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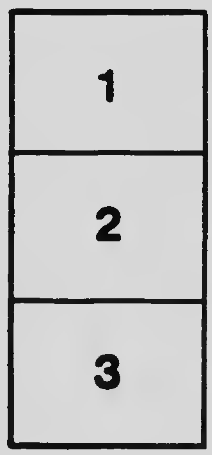
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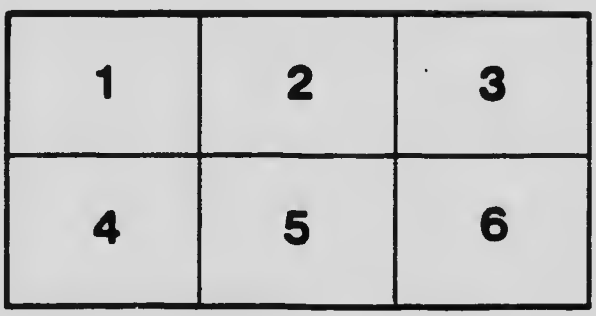
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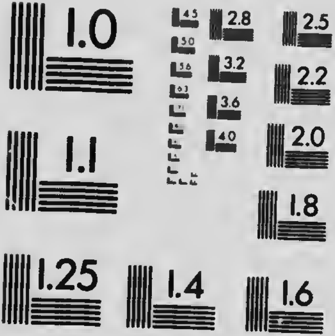

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TRANSPACIFIC LONGITUDES

CANADA AND AUSTRALIA AND NEW ZEALAND

1903-1904

APPENDIX 3.

REPORT OF THE CHIEF ASTRONOMER, 1905.

TRANSPACIFIC LONGITUDES BETWEEN CANADA AND AUSTRALIA AND NEW ZEALAND, EXECUTED DURING THE YEARS 1903 AND 1904

BY

OTTO J. KLOTZ, LL.D.

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APPENDIX 3.

DEPARTMENT OF THE INTERIOR,
OFFICE OF CHIEF ASTRONOMER,
OTTAWA, CAN., December 30, 1905.

W. F. KING, Esq., LL.D.,
Chief Astronomer,
Ottawa.

SIR,—I have the honour to submit the final report on 'Transpacific Longitudes' carried out under my charge.

With me in the work was associated Mr. F. W. O. Werry, B.A., as observer, and he occupied Fanning and Norfolk isl[illegible]

Mr. F. A. McDiarmid, B.A., [illegible] to the clock exchange at Bamfield, Vancouver Island, with the observatory [illegible] Vancouver and the one at Fanning. He also computed all the transits.

I occupied Vancouver; Suva, Fiji; Southport, Queensland; and Doubtless Bay, New Zealand, besides the observatories at Brisbane, Sydney and Wellington for personal equation.

I have the honour to be, sir,
Your obedient servant,

OTTO J. KLOTZ.

REPORT ON TRANSPACIFIC LONGITUDES BETWEEN CANADA AND AUSTRALIA AND NEW ZEALAND, EXECUTED DURING THE YEARS 1903 AND 1904.

NOTES ON THE BRITISH PACIFIC CABLE.

On Decem[illegible] 1, 1900, articles of contract were made by Her Majesty's Government, Canada, [illegible] South Wales, Victoria, New Zealand and Queensland on the one part and the Telegraph Construction and Maintenance Company on the other, for the construction and laying of the Pacific Cable.

The contract called for the completion of the whole cable on or before December 31, 19[illegible] The cable was finished two months earlier, and after undergoing the required tests of a month, entered upon its commercial career on December 8, 1902.

Thus was the project, that had been advocated with persistence from some quarters for a quarter of a century, made an accomplished fact. The missing link of about 8,000 miles across the Pacific between Canada and Australia in the world's metallic girdle was now supplied.

Before the cable was laid a survey was made of the route and the character of the ocean bed examined.

From the survey the number of miles (nautical) of cable required for the different sections was as follows:—

From Vancouver Island to Fanning Island	3,654
" Fanning Island to Suva, Fiji	2,181
" Suva to Norfolk Island	1,019
" Norfolk to Queensland (Moreton Bay)	906
" Norfolk to New Zealand	513

The first section of the cable is about a thousand miles longer than any that had been laid before. This necessitated a considerable increase in copper for the conductor and in gutta percha for the dielectric. The working speed of a submarine telegraph cable depends on, and is inversely proportional to, the product of the total resistance of the conductor multiplied by the total electro-static capacity of the core, so that, other things being equal, the speed varies inversely as the square of the length of the cable. In the long section there were used 600 lbs. of copper and 340 lbs. of gutta percha per nautical mile. On the Fanning-Suva section 220 lbs. of copper and 180 lbs. of gutta percha; and on the remaining three sections the copper and dielectric were in equal proportions of 130 lbs. each.

In the neighbourhood of Fiji at a depth of 2,500 fathoms, a temperature of 34°·4 Fahrenheit was noted, being the lowest temperature taken during the survey. There is very little difference in the temperature of the ocean at great depths, say below 3,000 fathoms, over a great extent of the earth's surface, the temperature being only a few degrees above freezing point, or 32° Fahrenheit. The greatest depth, 3,070 fathoms, about three and a half miles, was found on the Fiji-Fanning section, where the bottom specimens consisted principally of radiolarian ooze. This ooze is found at the greatest depths, and was obtained by the *Challenger's* deepest sounding in 4,475 fathoms. The United States steamer *Nero* sounded in 5,269 fathoms, 6 miles (this last being the deepest sounding recorded in the ocean), and the material brought from the bottom was radiolarian ooze.

Of the 597 samples of sea bottom obtained on the Pacific Cable survey, 497 were such that they could be divided into distinct types of deposits. It was found that:—

294	samples referred to	globigerina ooze.
65	" "	red clay.
43	" "	radiolarian ooze.
15	" "	coral mud or sand.
27	" "	pteropod ooze.
12	" "	blue or green muds.
41	" "	organic mud or clay.

The pressure at a depth of 3,000 fathoms, in which a considerable portion of the Pacific Cable is laid, is about four tons to the square inch. When the cable is being laid at such depths, it will be approximately twenty miles astern of the ship before it touches the bottom.

Deep sea cables last longer in the tropics than in the northern oceans. The reason is to be found in the fact that in the tropics marine life, from which globigerina ooze is derived, is more abundant than in the more northerly or southerly waters. It is the sun and the warm surface water that call into life these countless globigerina, which live for a short space, then die and fall to the bottom like dust, making such a good bed for the cable to rest in. In the Arctic currents, where the surface is cold the water does not teem with life in the same way as it does in the tropics, and consequently there is less deposit on the bottom of the ocean.

A submarine cable consists, first of a core, which comprises the conductor, made of a strand of copper wires, or of a central heavy wire surrounded by copper strips as in the Pacific Cable, and the insulating covering, generally made of gutta percha, occasionally of india rubber, to prevent the escape of electricity. As far as cabling is concerned, this is really all that is necessary, an insulated conductor. This, however, would not, in the first place, be sufficiently heavy to lay in the ocean, and secondly, would be too easily injured and destroyed by the many vicissitudes to which it would be subjected. For this reason, a protection in the form of a sheathing of iron or steel wires surrounds the core; the nature, size and weight of the sheathing being dependent upon the depth of the water and kind of ground over which it has to be laid. The deep sea section, being the best protected from all disturbing influences outside of displacement of the earth's crust by earthquakes or volcanic action, is naturally the one of smallest dimensions; and for the shore end, which is exposed to the action of the waves, to driftwood, to the grinding of ice in the more northerly latitudes, and to the danger of anchorage, especially of fishing boats, the sheathing must be very heavy. So that while the deep sea cable is somewhat less than an inch in diameter, that for the shore ends is nearly 2½ inches in diameter. The action of the waves is limited to a depth of only about 13 fathoms, so that their influence on the cable, manifested by wear and chafing, is confined to the shore end.

The Pacific Cable is equipped with the most modern apparatus at the various stations, and the cable is worked duplex, that is, messages are sent and received on the same cable at the same time.

Canada had carried longitude work from Greenwich across the Atlantic and thence to Vancouver. The completion of the British Pacific Cable offered an opportunity for continuing the work across the Pacific in the interests of navigation and geography, besides tying for the first time longitudes brought eastward from Greenwich with those brought westward, making the first longitude girdle round the world.

In October, 1902, the Honourable Mr. Clifford Sifton, Minister of the Interior, authorized the carrying out of the Transpacific longitudes, and the Governors of the South Sea, Australia and New Zealand were respectively officially notified thereof.

In preparing the programme for carrying out the work, the climatic conditions of the various stations to be occupied were studied so that the most favourable times and seasons might be chosen. It was found that Suva, Fiji, was the governing factor, as it was by far the rainiest place of the series.

Besides the transit outfit, I carried, too, a half-seconds pendulum apparatus, and a Tesdorpf magnetic instrument, the latter similar to the ones furnished to Drygalski of the *Gauss* on his Antarctic expedition.

ITINERARY.

Mr. Werry left Ottawa on February 27, 1903, and proceeded to San Francisco, whence he sailed for Samoa, where he took the northbound steamer for Fanning island. The southbound steamers in passing Fanning do not call there. In the latter part of March, Mr. McDiarmid and I proceeded to Bamfield, Vancouver island, the eastern terminus of the Pacific Cable. After installing the sideral clock and its connection with the cable, I returned to the Vancouver observatory to begin observations. Bamfield, where no observations were taken, was simply used as a clock exchange station for making comparison between the Fanning and Vancouver clocks.

By the end of April a satisfactory number of observations had been obtained at Fanning and at Vancouver, and the first link of the Transpacific longitudes completed.

I took passage on the Canadian-Australian steamer *Miowera*, and sailed on May 2 for Suva, Fiji. We called en route at Honolulu. Here were met the two American astronomers, Mr. Edwin Smith and Mr. Fremont Morse, who were engaged in the determination of the difference of longitude, San Francisco-Honolulu. Suva was reached May 20, and immediate steps were taken for the erection of the pier and the observatory. The Fanning-Suva longitude was completed on June 24. It may be stated that as Suva is just west of the 180th meridian, and Fanning east of it, the dates for the observations of the same night differ by a day. Mr. Werry left Fanning on June 27 for Norfolk island some 3,000 miles distant. This necessitated a rather circuitous route of about 7,000 miles for lack of suitable steamer connections. He had to return to Honolulu thence to Samoa, Auckland, New Zealand, Sydney Australia, and finally to his destination, which he reached in the beginning of August, occupying about six weeks to reach the cable station at Norfolk island. During this interval I made pendulum and magnetic observations at Suva, and also paid a visit on invitation of Roko Kandavu, grandson of the great cannibal king, Cakobau, the present ruler, at the old Fijian capitol on the small island of Bau, some 20 miles from Suva.

About a month was occupied in determining the difference of longitude, Suva-Norfolk. On September 7 I sailed on the *Aorangi* for Brisbane, where we arrived on Saturday, the 12th. On the following Monday I proceeded by rail with the astronomic outfit of many cases to Southport, the cable station, fifty miles south of Brisbane.

Mr. H. C. Russell, government astronomer at Sydney for New South Wales, hearing of my arrival, immediately wired his hearty co-operation in connecting Sydney with Southport. Similar co-operation was readily granted by Mr. A. A. Spowers, Chief Surveyor for Queensland, with the Brisbane observatory in charge of Mr. T. D. Fraser. By September 25 the pier and observatory were built and observations begun. Southport formed a unique station, for nightly clock exchanges were had in succession with Brisbane, with Norfolk and with Sydney, at each of which time observations were being taken. It was on September 29 that the first mutual observations and clock exchange were had with Sydney, and so this night may be considered as the one when for the first time longitude from the west clasped hands with longitude from the east, and the first astronomic girdle of the world was completed.

By October 16 the last link, Norfolk-Southport, of the direct Transpacific longitude was completed. Mr. T. D. Fraser and I observed for personal equation at Southport and at the Brisbane observatory. Magnetic observations at Southport were also taken. On November 3 I arrived at Sydney, and after observing for personal equation, with the two observers, Mr. H. A. Lenehan, acting government astronomer, and Mr. W. E. Raymond, left on November 7 for Wellington, New Zealand. Here I was met by Sir James Hector, the former director of the observatory, and by Mr. Thomas King, who now has charge of the time observations. The Premier, the Honourable R. J. Seddon, extended every facility the government could offer to further the success of the work. Observations were made for personal equation by Mr. King and myself. After making the necessary arrangements for subsequent clock exchange signals at the observatory, I left for the cable station at Doubtless Bay, at the north end of New Zealand, going by rail to New Plymouth, thence by steamer to Onehunga, across the narrow isthmus by rail to Auckland and thence by steamer to Mangonui, the most northerly port on the east coast. From there I had to drive over an execrable road some miles to the cable station. Here a pier and observatory were built similar to the ones at Suva and Southport. Longitude observations were begun on December 3 and finished on December 19. Before leaving this station a set of pendulum observations was obtained, and the magnetic elements were also determined.

Returning to Wellington, another set of personal equation observations was taken, and similarly in Sydney in January, 1904.

This completed the work of the Transpacific longitudes.

I wish here to express thanks for the hearty co-operation of the chief electrician of the Pacific Cable and of the superintendents at all the stations; of the superintendents, Mr. Hesketh, of the government telegraphs in Queensland; Mr. Young, for New South Wales, and Mr. John Logan, for New Zealand. Mr. G. A. Buzacott, Deputy Postmaster General of Queensland; Mr. J. Dalgarno, for New South Wales, and Sir Joseph Ward, Postmaster General of New Zealand, kindly placed the use of the respective telegraph lines at my disposal for the nightly clock exchanges.

At the Wellington observatory batteries and telegraph instruments had to be installed for the clock exchanges with Doubtless Bay. This was done by Mr. Buckley, government electrician, who also kindly attended every night during the campaign at the observatory to the exchange of signals. In short, wherever and whenever any assistance was required it was readily and cheerfully extended, and the success of the work is in no small measure attributable thereto.

The number of stations between Vancouver and Australia, as well as between Vancouver and New Zealand, is odd, and as the two observers occupied alternate stations, the terminal stations, Southport and Doubtless Bay, are each free by this means from personal equation.

KLOTZ—INSTRUMENTAL EQUIPMENT.

Transit.—The transit (Fig. 1) is by T. Cooke and Sons, and known as No. 504 of their catalogue, 1900, with slight modifications. This instrument was specially ordered for the Transpacific longitude, and was received only a short time before departure for Vancouver, where it was mounted for the first time, and the large inequality of pivots discovered. It has an object glass of three inches, clear aperture, and is mounted in a tube of double conical shape with dew-shade: focal length about 36 inches, axis $1\frac{3}{4}$ inches in diameter, Y's $1\frac{3}{16}$ inches in width; the support of each end of the axis is two cylindrical segments having arcs $\frac{3}{4}$ inch long.

The telescope is provided with two $6\frac{3}{4}$-inch setting circles reading by verniers to 20 seconds of arc. One of these circles is provided with a special arm for carrying the latitude level, when using the transit as a zenith telescope. Above the level there is a device for an attachable mirror, a strip of silver glass set in a metal frame. In using the transit as a zenith telescope the level readings cannot be satisfactorily read for stars near the zenith, as one end of the bubble will be directly behind one of the transit standards. To avoid parallax in reading the level, the mirror, secured at an angle of 45 degrees, and at the height of the eye, overcomes the difficulty.

A striding level is provided. The vial rests on cork tips, and is retained in position by light cork tipped springs. There is a glass covering to prevent sudden change of temperature of the vial. A single wooden knob on the level frame serves for handling the striding level. On account of the long legs it was found necessary to attach lateral legs to prevent accident from toppling over through gusts of wind or other cause. A dew-cap 6 inches long is used when observing. The eye-piece attachment carries a micrometer for the movable thread used for latitude work. The micrometer is divided into a hundred parts, equivalent to about 56 seconds of arc, so that by estimation to tenths of a division, about six-hundredths of a second of arc may be read. The eye-piece attachment with micrometer may be turned through 90° from the ordinary position when observing transits, in order to make the movable thread available for measuring zenith distances in latitude work. Instead of having a comb for counting the revolutions of the micrometer there is a small, toothed, geared and numbered wheel outside to effect the same purpose. This has the advantage of obviating erroneous counting which may happen with the comb in counting from left to right, instead of from right to left or vice versa.

Of the different eye-pieces with which the telescope is provided the same rectangular (erecting) eye-piece was used throughout. The eye-piece is set in a cross-slide with quick-traversing screw and milled-head.

There are on the diaphragm thirteen spider threads, two outside ones and then two groups of three each placed symmetrically about a middle group of five threads. The equatoral interval between two adjoining threads in a group is about 1·6 seconds of time. The illumination of the threads was effected through the hollow axis by an oil lamp, placed on an arm 9 inches long. To prevent unequal heating of the axis, a lamp was placed at each end of the transit axis. Lucca oil is found the most satisfactory for burning in the small instrument lamps.

The transit was supplied with reversing apparatus. The cast-iron stand rested on a base-plate and was supported by three large screws, one at one end and two at the other, fitting into spherical holes in the base-plate. For meridional adjustment two opposing screws at the foot of the stand and near the supporting screws acted on a projection on the base-plate, the levelling was done by the single supporting screw at one end. The base-plate was not bolted to the cement capping of the pier. The weight of the whole instrument and plate was sufficient to retain the latter in a permanent position with reference to the pier.

Clocks.—Two clocks or rather chronometers were carried. They were adjusted to sidereal time. Both had break-circuit electrical attachments.

Dent No. 48419 had two-second breaks at the even seconds, omitting the 58th second break in order to indicate the 60th or minute break.

To the inside of the outside case were attached maximum and minimum thermometers and an ordinary thermometer within the chronometer box proper. One dry cell was generally found sufficient for the clock circuit, and would retain its efficiency for two months. During the day time when not observing, the clock circuit was of course left open. The clock at each cable station was placed in one of the 'artificial line' cabinets, so that its temperature might be as uniform as possible. The fluctuation in temperature during the twenty-four hours was small, being confined within about two degrees Fahrenheit. At Vancouver the chronometer was kept in a small brick vault near the observatory, used for storing the powder for the signal gun, a quarter of a mile distant, which is fired daily at 9 p.m. Pacific standard time. Insulated copper wire connected the clock with the switchboard in the observatory, hence with the chronograph circuit; and by another set of wires with the sounder on the pier of the cable instruments, by means of which, as more fully explained elsewhere, the clock was made to record its beats by a special siphon on the cable fillet of paper.

The clock was wound daily at 4.30 p.m.

Bond No. 516 made two second breaks also; instead of omitting the 58th second break, however, a break for the 59th second was interpolated to identify the following one for the full minute.

Chronograph.—A Fauth (Saegmüller) barrel or cylinder chronograph was used. The cylinder was 6¾ inches long and 4 inches in diameter. It was geared to two speeds, but the slower speed of one revolution per minute was the one always used. A Waterman fountain pen answered the purpose as recording style, but it requires attention. The perversity of some things at times seems inexplicable.

The pen, being actuated by the small armature of the magnet of the chronograph, and the electric circuit of the latter by the clock also by the observing key, records both the clock and star transit.

It was customary to use one chronograph sheet for each position of the instrument, so that for a complete set there would be four sheets for a night's observations, and an extra sheet when there was an exchange of clock signals over land lines. The chronograph sheets are infinitely more convenient for sealing a set of observations than the Morse fillet so common in the European observations. For subsequent reference too the sheet is vastly superior to the yards or fathoms of fillet.

The measurements on the chronograph sheets were made by means of a convergent-divergent glass scale, covering the two-second spaces, and dividing the same into tenths of a second, which by estimation were read to hundredths. Fig. 2 shows one of the chronographs used.

Levels.—Both the latitude and striding levels used were supplied with the transit by T. Cooke & Sons.

Their value was determined before and after the work by means of a level-trier, 114·40 inches between the pivots, and the Whitworth micrometer screw for raising and lowering one end of the trier read directly to one-thousandth of an inch. Determinations for value of one division of level were also made by placing the level longitudinally on the telescope tube of transit No. 2, then comparing the displacement of the bubble with the corresponding angular movement of the telescope as measured by the micrometer on some distant fixed object.

The method by level-trier is more accurate than the one by the micrometer, as the latter involves the uncertainty of constant bisection with the micrometer thread.

Electrical Apparatus.—The switchboard which has been used for many years very satisfactorily in connection with the Canadian transcontinental longitude work, was used at every station. For clock exchange by cable all its parts were not required; it then only served for the observations themselves by making the necessary connection between clock, chronograph and observing key.

However, at Vancouver, Southport and Doubtless Bay, where clock exchange signals were made over land lines and the conversation was done over the wires from the observatory, all parts of the switchboard were brought into requisition.

The accompanying diagram (Fig. 3) will illustrate the various parts and connections of the switchboard.

When observing, the switch is to the left, and plug 1 is in. The chronograph circuit is broken by the chronometer at the points of the clock relay, as well as by the observing key.

For simply talking over the line the switch is to the left, plug 2 in, plug 3 out, and also plug 8 out if the sounder is to be used. Experienced operators do not need the sounder but read off the relay.

For clock exchange, both clocks (of the two stations) beating simultaneously over the wire, the switch is put to the right, plugs 1 and 2 out; 3 may be out or in. When 3 is in, the talking relay is cut out. In clock exchange the main line current passes over the points of the clock relay and is there broken; similarly the distant clock breaks the local chronograph circuit at the points of the signal relay.

