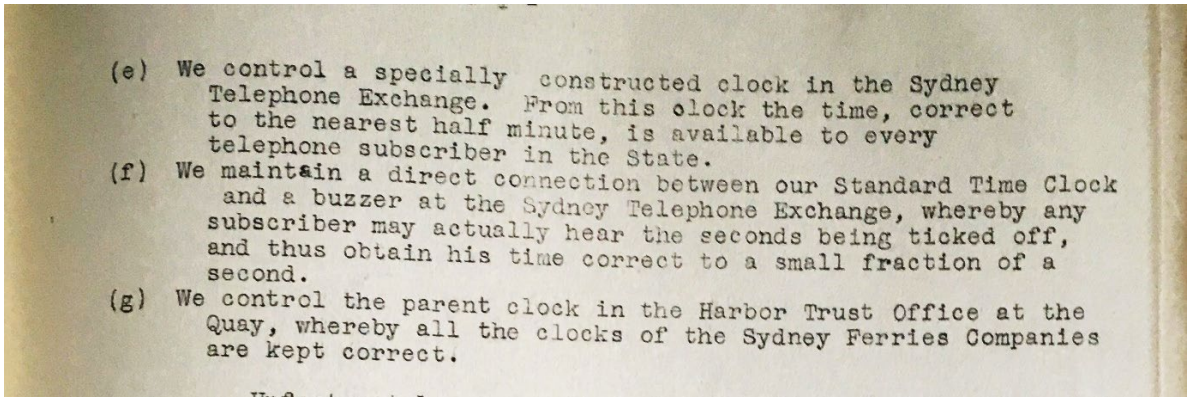
'(g) We control the parent clock in the Harbor Trust Office at the Quay, whereby all the clocks of the Sydney Ferries Companies are kept correct.'



particular subjects which are distinctly Australian.
One such subject is now forcing itself strongly upon our attention, viz. the maintenance and dissemination of accurate time. That is closely allied to our transit work and to the special research we are endeavouring to undertake in connection with recommendations of the International Astronomical Union. I think no fault can be found with our present arrangements compared with our oppirtunities. Briefly:-

(a) We drop a time-ball at 1 p.m. daily.
(b) We issue wireless time signals via. Pennant Hills radio at 1 p.m. and 9 p.m. daily.
(c) We drop a time-ball at Newcastle at 1 p.m. daily.
(d) We give a special all-day service to certain Sydney clockmakers.

/(e) ....



(e) We control a specially constructed clock in the Sydney Telephone Exchange. From this clock the time, correct to the nearest half minute, is available to every telephone subscriber in the State.

(f) We maintain a direct connection between our Standard Time Clock and a buzzer at the Sydney Telephone Exchange, whereby any subscriber may actually hear the seconds being ticked off, and thus obtain his time correct to a small fraction of a second.

(g) We control the parent clock in the Harbor Trust Office at the Quay, whereby all the clocks of the Sydney Ferries Companies are kept correct.

Fig.28 Excerpt from 1924 Annual Report to Observatory Board of Visitors.

So the system was still going after ten years! The *Telegraph* reported in 1926 that 'something like 40,000,000 passengers are carried by the two companies on 57 steamers.. every year. Sydney Ferries, in fact, is the largest ferry company in the world.'

As one of those daily passengers, Murday must have felt some satisfaction, even if hardly anyone else knew about it.

As mentioned above, inspection of the Observatory building and Museum stores at Castle Hill yielded no signs of the connection. Carey Ward remembered:

> When I started at the Observatory in 1980, we were only supplying the 6 dot signal to 2GB and maybe the ABC. In the box that contained the output relays, was a board with all the radio stations etc. that received (or used to receive) the signals from the Observatory. I seem to recall seeing the 'Prouds' name against the 'Continuous' relay. Only part of this equipment was acquired at the time and it currently is under acquisition number 85/38-1:10. I have attached the web image for you. At the top right, you can see the list of radio stations. Below this are some relays, and the black bakelite baseboard may contain the information/evidence you are looking for. The object in the lower left is the mechanical mechanism that produced all three signals, although it has been placed upside down. These objects may have been captured in the recent digitisation project, so better images may be available. Andrew may be able to answer that as well as possibly providing access to the original object.

Carey Ward worked at Sydney Observatory as technician from 1980 to 1982. In 1982 the Observatory was absorbed into MAAS where he then worked in the Registration department until his retirement in about 2022. On a subsequent visit to the stores with Andrew Jacob, we were able to examine 85/38 closely. A board with radio station callsigns including 2GB and ABC was located (fig. 29). If that was associated with the 6 dot signal, that would not have involved the connection to Circular Quay. Another board (presumably originally associated with terminals) included four spaces for 'CONT' (fig.30). That is presumably an abbreviation for 'continuous' and would have denoted a continuous stream of pulses separated by 1 s intervals which is what Prouds would have needed to synchronise their master clock in the Sydney Harbour Trust Building vestibule. There were probably other users too.

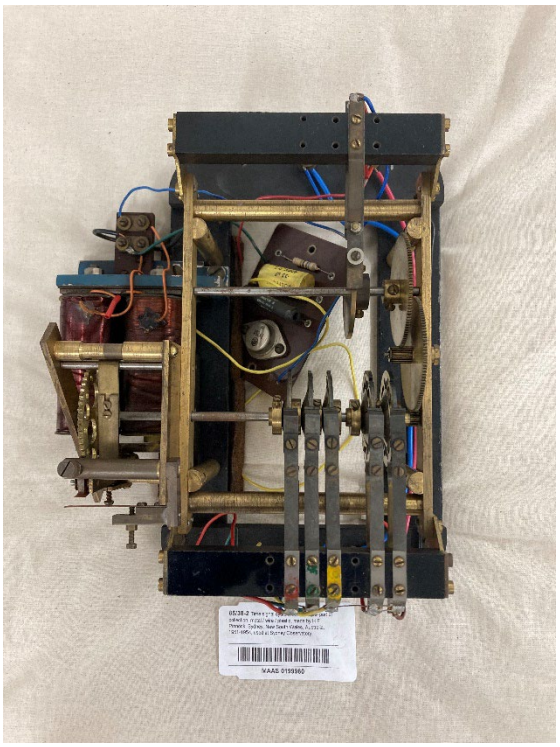


Figure 29 *Figure 30* *Figure 31*

Unfortunately, we were unable to find any reference to ‘PROUDS’ anywhere, so the evidence of the connection remembered by Carey Ward seems not to have been preserved.

Still, there is probably material evidence here of Prouds’ involvement in other Observatory activities, even if much altered by subsequent users. Although such involvement has never been in doubt, it is nice to see.

Item 85/38-2 (fig. 31) has all the appearances of something from the Prouds workshop. Details like the layout of the the electromagnet section, the colours of the wire and the insulation material and the brass lacquer, the way some wheels are lightened by drilling multiple holes instead of filing crossings are all seen in other Prouds products. It has been attributed to H.F. Pinnock in the 1950s but could have been made earlier and reused by him.

Or it could have been made by Lawrence Taprell and Cecil Gross, both of whom worked at Prouds.

Chapter 5. Conclusions

Unfortunately, although few stones were left unturned, the study turned up very little new information about the role of the Observatory in making the time the ferries ran on.
No relevant material relics were found in the MAAS collection.
Observatory correspondence was incomplete in the archives for the relevant period.
It's possible that something might yet be found in the PMG archives.
However, enough evidence was found to confirm what was previously believed, and to establish that although the Government Astronomer paid little attention to it while he fought for the survival of the Observatory, the service provided did ensure that the time the ferries ran on was potentially exceptionally accurate.
It is not known how long the Prouds installation at Circular Quay lasted. The fragmentary nature of the Sydney Harbour Trust archives, the destruction of any Prouds archive decades ago, and the low profile of the Observatory connection all suggest that it might be difficult to find out.
Perhaps an entertaining way to end this report is to reproduce an article from the *Sun* from Sunday, October 7, 1928 (Fig. 27). Although no other negative reports were found, here 'M.H.' complains.:

> Standing in front of the Customs House, you
> can see three clocks without change of position.
> It may be that on rare occasions they have agreed,
> But none of these occasions can be remembered.
> On one recent day the two clocks on different
> Ferry wharf towers showed a divergence of opinion
> on the subject of the time of twelve minutes. Con-
> sulted as a sort of mediator between them, the
> Customs House clock de-
> clared for a time not quite
> midway between the two.

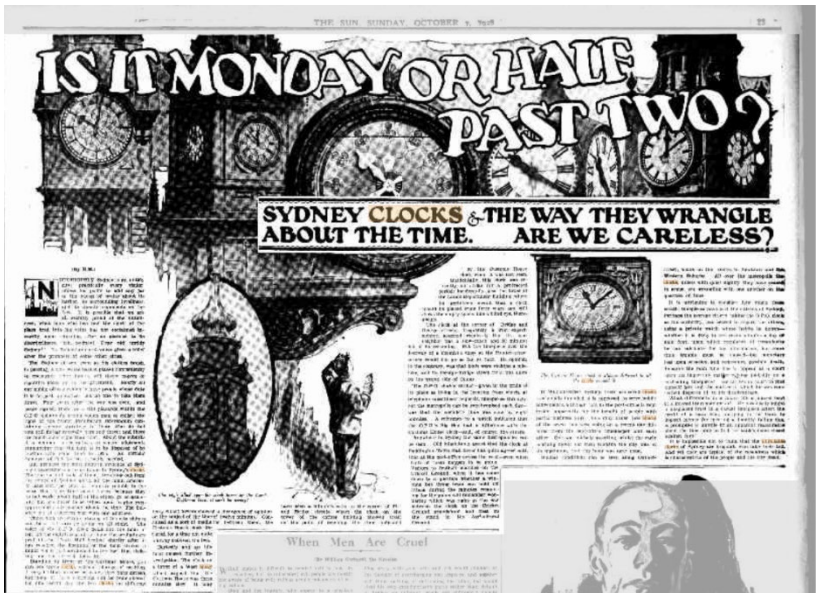

IS IT MONDAY OR HALF PAST TWO?
SYDNEY CLOCKS & THE WAY THEY WRANGLE ABOUT THE TIME. ARE WE CARELESS?
When Men Are Cruel

Fig. 27

Sic transit gloria mundi

(The Circular Quay clocks were not the only subjects for criticism.)

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