For arbitrary signals, sent with the break-circuit signal key, the switch is to left and plugs 1 and 2 out, so as to throw the chronograph circuit over the points of the signal relay. Under all conditions the chronometer always records on its own chronograph.

When the switch is to one side, the opposite points are in contact. The switch separates them, and changes thereby route of current. One dry cell (Mesco) is sufficient for the clock circuit. This is always independent of any other current, and to protect the points of clock contact only one cell is used.

For the circuit of the observing key and chronograph two or sometimes three cells are used.

Cable Attachment.—From former experience it was found undesirable to have a direct connection between the clock and the cable siphon, *i.e.*, to have the clock recording directly by means of the cable siphon. It is better to have an independent clock siphon tracing a line parallel to the one of the cable siphon.

To obtain the local clock record or two-second beats on the cable fillet, an ordinary sounder (Fig. 4) was provided with a 4½-inch long threaded rod attached vertically to one end of the sounder arm. Over the rod fitted loosely an oval ring held in position by two opposing screws and also by two nuts, one above and the other below the ring. The heads of the screws were perforated to admit of centering and fastening the silk fibre, to be spoken of presently. The sounder was screwed on a small board and the latter securely attached to the pillar on which the cable instruments are set, as it was found that by placing the sounder on the table the vibrations to which it was subjected by walking or other causes, made the siphon record unsatisfactory. On the brass frame (of the cable instrument) carrying the ordinary cable siphon was stretched another thin wire to which was attached a siphon which was connected by a raw silk fibre with the rod of the sounder arm, so that the siphon responded to the pulsations of the sounder and hence when filled with ink would leave a record on the cable fillet.

The recording of this siphon differed [illegible]om that of the ordinary cable siphon, in as much as it dragged a continuous line o[illegible]illet, while the other makes necessarily a dotted line, produced by the small vibra[illegible]pping the frame. The magnetic effect, produced by the weak current used on cables, and which actuates latterally the cable siphon, is too weak to permit the siphon to rest permanently on the fillet, it could not draw it aside, so the siphon is kept just above the paper and by means of the vibrator is made to deposit drops of ink—about 60 per second—and thereby leave a record.

Before attaching the silk fibre to the sounder rod and siphon it was subjected to a constant pull by means of a small weight for a day in order to remove its elasticity sufficiently to permit of instantly responding on the siphon to the movements or pulsations of the rod. The tension of the fibre was adjustable by means of the two small opposing screws in the oval rings of the rod.

The local clock record on the cable fillet was necessary in order to be able to interpret the arbitrary signals sent from the other observing station and recorded by the cable siphon. In receiving signals there were two records on parallel lines on the fillet, the signals as shown by the cable siphon, and the clock beats shown by the other siphon. The trace of the latter was the foot-rule, so to speak, or scale for measuring the other. The two-second breaks in the line drawn by the clock siphon were projected vertically by a fine pencil lii on the line of the cable siphon and the relative position of the arbitrary signals measured by a glass scale, similar to the one described, but somewhat larger, as the two-second breaks on the fillet were made considerably larger than those on the chronograph sheets. The speed of the fillet is adjustable by the small motor.

Although the siphons were generally placed fairly opposite each other, that is, in the same perpendicular to the fillet, yet it was necessary to know their parallax. To attain this end the local clock circuit was put in connection with one of the cable keys, the one (positive) used for sending arbitrary signals. A special arm was attached to that cable key so that when the cable key was depressed to make circuit and send a signal into the cable, the arm would at that moment break the local clock circuit, hence record the time on the fillet. By comparing the relative positions to a vertical of the break made by the cable siphon with that of the other siphon for an arbitrary signal, the apparent parallax of the siphons is obtained. To this parallax there may be a small outstanding correction due to want of perfect adjustment, that is, that the make of the cable key absolutely synchronizes with the break on the clock circuit. To obtain the absolute parallax the metal frame carrying both siphons was given a slight sharp tap, generally with the back of a pocket knife. By this means there was a momentary simultaneous displacement of both siphons and the parallax obtained, and by comparison with the above, an adjustment, if necessary, made.

The correction was always a small quantity—if anything at all—and about one-hundredth of a second of time.

Observing key.—This was an ordinary American telegraph key mounted on a small piece of wood. The spring adjustment was made weak, and the platinum points about a fortieth of an inch apart. The same conditions were maintained throughout the work. The moment the key was touched the circuit was broken and the transit recorded, independent of the spacing between the points of the key, which is not the case in a make-circuit key.

SYSTEM OF WORKING.

Programme.

It was decided that for each final differential longitude there should be five mutually complete nights or their equivalent.

Time set.—A complete night's programme comprised twenty-eight stars, divided into four sets of seven stars each. One of the seven being a polar, while the others were distributed between the zenith and an equatorial zone.

Two of these sets—one clamp east and one clamp west—comprised a time determination, so that each night, when clear, there would be two independent time determinations, and a measure of the individual hourly clock rate obtained, beside the daily rate shown by the observations of successive days.

For the northern hemisphere the Berliner Jahrbuch has generally been used for the selection of stars, but for the southern hemisphere the British Nautical Almanac furnished the most suitable stars. Both were supplemented by the American Ephemeris and Connaissance des Temps. On account of the difference in longitude between any two stations, and for other reasons it was not practicable for the two observers to use the same sets of stars for the purpose of eliminating errors in right ascension, which in the standard stars alone used is supposedly a very small quantity. The programmes were always so arranged that each observer would, with clear sky, have completed his first time determination, that is, would have observed one set clamp east and one set clamp west, before the time of exchange, generally at 9.30 p.m., of clock signals. These signals would therefore fall between the first and second independent time determinations. It is all-important that the respective clock errors be accurately known at the time of exchange of clock signals. This is best obtained and assured when there is a time determination immediately preceding and one immediately following such exchange. Through clouds or rain, or other unpropitious weather it was not always possible to obtain the time determination when desired.

Exchange on Cable.—Along the whole system of the Pacific cable Greenwich mean time is used for the commercial work. For Fiji through which runs the anti-meridian of Greenwich, the Greenwich mean time 12 hour clock dials would practically show local time for Suva. It was desirable in the cable offices that the time for exchange of clock signals be fixed at some definite time so that the officers could govern themselves accordingly and have the spare cable instrument in readiness at the appointed time. The time was so arranged that the westerly observer had time to obtain his first time determination before the exchange. In the tropics observing may be begun almost immediately after sunset, as there is little twilight. The exchange consisted in each observer sending alternately not less than thirty arbitrary signals at irregular intervals, averaging about two seconds apart, the interval being always sufficiently long to permit the siphon to have well resumed its normal position in tracing the zero line of dots on the fillet. The signals having been mutually and satisfactorily received, the record of the night's work and of the preceding night was mutually communicated, and this ended the use of the cable for the night. If all went well, the whole exchange of signals and communications would occupy less than ten minutes. This was, however, not always the case; the ink in the siphon might give trouble, or the vibrator, or some other vicissitude for which one must always be prepared not only at the cable instrument, but also in the observatory.

Throughout the whole work, received signals were scaled by Klotz on the cable siphon record, by projecting the 2 second breaks of the clock on the lower or clock siphon record upon the upper one. This method was preferred to projecting the received signals (beginning of deflection of cable siphon) on the lower line to avoid obliterating or obscuring by a pencil line as ordinate the dot or dots (vibration of siphon) indicating the arrival of the signal. In the method pursued, after adjusting the glass scale to cover the intersection of the ordinates from the clock breaks with the zero line of the cable siphon, one could deliberately determine the first indication of the cable siphon leaving its zero line of undisturbed position.

The scaling of the signals sent, which were recorded by both siphons, was always done on the clock siphon record, hence it is necessary to apply to all scaling of signals received, which were recorded of course only on the cable siphon, the parallax of the cable siphon. This parallax was readily obtained from the signals sent, because in that case we have the record for eac[illegible] ignal by the two siphons. To test th[illegible] adjustment of the cable key with the local clo[illegible] circuit, *i.e.*, whether the two siphons recorded simultaneously, the cable key make a[illegible] l the clock circuit break, the frame carrying the two siphons was lightly tapped after the exchange of signals thereby making simultaneously a break in the two lines made by the siphons, and the absolute parallax expressed in time found. If the apparatus is well adjusted, this absolute parallax is identical with the one obtained as described above. When a difference was found it was confined to about one-hundredth of a second.

Mr. Werry invariably scaled the cable siphon record both for sending and receiving signals on the clock siphon line by projecting the same on that line. The parallax of the siphons was obtained in a manner similar to the one described above.

The accuracy with which a comparison between two clocks or chronometers can be made by means of a cable, is practically only a matter of careful scaling of the time signals on the tape. So that with the tape running out approximately an inch a second it is found that an exchange of thirty signals gives a probable error for the mean difference of the two chronometers of less than ± ^{s}.002. Small as this quantity is, it includes error of scaling, irregular running out of tape, irregularity of clock beats, and differential rate.

Compared with the many other quantities—star places, level readings, temperature with its hidden effects on instrument and chronometer, errors of observation, personal equation—entering into the determination of the difference of longitude, the probable error of an exchange of time signals is almost a vanishing quantity. The same remark holds true for an exchange over land lines. Fig. 5 illustrates a cable record, both receiving and sending.

Clock Exchange on Land Lines.—Land line exchanges were made between Vancouver and Bamfield, Southport and the observatories at Brisbane and Sydney, the former fifty miles distant by wire, and the other 753 miles. Also between Doubtless Bay and the observatory at Wellington, 701 miles. The exchanges were effected without the interposition of relays on the line.

It was customary to allow both clocks to record over the wire at the same time and record on the chronographs of the two stations. This was a mere check on the actual exchange by arbitrary signals and to show the relative position on the chronographs of some one minute (the 60th second) of the one clock and some one minute of the other clock. Experience has long shown that a more accurate comparison between two clocks can be made by arbitrary signals, that is by breaking the local clock circuit as shown on the chronograph, and by that same depression of the key, breaking the main line and hence sending a signal to the distant station there to be recorded on the chronograph, than by simply allowing the clocks to record over the line. The particular merit of the arbitrary signals lies in the fact that in scaling the chronograph sheets the mind is and remains unbiased in making the measurements, whereas when scaling the record of the two clocks recording simultaneously on the chronograph, the mind involuntarily becomes biased after making one measurement. We know in advance what the remaining measurements should be. It is impossible to get rid of the influence of knowing in advance what to expect. This undesirable condition in exchange of clock signals is obviated by adopting the method of arbitrary signals. The measurements on the chronograph sheets as well as on the cable fillets were read to the one-hundredth of a second of time.

At the three observatories, Brisbane, Sydney and Wellington the Morse register with fillet of paper and two styles was used for recording the exchange of clock signals. It is somewhat surprising how tenaciously this form of chronograph is maintained not only at these observatories (Sydney had a drum chronograph too) but also at those in Europe. The cylinder chronograph is to one who has used both so manifestly superior for convenience of reference and reading and saving of time that it is difficult to understand why the Morse form is retained.

Rate.—Rate is one of the most difficult problems with which we have to deal in longitude work. It is not the magnitude of the rate, although a small rate is very desirable, but the constancy. This is the crux. A chronometer may have an apparently constant daily rate, yet the hourly rate for the twenty-four hours may and does vary. Again the rate is not the same when the current is on, as when it is off; the former condition obtaining when observing, and the latter the rest of the day. The rate deduced from two indepedent time determinations of the same night, when the temperature is practically constant for the clock during the time of observation, and the clock is in circuit with the battery only during that time, is seldom, if ever, the same as that obtained from day to day observations.

In our programme we have two independent time determinations for each night. Each set of transits is reduced to the epoch of the mean of the times of transit of the stars comprising the set. The rate which is applied for each transit to the mean epoch, and for which some magnitude must be assumed, is practically a vanishing quantity in the resulting clock correction. The ideal time of exchange would be at that epoch, when the effect of rate is eliminated. But for various reasons this is found to be impracticable. In the programme then of two independent time determinations, for obvious reasons the exchange was arranged to take place about midway between the two epochs. An interpolation between the two epochs gives the clock correction at the instant required, that of the signals. This assumes that the rate is constant during the interval, and is represented by a straight line. If extrapolation is necessary, as sometimes occurs, the rate value has less weight.

Transmission Time. On the assumption that the time of transmission is the same in both directions and that the chronometers have the same rate, the difference of records at two stations of the exchange of time signals will represent twice the time of transmission.

We are obliged to assume that the transmission time is the same in both directions, but to the difference of the records of exchange of time signals there must be applied the relative rate for the interval between the means of the times of the two exchanges. This interval is confined to about two minutes.

From the two independent time determinations made at each station on the same night the hourly rate of each chronometer when in circuit is obtained. The algebraic difference of these hourly rates gives the relative hourly rate of the two chronometers and the proportional part for the above interval is the quantity entered in the column 'Relative rate' of Table.....

On exchange by land-lines, it will be seen, referring to the diagram of the switchboard that the deduced transmission time is free from any retardation by the signal relays or by the secondary circuits of the chronographs. The effect upon the comparison of the clocks of retardation by the signal relays and secondary circuits will disappear in the mean of the two exchanges provided the sum of the retardations by signal relay and secondary at one station is equal to that at the other. This condition is, however, not necessary for finding the time of transmission.

Personal Equation.—Fortunately for the connection between Canada (Vancouver) and Australia (Southport), also New Zealand (Doubtless Bay), the personal equation between the two observers was eliminated. This is, of course, on the supposition that the personal equations remained constant. As the climatic conditions, as far as temperature was concerned, and the surroundings were favourable for personal comfort, there was no *a priori* reason for suspecting any change during the campaign in the personal equation. The elimination referred to was due to the fact that the number of stations was odd, and that the observers occupied alternate stations. I occupied the terminal and middle stations, while Mr. Werry occupied the other two—Fanning and Norfolk Islands,—and for these two stations differential personal equation must be applied. To determine such we observed on our return with the same two transits of the Transpacific longitude, on several nights in a manner identical with that at work in the South seas, and under similar climatic conditions. It may be remarked that it was impracticable before leaving Ottawa to observe for personal equation. In the first place it was winter, thermometer below zero, and secondly my Cooke transit had not yet arrived when Mr. Werry set out for Fanning island, via Samoa.

For the longitude of Brisbane, Sydney and Wellington, I observed with each of the observers at the respective observatories, by determining the clock correction for the respective common epochs.

Instrumental Constants.

Thread Intervals.—These were determined by both instruments by observing the transits of slow-moving (polar) stars and the intervals were all referred to the mean and not to the middle thread. The times of transit are corrected for level (if any change of level has taken place during the transit) and for rate. Multiplying the time interval of any thread from the mean thread by the cosine of the star's declination gives the equatorial interval for the same. For circumpolar stars, whose motion during the time of transit from one thread to another is sensibly an arc of a circle the interval must be further multiplied by the cube root of the cosine of the hour angle of the star for the respective threads.

The following are the values of the equatorial intervals for Klotz transit, determined from transits of α Crucis, γ Trianguli, α Trianguli and β Chamaeleontis.

Clamp East.

	s.
1	− 9·939
2	− 8·273
3	− 6·690
4	− 3·279
5	− 1·640
6	+ 0·038
7	+ 1·576
8	+ 3·200
9	+ 6·662
10	+ 8·352
11	+ 9·995

For the Werry transit, the values determined from transits of λ Centauri, α Crucis, Groombridge 1930 and δ Draconis are:—

Clamp East.

	s.
1	−14·209
2	−11·903
3	− 9·573
4	− 4·794
5	− 2·196
6	− ·110
7	+ 2·454
8	+ 4·684
9	+ 9·591
10	+11·906
11	+14·153

Inequality of Pivots.—The Klotz transit was received from the maker in the dead of winter and just prior to leaving for the Pacific so that no opportunity was afforded to determine any of its constants at Ottawa.

The inequality of pivots was determined both by special series of observations and also from the many level readings just before and after reversal of transit in the daily (clear nights) time determinations.

In this transit there was a considerable change in the inequality of pivots from April to December. For Vancouver and Suva the values are identical, thence onward there is an increase for Southport and still more for Doubtless Bay. The cause of the change is not apparent. Before beginning observing in Southport I removed with great difficulty the plug carrying the lens in the clamp end of the axis as the inner surface of the lens was covered with brass filings. In re-inserting the plug I did not get it quite 'home.' This might perhaps have affected the diameter of that pivot. Whatever the reason, the quantity was accurately determined and applied to the level correction.

The mean value for Vancouver of seven determinations gave for p the pivot inequality correction ".080, the inequality being twice that quantity.

A similar determination at Suva gave p = ".080.

At Southport a double series was taken, one by continuous readings on many reversals, the other from many nights level readings during the time of transit observations. From these we obtain p = ".117.

At Doubtless Bay the value was obtained from level readings extending over the whole period of time determinations in December and the resulting value for the correction of inequality of pivots is p = ".151.

All the corrections are additive for clamp east, the axis opposite the clamp being the larger. The respective values of p were applied for each station.

Level.—The value of the striding level of Klotz transit was obtained from two series of readings on different da[illegible] by placing the striding level longitudinally on the telescope of the Werry transit. The telescope was clamped in a position to allow the bubble in the striding level to play near one end of the tube. By means of the micrometer and its thread a reading was taken on a distant object. Then by means of the tangent screw of the telescope, the latter together with the level was displaced. This displacement was measured by the micrometer screw and expressed in angular measure. Repeated and satisfactory measurements were thus obtained.

The mean value of one division of the level at 68° F. is ".085.

By the use of the level trier the mean value [illegible] the striding level (a Pessler) of the Werry transit was found to be ".100.

Micrometer.—The value of the micrometer of either instrument was not required in the longitude work, only for the latitude determinations, by using the transit as a zenith telescope and observing by Talcott's method. The value of the micrometer was obtained from a series of transits of slow-moving stars over the micrometer thread, set in advance at intervals of five revolutions. The times of transit were corrected for rate and for hour angle. The mean of the time intervals was taken and reduced by multiplying by the cosine of the star's declination.

From such observations the value of one revolution of the Klotz transit micrometer was 56".878.

That for the Werry transit is 60".558.

Diurnal Aberration.—The correction for diurnal aberration was obtained for each star by the usual formula −". 0207 Cos. ϕ Sec. δ and applied to the time of transit, ϕ and δ being the latitude and declination respectively.

For lower transit the correction is positive.

Collimation.—The correction for collimation was determined from the simultaneous reduction of a set (clamp east and clamp west) of transits for time.

No direct measures were made by means of observations with colli[illegible]ating telescope or mercury collimator.

Azimuth.—For the determination of the deviation of the transit instrument from the meridian a polar or slow-moving star was observed in each position of the instrument in the set of time observations. The value was obtained as in the preceding case from the simultaneous reduction of the condition equations constituting a time determination. As the principal unknown sought is the clock correction, the stars comprising an observation set may be so chosen that both the collimation and azimuth corrections, irrespective of magnitude, have little effect on the deduced time.

Reduction of Observations.—As already stated a complete time determination consisted of the observation of fourteen stars, seven for position clamp east and seven for clamp west.

On a clear night two of such determinations were made. For each position there was one polar star the others being time stars. The mean of the eleven threads was taken for the time of transit. This time was corrected for level, inequality of pivots, aberration and rate, giving thereby the corrected time of transit, but still involving the azimuth and collimation corrections besides the clock error.

The right ascensions for a given date were interpolated from the respective ephemerides, and 'the corrections to the R.A. of the Nautical Almanac' as well as of the Berliner Jahrbuch, were applied.

Assuming then a clock correction ΔT for the mean clock time of the transits of a set, and to which time the rate was referred for obtaining the rate correction, we have for each star observed a condition equation of the form.

$$\Delta T + \delta T = (\alpha - t) + Aa + Cc.$$

where $\Delta T + \delta T$ is the clock or chronometer correction. From the fourteen (or less) condition equations the three normal equations are deduced in the usual manner, and the three unknowns determined. As a rule, after beginning observing no attempt was made to level the instrument, but instead frequent readings of the level were taken. There was only one azimuth deduced for one set of clamp east and clamp west, except in a few instances, which showed displacement in azimuth after reversal. This change was due either to reversal or to the levelling done at the time of reversal. The latter reason is apparently the one for the Werry transit, and may be explained by the unsymmetrical motion of the base of the heavy levelling screw in its socket in the base plate. The change in azimuth in the few cases became only apparent, when making the final reductions. In the recomputation for such cases the normal equations were solved for two azimuths, one for each position of the instrument.

Ordinarily the exchange of clock signals took place during the interval between the two independent time determinations which each observer made nightly, provided the sky was clear. The arithmetic mean corrected for parallax of siphons of the differences of the clocks from the individual signals was taken as the difference of the clocks at the mean time of all the signals sent from or received by the respective observers, so that there was no necessity for applying a correction for differential rate. The thirty-five arbitrary signals sent by each observer were usually comprised within less than two minutes. The differential rate, however, was applied for determining the time of transmission. That is, in comparing the differences between the clocks at the mean times of the two exchanges, differential rate was applied for the interval between the mean times of the two exchanges.

We have then two clock comparisons, and they differ from each other by twice the time of transmission.

To obtain the difference of longitude, the necessary data is now available, and a simple computation from the following formula gives the difference sought.

Let t_e and ΔT_{oe} = the chronometer time and its correction at the eastern station when sending a signal.

t_w and ΔT_{ow} = similarly for the western station, when receiving the above signal.

and t'_w and $\Delta T'_{ow}$ = the chronometer time and its correction at the western station when sending a signal.

t'_e and $\Delta T'_{oe}$ = similarly for the eastern station when receiving this signal.

μ = transmission time.

$d\lambda$ = difference of longitude, west longitude being reckoned positive.

We have then from an eastern signal.

$$d\lambda - \mu = t_e + \Delta T_{oe} - (t_w + \Delta T_{ow}) = d\lambda_e$$

and from a western signal,

$$d\lambda + \mu = t'_e + \Delta T'_{oe} - (t'_w + \Delta T'_{ow}) = d\lambda_w$$

$$\text{hence } d\lambda = \tfrac{1}{2}\ (d\lambda_e + d\lambda_w)$$

This is on the supposition that the relative personal equation has been applied to the chronometer correction, and furthermore, that the time of transmission from east to west is the same as from west to east, an assumption which must be made.

Hence we obtain also $\mu = \frac{1}{2}\ (d\lambda_w - d\lambda_e)$

If we let K = the relative personal equation between the two observers the following formulæ express the difference of longitude for the several links across the Pacific, the observers occupying alternate stations.

Vancouver-Fanning $dL^{I} = \frac{1}{2}(d\lambda^{I}_{e} + d\lambda^{I}_{w}) + K$.

Fanning-Suva $dL^{II} = \frac{1}{2}(d\lambda^{II}_{e} + d\lambda^{II}_{w}) - K$.

Suva-Norfolk $dL^{III} = \frac{1}{2}(d\lambda^{III}_{e} + d\lambda^{III}_{w}) + K$.

and Norfolk-Southport $dL^{IV} = \frac{1}{2}(d\lambda^{IV}_{e} + d\lambda^{IV}_{w}) - K$.

hence for Vancouver-Southport $dL = \frac{1}{2}(\Sigma d\lambda_{e} + \Sigma d\lambda_{w})$

That is, the difference of longitude between Vancouver and Southport, Australia, and similarly for Suva and Doubtless Bay, New Zealand, is free from personal equation even without knowing its magnitude, which, however, was determined, as stated elsewhere, for application to the Fanning and Norfolk longitudes.

The probable error of a difference of longitude was found from the probable errors of the two chronometer corrections and the probable error of the exchange of time signals.

We have then $E_{d\lambda} = \sqrt{E_{e}^2 + E_{w}^2 + E_{s}^2}$.

For the weighted mean difference of longitude of a number of nights we have

$$d\lambda = \left(d\lambda_1 \frac{1}{E_1^2} + d\lambda_2 \frac{1}{E_2^2} + d\lambda_3 \frac{1}{E_3^2} \dots\right) \text{divided by} \left(\frac{1}{E_1^2} + \frac{1}{E_2^2} + \frac{1}{E_3^2} + \dots\right),$$

the latter quantity representing the sum of the weights, which we may write $[p]$. From the weighted mean and the individual values of the difference of longitude we obtain a series of residuals v.

The probable error of the weighted mean is found from

$$E_0\, d\lambda = .6745 \sqrt{\frac{[p\,v\,v]}{[p]\,(n-1)}}$$

where n represents the number of individual values.

This gives then the probable error for the final difference of longitude between two successive stations.

The probable error of the longitude of a station is the square root of the sum of the squares of the probable errors of the various stations forming the chain from the prime meridian, or Greenwich, that is, $E_{\lambda} = \sqrt{[E_{d}^2]}$

SYDNEY OBSERVATORY.

The following description of the instruments used at Sydney in the recent determination of the difference of longitude Sydney-Southport, has been kindly furnished by Mr. H. A. Lenehan, F.R.A.S., acting government astronomer at Sydney for New South Wales.

'The transit has a 6-inch object glass by Troughton & Simms, of London, who constructed the instrument in 1875. The focal length is 6 feet, and it is provided with a dew-cap 18 inches long.

'The bearings of the instrument are on fixed gun-metal bearings on cast-iron columns; no adjustment for corrections of level or azimuth being provided. This was designedly done, so that there would not be a possibility of alteration in any way. The eye-piece used magnifies 118 times. The instrument has two circles 2 feet in diameter, graduated to every 5 minutes of arc, and these graduations are still further sub-divided by the micrometer microscopes, which are readily read to the tenth of a second of arc. There are two setting circles one on each side of the tube, graduated to 20 minutes of arc, and further divided by the vernier.

'Counterpoises on each pier take off the greater weight on friction wheels from the bearings, leaving very little resistance on moving in declination. A sliding reflector in the instrument regulates the illumination of the field of wires from a lamp at the end of the axis. A set of seven vertical wires and a horizontal one is provided; the equatorial intervals being about 5 seconds of time apart; and these wires are from the cocoon of one of the silk worms readily got in the gardens here. These cocoons have small sticks attached to the outer surface. We find the fibres of silk are stronger than the spider lines, and they last longer, the only drawback being their varying thickness, but this is not so marked as to cause them to be rejected.

'The instrument has a collimating telescope outside the building to the north, and reading by this (with the micrometer moving the wires) in its field, through holes in the transit circle and again through a 40-foot lens on the southern wall to a silver plate with vertical and horizontal crosses on its face. This plate is on a pier on the same level as the northern collimating telescope. We adjust the moving wires of the collimating telescope on this mark, and then take readings with the transit circle telescope on both, the mean of the adjusted wires on the northern collimator and on the southern mark gives the collimation of the transit circle, which deducting ".010 for aberration is the final setting of the R. A. micrometer.

'Level readings are by reflection of the wires in a mercury trough on Pritchett's principle, viz., a shallow copper trough 6 inches square with an amalgamated surface containing only about ⅛ inch of mercury. This is placed in a recess below the instrument on the solid stone which carries the piers. The instrument is protected in every way from any vibrations of the building or floors, being on a separate pier extending from the bed-rock below the foundation. The observer mounted on the remover reads through a Bohnenberger eye-piece the wires covering their reflections by moving the micrometer, and the mean of these (10) readings are subtracted from the collimation, a smaller reading giving a +, a greater − sign, and expressed in the equivalent of the micrometer screw.

'Azimuth is determined by the stars by observing upper and lower transits of slow-moving circumpolar stars, and we find the instrument so extremely steady that any variation of over a fraction of a second of arc is practically not existant.

'The sidereal clock is by Frodsham, of London, and has at present a small wheel on the pendulum rod, which as it swings to the vertical presses a delicate spring into contact and marks on the chronograph for each second, omitting the 60th, thus only recording 59 beats to the minute and one break.

'A cylinder chronograph is used for observations and by diversion of current these contacts go to a tape chronograph; this is generally used with longitude. On this tape can be recorded with two pens, and can vary the beats of the clock to each pen, and the same with any signals received from longitude stations.

'The transit observations are recorded on the same chronograph as the clock by a flexible connecting wire and handle held by the observer, who presses a small spring with his thumb to make the necessary contacts recording the bisection of the star.

'The electricity is generated in four Edison-Lalande large cells, and the life of the battery is long.

'The seven wires observed are entered in the transit book and a mean taken for the central wire. This is corrected for the inequality of the divisions of the wires from the central wire, and then level and azimuth are applied, collimation being non-existing as already explained. Then follows the usual mode for arriving at the errors of the true and observed transits. The mean of these results gives the clock error at the mean time of transits. Correction for rate is applied to each star.

'The value of the wires determined from many observations of slow-moving southern stars is here given.

Wire 1	15·156 from central wir		s.
2	10·176		+ 30·486
3	5·154		
4	0·000		
5	5·247		s.
6	10·207		30·861
7	15·107		
			s.
		Difference	·375
		−	·051

BRISBANE OBSERVATORY.

The services of the observatory are essentially for time purposes. The transit is by Troughton and Simms, 1883, and is mounted on a stone pillar. The objective is of 2½ inches clear aperture and 30 inches focal length. The reversing is done by hand. The reticule has seven threads, the five central threads at equatorial intervals of about six seconds. The pivots are cylindrical and there is no inequality of pivots.

On the striding level provided, fifty-six divisions are equivalent to sixty seconds of arc.

The time-piece used for the longitude work, including personal equation, was a Kullberg sidereal chronometer, provided with a one-second electric break. The chronometer had a losing rate of about three-quarters of a second per day.

The transits and exchange of clock signals were recorded on a Morse register by embossing. The register has two styles, one always recording the clock and the other, the transit key or the time signals to or from Southport, when making exchange for difference of longitude. For the clock circuit three Leclanche cells were used, and the same number for the chronograph circuit. The telegraph line connecting Brisbane with Southport is fifty miles in length.

The following are the equatorial intervals, determined by means of the micrometer, one revolution of which 70″·s, by Mr. T. D. Fraser.

Clamp West.

	s.
1	+23·95
2	+12·46
3	+6·12
4	+0·33
5	− 5·96
6	−12·55
7	−21·35

WELLINGTON OBSERVATORY.

The observatory was established in 1869 and is used for time service only. It is situated on the summit of the hill within the old cemetery, and overlooks the city, harbour and surrounding country. The building has two rooms, a clock-room and a transit-room.

Clocks. In the former are three mean time clocks, and one sidereal Dent No. 39720—having electrical attachment making contact or circuit every second except the 60th in order to identify the minute. The clocks are all mounted on brick and cement bases, and are fastened to substantial braced frames.

Transit.—The transit is by Troughton & Simms, and is mounted on a rather high stone pillar. It has an aperture of 2¼ inches, and a focal length of 32 inches. The reticule has seven threads at equal equatorial intervals of about 17 seconds of time. There is a sensitive striding level, and one oil lamp for illuminating the field. The single small setting circle reads to minutes and the reversing of the telescope is done directly by hand.

Meridian Mark.—The meridian mark, placed 35 years ago, which also serves for testing collimation in the day time, is a 3-inch iron bar set in cement, and shows well above the sky-line of the Tinakori range to the north.

Chronograph.—The chronograph is of the Morse pattern and records on a tape. It is provided with two styles, side by side. The one records, embossing by make-circuit, the second-beats of the sidereal clock, while the other similarly records the signals by the transit key, also the clock or arbitrary signals received (from Doubtless Bay) when making a comparison of the clocks for the determination of the difference of longitude. The transit and arbitrary signals on the tape are readily interpolated, and expressed in time, from the embossed dots or records indicating the seconds of the local sidereal clock.

Electrical Apparatus.—Mr. J. K. Logan, Superintendent of Government Telegraphs, has furnished the following description and diagram (Fig. 6) of the arrangement especially installed at the Wellington observatory, for the differential longitude work with Doubtless Bay as this was the first time that an aut[illegible]atic exchange of clock signals had been made with the observatory.

The Wellington clock made contact (circ[illegible] every second, while the chronometer at Doubtless Bay was arranged to 'break' cir[illegible]

" Two British post office polarised relays, the coils of each of which were joined in parallel, giving a resistance of 150 ohms for each relay, were connected in multiple through three Leclanche cells to the terminals of the clock. One hundred and twenty Leclanche cells, with the copper earthed were joined to one of the local terminals of one of these relays and by adjustment, the tongue of this relay was made to bear against the stop connected to that terminal. The terminal connected with the tongue was then joined to the copper terminal of a Siemens relay of 500 ohms resistance. The line was connected to the Z (zinc) terminal of the Siemens relay through a switch arranged to disconnect it from the time recording instruments and connect it to the speaking (Morse) instruments when required.

The local terminals of the Second British P.O. polar relay were connected through 8 Leclanche cells to the terminals of the magnet coils of the back style of the chronograph. The local terminals of the Siemens' relay were connected through 8 Leclanche cells to the terminals of the magnet coils of the front style of the chronograph. At every make of the clock the tongue of the P.O. relay that was connected to the back style coils, made contact and caused the style to emboss, thus registering every clock beat. The other P.O. relay at every beat of the clock broke contact at its tongue, the line current was thus broken and a signal recorded at Doubtless Bay. As this line current passed through the Siemens' relay at the observatory, and while passing held the tongue of that relay open against the bias given to it, at every break of the current the tongue by reason of that bias, moved across and closed the local circuit, thereby recording marks on the front style.

When signals were to be received from Doubtless Bay, the observatory battery of 120 cells was cut off, battery being applied at the sending end.

At every break of the current at Doubtless Bay the Siemens' relay tongue moved to close the circuit and the breaks were recorded by the front style, marks being made at the same time by the observatory clock with the other style. Arbitraries were received from Doubtless Bay in the same way.

When arbitraries were being sent from the observatory it was arranged by means of a two-way switch, to cut off the clock from one P.O. relay, i.e., the one, the tongue of which was in the main line circuit. This relay was then worked by the closing of a key, the line current being broken at the tongue of the relay in the same way as when the clock was operating the relay. This break was recorded at Doubtless Bay and also on the front style at Wellington by the movement of the tongue of the Siemens' relay, at the same time the clock was recording on the back style.

It is desired to indicate that for received signals the tongue of the Siemens' relay had to move to close the circuit and the front style then to move to mark the tape. The signals of the observatory clock had to cause the P.O. relay tongue to move to close the circuit and the back style then to move to mark the tape. The record of the outgoing signals either from the clock or by arbitraries was got after the clock or the key had caused the P.O. polar relay tongue to break the circuit which in turn caused the Siemens' relay tongue to move to close the circuit of the front style and which style had then to move to impress the tape.

The line was 704 miles long, Wellington to Doubtless Bay, and was of 11½ copper throughout, 200 pounds to the mile."

No repeaters were used.

DESCRIPTION OF STATIONS.

Vancouver.

At Vancouver the permanent observatory built in 1904 for longitude work was occupied. It is situated on Brockton Point, immediately to the south of the lighthouse. The transit was mounted on a brick pier and a single wire connects the observatory with the city office, distant about 3 miles, of the Canadian Pacific Telegraph system. Every night at a given time, 10.30 p.m., the observatory was put in circuit with the line to Bamfield, the terminus of the Pacific Cable, for exchange of clock signals.

Fanning Island

This island or the group of three islands, of which it is one, was discovered by Captain Edmund Fanning on June 1., 1798.* At the time of its discovery it was uninhabited, although 'a stone case, filled with ashes, fragments of human bones, stone, shell and bone tools, various ornaments, spear and arrow heads of bone and stone, &c.,' were found.

The island is a coral atoll, about 10 miles long and 5 wide. It is only about 10 feet above the level of the ocean. The lagoon is surrounded by a fringe a quarter to half a mile in width on which is the plantation of cocoa-nut trees, for the production of the commercial article known as copra, owned by Greig brothers.

The cable station is at the northwest part of the island at Whaler Anchorage, and the observatory with pier was erected near the cable station. (See Fig. 7.)

Suva, Fiji.

The Fiji group, comprising several hundred islands, is too well known to require any further description. The two larger islands, Viti Levu and Vanua Levu, are both mountainous and have extinct volcanoes. The red volcanic soil of Taviuni, reminding one of the soil of the Hawaiian islands, is very fertile. The sea surrounding the group is studded with coral reefs dangerous to navigation. The vegetation on the islands is tropical and luxuriant. Commercially the principal products are sugar, copra and green fruits. Among other products may be mentioned the vanilla bean and trepang or bêche de mer, the latter for the Chinese market. The natives at one time the most ferocious cannibals are now docile under British rule. Bounteous nature makes them indolent, since their vocation—fighting—is gone.

Two factors militate against the development of Fiji—one is, want of labour, and the other, the difficulty of acquisition of land,—all the land, save a small part, being

* 'Voyages Round the World' by Edmund Fanning: London, O., Rich, 1834.

still held by the natives and in common, so that there is great difficulty in securing land for cultivation. Suva, on Viti Levu, is the official capital, and the residence of the governor of the South Sea Islands. No military is stationed here, but a native constabulary is maintained.

The observatory (Fig. 8) was built on the Pacific Cable premises (Figs. 9 and 10). The material used in construction was planed, tongued and grooved flooring throughout. The building is ten feet square, gable roofed, and has a three-inch opening around the eaves for circulation of air. This arrangement worked very well and prevented the instrument during the day-time becoming unduly heated. There were two shutters on each side of the roof, giving a clear opening of two feet.

The pier was built of concrete. A cubic yard of concrete was sunk in the earth and the pier proper, 22 inches by 27 inches, built to a height of 30 inches above the floor of the observatory. It was learned afterwards that the ground upon which the pier was built had been filled in something over a year before to a greater depth than the excavation for the pier. This may in a measure account for the movement of the pier, although part of this motion is undoubtedly attributable to the tides. That is, the daily loading (twice) of the ocean bottom near the shore by high tide would have the tendency to tilt the pier towards the sea, which effect would later be counteracted when low tide had set in. The pier is situated 17 feet west from the cable building (verandah), 12 feet north from the south limit of the cable lot, and 11 feet from the edge of the sea at high tide.

For the pendulum observations another similar pier but only 2 feet above the floor was built within a adjoining hut, 7 feet square, to the east. The south walls of the observatory and pendulum huts were in straight line. The floors of the two buildings were 5 feet 8 inches above high tide, so that the pendulum bob was, say, 8 feet above high tide.

The tides at Suva harbour average between 3½ to 5 feet.

For the magnetic station it was not so easy to find ideal ground. The ground had to be within reasonable distance from the observatory, to carry the instrument and chronometer to and fro.

Corrugated iron has become a most important element in building operations of the most diverse kinds in the tropics. It is used for roofs, for fences, in place of weather boards, and for many other purposes. Especially in Australia does corrugated iron meet the eye at every turn.

After examining the vacant grounds in Suva, the embryo park to the south of the cable premises was chosen for a site for the magnetic station.

The local surveyor, Mr. G. Heimbrod, who laid down a meridian for erecting the pier and observatory, also made the connection between the astronomic and magnetic stations and gave the true azimuth of some reference points from the latter. The Honourable Geo. Moore, Commissioner of Public Works, kindly placed a tent at my disposal for shelter to the instruments while observing at the magnetic station.

Norfolk Island.

Historically this isolated island (about 9,000 acres) is best remembered as a British penal colony, and later (1856) as the new home of the Pitcairn islanders, the descendants of the mutineers (1789) of the ship *Bounty*, Captain Bligh. In former days the island was the chief centre of the large whale fishing industry of the South seas. This industry has, however, much declined. The best known product of the island is the Norfolk island pine (Araucaria excelsa). An avenue of these trees is a superb sight, but in the individual tree the branches are rather too far apart to give it a finished symmetry and beauty.

The cable lands at Anson bay at the northwestern part of the island, and the cable buildings are in close proximity to the precipitous cliffs of the shore. The observatory with pier was erected between the cable building and con- ted in distance and azimuth to a stone monument as shown on the accompanying diagram (Fig. 11).

Southport.

The observatory built here was erected 30 feet southerly from the brick pillar supporting the water tank near the south entrance to the offices of the cable building. The magnetic station was in the vacant field of the cable premises and 186 feet southward from the astronomic station (Fig. 12). The observatory was 10 feet square and built similar to the one at Suva already described. For foundation of the pier a cube of grouting was built in the earth, leaving its sides free from firm contact with the earth. The pier 22 inches by 27 inches itself was built of brick with an inch cap of concrete.

The alignment for the pier and observatory was obtained without the aid of instruments by low north and south stars and a plummet, sidereal time having been deduced from the noon mean time signal from the observatory at Brisbane.

At this station, connection was made with the observatories at Brisbane and Sydney; and for this purpose, the land line in the cable office was led to the observatory so that the clock and arbitrary signals during the nightly exchange with those observatories could be recorded on the chronograph.

The route line distance to Brisbane was 50 miles, and to Sydney, 773 miles. The conductor was of copper, weighing 200 lbs. to the mile. The line was cut through to Sydney direct during the exchange, that is, no relay was interposed between the terminal stations.

Doubtless Bay, N.Z.

At the foot of the deep bay of the above name the cable from Norfolk island lands on a sandy beach. Close to the cable station the pier and observatory were built (Fig. 13). The foundation of the brick pier was in compact sand, and hence very satisfactory. The building and pier were of the sa[illegible] ns as those of Southport and Suva.

A triangulation has been carried over the North [illegible] and by the Survey Department of New Zealand. By instruction of the Surveyor General, Mr. J. W. A. Marchant, the district surveyor, Mr. V. J. Blake, made a connection of the triangulation system with the observatory, pendulum pier and magnetic station, as shown on the accompanying sketch (Fig. 14).

The country about the station is open and hilly. Much of the ground is covered with ti-tree scrub, and in the valleys the tree fern, cabbage tree and the kauri pine are found. Near the sea-coast on rocky exposures scattered pohutukawas, or Christmas trees, with their beautiful, large, red flowers and glossy leaves are seen. The English name of the tree was given because it flowers at that season.

The rocks observed were strongly impregnated with iron.

AUSTRALIAN LONGITUDES.

Former Values.

Australia.

The transit of Venus in 1874 gave an impetus to the determination of longitudes. Some of these longitudes were determined by means of the telegraphic submarine cables, while others were dependent upon absolute methods, moon culminations and occultations.

To the latter belonged Sydney. Consequent to the German Venus expedition to the Auckland islands, Dr. A. Auwers recomputed the voluminous data (mostly from Mr. Tebbutt and Mr. Russell) on hand for the longitude of Sydney, through which he laid the fundamental meridian for Australia.

This gives the longitude of Sydney as $10^h\ 04^m\ 49^s{\cdot}60$.*

* Astron. Nach. No. 2036.

In the joint report † of the government astronomers, Ellery, Todd and Russell we read: 'Some time prior to the transit of Venus, in December, 1882, we severally received communications from the President of the Royal Society, London, relative to the telegraphic determination of the longitude of Australian observatories, which involved, as a first step, the telegraphic determination of the difference of longitude between Port Darwin and Singapore . . . . . . Singapore being the initial point of these determinations, the actual longitude of Port Darwin and hence all Australian longitudes would depend on the accuracy of the assumed longitude of Singapore, which has twice been telegraphically determined—first, in 1871, by Dr. Oudemans, of Batavia, and Mr. Pogson, of Madras, and more recently, in 1882, by Commander Green, United States Hydrographic Department. For reasons given in the appendix, we agreed, after full consideration, to accept Commander Green's position of Flagstaff at Fort Canning, viz., 6^h 55^m $23^s{\cdot}50$. Reducing this to Captain Darwin's observing station + $1^s{\cdot}51$, makes the longitude of Captain Darwin's transit instrument 6^h 55^m $25^s{\cdot}01$. The difference of longitude, Port Darwin-Singapore, determined by Captain Darwin and Mr. Baracchi, is 1^h 47^m $57^s{\cdot}18$, making the longitude of Port Darwin 8^h 13^m $22^s{\cdot}19$ E. of Greenwich.'

The station at Port Darwin was marked by a masonry pillar 4 x 2 x 2 feet, upon which the transit stood, and is the origin of Australian longitudes.

By means of the telegraph lines Port Darwin, Adelaide, Melbourne and Sydney were connected in longitude, and similarly by cable Melbourne with Hobart, and Sydney with Wellington, New Zealand. It must be remembered that up to this time in most cases, when the cable was used for the exchange and comparison of clock signals, the small deflecting mirror, throwing a beam of light on a scale, indicated the arrival of the signal impulse. This visual manifestation had then to be recorded in time, either by the 'eye and ear' method or by tapping a key in circuit with a chronometer and chronograph. Comparison of chronometers over a cable by this means has not nor cannot have that accuracy obtained in more recent times by the exclusive use of the Thomson (Lord Kelvin) siphon recorder, to be described later. In the Bombay-Aden-Suez, 1877 longitude, the siphon was used.

In order to estimate the value of Australian longitudes it is necessary to examine the assumed position of Singapore upon which those longitudes rest.

Mr. P. Baracchi, who was the observer at Port Darwin, and is now Government Astronomer, at Melbourne, for Victoria, presented a paper on 'The most Probable Value and Error of Australian Longitudes' to the Australasian Association for the Advancement of Science, at the meeting in Brisbane in 1895.

Mr. Baracchi has expended much labour in compiling from so many sources the required data, and has put the results in such compact form, that I avail myself in reproducing the greater part of it here. He always gives the 'mean error' instead of the 'probable error' as is customary in our work. The former is readily converted to the latter by simply multiplying it by ·675.

He writes:—I shall therefore commence at the beginning, viz., the prime meridian. The values of intervals, as given in Appendix, Table 1, will be referred to by the letters respectively attached to them.

Longitude of Alexandria—Six different values—viz., (*a*), (*b*), (*c*), (*d*), (*e*) and $\frac{1}{2}$ $(f+f_1)$—may be combined, giving three values for this longitude, two of which are quite independent.

(*a*) Greenwich-Mokattam.—This was determined by exchange of galvanic signals between Greenwich and Porthcurno; Porthcurno and Alexandria (by joining the five lengths of cable, Porthcurno, Vigo, Lisbon, Gibraltar, Malta, Alexandria); and finally, between Alexandria and Mokattam. Time observations were made with transit instruments at Greenwich, Alexandria, and Mokattam, but those at Alexandria were not used for this interval. The observers were Mr. Criswick at Greenwich, Mr. Ellis

† Report of the Telegraphic Determination of Australian Longitudes—Melbourne, 1886.

at Porthcurno, Mr. S. Hunter at Alexandria, and Capt. C. Orde Brown, R.A., at Mokattam. Transits were recorded by eye and ear at these two latter places. All galvanic signals were sent by hand, and observed by eye and ear. The operations were executed in November, 1874, on the four nights, 11th, 15th, 21st and 22nd. The personal equation in observing transits between Mr. Criswick and Capt. Brown was determined before and after the longitude operations, and varied from 0·025 sec. to 0·655 sec. (8) page 288.

(*b*) *Alexandria-Mokattam.*—(8) On the same four nights, November 11, 15, 21 and 22, Mr. Hunter, at Alexandria, made transit observations with a portable transit instrument, in addition to exchange of signals with Mokattam. His station, which was on the roof of the Hotel de l'Europe, does not seem to have offered the necessary stability for delicate work. Dr. Gill remarks of this station—(7) page 63—'The observer had to abstain from movement during each complete observation, otherwise the level was disturbed by the change of his position.' The personal equation of the two observers was determined after their return to England. At Alexandria the chronometer had to be carried to the telegraph office for exchange of signals, which was at a distance of about five minutes' walk.

(*c*) *Greenwich-Berlin.*—Result of several determinations—(9) page 190.

(*d*) *Berlin-Malta.*—Observers: At Malta, Dr. Löw, chief of the German expedition of the Transit of Venus, 1874, to Mauritius; at Berlin, the astronomers of the observatory, Drs. Becker, Auwers and Knorre. Dr. Löw made time observations with a portable transit instrument, recording by the eye and ear. Galvanic signals exchanged by hand on six nights in 1875, March 10, 11, 12, 13, 14 and 1[illegible] Personal equation well determined. Signals satisfactory—(9) page 360-393.

(*e*) *Malta-Alexandria.*—Observers: Dr. Löw at Malta, Dr. Gill at Alexandria, same station as Mr. Hunter's. Dr. Gill made his time determinations with an altazimuth. Operations repeated on the nights of March 10, 11, 12, 13 and 14 (1875). Personal equation of these observers well determined.

The chronometers had to be carried to the telegraph station for exchange of signals, as in the case of (*b*)—(9) page 306-320.

(*f*) *Berlin-Alexandria.* Direct measurement made on February 28, March 6, 7, 10, 12, 13 and 14 (1875). Personal equations of the observers, known through Dr. Löw; the observers being Dr. Gill at Alexandria, and the astronomers of the observatory at Berlin. This value was deduced by Dr. Copeland. It is remarked in (9) that the signals were unsatisfactory, and the combination of the two intervals (*d*) and (*e*) was adopted in preference of the direct value—(9) page 320-318.

(f_1) *Berlin-Alexandria.*—Same operations as in (*f*). Value deduced by Dr Auwers—(7) page 60.

The three values for the longitude of Alexandria are:—

	h.	m.	sec.
By the combination (*a*)-(*b*)	1	59	33·69
(*c*)+(*d*)+(*e*)	1	59	33·827
(*c*)+½ [(*f*)+(f_1)]	1	59	33·750

The following values were adopted, viz.—

(9) Page 491—

By Dr. Copeland. . . . $1^{h.}\ 59^{m.}\ 33^{s.}\cdot 807$

(7) Page 60—

By Dr. Auwers. . . . $1^{h.}\ 59^{m.}\ 33^{s.}\cdot 885$

Mean error.

mean $1^{h.}\ 59^{m.}\ 33^{s.}\cdot 846 \pm 0^{s.}\cdot 078$ I.

(8) Page 330—

By British Transit of Venus Expedition. $1^{h.}\ 59^{m.}\ 33^{s.}\cdot 69 \pm 0^{s.}\cdot 156$ II.

The values I. and II. of the longitude of Alexandria are independent. Their difference is 0·156 seconds.

(*g*) *Alexandria-Suez.*—Observers: Dr. Löw at Suez, Dr. Gill at Alexandria. Instruments for time determination, same as already stated above. Galvanic signals exchanged on five nights, viz., 1875, February 19, 20, 23, 24 and 25. Signals sent by hand; observations made by eye and ear. At both stations the chronometers had to be carried for some distance to exchange signals. Result computed by Dr. Copeland (9) page 192.

(g_1) *Alexandria-Suez.*—Same operations as in (g). Result deduced by Dr. Auwers—(7) page 60.

(h) *Mokattam-Suez.* Observers: Mr. Hunter at Suez, Captain Brown at Mokattam. The instruments used by these observers have already been referred to in (a) and (b). The signals were sent by hand, and the observations made by eye and ear. Operations repeated on four night, viz., 1874, December 1, 5, 7 and 11. The station used by Mr. Hunter was not the same as Dr. Löw's station. The former appears to have given trouble on account of its instability. It is remarked by Mr. Hunter (8) page 333 'The only defect arose from the looseness of the soil, causing the level readings to vary a good deal.' The same complaint is also made by the officers of the Great Trigonometrical Survey of India, who used this station in 1877, viz., that their observations may be somewhat vitiated by the unsteadiness of their instruments, due to looseness of the soil (12) page 15a.

(i.) Difference of longitude between Dr. Löw's and Mr. Hunter's stations at Suez.

This was determined by Dr. Gill by time observations made by himself with Dr. Löw's transit instrument mounted at one station, and with his altazimuth mounted at the other station, and by transportation of nine chronometers to and fro. The value thus found was 0·32 seconds—(9) page 262-266.

(i_1) The same interval as (i), determined by a traverse under the direction of Captain (now Colonel) Campbell, R.E.; its value was found to be 0·025 seconds—(9) page 491 and (11) Appendix to Part II., page 109. The discordance between the two above values is 0·295 seconds. This may be probably accounted for, or at least partly, by the length and complex character of Dr. Gill's operations, when compared with a simple traverse; and also by the circumstance remarked in (9) page 262, that 'these operations required seven and a-half hours of continuous observing, involving great fatigue.'

We have thus the two following independent values for the interval Alexandria-Suez, reduced to Hunter's station, by adopting value (i_1), viz.:—

	h.	m.	sec	sec.
$\frac{1}{2}\{(g)+(g_1)\}+i_1$	0	10	39·025	± 0·082
$(b)+(h)$	0	10	39·481	± 0·160

which differ by 0·456$^{sec.}$

The value for Alexandria-Suez, deduced from the two above, weighted in terms of their respective mean error, is—

	h.	m.	sec.	sec.
Interval Alexandria-Suez.	0	10	39·120	± 0·073. . . III.

(k) *Suez-Aden.*—Observers: Dr. Löw at Suez, Dr. Gill at Aden. Time observations at Aden were made with some difficulty; in fact, 'opportunities for observing were few and unsatisfactory'—(9) page 5. At Aden, the distance between the observing station and the telegraph office where signals were sent and received was nearly two miles. The operations were very limited, and the result depends on time observations of the single night of January 31, and on the exchange of galvanic signals on the two nights of January 30 and 31. This result was computed by Dr. Copeland—(9) pages 196-227.

(k_1) *Suez-Aden.*—Same operations as in (k). Result given by Dr. Auwers—(7) page 61.

(k_2) *Suez-Aden.*—Observers: Captain (now Colonel) Campbell, R.E., at Suez; Captain (now Colonel) Heaviside, R.E., at Aden. Station at Suez the same as Mr. Hunter's. Station at Aden, a few yards north of the cable offices at Telegraph Bay.

These officers aimed at the highest refinement possible, and had at their disposal the necessary equipment and conveniences wherewith to attain their purpose—(11), Part I., Chapter I. Their transit instruments were of similar dimensions and workmanship (5″ object glass, with collimators, and means of levelling by mercury reflection, &c.). They recorded observations by chronograph. Galvanic signals were always exchanged directly between the stations, being sent by hand, and simultaneously recorded on both chronographs. Their operations were repeated on the six nights of 1877, May 25, 26, 27, 28, 29, and 30, giving very accordant results. Their personal equation was determined on four nights in April, 1877; and although it was not redetermined after the expedition, no serious consequences may be feared on that account. The observers themselves are confident that it remained fairly constant—(11), Part I., page 31. On the other hand, if their usual mode of observing was liable to sudden changes of considerable magnitude (of which there is no evidence), a redetermination after the expedition would have given very little help in finding the actual changes that took place at Suez and Aden. The only disadvantage in this measurement is to be attributed to the unsteadiness of the station at Suez, as already pointed out in (h)—(11), Part II.

(l) Difference of longitude between Dr. Gill's and Captain Heaviside's station at Aden.

This was determined by a careful triangulation, made under the direction of Captain Heaviside—(11) App., Part II.

We have, then, for the interval Suez-Aden reduced to Mr. Hunter's station at Suez, and Captain Heaviside's at Aden—

	h.	m.	sec.	sec.
$\frac{1}{2}\{(k)+(k_1)\}-i,\ l$	0	49	42·839	± 0·120
(k_{11})	0	49	42·662	± 0·060

The difference between these two independent results is 0·177 sec. Combining them according to their mean errors, we have—

	h.	m.	sec.	sec.	
Suez-Aden	0	49	42·697	± 0·054	. . . . IV.

The longitude of Aden, reduced to Captain Heaviside's longitude station, may now be derived by combining the several values shown in the foregoing, in the manner adopted by Dr. Gill—(7) pp. 60-62—omitting the value given for Alexandria-Mokattam, viz.:—

By the British Transit of Venus Expedition of 1874, and the officers of the G. T. S. of India.

	h.	m.	sec.	sec.
(a) . .	2	05	06·240	± 0·098
(b) . .	0	05	06·931	± 0·103
(k_1) . .	0	49	42·662	± 0·060
A	2	59	55·833	± 0·151

By Lord Lindsay's Expedition of 1874, and Dr. Löw.

	h.	m.	sec.	sec.
I	1	59	33·846	± 0·078
$\frac{1}{2}\{(a)+(a_1)\}$	0	10	39·000	± 0·082
$\frac{1}{2}\{(k)+(k_1)\}$	0	49	43·712	± 0·120
(l)	0	00	00·877	± 0·
B	2	59	55·711	± 0·165

	h.	m.	sec.	sec.
A . .	2	59	55·833	± 0·151
B	2	59	55·711	± 0·165
Longitude of Aden (Capt. Heaviside's sta.)	2	59	55·776	± 0·112

Dr. Gill considered the mean errors of the two values A and B as equal, and adopted for the definitive longitude of Aden $\frac{1}{2}$ (A + B) (7) p. 62, viz.:

Aden E. of Greenwich $2^h\ 59^m\ 55^s{\cdot}772 \pm 0{\cdot}079^{sec}$ (should be $0{\cdot}076^{sec}$?)

(*m*) *Aden-Bombay.*—Observer: Dr. Gill at Aden (Gill's station). The operations at Bombay were conducted under the direction of Mr. C. Chambers, Superintendent of the Colaba Observatory. Time at Bombay was determined by a transit instrument 5 feet focal length. Records made by chronograph. Time signals sent by hand, and observed by eye and ear at both stations. These operations took place in 1875, on 31st January, concurrently with the determination Suez-Aden by Drs. Gill and Löw: the time observations of this single night being all that could be secured at Aden. The personal equation between the observers not determined (91 pages 182-195.

(m_1) *Aden-Bombay.* Observers: Captain Campbell at Aden, and Captain Heaviside at Bombay. This measurement was made with the same instruments and methods described in (k_{11}). The station at Aden was the same as that occupied by Captain Heaviside in determining the interval (k_{11}). That at Bombay was $0{\cdot}131^{sec}$ east of the Colaba Observatory transit instrument. The operations were repeated on nine nights in 1877—April 30, May 1, 2, 3, 4, 5, 7, 8, and 9—giving accordant results.

The two values (*m*) and (m_1) are quite independent. The former is based on observations and conditions not altogether satisfactory (as we have seen), with very limited time and great disadvantages, and involving the unknown element of the personal equation of the observers. The latter value (m_1) is the result of elaborate operations extending over a period of nine nights, and made under the best possible conditions; yet these two results differ only by $0{\cdot}03^{sec}$.

(*n*) *Bombay.*—Difference of longitude between Captain Heaviside's station and the transit instrument of the Colaba Observatory. This was determined by a traverse measured under the direction of Captain Heaviside (11).

(*o*) *Bombay-Madras.*—Observers: Captains Campbell and Heaviside. Station at Bombay the same as that used for the interval (m_1). That at Madras was 65 feet due north of the transit circle of the Madras Government Observatory. This interval, though not determined directly, is certainly as well ascertained as any other—(11), Part I.

Its value is deduced from the telegraphic measurement of the difference of longitude of nine Indian arcs joining the six stations—Bombay, Bolarum, Bellary, Mangalore, Vizagapatam, Madras; the most direct route being Bombay-Bellary-Madras. (See diagram in (11) Part I., page 16.) The operations were executed by these officers in 1875-76-77 through the land lines, using the same instruments as mentioned in (k_{11}). Time signals were exchanged automatically, and simultaneously recorded at the two stations. Every possible precaution was taken to guard against error, systematic or accidental, and the work generally was carried out with a completeness that leaves nothing to be desired. The result for this interval is shown in (11) Preface to, Part I., page (xviii.).

We are now enabled to deduce the longitude of Madras; but before doing so, I shall mention and consider another set of totally independent operations, which must be regarded as a powerful check upon all others hitherto discussed—viz., the determination of the longitude of Madras, via Ispahan-Kurrachee. Indeed, if it were not for the very limited and somewhat incomplete observations at Kurrachee, and the undetermined personal equation of the observers at Ispahan and Madras, this chain would be entitled to much greater weight than the one via Suez-Aden-Bombay, because it connects Madras with Greenwich in four steps including only five stations, three of which are fixed national observatories, in addition to having the interval Kurrachee-Madras measured twice independently. I regret that, with the exception of the operations at Madras and Kurrachee, the details of the observations are not at hand; the results given here being taken from General Addison's paper (10) page 83, and (15) pages 17, 54, 81. The actually measured intervals are as follow:

(*p*) *Berlin-Ispahan.* Observers: The astronomers of the Berlin Observatory, at Berlin; and Dr. Fritsch, chief of German Transit of Venus Expedition in Persia (1874), at Ispahan. The operations were repeated on eight nights, viz., November 16, 17, 18, 19, 20, 21, 23 and 27.

(*q*) *Ispahan-Kurrachee.* Observers: Dr. Fritsch at Ispahan, and General T. Addison, C.B., at Kurrachee. General Addison observed for time with a portable transit instrument, and recorded his observations as well as galvanic signals by chronograph. Signals were exchanged on December 11 and 12, 1874. Personal equation between the observers not determined (10) page 83.

(*r*) *Kurrachee-Madras.* General Addison at Kurrachee, and Mr. Norman Pogson, Government Astronomer, at Madras. Galvanic signals were exchanged on one night only, viz., December 13. The time at Kurrachee depends on the observation of three stars. Results given by General Addison (10) page 83.

(r_1) *Kurrachee-Madras.* Same operations as in (*r*); value deduced by Mr. Pogson (15) pages 17, 54, 81.

(r_{ii}) *Kurrachee-Madras.* This interval was determined indirectly through Bombay and Bellary and other Indian arcs by Captains Campbell and Heaviside in their usual excellent manner, as already spoken of. The operations were executed in 1880-81.

(*s*) Difference of longitude between General Addison's and Captain Campbell's station. The position of the former was 0·60 sec east of the station 'used in the Great Trigonometrical Survey at that place' (10) page 84. The position of the latter is described in (11) Part I., page 252, as being 64 feet north, and 152 feet (1″·65 = 0·11sec) west of the 'Telegraph Office Station,' which is a point 'on the eastern terrace of the upper story of the block of dwelling quarters standing in the angle between Macleod road and Telegraph road, marked by a circle and dot engraved on the floor of the terrace, and connected with the Hill Stations A and Mutrani of the G. T. S.' It seems, therefore, that the 'Telegraph Office Station' is the one referred to by General Addison as being 0·60sec west of his observatory.

We may now compare the three values (*r*), (r_{I}), (r_{II}) of the interval Kurrachee-Madras, reducing them all to the Telegraph Office Station of the Great Trigonometrical Survey.

	sec.		h.	m.	sec.
(*r*)	+ 0·60	=	0	53	06·82
(r_1)	+ 0·60	=	0	53	06·45
(r_{ii})	− 0·11	=	0	52	55·61

The two values (*r*) and (r_1) are derived from the same few and simple observations of a single night. Their difference is 0·37sec and has not been accounted for by the astronomers concerned. The value (r_{ii}) is 11·21sec smaller than (*r*), and 10·84sec smaller than (r_1). This large error was pointed out in (6), page 31. No doubt some clerical mistake occurred somewhere, or the position of General Addison's station may be misunderstood; but to assume that this is a clerical error of ten seconds so as to make it a round number, as Mr. Pogson proposes (15) page 81, seems arbitrary. It is strange that in all these years we have never heard an explanation of this matter.

The longitude of Madras is thus arrived at by two routes, as follows:—

Via Suez-Aden-Bombay.

	h.	m.	sec.	sec.
Longitude of Aden (Gill)	2	59	55·772	± 0·113
Aden-Bombay (m_1)	1	51	19·973	± 0·056
Bombay-Madras (*n*)	0	29	43·530	± 0·058
Longitude of Madras, VI	5	20	59·275	± 0·139

Via Ispahan-Kurrachee.

	h	m	sec
(r)........	0	53	34·865
(p)........	2	33	05·11
(q)........	1	01	13·09
$\frac{1}{2}\{(r) + (r_1)\}$........	0	53	06·035
Longitude of Madras........	5	20	59·130 ...VII.

It would appear from result VII. that the error at Kurrachee vanishes in the sum of the two intervals Ispahan-Kurrachee and Madras-Kurrachee; in which case the results VI. and VII. compare very well indeed, considering that the unknown personal equation (Fritsch-Pogson) is involved in VII. I think, however, that this latter value may not be used for any further purposes at present. It would be difficult to do proper justice to it, even if favourable assumptions were made, which is always a dangerous course.

(*l*) *Madras-Singapore.*—Observers: Dr. J. A. C. Oudemans, Surveyor General of Java, at Singapore; Mr. Pogson, at Madras. This measurement was made in July, 1871, by the exchange of galvanic signals, through the cable, on the evenings of 24th, 25th, 26th and 28th. Mr. Pogson observed with the transit circle of the observatory and clock, but had to carry a mean time chronometer to the cable offices for exchange of signals at a distance of four miles. Dr. Oudemans made his time determinations on the 24th by observing zenith distances of two stars with a universal instrument. On the 25th and following dates the observations were made with a 'broken transit instrument' viz., one of the form in which the eyepiece is at one end of the horizontal axis. He also had to carry his chronometer to the cable offices for exchange of signals at a distance of three-quarters of a mile. Observations at both stations were made by eye and ear, no chronographs being used. The personal equation of the observers was not determined (13) page 11, and (15) page 69. The point to which Dr. Oudemans referred his longitude was the position of the flagstaff on Fort Canning in 1871—see (15) page 69, and (14) page 214.

This result was [illegible] by Dr. Oudemans (14) page 214.

(l_1) *Madras-Singapore.* Same operations as in (*l*). Result given by Mr. Pogson (13) pages 11-21

(l_2) *Madras-Singapore.* This determination was made by Lieut. Commander C. M. Davis, U.S.N., at Madras, and Lieut. John A. Norris, U.S.N., at Singapore, in 1882: the operations being repeated on the five nights of January 20, 21, 23, 26, and 27. These officers made their time observations with the so-called 'broken transit instruments,' which offer the great advantage that the observer remains in the same position during observations of stars at all altitudes, a condition greatly favouring the constancy of personal equation. They exchanged galvanic signals directly from their huts, thus avoiding the danger of having their chronometer rates accidentally disturbed, and errors of comparison. They had chronographs upon which their observations were recorded, and their personal equation was continuously tested by 'absolute personal equation instruments,' each observer being provided with one. This equation, however, was not introduced in the results, on account of its being always very small, and probably no greater than its possible variations. Cable signals were observed by reflecting galvanometers. The observers were especially well trained for that class of work, having made together many longitude determinations in various parts of the world. Their plans were all prearranged and methodically carried out, and the excellence of their results is shown in the agreement of values deduced from each night's observations. The discrepancy between the values (t) and (t') is 0·71 seconds, and that between (t) and (t') is 0·51 seconds. The Australian astronomers, in their report (6) page 31, adopted the value (t), which course, considering the circumstances surrounding the two determinations of this interval, was no doubt the best.

(a) *Singapore to Port Darwin.* This interval was determined in 1883, the observers being Captain (now Major) L. Darwin, R.E., at Singapore, and myself at Port Darwin. Captain Darwin made his time observations with the transit instrument previously used by the British Expedition of the Transit of Venus in New Zealand in 1882, and I observed with an excellent portable transit instrument (3" inches object glass). The observations were recorded by chronograph. Galvanic signals were exchanged directly between the stations, sent by hand, and observed by reflecting galvanometer at each receiving observatory. Our personal equation was determined before the undertaking at Melbourne, and experiments were made at Melbourne and Sydney to test our mode of observing and transmitting signals. Three different methods were used in exchanging signals, in accordance with the plan proposed by Captain Darwin, which was strictly adhered to throughout. This plan is described in (6) page 26. The operations were repeated on the nights of February 13, 14, 15, 22, 23, 25, and 26.

The two cable lengths Singapore Banjoewangie and Banjoewangie to Port Darwin were joined; and the signals, though passing through a distance of over 2,000 miles, were satisfactory when the circuit was good. On some occasions they appeared unsteady; but the greater attention then required in observing them seemed to compensate for their inferior quality, as the individual results show.

(c) Difference of longitude between the flagstaff on Fort Canning (station of 1871) and Lieut. Norris' station at Singapore in 1882. This latter is the same as that occupied by Captain L. Darwin in 1883. This value is given in (15) page 68, and was determined by measurement by Lieut. Norris. The flagstaff was west of Lieut. Norris' station. My station at Port Darwin was on the ground of the Eastern Extension Telegraph Company, 56 feet N. 10·22 E. of the veranda post at the northeast corner of the cable officer's quarters. It was marked by a masonry pillar 1 x 2 x 2 feet, upon which the transit instrument stood. This point is now the origin of the Australian longitudes (6).

(w) *Singapore-Banjoewangie.* Observers: Captain Darwin at Singapore, and Captain H. Helb of the general staff, Batavia, at Banjoewangie. Captain Helb made his time determinations by observing zenith distances with a portable universal instrument. Galvanic signals were exchanged on February 17, 18, 19, 21, and 23, 1883. The personal equation between the observers was not determined (6) page 29.

(w') *Banjoewangie to Port Darwin.* This interval was determined by Captain Helb and myself. Signals were exchanged on four nights, viz., January 28, February 1, 22, and 23, 1883. Personal equation between the observers not known.

These operations were arranged at the request of the Dutch Government in order to verify the longitudes of Batavia. We were glad to have Captain Helb's co-operation, as it was not certain whether the direct signals between Singapore and Australia would be good enough for the purpose, and also as a check to our work. Captain Helb shortly after sent all his observations in detail over to Melbourne, where they were found in every respect excellent.

The two values (w) and (w') offer a partly independent value of the interval Port Darwin to Singapore, although the Banjoewangie longitude itself remains affected by the unknown personal equation of H. D. and B. The difference between the direct value (a) and the indirect one (w) + (w') is as follows, viz.:—

	h.	m.	sec.	sec.
(w) .	0	12	06·78	± 0·076
(w_1)	1	05	50·84	± 0·091
	1	47	57·62	
Personal equation (D.B.) . .			·02	

	h.	m.	sec.	sec.	
Singapore to Port Darwin (indirect) . .	1	47	57·60	± 0·119	Difference
Singapore to Port Darwin (direct) (u)	1	47	57·48	± 0·046	0·12sec.

These combined in terms of their mean errors give:—

Singapore (Captain Darwin's station)—

	h.	m.	sec.	sec.	
Port Darwin	1	47	57·49	± 0·045	. . . . . . VIII.

The longitude of Port Darwin may now be deduced, viz.:—

	h.	m.	sec.	sec.
Longitude of Madras (VI.	5	20	59·275	± 0·139
Madras to Singapore (t_{11}). .	1	34	24·07	± 0·040
(v) . . .			1·51	±
Singapore to Port Darwin (VIII.	1	47	57·49	± 0·045
Longitude of Port Darwin (IX.)	8	43	22·31	± 0·152

(x) *Port Darwin to Adelaide.* Observers: Mr. (now Sir Charles) Todd at Adelaide, and myself at Port Darwin. The observations at Adelaide were made with the transit instrument of the observatory. The exchange of galvanic signals here consisted in sending clock-beats to each other automatically (generally two sets of two minutes each), which were simultaneously recorded on the chronographs at the two stations, the chronograph of the receiving station recording at the same time the beats of its own clock. The personal equation between the observers was determined on several occasions through Mr. E. J. White, then Chief Assistant at the Melbourne Observatory, and directly in Melbourne. The operations were repeated on six nights viz., February 11, 15, 22, 23, and 26, and March 2, 1883—(6) page 22.

(y) *Melbourne-Adelaide.*—The operations for this interval were carried out at the two observatories under the direction of their respective government astronomers, Mr. Ellery and Mr. Todd. The observations were made by the latter at Adelaide, and by Mr. E. J. White at Melbourne. Clock-beats (generally two sets of two minutes each) were exchanged, and simultaneously recorded on the chronograph of both stations, &c., as in the case of the interval (x), Port Darwin to Adelaide. Personal equation between Messrs. Todd and White was determined several times. Comparisons made on five nights—viz., February 15, 17, 23, 26, and March 2 (1883).

(x_1) *Port Darwin to Melbourne.* Observers: Mr. E. J. White at Melbourne, and myself at Port Darwin. The operations were exactly similar to those described in the two preceding intervals. Time signals were exchanged on four nights—viz., February 15, 23, 26, and March 2 (1883), the individual results being very fairly accordant. The personal equation between the observers was determined before and after the expedition—(6) page 22.

The value (x_1) ought to be equivalent to the sum of (x) and (y).

We have, in fact

	h.	m.	sec.	sec.
Adelaide to Port Darwin (x). .	0	30	57·80	± 0·044
Melbourne to Adelaide (y) . .	0	25	33·84	± 0·050
Melbourne to Port Darwin, indirect	0	56	31·64	
Melbourne to Port Darwin (x_1), direct . .	0	56	31·66	± 0·044

(z) *Sydney-Melbourne.* This interval was measured five times by direct connection of the observatories between the years 1861 and 1884. The operations consisted, as usual, in the automatic exchange of clock-beats, producing chronographic records at the two observatories, and in time determinations made with the transit circles of these institutions, the whole under the direction of the respective government astronomers. An indirect determination was made in 1868 through the longitude station at the western boundary of Victoria, of which more hereafter.

The last indirect measurement took place in 1887, through Mr. John Tebbutt, private observatory at Windsor, New South Wales. Mr. Tebbutt made his time determinations with a small transit instrument; sent his signals by hand from the local telegraph office, which is at a distance of (4) miles from his observatory, using a mean time chronometer, and observing the incoming signals by coincidence of beat. His operations were conducted with great care, and gave very satisfactory results.

The astronomers at Melbourne give great weight to the value of 1861, and to those of May and August, 1884. The mean of the five independent values is 21m. 55·408sec. The mean of the last two is 21m. 55·395sec., and that of 1861 is 21m. 55·38sec. The value 21m. 55·40sec. was adopted in (6) page 21 as the most probable. We may now conclude the longitudes of the three principal observatories east of Greenwich on the evidence of the telegraphic method alone, as follows, viz.:

	h.	m	sec.	sec.
Longitudes of Port Darwin, IX..	8	43	22·34	± 0·152
Port Darwin to Adelaide Observatory (x)..	0	30	57·80	± 0·011
Longitude of Adelaide Observatory, X.. ..	9	14	20·14	± 0·157
Melbourne-Adelaide (y)..	0	25	33·84	± 0·050
Longitude of Melbourne Observatory..	9	39	53·98	± 0·165
Longitude of Port Darwin, IX..	8	43	22·34	± 0·152
Melbourne to Port Darwin (x1)..	0	56	31·65	± 0·011
Longitude of Melbourne Observatory, XI..	9	39	53·99	± 0·158
Sydney-Melbourne (z)..	0	21	55·40	± 0·091
Longitude of Sydney Observatory, XII....	10	01	49·39	± 0·182

Probable amount of Uncertainty of the Australian Longitudes.

It remains now to be seen with what degree of confidence the given results may be taken.

The theoretical errors attached to the longitudes of Adelaide, Melbourne and Sydney, found above, are respectively ± 0·157sec., ± 0·158sec., and ± 0·182sec. It has already been stated that these errors represent only that part of the probable uncertainty due to the disagreement of separate results of the same measure derived from each night's work when compared with their mean value. It would appear then that the really and purely accidental errors incurred in each single night of the period upon which a longitude result depends are fairly measured by the theoretical errors; or, if this measure is not quite satisfactory, is at least the best that can be obtained. But there may be involved systematic errors common to all the nights of that period, some of which are beyond the reach of investigation, and others that might possibly be discovered only by delicate and continued experiments in fixed institutions, but not in the temporarily arranged longitude observatories.

Altered personal equations at each new place of observation, instrumental changes, flexure, physical peculiarities of the localities, and many other known and unknown causes may bring in systematic errors not easily discovered. The theoretical error has no concern in these matters, and gives no help. It is when new instruments and new observers are employed in different years, so as to make the redeterminations entirely independent, that the existence of these systematic errors is revealed, if the results do not agree. But even then it is difficult, if not sometimes impossible, to locate them. There are, besides, inaccuracies the causes of which are traceable, such as unsteadiness of stations, imperfect adjustment of electric instruments, changeable strength of circuits, level imperfections, unfavourable conditions such as having to carry time pieces to a distance, and others; but their effect can only be made evident by new measurements.

Every determination of differential longitude, however short the [illegible]terval may be, is weakened by at least some of the causes here enumerated.

Admitting consummate skill in the great majority of the observers concerned, we may then look at the conditions under which this long longitude chain, Greenwich-Australia was developed, in order to see where its deficiency in strength is more especially to be feared.

There appears to be at first a natural division at Aden. The three intervals on the western portion were all measured twice, the results giving, as we have seen, the following discordances:

	sec.
Greenwich-Alexandria	0·156
Alexandria-Suez	0·456
Suez-Aden	0·177

Indeed, remembering the circumstances, these differences seem very small. Yet, although the aggregate error in the Aden longitude may not be more than one-fifth of their sum, it would not be unreasonable to suspect that it may amount to half a second of time or even more, for the unsteadiness of the stations at Alexandria and Suez and the great variations in the personal equation of the observer at Mokattam are serious matters.

The operations east of Aden all along to Australia were decidedly made under better conditions and with more complete equipments, and, unlike the others (which were only chiefly made for the purposes of the observations of the Transit of Venus), they were intended for the establishment of fundamental longitudes.

The portion from Aden to Madras depends on the elaborate and refined operations of the officers of the Great Trigonometrical Survey of India, of which the interval Aden-Bombay, with its two independent and extremely accordant values, obtained under such uneven share of advantages, offers a remarkable instance of how a good result is sometimes found where we might be justified by the nature of the case i[illegible]ng it but little weight.

From Bombay to Madras the telegraphic results, though in every res[illegible]ly trustworthy, are not corroborated by any other entirely independent telegrap[illegible]determination. It appears also that the geodetic value of this interval, derived from the principal triangulation, is 12″·29 0·819$^{sec.}$ in excess of the telegraphic value, the difference being partly attributed to local attractions—(11) Preface, page xviii.

Up to this point we have another test for the whole of the operations in the longitude chain via Berlin-Ispahan-Kurrachee, and but for the doubts attached to the Kurrachee station this test would be invaluable.

We have now the determinations Madras-Singapore of 1871 and 1882. It is not unfair to assume the superiority of the latter value. The chief weakness of the earlier one arises, perhaps in the carriage of the chronometers to considerable distances f[illegible] the exchange of signals, and in the unknown personal equation of the obser[illegible] There is a difference of more than half a second of time between the two results, and it is not quite certain, though most probable, that the whole of this error is attributable to the observations of Dr. Oudemans and Mr. Pogson. The interval Singapore to Port Darwin depends solely on one set of operations—viz., those of 1883. I can only say that the observers felt satisfied about the quality of their work; but still the receiving of galvanic signals by observing the sudden motion of a beam of light not always regular or well defined, involves greater uncertainty than transit observations, and may be subject to comparatively large variations in its amount. The result is partly checked by the two separate intervals formed by the intervention of Banjoewangie, but is not corroborated by entirely independent operations. The difference between the direct and indirect result is 0·12sec.

There remain now the Australian operations. In the two intervals Port Darwin to Adelaide and Port Darwin to Melbourne, the unknown error of the results rests almost entirely on the time determinations at Port Darwin, as the exchange of signals was entirely automatic, and transit observations at the fixed observatories involve very little uncertainty.

The various measurements of the interval Sydney-Melbourne, as we have repeatedly observed in these pages, range from $21^m\ 55·30^{sec}$ to $21^m\ 55·81^{sec}$, which may give reason to suspect some unknown disturbing cause interfering with this kind of work. Fortunately, fresh determinations may be frequently repeated without inconvenience, and I believe it is the intention of the government astronomers of these colonies to make arrangements for that purpose.

We have, finally, the boundary longitudes.

Here an error of more than half a second of time was disposed of in what was thought the only possible way under the circumstances; but it does not by any means clear the doubts attached to the discrepancies produced by the operations of 1868.

These are the principal facts upon which an opinion is to be formed as to the amount of uncertainty inherent to the adopted results.

I think that the longitudes of the Australian observatories may be accepted as true only within one second of time.

Possible Improvements of the Adopted Values.

No doubt, even with the present means of astronomical science, the Australian longitudes could be strengthened by a new determination of the longitude of Aden, as recommended by Dr. Gill, and of the interval Ispahan-Kurrachee. The importance of these operations could not be overrated, and it is to be hoped that they will be undertaken at the first opportunity.

APPENDIX—TABLE I.

Reference Letter.	Difference of Longitude.	Computed Mean Error.	Description of Interval for which the Difference of Longitude is given.
	h. m. sec.	sec.	
(a)	2 05 06·240	0·098	Greenwich Mokattam-Cairo.
(b)	0 05 32·550	0·122	Alexandria (Hunter's station) to Mokattam.
(c)	0 53 31·865	....	Greenwich Berlin (Transit Circle).
(d)	0 04 28·316	0·058	Berlin Malta.
(e)	1 01 30·646	0·030	Malta Alexandria.
(f)	1 05 58·750	0·078	Berlin Alexandria. Dr. Copeland's value.
(f_1)	1 05 59·020	0·078	Berlin Alexandria. Dr. Auwers' value.
(g)	0 10 38·923	0·082	Alexandria (Hunter's station) to Suez (Low's station). Dr. Copeland's value.
(g_1)	0 10 39·078	0·082	Alexandria (Hunter's station) to Suez (Low's station). Dr. Auwers' value.
(h)	0 05 06·931	0·103	Mokattam Suez (Hunter's station).
(i)	0 00 00·320	.	Suez (Hunter's station, east of Low's station) to Dr. Gill's determination.
(i_1)	0 00 00·025	....	Suez (Hunter's station, east of Low's station) to Captain Campbell's traverse measurement.
(k)	0 49 43·750	0·120	Suez (Low's station) to Aden (Gill's station). Dr. Copeland's value.
(k_1)	0 49 43·733	0·120	Suez (Low's station) to Aden (Gill's station). Dr. Auwers' value.
(k_{11})	0 49 42·662	0·060	Suez (Hunter's station) to Aden (Heaviside's station).
(l)	0 C9 00·877	[illegible]	Aden (Gill's station, east of Heaviside's station).
(m)	1 51 18·940	[illegible]	Aden (Gill's station) to Bombay (Chamber's station, Colaba Observatory).
(m_1)	1 51 19·973	0·056	Aden (Heaviside's station) to Bombay (Heaviside's station).
(n)	0 00 00·134	....	Bombay to Captain Heaviside's station (east of the Colaba Observatory Transit Instrument or Chamber's station).
(o)	0 29 43·530	0·058	Bombay (Heaviside's station) to Madras (Observatory Transit Circle).
(p)	2 33 05·440		Berlin Ispahan.
(q)	1 01 13·090		Ispahan Kurrachee (Addison's station).
(r)	0 53 06·220		Kurrachee Madras (Addison and Pogson). General Addison's value.
(r_1)	0 53 05·850		Kurrachee Madras (Addison and Pogson). Mr. Pogson's value.
(r_{11})	0 52 55·720		Kurrachee (Captain Campbell's station) to Madras Observatory. Determination by the officers of the G.T.S.
(s)	0 00 00·710		Kurrachee (Campbell's longitude station, west of Addison's station).
(t)	1 34 23·365		Madras (Observatory) to Singapore (flag staff on Fort Canning, 1871). Prof. Oudemans' value.
(t_1)	1 34 23·560		Madras (Observatory) to Singapore (flag staff on Fort Canning, 1871). Mr. Pogson's value.
(t_{11})	1 54 24·070	0·010	Madras (Observatory) to Singapore (Lieut. Norris' station).
(u)	1 47 57·480	0·046	Singapore (Lieut. Norris' and Captain Darwin's station) to Port Darwin (Baracchi's station).
(v)	0 00 01·510	.....	(Lieut. Norris' station is the same as Captain Darwin's station). (Darwin's station, east of flag staff on Fort Canning, 1871).
(w)	0 42 06·780	0·076	Singapore (Darwin's station) to Banjoewangie (Capt. Helb's).
(w_1)	1 05 50·840	0·091	Banjoewangie (Helb's station) to Port Darwin (Baracchi's station).
(x)	0 30 57·800	0·011	Port Darwin (Baracchi's station) to Adelaide (Observatory).
(y)	0 25 33·840	0·050	Melbourne (Observatory) to Adelaide (Observatory).
(x_1)	0 56 31·660	0·044	Port Darwin (Baracchi's station) to Melbourne (Observatory).
(z)	0 24 55·400	0·091	Sydney (Observatory) to Melbourne (Observatory).

II.—List of Works Consulted.

(1) Report on the Determination of Differences of Longitude in the West Indies and Central America. By Lieut.-Commander F. M. Green, U.S.N.

(2) Smithsonian Contributions to Knowledge, No. 223, vol. 16.

(3) Astronomische Nachrichten, No. 2636.

(4) United States Coast Survey Report. App. 18.

(5) Royal Astronomical Society, vol. 51.

(6) Report on the Telegraphic Determination of Australian Longitudes, via Singapore, Banjoewangie, and Port Darwin.

(7) Annals of the Cape Observatory, vol. i., Part II. (Dr. Gill.)

(8) Account of Observations of the Transit of Venus of 1874. (Edited by Sir George Airy.)

(9) Dunecht Observatory Publications, vol. iii. (By the Earl of Crawford and Balcarries.)

(10) Royal Astronomical Society, vol. 38. (General T. Addison, C.B.)

(11) Account of the Operations of the Great Trigonometrical Survey of India, vol. ix. (General J. T. Walker C.B., R.E., F.R.S., &c.)

(12) Report of the Great Trigonometrical Survey of India for 1876-77.

(13) Telegraphic Determinations of the Difference of Longitude between Karachi, &c., and the Government Observatory, Madras. (By Norman Pogson, C.I.E., F.R.A.S., &c., Government Astronomer.)

(14) Astronomische Nachrichten, No. 2486. (Prof. J. A. C. Oudemans.)

(15) Telegraphic Determination of Longitudes in Japan, China, &c. (By Lieut. Commanders F. M. Green and C. H. Davis and Lieut. J. A. Norris, U.S.N.)

(16) Royal Astronomical Society, vol. xlviii. (By John Tebbutt, F.R.A.S., &c.)

(17) Report on the Determination of the Boundary Line of Colonies of South Australia and New South Wales. (By Charles Todd, F.R.A.S., Observer and Superintendent of Telegraphs, South Australia, 11th December, 1868.)

Since Mr. Baracchi compiled the preceding, a fresh determination, Greenwich-Madras via Potsdam, has been made (1894-96) by Capt. Burrard and Capt. Conyngham, and still later (1903) a re-determination of Greenwich-Potsdam, whereby the preceding suffers a small correction so as to bring Capt. Burrard's value for Potsdam in accord with that of Professor Albrecht. From the recently published details of Professors Albrecht and Wanach's work, it would appear that we now have a practically absolute value for the difference of longitude Greenwich-Potsdam, and hence Berlin, that will not suffer material correction.

The meridian of Madras is the one of reference for the Great Trigonometrical Survey of India, and on its position the one of Singapore rests.

For over a century observations have been taken, from time to time to determine the longitude of Madras. In 1891 the survey of India had not adopted the then best value, so that at the International Geographic Congress held at Berne in that year the question arose, why the known error in longitude of 2′ 30″ was not corrected on the Indian maps and charts. This gave rise to a discussion in India and the whole longitude work was reviewed, with the result that a determination *de novo* was decided upon, carrying the work directly from Greenwich via Potsdam, Teheran, Bushire and Karachi, where connection was made with the three arcs of the Great Trigonometrical Survey between Karachi and Madras. This is the work referred to above and carried out in 1894-96.

In Volume xvii., Appendix No. 2 Great Trigonometrical Survey of India, 1901, Major S. G. Burrard, R. E., tabulates the various independent values of Madras into Series A, B, C, D and E.

Series A leads via Pulkowa to Vladivostock, with thirteen links, carried out by the Russian general staff, and thence by officers of the U.S. navy via Shanghai, Hong Kong, St. James, Singapore to Madras.

Series B was obtained in connection with the German Transit of Venus expeditions of 1874 and 1882, but owing to some serious error at Karachi, its value is rejected.

Series C gives the results of the most recent (1894-96) determination and the details are given in Capt. Burrard's report. The value for Madras of this series, corrected for Dr. Albrecht's value of Potsdam will be used for deducing Singapore. The difference between this new value for Singapore and the one adopted in the Singapore-

Port Darwin determination will be applied to the present value of Sydney, Brisbane, and Wellington for comparison with the Canadian longitudes brought across the Pacific.

Series D. This leads via Berlin, Malta, Alexandria, Suez, Aden, Bombay and Bellary to Madras.

Mr. (now Sir) David Gill, who was one of the observers on this series, writes in volume I. of the Annals of the Cape Observatory: 'In the case of Lord Lindsay's Expedition (i.e. of Series D.) the observations lay no claim to high refinement. They were made throughout in the open air, with small portable instruments, which in the case of Alexandria were placed on the roof of a hotel, where the observer had to abstain from movement during each complete observation, otherwise the level was disturbed by the change of his position. At Aden and Alexandria the chronometers had to be carried a long distance between the observing station and the telegraph office. The observers were without personal assistance and the crucia, observations for time had often to be made under conditions of extreme fatigue, amounting on one or two occasions nearly to exhaustion on the part of the observer engaged. In fact the character of the work was only such as it was possible to organize and execute en route, and the results fully realized the accuracy expected from them.'

Series E. This leads from Greenwich to Mokattam (Cairo) and thence to Suez and Madras as in Series D.

This series, too, Sir David Gill considers wanting in that refinement essential for fundamental longitudes.

The result of the five series of operations, Capt. Burrard tabulates as follows:

	Longitude of Madras h.	m.	sec.	Probabl Error. sec.
Series A	5	20	59·750	± ·155
B			59·010	± ·163
C			59·137	± ·022
D			59·233	± ·127
E			59·121	± ·123

On the first link Greenwich-Potsdam of Series C, there is a check by another determination.

The adopted value of Berlin, as given in the Berliner Jahrbuch, up to 1903 is $0^{h.}\ 53^{m.}\ 31{\cdot}910^{sec.}$

Berlin-Potsdam, $1^{m.}\ 18{\cdot}721^{sec.}$, Astron. Geod. Arbeiten in 1891. Longitude Potsdam, $0^{h.}\ 52^{m.}\ 16{\cdot}189^{sec.}$ By Series C, $0^{h.}\ 52^{m.}\ 15{\cdot}953^{sec.}$, Vol. xvii. p. 208 G. T. S. India, or $\cdot 234^{sec.}$ less than the German value.

The value of Potsham of Series C, $0^{h.}\ 52^{m.}\ 15{\cdot}953^{sec.}$ is the mean of the two values $0^{h.}\ 52^{m.}\ 15{\cdot}623^{sec.}$ and $0^{h.}\ 52^{m.}\ 16{\cdot}283^{sec.}$, obtained by exchange of stations by the observers Capt. Burrard and Capt. Conyngham. This gives a difference of $\cdot 660^{sec.}$ between the two results, and the personal equation is half, or $\cdot 330^{sec.}$, a quantity larger than had been obtained by direct observation therefor both at Greenwich and in India.

In 1903 a re-determination of Greenwich-Potsdam was carried out by Dr. Albrecht and Mr. Wanach. Stations were exchanged and the observations made with a Repsold registering micrometer. The whole work was carried out with so high a degree of refinement, that it is not probable that the work will ever require revision or repetition.

From the above 1903 determination, we have Potsdam $0^{h.}\ 52^{m.}\ 16{\cdot}051^{sec.} \pm \cdot 003^{sec.}$ p.e.* or $\cdot 098^{sec.}$ more than that of series C, and $\cdot 138^{sec.}$ less than the former German value.

New Zealand.

In volume 35 of the Transactions of the New Zealand Institute, Mr. T. King, observer at Wellington, gives a full account of the various determinations made for

* P. No. 15 Veroffentlichung des K. Preussschen Geodätischen Instituts.

the longitude of a prime meridian for New Zealand. This meridian, passing through the former Mount Cook observatory, is the one to which the surveys of New Zealand are referred. It may be remarked that the observatory was not on or near the well-known Mount Cook of the South or Middle island, but in Wellington on a site now occupied by prison buildings.

The longitude hitherto adopted for that meridian is 11h 39m 09·92s, derived from moon culminations, 1869-71. In 1876 a telegraphic difference of longitude was obtained between Sydney and Wellington by Messrs. Russell and Stock. However, as the accurate longitude of Sydney was at that time in doubt, no definitive meridian for New Zealand resulted from the 1876 work.

In 1883, as already noted, Sydney was connected with Greenwich by a chain of telegraphically connected stations entering Australia at Port Darwin, and the resulting longitude was 10h 04m 49·54sec †

In the same year Messrs. Russell and Adams connected Sydney with Wellington (Mount Cook station), obtaining a difference of longitude 1h 34m 16·983sec ± ·020sec. (A very full and interesting account of this good work is given by Mr. C. W. Adams in the report on the surveys of New Zealand for the years 1883-84.)

This gave for the longitude of Mount Cook Initial Station, 11h 39m 06·52sec. This value is less than the hitherto accepted value by 3·40sec, or 51 seconds of arc.

By triangulation a connection has been made between the Mount Cook station and the present observatory, both in Wellington. The latter was found east of the former 1·21sec, so that the longitude of the present Wellington Observatory, is 11h 39m 05·31sec east of Greenwich.

This value is based on:—

1883, Wellington-Sydney. Adams and Russell.
1883-84, Sydney-Melbourne-Port Darwin. Ellery, Todd, Russell, Baracchi.
1883, Port Darwin-Singapore. Baracchi, Capt. Darwin.

As Singapore is dependent upon Madras, whose longitude has already been discussed, all New Zealand longitudes, by accepting the last quoted longitude for Wellington, will be affected by any change in the value of Madras. Although the 1883 value for Mount Cook initial station was at the time considered definitive, yet its value has not for a period of twenty years thereafter, been introduced on the Admiralty Charts (except on No. 1123) nor on the maps of New Zealand. This was due to the great labour involved in changing the engraved plates.

Mr. T. King in his report,* writes: 'I undertsand, however, that the Surveyor General purposes taking advantage of an intended re-issue of the Department maps to revise the longitudes on the basis of Mr. Russell's and Mr. Adams' determination.'

The change of longitude by the 3·40sec, will shift the topography relative to the meridians about three quarters of a mile to the west.

LATITUDE.

For the differential longitude determinations, the value for the latitude enters only for computation of the star factors, and was not required to be of such accuracy as in geodetic computations.

Vancouver. The value used was that of former years, this station having been occupied at various times for longitudes in British Columbia:

$$\phi = 49° \ 17' \ 18''$$

Fanning Island.—Mr. Werry observed here 29 pairs of stars between the 19th April and 11th May, 1903, Talcott's method, and obtained the value:—

$$\phi = +3° \ 54' \ 37''.53 \pm ''.015$$

† Report on the Telegraphic Determination of Australian Longitudes - Melbourne - 1886.
* Trans. New Zealand Institute, Vol 35, p. 146

Suva, Fiji. Between June 27 and July 27, 1903, D. Klotz obtained here 28 pairs of stars from which the latitude was found to be:—

$$\phi = -18^\circ\ 08'\ 45''\cdot02 \pm ''\cdot014.$$

Norfolk Island.—Mr. Werry observed here 28 pairs of stars between Sept. 17 and 23, 1903, and obtained the value:

$$\phi = -29^\circ\ 00'\ 28''\cdot94 \pm ''\cdot014.$$

Southport, Queensland. The transit instrument not being available for latitude work on account of the broken micrometer thread, several observations for latitude were taken by the method of observing pairs of stars at eastern and western elongation respectively, with a 6-inch transit theodolite, kindly loaned by Mr. A. A. Spowers, Chief Surveyor, Brisbane.

The mean value of three pairs was:

$$\phi = -27^\circ\ 58'\ 53''.$$

Brisbane. The position of the observatory, where the observations were taken is (given in the Nautical Almanac):—

$$\phi = -27^\circ\ 28'\ 00''\cdot0.$$

Sydney.—The position of the observatory, where the observations were taken is (given in the Nautical Almanac):—

$$\phi = -33^\circ\ 51'\ 41''\cdot1.$$

Wellington.—The position of the observatory, where the observations were taken is:

$$\phi = -41^\circ\ 16'\ 47''\cdot4.$$

Doubtless Bay.—The observatory here was connected, through the courtesy of the Surveyor General, J. W. A. Marchant, by Mr. Vincent J. Blake, Government Surveyor, with Station 20 of the triangulation system, spread over the North Island.

The latitude of Station 20, based on initial Station Mt. Cook at Wellington, was furnished by the Surveyor General under date November 11, 1902, as

$$\phi = -34^\circ\ 58'\ 58''\cdot1$$

Applying it to Mr. Blake's survey we have:—

Station 20 – A..			22″·87
Station A..	34°	59′	20″·97
Station A – Observatory..			1″·07
Observatory..	−34°	59′	22″·04

TRANSIT OBSERVATIONS.

Station: Vancouver. Date, April 10th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Sum of corr. + transit.	R. A.	Chronometer Correction.	
		h. m. s.	s.	s.	s.	s. ·006	s.		h. m. s.	s.	s.
E	157.	9 24 17 77	80	35	23	04	10	17 41	9 23 22 31	55 10	00
	119.	29 14 01	17	03	04	03	02	13 80	28 18 79	01	00
	142.	41 17 88	13	04	04	02	02	17 71	40 22 59	12	02
	572.	47 17 70	08	08	03	01	01	17 61	46 22 58	03	07
	423.	56 02 42	10	06	03	00	02	02 27	55 07 11	16	06
	115.	10 02 59 87	12	05	03	00	02	59 71	10 02 04 56	15	05
W	148.	10 12 15 05	24	04	04	01	02	14 72	11 19 68	04	06
	149	17 30 65	32	02	04	02	02	30 27	16 35 16	11	01
	126.	23 14 10	30	02	04	02	02	13·74	22 18 56	18	08
	750.	27 51 35	91	18	14	03	06	50 45	26 55 36	09	01
	431.	41 25 80	27	03	04	04	02	25 48	40 30 37	11	01
	432.	45 06 90	20	06	03	04	02	06 63	44 11 55	08	02

[illegible] ·094 [illegible] ·033

Chronometer correction at 10h 00m = 55s·068 ± ·012

TRANSIT OBSERVATIONS

Station: VANCOUVER. Date, April 15th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer Correction.	v
		h. m. s.	s.	s.	s.	s. r ·06	s.		h. m. s.	s.	s.
E	127.	8 41 38 54	03	04	03	05	02	38 54	8 40 51 22	47 32	13
	129.	51 04 82	02	08	03	04	04	04 90	50 17 45	45	00
	132.	55 09 67	04	02	04	04	02	09 71	54 22 34	37	08
	133.	57 49 33	04	00	04	04	02	49 35	57 02 01	34	11
	134.	9 10 08 04	02	08	03	03	01	08 13	9 09 20 62	51	06
	136.	15 57 97	03	03	04	02	02	58 03	15 10 49	54	09
	137.	24 09 32	15	41	21	01	10	09 16	23 21 68	48	03
W	142.	41 10 07	08	05	03	01	02	10 00	40 22 50	50	05
	423.	55 54 47	06	07	03	02	02	54 45	55 07 05	40	05
	145.	10 02 52 00	07	06	03	03	02	51 97	10 02 04 50	47	02
	148.	12 07 15	08	05	03	04	02	07 14	11 19 62	49	04
	149.	47 22 68	11	02	04	01	02	22 57	16 35 07	50	05
	426.	23 06 11	10	03	04	05	02	06 03	22 18 48	55	10
	150.	27 43 10	31	21	13	05	06	42 44	26 55 04	40	05

a = ·311 c = ·030
Chronometer correction at 9h 34m = 47s·451 ± ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer Correction.	v
W	433.	10 53 04 18	35	28	02	03	07	03 47	10 52 16 18	47 29	02
	154.	58 34 84	47	06	01	02	04	34 56	57 47 14	42	11
	434.	11 00 50 18	06	08	01	02	02	50 17	11 00 02 82	35	04
	155.	05 02 14	11	01	01	02	02	01 98	04 14 82	16	15
	156.	09 46 42	08	06	01	01	02	46 38	08 59 04	34	03
E	160.	11 16 57 38	05	08	01	01	01	57 48	16 10 16	32	01
	162.	26 29 27	17	42	01	0	05	29 24	25 41 90	34	03
	163.	41 45 44	09	00	01	02	02	45 22	40 58 00	22	09
	164.	44 56 01	05	07	01	02	02	56 12	44 08 82	30	01
	166.	49 33 40	10	02	01	03	03	33 47	48 46 15	32	01
	167.	12 01 05 43	05	08	01	04	02	05 57	12 00 18 24	33	02

a = ·118 c = [illegible]
Chronometer correction at 11h 23m = 47s·309 ± ·016

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer Correction.	v
						r ·056					
E	477.	13 08 10 13	04	01	01	04	02	10 13	13 07 22 99	47 14	04
	178.	20 50 75	06	01	01	03	03	50 75	20 03 61	14	04
	452.	24 29 88	11	09	02	02	05	29 85	23 42 68	17	04
	179.	30 54 50	02	02	01	02	01	34 52	29 47 32	20	02
	180.	43 28 47	03	02	01	00	02	28 51	42 44 34	17	04
	182.	50 53 23	03	02	01	00	02	53 27	50 06 14	13	05
W	184.	14 02 35 68	15	02	01	01	03	35 48	14 01 48 27	21	03
	458.	06 47 86	07	04	01	02	02	47 79	06 00 68	11	07
	459.	10 04 29	29	07	03	02	07	03 85	09 16 72	13	05
	488.	13 34 22	10	00	01	02	02	34 11	12 43 96	15	03
	190.	22 43 31	11	00	01	03	02	43 20	21 55 88	32	14
	192.	28 28 41	07	01	01	04	02	28 36	27 41 10	26	08

a = ·029 c = ·007
Chronometer correction at 13h 18m = 47s·181 ± ·013

TRANSIT OBSERVATIONS

Station: Vancouver. Date, April 16th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of comp. transit.	R. A.	Chronometer Correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
						07					
E.	150.	10 27 11 11	15	26	12	05	06	10 71	10 26 51 98	45 73	02
	131	41 16 02	05	05	03	03	02	16 00	10 30 30	70	01
	132	44 57 12	03	09	03	03	02	57 16	11 11 10	67	04
	152.	48 40 90	05	04	03	02	02	10 88	47 55 29	59	12
	134.	11 00 48 64	04	09	03	01	02	48 66	11 00 02 82	84	13
	155	05 00 53	06	02	01	00	02	00 51	04 14 80	75	00
W.	159.	11 02 39	21	04	03	01	02	02 18	13 16 48	76	01
	160.	16 55 82	14	09	03	01	01	55 71	16 10 15	59	12
	162	26 28 22	39	14	08	02	05	27 58	25 41 87	71	00
	138.	32 46 85	12	10	03	03	01	46 82	32 01 06	76	05
	164	44 51 65	13	08	03	04	02	54 59	44 08 81	78	07

a = .138 c = .098
Chronometer correction at 11h 8m = 45s.708 ± .017

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of comp. transit.	R. A.	Chronometer Correction.	
W.	177.	13 08 08 47	01	06	06	05	02	08 51	13 07 23 00	45 51	05
	151.	13 59 33	01	03	07	01	02	59 36	13 13 84	52	04
	178.	20 49 63	01	03	09	03	03	49 12	20 03 61	51	05
	152.	24 28 14	03	20	17	03	05	28 30	23 42 67	63	07
	154.	31 15 59	01	04	06	02	02	15 64	30 30 14	53	03
	180	43 26 81	01	08	05	01	02	26 93	42 41 35	58	02
E.	182.	50 51 68	08	08	05	00	02	51 77	50 06 15	62	06
	183.	57 30 40	06	10	05	01	01	30 51	56 44 88	63	07
	184.	14 02 33 67	20	09	12	02	03	33 65	14 01 18 27	38	18
	158.	06 40 27	00	06	06	02	02	16 36	06 00 68	68	12
	159.	10 02 58		32	24	03	07	02 35	09 16 73	62	06
	188	13 29 43		01	07	03	02	29 77	12 43 97	54	02
	192.	28 26 55	10	05	06	05	02	26 67	27 11 11	56	00

a = .139 c = .050
Chronometer correction at 13h 48m = 45s.561 ± .017

TRANSIT OBSERVATIONS.

Station, Vancouver. Date, April 18th, 1903. Observer, Otto Klotz.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v
		h. m. s.	s.	s.	s.	.03	s.		h. m. s.	s.	s.
E.	141.	9 36 43 36	05	08	02	02	02	43 43	9 36 00 40	43 33	07
	142.	41 05 76	06	06	05	02	02	05 84	40 22 46	35	05
	144	47 59 92	06	05	03	02	02	59 96	47 16 59	37	0?
	123	55 50 36	05	08	02	01	02	50 41	55 07 01	43	03
	162.	11 26 25 30	1?	1?	06	03	05	25 24	11 25 41 81	43	03
	138	32 44 37	0?	10	02	03	04	44 50	32 01 05	45	05
W.	152	10 48 38 72	06	04	03	01	02	38 72	10 47 55 28	44	04
	153	52 59 83	25	30	08	01	07	59 30	52 15 98	32	08
	453	56 45 30	12	06	05	02	04	45 15	56 04 67	48	08
	434	11 00 46 42	04	08	02	02	02	46 18	11 00 02 80	38	02
	155.	04 58 46	08	01	03	02	02	58 42	04 44 78	34	06
	156.	09 42 39	05	06	02	02	02	42 42	08 59 02	40	00
	159.	13 59 90	07	04	03	02	02	59 90	13 16 46	44	04

a = .123 c = .024
Chronometer correction at 10h 24m = 43.302 ± .011

E.	180	13 43 24 53	07	10	04	03	02	24 61	13 42 41 36	43 25	05
	182 .	50 49 31	08	10	04	02	02	49 44	50 06 16	25	05
	183 .	57 28 44	06	13	04	02	01	28 23	56 44 90	33	03
	184 .	14 02 31 60	19	11	09	01	03	31 55	14 01 48 29	26	04
	458 .	06 43 84	08	08	04	01	02	43 95	06 00 70	23	07
	459 .	10 00 45	35	43	18	01	07	00 44	09 16 75	36	06
	188 .	13 27 19	12	01	05	01	02	27 24	12 43 99	25	05
W.	190 .	22 39 47	44	02	06	00	03	39 37	21 55 92	45	15
	192 .	28 24 46	07	07	01	00	02	24 48	27 41 13	35	05
	197	42 06 22	04	13	04	04	01	06 35	41 22 97	38	08
	198	51 45 59	22	28	14	01	05	45 19	51 01 98	24	09
	199	59 02 92	08	04	05	02	02	02 93	58 19 62	34	01
	465 .	15 01 02 69	07	08	04	02	02	02 74	15 00 19 46	28	02
	201 .	12 20 87	08	06	04	03	02	20 90	11 37 61	29	04

a = +.186 c = +.036
Chronometer correction at 14h 28m = 43s.302 ± .010

TRANSIT OBSERVATIONS.

Station: Vancouver. Date: April 21st, 1903. Observer: Otto Klotz.

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Star's deduced corr. transit	R.A.	Chronometer correction	v
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E.	193	14 36 19 80	01	00	05	03	02	19 88	14 36 12 30	37 58	10
	197	42 00 57	00	12	[illegible]	02	01	00 69	41 23 00	69	01
	198	54 39 84	06	24		02	05	39 76	54 02 03	73	05
	199	58 57 14	04	03	6	01	02	57 24	58 19 66	58	10
	165	15 00 57 06	03	07	05	00	02	57 19	15 00 19 57	62	01
W.	201	42 15 31	02	05	06	00	02	15 30	41 37 65	65	03
	203	21 33 31	12	20	15	01	04	33 05	20 55 43	62	06
	206	28 06 44	07	03	06	02	02	06 48	27 28 79	69	01
	209	31 14 60	06	07	05	02	02	14 68	30 36 95	73	05
	210	36 23 23	08	04	06	02	02	23 29	35 45 59	70	02
	211	39 19 86	08	07	05	02	02	19 96	38 42 26	70	02
	213	42 22 43	07	09	05	03	02	22 55	41 44 78	77	09

a = .159   e = ± .046

Chronometer correction at 15h 10m = 37s.677 ± .013

TRANSIT OBSERVATIONS.

Station: VANCOUVER. Date, April 23rd, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r ·069	s.		h. m. s.	s.	s.
W	154.	10 58 21·94	·23	·08	−·06	·05	·04	21·60	10 57 46·92	34·68	·05
	155.	11 04 19·48	·15	·02	−·04	·04	·02	49·33	11 04 14·70	·63	·00
	156.	09 33·63	·10	·09	−·03	·03	·02	33·60	08 58·96	·64	·01
	159.	13 51·11	·13	·06	−·03	·02	·02	51·03	13 16·40	·63	·00
	160.	16 14·64	·08	·12	−·03	·02	·02	44·67	16 10·09	·58	·05
E	162.	26 16·65	·08	·18	·08	·01	·05	16·25	25 41·63	·62	·01
	438.	32 35·63	·02	·13	·03	·00	·01	35·70	32 01·01	·69	·06
	163.	41 32·52	·05	−·01	·04	−·02	·02	32·44	40 57·89	·55	·08
	164.	44 43·32	·03	·10	·03	−·02	·02	43·36	44 08·77	·59	·04
	166.	49 20·81	·05	·03	·04	−·03	·02	20·70	48 46·03	·67	·04
	167.	12 00 52·81	·02	−·11	·03	−·05	·02	52·90	12 00 18·21	·69	·06

$a = -$ ·172 $c = -$ ·025

Chronometer correction at 11ʰ 29ᵐ = 34·633 ± ·011

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
E	177.	13 07 57·49	·07	−·07	−·03	·06	·02	57·44	13 07 23·00	34·44	·01
	178.	20 38·20	·12	·03	−·04	·03	·03	38·03	20 03·59	·44	·01
	152.	24 17·54	·22	·24	−·08	·03	·05	17·08	23 42·61	·47	·02
	454.	31 01·62	·09	−·04	−·03	·02	·02	01·56	30 30·12	·44	·01
	180.	43 15·84	·06	·09	−·02	·00	·02	15·87	42 41·38	·49	·04
W	182.	50 40·71	·07	−·09	·02	−·01	·02	40·70	50 06·18	·52	·05
	183.	57 19·33	·05	·13	·02	−·02	·01	19·40	56 44·93	·47	·02
	184.	14 02 23·03	·18	·11	·05	·03	·03	22·69	14 01 48·30	·39	·06
	458.	06 35·17	·08	·08	·03	−·03	·02	35·15	05 60·73	·42	·03
	159.	09 52·12	·34	·40	·11	−·04	·07	51·21	09 16·76	·48	·03
	190.	22 30·53	·13	·02	·04	−·06	·03	30·37	21 55·95	·42	·03

$a = -$ ·173 $c = -$ ·023

Chronometer correction at 13ʰ 45ᵐ = 34·451 ± ·008

TRANSIT OBSERVATIONS.

Station: Vancouver. Date, April 24th, 1903. Observer: Otto Klotz.

r ·09

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E.	154.	10 58 18·70	·92	·05	·02	·09	·04	19·42	10 57 46·89	32·53	·06
	156.	11 09 31·09	·41	·06	·01	·08	·02	31·45	11 08 58·95	·50	·63
	159.	13 48·45	·50	·04	·01	·07	·02	48·89	13 16·39	·50	·03
	161.	19 26·30	·35	·07	·01	·06	·02	26·63	18 54·06	·57	·10
	166.	49 17·66	·75	·02	·02	·02	·03	18·32	48 46·01	·31	·16
W	170.	12 15 30·85	·22	·08	·01	·02	·02	31·16	12 14 58·79	·37	·10
	442.	21 38·30	·44	- ·02	·01	·03	·02	38·78	21 06·38	·40	·07
	171.	29 55·07	- ·91	·12	·03	·01	·04	55·92	29 23·43	·49	·02
	172.	37 18·99	·22	·08	·01	·06	·01	19·35	36 16·95	·40	·07
	174.	51 17·49	·24	·08	·01	·07	·01	17·88	50 45·28	·60	·13
	175.	52 03·59	·43	- ·03	·01	·08	·02	04·12	51 31·62	·50	·03
	451.	13 13 45·76	·45	·02	·01	·10	·02	46·32	13 13 13·84	·48	·01

a = + ·110 c = ·010

Chronometer correction at $12^h\ 01^m$ = $32^s·471$ ± ·020

TRANSIT OBSERVATIONS.

Station: VANCOUVER. Date, April 25th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r + ·09	s.		h. m. s.	s.	s.
E	184.	14 02 19·94	41	·08	03	·05	03	19 31	14 01 48·30	31 01	+ 07
	190.	22 27 13	32	− 01	02	02	03	26 73	21 55 96	30 77	·17
	192.	28 12 37	21	- 05	01	·01	02	12·17	27 41·18	30 99	+ ·05
	194.	36 43·48	17	· 07	·01	·00	02	43 35	36 12 33	31 02	+ 08
W	197.	41 54 05	18	·00	· 01	·01	01	53 97	41 23·04	30·93	01
	198.	51 34 06	·88	19	06	− ·02	·05	33 02	51 02 07	30 95	· ·01
	199.	58 50·97	·34	02	· 02	· ·03	·02	50 68	58 19·70	30 98	+ 04
	465.	15 00 50·64	27	- 04	·01	03	02	50 43	15 00 19 54	30 89	05
	201. ...	12 08·86	30	+ ·05	+ 01	+ ·05	02	08·65	11 37·70	30 95	+ 01

a = + ·124 c = · ·013

Chronometer correction at 14 30·943 ± ·020

TRANSIT OBSERVATIONS.

Station: VANCOUVER. Date, April 26th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction	r
		h. m. s.	s.	s.	s.	s. r = +·10	s.		h. m. s.	s.	s.
E	150.	10 27 21·44	−·22	·34	+·03	−·09	·06	23·76	10 26 54·29	29·47	11
	431.	40 59 72	·07	+·06	·01	−·07	−·02	59 63	40 30 16	·47	11
	432.	44 40 [illegible]	·05	+·11	+·01	·06	·02	40 92	44 11 38	·54	04
	1[illegible]3.	56 3[illegible]	11	−·04	·01	04	·03	31·21	56 01 48	73	+15
	434.	11 00 32 [illegible]	05	+·12	+·01	03	·02	32 37	11 00 02 72	65	+·07
	155.	04 44·39	·08	−·02	·01	03	02	44·29	04 14 64	·65	+·07
	156.	09 28 62	−·06	+·09	+·01	·02	−·02	28·[illegible]	08 58 93	·69	·11
W	438.	32 30·49	−·09	+·14	−·01	+·02	01	30·54	32 00·99	·55	03
	163.	41 27 68	−·21	+·01	·01	+·01	−·02	27·49	10 57 85	·64	+·06
	165.	46 10 12	−·10	+·13	·01	+·0[illegible]	−·02	10·16	45 40 65	·51	−·07
	166.	49 15 77	24	−·03	−·01	+·05	03	15 51	48 45·98	·53	·05
	167.	12 00 47 63	−11	+·12	−·01	+·07	02	47·68	12 00 18·19	·49	09
	168.	08 13·67	−·60	−·42	·04	+·08	07	12 62	07 43·01	·61	+·03
	170.	15 28 19	−·09	+·14	·01	+·09	01	28 31	14 58·78	·53	−·05

$a = +^s\cdot179$ $c = +^s\cdot008$

Chronometer correction at $11^h\ 20^m$ = $29^s\cdot576 \pm^s\cdot017$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction	r
W	182.	13 50 35 71	−·19	+·03	+·04	−·07	−·02	35·50	13 50 06·20	−29·30	+·04
	183.	57 14·34	−·14	+04	+·04	−06	−·01	14·21	56 44·94	·27	+01
	458.	14 06 30·17	−·20	+·02	+·04	−·05	−·02	29·96	14 05 60·74	22	04
	459.	09 46·88	−·84	−·11	+·18	−·04	−·07	46·00	09 16·74	·26	·00
	188.	13 13·46	−·29	·00	+·05	−·04	−·02	13·16	12 44·[illegible]	·13	−·13
	190.	22 25 43	−·33	·00	+·06	−·02	−·03	25 11	21 55 [illegible]	·14	−·12
	192.	28 10·62	−·13	·04	+·04	−·01	−·01	10 55	27 41·19	·36	+·10
E	197.	41 52·32	·03	+·04	−04	−01	−·01	52 29	41 23·05	·24	−·02
	198.	51 31·79	17	−·07	−·14	+·02	−05	31·38	51 02·08	·20	·04
	199.	58 49·02	−·06	+·01	−·05	+·04	02	48·94	58 19 71	23	−03
	465.	15 00 48·93	05	+·02	·04	+·04	−02	48·88	15 00 19 55	·33	+07
	201.	12 07 05	−06	+·02	·04	+·06	−02	07 01	11 37 71	·30	+·04
	202.	21 21·04	−06	+·01	−05	+07	·02	20 99	20 51·70	·29	+·03

$a = +^s\cdot049$ $c = -^s\cdot037$

Chronometer correction at $14^h\ 35^m = -29^s\cdot260 \pm^s\cdot015$

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, April 15th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s. r	s. ·11	s.		h. m. s.	m. s.	s.
E	149	10 15 20 11	·03	·29	53	06	02	19 33	10 16 35·07	+1 15 74	·13
	574	20 10·45	·09	13	41	05	02	10 19	21 25·93	71	·13
	127	23 12 72	·10	51	·71	01	02	11 54	21 27 50	96	·09
	ρ Leonis	26 28·63	·09	04	40	·03	02	28·23	27 41·18	95	08
	576	35 14·47	09	03	40	02	02	14 15	36 36 05	·90	03
W	ι Antliæ	50 57·83	02	29	·49	01	·02	58·58	52 11·54	·96	·09
	d Leonis	54 18 96	02	00	·40	02	02	19 34	55 35·10	76	+ 11
	434	58 46 73	02	02	·40	·02	·02	47·09	11 00 02·82	75	+ ·14
	578	11 05 38 98	·02	17	+ 43	·04	02	39 58	06 55·48	90	·03
	156	07 42 83	02	·11	+ ·12	− ·01	02	43·14	08 59·04	90	·03
	579	13 15·15	·02	11	·41	05	·02	15 68	14 31·64	·96	·09

a = ·355 c = ·396

Chronometer correction at 10[h] 15[m] = + 1[m] 15[s]·865 ± ·021

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	τ Leonis	11 21 42 72	·03	·09	11	·07	− ·02	43 01	11 22 59 06	+1 16·05	·04
	581	26 59 65	03	·33	48	06	02	60 35	28 16 38	16·03	·02
	438	30 44·82	− 03	+ 03	+ ·41	05	02	45 16	32 01·07	15·91	+ ·10
	164	42 52·49	·03	− ·10	+ 43	− 03	·02	52 74	44 08·82	16·08	− ·07
	B Centauri	45 03 70	− ·03	− ·52	·58	03	·03	04 71	46 20·76	16·05	·04
	π Virginis	54 40 03	·03	− ·03	+ ·41	01	·01	40 36	55 56·30	15·94	+ 07
E	582	12 03 55·05	− ·05	+ 23	·44	·01	02	54 78	12 05 10 63	15·85	·16
	170	13 43·35	− ·05	+ ·03	·41	+ 02	02	42 92	14 58·82	[illegible]	+ 11
	584	23 37·44	05	+ 17	− ·43	+ 01	·02	37 15	21 53 14	[illegible]	·02
	585	28 04 13	− ·05	+ ·24	− ·44	+ ·05	·02	03 91	29 20·04	[illegible]	[illegible]
	172	35 31 18	− ·05	+ ·04	− ·11	·06	·02	30 80	36 46 96	16·16	[illegible]
	31 Comæ	45 45 34	− ·05	− ·23	− ·46	·08	·02	41 66	47 00·65	15·9	+ 02

a = + ·495 c = − ·410

Chronometer correction at 12[h] 00[m] = + 1[m] 16[s]·005 ± ·023

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, April 16th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r = 19	s.		h. m. s.	m. s.	s.
E	γ Cancri..	8 36 22 44	05	04	19	14	02	22 46	8 37 11 85	1 19 39	07
	α Mali....	38 23 60	05	10	21	13	02	23 51	38 43 03	52	06
	127.	39 31 65	06	07	20	13	02	31 71	40 54 [illegible]	·48	02
	131........ ..	51 53 09	07	0_	18	09	02	53 11	53 12 43	32	14
	132.	53 02 62	07	12	·24	·09	03	02 79	54 22 32	53	07
	133.	55 42 30	08	14	26	08	03	42 51	57 01·99	48	02
W	κ Cancri.. ..	9 01 11 24	02	02	18	06	02	11 68	9 02 31 18	50	01
	142.	39 03 13	02	05	19	06	02	·03 01	40 22 19	48	02
	143	42 48 51	03	23	35	07	06	48 37	44 07 81	·44	02
	572..	45 03 23	02	02	18	·08	02	03 07	46 22 49	42	01
	α Leonis..	45 57 31	02	06	20	08	02	57 21	47 16·62	41	05
	423... .	53 47 70	02	04	18	10	02	47 59	55 07 03	44	02
	145.	10 00 45 00	02	03	19	14	·02	41 94	10 02 04 49	55	09

a = ·142 c = ·177

Chronometer correction at 9h 20m = 1m 19s 456 ± 014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	576..	10 35 10 67	05	02	25	·08	·02	10 25	10 36 29·05	1 19 80	03
	431.	39 10·76	·05	14	29	06	02	20·48	40 30·30	82	05
	α Argûs........	41 15 68	·05	·31	38	06	02	18 86	42 38 63	77	00
	577..........	43 33·11	05	09	26	05	03	32 66	44 52 42	76	01
	ι Antliae.......	50 55 29	05	21	31	03	02	54 67	52 11 54	·87	10
	d Leonis.......	54 15 84	·05	00	25	02	·03	15 40	55 35 10	·61	16
E	155....	11 02 54 44	01	·21	35	·01	02	55·01	11 01 14 80	·79	02
	578....	05 35 52	00	·13	27	02	03	35 65	06 55 47	82	05
	156......	07 38 92	00	09	·26	·02	02	39 27	08 59 07	80	03
	579....	13 11·7	·00	09	25	·01	02	11·91	11 31 63	72	·05
	160....	14 50 23	·00	·01	25	04	·02	50 51	16 10·15	64	13
	τ Leonis... ...	21 38·87	00	·00	25	06	02	39·16	22 59 03	·90	13
	158..	30 41 03	00	02	25	09	02	41 33	32 01 06	73	04

a = ·261 c = ·246

Chronometer correction at 11h 00m = 1m 19s 770 ± 017

TRANSIT OBSERVATIONS

Station: Fanning Island. Date, April 18th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r = +·22	s.		h. m. s.	m. s.	s.
E	429.	8 47 51 09	+ ·03	− ·01	+ ·30	·27	·02	51·12	8 50 17 40	+2 26 28	− ·20
	133.	54 35·90	+ ·04	·29	+ ·43	·24	− ·03	25 81	57 01 94	·13	·05
	κ Cancri	9 60 05 05	+ ·03	·03	+ ·30	− ·22	− ·02	05 11	9 02 31·45	·04	+ ·04
	134.	06 54·40	+ ·03	+ ·01	+ ·30	− ·20	·02	51 52	09 20·58	·06	+ ·02
	417.	11 09 68	+ ·03	− ·67	+ ·31	·18	− ·02	09·75	13 35·65	25 90	+ ·18
W	ρ Leonis	10 25 18 42	+ ·01	·09	− ·30	+ ·09	·02	18·11	10 27 44·14	26 03	+ ·05
	434.	57 36·96	+ ·04	·05	− ·30	+ ·21	·02	36·81	11 00 02·80	25 99	+ ·09
	155.	11 01 49·68	·00	− ·81	− ·42	+ ·22	·03	48·64	04 14 77	26·13	− ·05
	578.	04 29 01	− ·01	+ ·42	− ·32	+ ·23	·02	29 31	06 55 46	·15	− ·07
	157.	06 45 21	− ·02	− ·20	− ·31	+ ·24	− ·02	44 90	09 11·00	·10	− ·02

$a_1 = +^s\cdot280$ $a_2 = +^s\cdot875$ $c = +^s\cdot296$

Chronometer correction at $10^h\ 00^m = +2^m\ 26^s\cdot081 \pm {}^s\cdot026$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	579.	11 12 05 21	− ·02	+ ·26	− ·30	− ·14	− ·02	04 99	11 14 31·62	+2 26 63	− ·15
	160.	13 44 17	− ·03	·03	·29	− ·13	·02	43·67	16 10·13	·46	+ ·02
	164.	41 42·97	− ·03	·16	·30	·05	− ·02	42·43	44 08·84	·38	+ ·10
	166.	46 21 27	− ·03	− 1·07	·50	− ·01	·04	19·62	48 46 10	·48	·00
E	167.	11 57 54 58	+ ·05	− ·07	+ ·29	+ ·03	·02	51·86	12 00 18·23	·37	+ ·11
	582.	12 02 43·31	+ ·04	+ ·38	+ ·31	+ ·04	·02	44·06	05 10·62	·56	·08
	169.	08 14·06	+ ·05	1·23	+ ·54	+ ·07	− ·04	13 45	10 40·02	·57	− ·09
	470.	12 34·77	+ ·05	+ ·06	+ ·29	+ ·08	·02	32·23	14 58·81	·58	·10
	585.	26 52·71	+ ·04	+ ·40	+ ·31	+ ·13	− ·02	53·57	29 20·03	·46	+ ·02
	ρ Virginis	34 34·02	+ ·05	− ·10	+ ·30	+ ·16	·02	34·41	37 00·73	·32	+ ·16

$a = +^s\cdot819$ $c = +^s\cdot290$

Chronometer correction at $11^h\ 50^m = +2^m\ 26^s\cdot481 \pm {}^s\cdot025$

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, April 23rd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r
		h. m. s.	s.	s.	s.	r = ·17 s.	s.		h. m. s.	s.	s.
E	λ Argûs	9 03 40·30	+ ·06	+ ·52	+ ·37	·07	·03	41·15	9 04 27·23	46·08	+ ·08
	134	08 34·04	+ ·04	+ ·01	+ ·27	− ·06	·02	31·28	09 20·50	·22	·06
	417	12 49·36	+ ·04	·11	+ ·28	·01	·02	49·48	13 35·57	·09	+ ·07
	136	14 21·25	+ ·04	·33	+ ·33	·04	·03	21·22	15 10·31	·12	+ ·04
	b Mali	16 26·56	+ ·03	+ ·28	+ ·30	·04	·02	27·11	17 13·34	·23	·07
W	ψ Argûs	26 08·21	·02	+ ·18	·35	·01	·03	08·28	26 51·42	·14	+ ·02
	419	27 33·17	·03	·36	− ·33	− ·01	·03	32·41	28 18·51	·13	+ ·03
	κ Hydræ	34 51·91	·05	·16	·28	+ ·01	·02	51·76	35 19·96	·20	·04
	572	45 36·49	·06	·07	·27	+ ·01	·02	36·25	46 22·39	·14	+ ·02
	422	51 01·00	− ·07	·42	·36	+ ·06	·03	00·18	51 46·11	·23	·07
	423	51 21·13	·09	− ·01	·27	+ ·08	·02	20·79	55 06·94	·15	+ ·01

a = −·523 c = +·267
Chronometer correction at 9h 30m = +46s·157 + s·012

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r
W	427	10 23 42·45	·10	·92	·40	− ·08	·04	40·91	10 24 27·29	+46·38	·00
	ρ Leonis	26 58·18	·07	− ·06	− ·22	− ·07	·02	57·74	27 44·08	·34	+ ·04
	576	35 13·92	·07	+ ·06	− ·22	− ·01	·02	43·63	36 29·97	·34	·01
	α Argûs	41 51·76	·07	+ ·77	·33	− ·02	·03	52·08	42 38·48	·40	·02
	d Leonis	51 48·92	− ·07	·01	+ ·22	− ·01	·02	48·61	55 35·03	·42	·04
E	578	11 06 08·52	·05	+ ·31	+ ·21	+ ·01	·02	09·04	11 06 55·41	·37	+ ·01
	157	08 24·48	− ·06	·15	+ ·23	+ ·06	·02	24·54	09 10·97	·43	·05
	579	13 44·79	·05	+ ·20	+ ·23	+ ·07	·02	45·22	14 31·58	·36	+ ·02
	160	15 23·56	·06	+ ·03	+ ·22	+ ·07	·02	23·74	16 10·09	·35	+ ·03
	τ Leonis	22 12·33	− ·06	+ ·01	+ ·22	+ ·08	·02	12·56	22 59·00	·44	− ·06
	581	27 29·22	·05	+ ·43	+ ·26	− ·11	·02	29·95	28 16·31	·36	+ ·02

a = +·640 c = +·220
Chronometer correction at 10h 50m = +46s·382 + s·008

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, April 26th, 1903 Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r + ·16	s.		h. m. s.	s.	s.
E	h Mali...	9 16 14·08	·10	·25	·20	14	02	14 27	9 17 13·28	+59·01	·02
	140.	25 25 34	·10	·56	+ 29	12	03	21 82	26 23 92	59·10	07
	419.	27 19 78	− ·11	·31	· 23	·12	03	19 44	28 18 49	59 05	02
	142.	39 23 43	12	17	· 20	08	02	23 24	40 22 33	59 09	06
	572.	45 23 30	10	06	+ 18	07	02	23 35	46 22 35	59 00	+ 03
	α Leonis...	16 17 71	10	20	+ ·20	06	02	17 53	47 16 46	58 93	· 10
W	423.	51 08 16	09	04	18	04	02	07 79	55 06 91	59 12	09
	145.	10 01 05 81	09	11	19	03	·02	05 37	10 02 04 34	58 97	· ·06
	573.	04 54·41	·09	· ·13	·18	·02	02	51 23	05 53 28	59·05	02
	η Velorum..	09 42 79	09	+ 44	24	00	03	42 78	10 41 86	59 08	05
	149.	15 36 46	− 09	38	21	− 01	03	35 73	16 34 86	59 13	·10
	434.	59 03 91	− 03	03	18	13	02	03 78	11 00 02 73	58 95	· 08
	155.	11 03 16 29	03	− 43	25	14	·03	15 69	04 14 64	58 95	· ·08

a = +·459 c = +·180
Chronometer correction at 10h 10m = +59·031 ± ·015

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	157.	11 08 12·13	02	− ·13	·24	− 08	02	11 64	11 09 10 94	+59·30	·02
	579.	13 32 42	·02	+ 19	·24	·07 −	02	32·26	14 31 55	·29	·01
	160.	15 11 08	− 02	·02	− 23	06	02	10 73	16 10·06	·33	05
	τ Leonis	22 00·06	01	+ ·01	23	− ·04	02	59 77	22 58 97	·20	+ ·08
	581.	27 16·87	01	+ ·39	·27	04	·02	16 92	28 16·28	36	08
	438.	31 01 96	01	+ 04	23	03	02	01 71	32 00·99	·28	·00
E	163.	39 58·79	− 02	·61	· ·35	·00	03	58 52	40 57 85	·33	− ·05
	B Centauri	45 20·42	02	+ ·60	+ 33	· ·02	·03	21 36	46 20·56	·20	· 08
	π Virginis...	54 56 83	02	03	· ·23	· 04	02	57·07	55 56 26	19	· 09
	167.	59 18 71	·01	05	+ ·23	· 05	02	18 93	12 00 18 19	26	· 02
	169.	12 09 40 96	− 02	·87	· 43	·08	04	40 58	10 39·89	31	03
	170.	13 59 14	· 01	· 04	+ 23	09	02	59 49	14 58 78	·29	01

a = +·579 c = +·231
Chronometer correction at 11h 40m = +59·278 ± ·012

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 2nd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E	179	13 30 01 77	05	03	10	08	02	01 75	13 29 47 28	14 47	05
	a Virginis	36 47 98	05	10	10	07	02	48 04	36 33 68	36	06
	180	42 55 97	·05	12	10	05	02	55 83	12 41·29	51	12
	588	11 52 88	·05	18	10	05	02	53 04	44 38 65	39	03
	182	50 20 75	05	13	10	04	02	20 61	50 06 12	49	07
	457	57 03 43	05	22	11	03	02	03 22	56 48 75	47	05
W	192	14 27 56 08	·14	25	11	02	02	55 58	14 27 41 19	39	03
	196	38 14 07	13	·08	10	04	02	13 91	37 59 48	46	04
	590	45 48 10	13	− 17	·10	05	02	48 07	45 33 53	54	12
	463	51 55 52	14	09	·10	06	02	55·23	51 40·93	30	12
	199	58 34 74	11	38	14	07	03	34 12	58 19 78	34	08
	465	15 00 31 34	11	21	11	08	02	33 91	15 00 19 69	25	17

a = ·476 *c* = ·096

Chronometer correction at 11ʰ 15ᵐ = 14·419 ·020

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	592	15 06 58 87	·13	33	12	07	02	58 86	15 06 44·48	14 38	05
	466	10 39 26	13	·02	11	06	02	38 92	10 21 63	·29	·04
	201	11 53 05	13	48	43	06	02	52 23	11 37 88	·35	02
	γ Lupi	28 58 23	·13	74	14	03	03	58 61	28 44 37	·27	06
	593	30 23 27	13	·25	11	·03	02	23 23	[illegible] 08 90	·33	·00
E	221	16 06 00 21	07	75	·15	03	03	59 54	16 05 45·29	25	08
	222	09 32·69	06	10	11	03	02	32 85	09 18 51	·34	01
	223	13 28 28	·06	12	11	01	02	28 47	13 14·11	36	03
	225	17 55 46	06	22	12	05	02	55 33	17 41 01	·32	01
	473	21 13 35	06	·14	·11	06	02	15 30	20 58·96	34	01
	λ Ophiuchi	26 18 25	06	02	11	06	02	18 36	26 04 02	34	·01
	230	31 16 01	06	68	15	07	·03	15·46	31 01 09	37	04

a = ·796 *c* = ·109

Chronometer correction at 15ʰ 48ᵐ 14·530 ·009

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 3rd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r + ·10	s.		h. m. s.	s.	s.
E	179	13 29 59 75	– ·01	+ 05	– ·12	07	02	59 81	13 29 47 27	– 12 57	+ ·09
	α Virginis	36 46 04	– 01	+ 14	+ 12	06	02	46 23	36 33 67	56	– ·08
	180	42 53 82	+ 01	16	– 13	05	02	53 73	42 11 29	·44	04
	588	41 50·78	+ 01	+ ·25	+ 13	04	02	51 11	44 38 65	·46	02
	182	50 18 68	+ 01	18	+ 13	03	02	18 59	50 06 12	·47	01
	457	57 01·46	– 01	30	– ·14	02	02	01 27	56 48 74	·53	+ 05
	π Hydrae	14 01 05 62	– 01	– 36	+ 14	01	02	06 10	14 00 53 71	·36	12
W	186	11 10 77	·04	+ ·10	12	·00	·02	10 69	10 58·15	·54	+ ·06
	188	12 57 15	·05	64	18	00	03	56 25	12 43·81	41	·07
	191	23 27·39	– 04	+ 06	12	+ 02	02	27 29	23 14·78	51	+ 03
	192	27 54 11	·05	·34	14	+ 03	02	53 59	27 41 19	40	·08
	196	38 11 95	·04	– 10	12	+ 05	02	11 92	37 59·47	·45	03
	ε² Bootis	41 00 34	05	29	13	+ 05	02	59 90	40 47 34	·56	+ ·08
	463	51 53 68	05	·12	13	+ 07	02	53 43	51 40 92	·51	– 03

a = +·649 c = ·121

Chronometer correction at 14^h 10^m = 12^s ·181 ·013

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	190	14 58 32 77	·05	·52	05	– 04	·03	32 08	14 58 19 78	12 30	08
	465	15 00 32 58	– ·05	·30	+ 05	03	02	32 13	15 00 19 68	45	+ 07
	592	06 56·74	04	+ ·28	04	02	02	56 90	06 44·48	42	+ 04
	201	11 50·80	05	– 39	·05	01	·03	50 27	11 37 87	·40	+ 02
	o² Librae	17 52·30	·04	+ 22	– ·01	00	·02	52 42	17 40·08	34	– ·01
E	468	21 32 36	+ ·02	– ·14	+ 04	·00	02	32 26	21 19 94	32	·06
	469	34 35 88	+ ·02	·53	+ 05	+ 02	– ·03	35·41	34 22 99	·42	+ 04
	210	35 58 65	+ 02	·45	+ 05	+ 03	·03	58 27	35 45·90	37	·01
	211	38 55 19	+ ·02	·22	+ ·05	+ ·03	02	55·05	38 42·62	43	+ 05
	213	41 57 59	+ 02	14	+ 01	+ 04	– ·02	57 53	41 45·18	·35	·03
	215	44 37 40	+ 02	·17	+ ·05	+ 04	·02	37 32	44 24 92	40	– 02

a = +·656 c = +·043

Chronometer correction at 15^h 19^m = -12^s·377 ·011

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 8th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. ·10	s.		h. m. s.	s.	s.
E	182	13 50 10 01	−·02	·10	+·02	·07	·02	09 86	13 50 06 08	03 78	·09
	157	56 52 72	·02	·17	·02	·06	·02	52 51	56 43 70	81	·06
	158	14 06 04 80	+·03	·15	+·02	·04	·02	04 64	14 05 60 65	99	·12
	186	11 01 97	−·03	·06	+·02	−·03	·02	02 03	10 58 13	00	·03
	188	12 48 09	·03	·36	+·02	·03	·03	47 72	12 43 78	94	+·07
	1?4	36 16 26	·03	·08	+·02	+·01	·02	16 22	36 12 40	82	·05
W	463	51 44 77	·01	·07	·02	−·03	·02	44 08	51 40 92	76	·11
	190	58 23 92	·01	·29	·02	·05	·02	23 63	58 19 75	88	+·01
	465	15 00 23 64	·01	·17	·02	·05	·03	23 46	15 00 19 67	79	·08
	592	06 48 14	·01	·15	·02	·06	·02	48 50	06 44 50	80	·07
	466	10 28 54	·00	·01	·02	·07	·02	28 56	10 24 62	94	·07
	201	11 42 12	·00	·22	·02	·07	·03	41 92	11 37 86	04 06	·19
	σ² Libræ	17 43 75	·00	−·12	·02	+·08	·02	43 91	17 40 07	03 84	·03

$a = +^s\cdot368$ $c = \pm^s\cdot015$

Chronometer correction at 14h 30m = 3s·866 ± ·021

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	202	15 20 55 97	+·06	−·34	·03	·06	·03	55 57	15 20 51 87	03 70	·01
	ζ¹ Libræ	22 54 75	+·06	+·18	·03	·06	·02	53 88	22 50 11	77	+·06
	206	27 33 36	+·06	·39	·03	·04	·03	32 73	27 29 04	69	·02
	207	28 25 19	+·06	−·39	·03	·04	·02	24 77	28 21 35	62	−·06
	593	30 12 60	+·06	·16	·03	·03	·02	12 74	30 08 93	81	+·10
	409	34 27 07	+·06	·39	·03	·03	·02	26 63	34 23 00	66	·05
	213	41 49 02	+·06	−·10	·03	·02	·02	48 91	41 45 19	72	+·01
E	σ Scorpii	16 15 24 13	·10	·26	+·03	·04	·02	24 54	16 15 20 87	67	·04
	225	17 44 88	+·09	·14	·03	·04	·02	44 88	17 41 05	·83	+·12
	473	21 02 62	+·09	·09	·03	+·05	·02	02 68	20 58 95	73	·02
	227	26 07 70	+·09	·01	+·03	·06	·02	07 87	26 04 06	81	·16
	τ Scorpii	29 57 09	+·10	·29	·03	·06	·02	57 55	29 54 05	50	·21
	597	31 55 49	+·09	+·12	+·03	·07	·02	55 69	31 52 00	69	·02

$a = +^s\cdot488$ $c = +^s\cdot026$

Chronometer correction at 15h 50m = 3s·706 ± ·018

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 9th, 1903. Observer: F. W. O. Werry.

Clamp	Star	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r = + ·06	s.		h. m. s.	s.	s.
E	458	14 06 03·32	·07	·24	·10	·05	·02	03·21	14 06 00·69	02·57	·02
	188	12 46·74	·08	·54	·12	·04	·03	46·36	12 43·76	·60	·01
	192	27 43·84	[illegible]	·27	·10	·03	·02	43·71	27 41·15	·56	·03
	194	36 [illegible]·99	·12	·12	·09	·02	·02	15·04	36 12·40	·61	·05
	463	51 43·41	·42	[illegible]	·09	·01	·02	43·49	51 40·92	·57	·02
[illegible]	502	15 06 46·84	·06	·22	·09	− ·01	·02	47·02	15 06 44·50	·52	·07
	465	10 27·30	+ ·10	·01	·09	·01	·02	27·29	10 24·62	·67	·08
	201	11 40·85	+ ·10	·31	·10	·01	·03	40·52	11 37·85	·67	·08
	202	20 54·79	·11	·36	·10	·02	·03	54·42	20 51·87	·55	·04
	205	23 54·89	·41	·26	·10	·02	·02	54·61	23 52·15	·49	·10
	215	44 27·74	·12	·14	·09	·01	·02	27·65	44 24·93	·72	·13
	218	52 03·57	·12	·11	·09	·05	·02	03·52	52 00·96	·56	·03

a = + ·518   c = + ·088
Chronometer correction at 15h 00m = 2s [illegible]89 ± ·015

Clamp	Star	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
						r = + ·07 s.					
W	219	15 54 39·50	− ·13	·24	·06	·03	·02	39·37	15 53 36·75	02·62	·13
	595	59 53·07	− ·13	·23	− ·05	·03	·02	53·33	59 50·89	·44	·05
	221	16 05 48·14	− ·11	·51	·07	·01	·03	47·66	16 05 45·26	·40	·09
	222	09 21·00	− ·13	·07	·05	·01	·02	21·12	09 18·55	·57	·08
	σ Scorpii	15 23·02	− ·13	·29	·05	·00	·02	23·37	15 20·87	·50	·04
	225	17 43·55	− ·13	·15	·05	·00	·02	43·46	17 41·05	·41	·08
E	231	37 42·82	·16	− ·30	·06	·02	·02	42·71	37 40·34	·40	·09
	232	39 39·51	·16	·40	·06	·02	·03	39·32	39 36·79	·53	·04
	ε Scorpii	43 58·25	·15	− ·41	·06	·03	·03	58·87	43 56·45	·42	·07
	478	47 44·99	·16	·11	·05	·03	·02	45·10	47 42·54	·56	·07
	233	53 09·66	·15	·05	·05	·04	·02	09·83	53 07·[illegible]	·52	·03

a = + ·545   c = + ·050
Chronometer correction at 16h 20m = 2s·487 ± ·019

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 10th, 1903. Observer: [illegible] W. [illegible]

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of star transit.	R. A.	Chronometer correction.	v
		h m s	s	s	s	s 07	s		h m		s
E	458	11 06 01 8[illegible]	07	20	09	06	02	01 71	11 06 00 63	01 13	10
	185	07 46 02	06	11	08	06	02	46 72	07 45 80	00 [illegible]	02
	186	10 59 06	07	08	08	05	02	59 22	10 58 10	01 12	11
	188	12 45 06	08	18	12	05	03	44 70	12 43 75	00 95	06
	192	27 42 35	07	26	09	04	02	42 17	27 41 11	01 03	02
	194	36 13 59	07	11	08	02	02	13 52	36 12 10	00 92	09
	196	38 00 22	07	08	08	02	02	00 41	37 59 46	00 95	06
W	21[illegible]	15 30 23 11	01	02	08	0[illegible]	02	33 05	15 30 32 03	0[illegible] 02	04
	213	41 46 [illegible]	04	10	08	05	02	46 17	41 45 19	00 98	03
	215	44 26 1[illegible]	01	13	08	05	02	25 98	44 24 93	01 05	04
	216	46 02 54	01	00	08	05	02	02 50	46 01 50	01 00	01
	218	5[illegible] 02 12	01	11	08	06	02	01 98	52 00 96	01 02	01

$a = [illegible] \cdot 192 \quad c = [illegible] \cdot 080$

Chronometer correction at 15h 00m = 1[illegible] ± 013

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of star transit.	R. A.	Chronometer correction.	v
W	595	15 50 51 69	01	33	09	03	02	[illegible] 89	15 50 50 89	01 00	1[illegible]
	223	16 13 15 17	00	12	08	02	02	15 17	16 13 14 16	01 01	11
	σ Scorpii	15 21 41	00	12	09	01	02	21 71	15 20 88	00 83	07
	225	17 42 27	01	22	09	01	02	41 92	17 41 05	00 87	03
	596	23 31 19	02	44	09	01	02	31 79	23 [illegible] 92	00 87	03
	228	26 06 80	02	20	09	00	02	06 11	26 05 [illegible]	00 83	07
E	597	31 52 57	05	2[illegible]	08	00	02	52 88	31 52 01	00 87	03
	231	37 41 58	06	1[illegible]	10	01	02	41 30	37 40 35	00 95	05
	478	47 43 46	06	16	09	02	02	13 45	47 42 54	00 91	01
	233	53 08 30	06	08	08	02	02	08 16	53 07 32	00 84	0[illegible]
	234	56 38 44	07	42	10	02	02	38 19	56 37 31	00 88	0[illegible]

$a = + \cdot 787 \quad c = + \cdot 083$

Chronometer correction at 16h 30m = [illegible] ± 014

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 15th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r +·015	s.		h. m. s.	s.	s.
E	457	13 56 42·37	·05	·30	+·01	·02	·02	42·02	13 56 48·62	+06·60	+·09
	π Hydrae	14 00 46·73	·05	+·36	+·01	·02	·02	47·04	14 00 53·67	·63	+·06
	185	07 38·90	·05	+·16	·04	·02	·02	39·10	07 45·77	·67	−·02
	188	12 37·61	·02	·61	·06	·02	·03	36·96	12 13·67	·71	·02
	192	27 34·76	+·01	·34	+·05	·01	·02	31·45	27 41·10	·65	+·04
	196	37 52·49	+·03	·10	·04	·01	·02	52·55	37 59·44	·81	·12
	ε² Bootis	10 40·75	+·03	·29	+·04	·01	·02	40·50	40 47·29	·79	·10
W	463	51 34·32	·02	·12	−·04	·00	·02	34·12	51 40·89	·77	·08
	199	58 13·62	−·02	·51	·05	·00	·03	13·01	58 19·68	·67	·02
	465	15 00 13·32	−·02	·29	·01	·00	·02	12·95	15 00 19·63	·68	+·01
	222	16 09 11·84	·02	+·08	·01	·00	·02	11·84	16 09 18·57	·73	·04
	223	13 07·57	·02	+·10	·04	+·01	·02	07·60	13 14·18	·58	+·11
	σ Scorpii	15 13·89	·02	+·35	·04	+·02	·02	14·18	15 20·90	·72	·03
	225	17 34·65	−·02	·18	·04	+·02	·02	34·41	17 41·05	·64	+·05

a = +ˢ·618 c = +ˢ·039

Chronometer correction at $15^h\ 10^m$ = +6ˢ·689 ± ˢ·015

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	228	16 25 59·25	+·08	+·24	·09	·01	·02	58·97	16 26 05·59	+06·62	+·10
	τ Scorpii	29 47·01	+·07	+·44	·10	·01	·02	47·39	29 54·10	·71	+·01
	597	31 45·31	+·06	+·18	·09	+·01	·02	45·43	31 52·03	·60	+·12
	231	37 34·01	+·07	·40	−·10	·01	·02	33·58	37 40·36	·78	−·06
	232	39 30·70	+·07	·54	−·11	·01	·03	30·08	39 36·79	·71	+·01
	ε Scorpii	43 49·26	+·06	+·55	·10	·00	·03	49·74	43 56·50	·76	·04
	30 Ophiuchi	55 52·82	+·06	+·10	·09	·00	·02	52·87	55 59·73	·86	−·14
E	237	17 10 09·54	+·09	−·14	+·09	·00	−·02	09·56	17 10 16·20	·64	+·08
	239	11 36·32	+·09	·50	+·11	·00	·03	35·99	11 42·76	·77	·05
	σ Ophiuchi	21 38·06	+·09	·00	+·09	+·01	·02	38·23	21 44·99	·76	·04
	241	30 21·96	+·09	−·11	+·09	+·01	·02	22·02	30 28·68	·66	−·06
	600	31 57·97	+·09	+·25	+·09	+·07	·02	58·39	32 05·10	·71	+·01
	245	38 36·79	+·09	−·01	+·09	+·01	·02	36·95	38 43·70	·75	·03

a = +ˢ·735 c = +ˢ·085

Chronometer correction at $17^h\ 00^m$ = +6ˢ·719 ± ˢ·015

TRANSIT OBSERVATIONS.

Station: FANNING ISLAND. Date, June 21st, 1903. Observer: F. W. O. WERRY.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
		h. m. s.	s.	s.	s.	s. + ·03	s.		h. m. s.	s.	s.
E	463	14 51 26 16	− ·05	·08	·02	·01	·02	26 12	14 51 40·85	+ 14·73	·06
	465	15 00 05 62	− ·05	·20	− ·02	·01	·02	04 86	15 00 19 59	73	− ·06
	592	06 29 57	− ·05	·18	+ ·02	·01	·02	29·75	06 44 47	68	− ·11
	466	10 09 63	− ·05	·01	− ·02	·01	·02	09 66	10 24 59	·93	·14
	201	11 23 21	+ ·05	·26	− ·02	·00	·03	22 99	11 37 76	77	− ·02
	o^2 Libræ	17 24 99	− ·05	+ ·14	·02	·00	·02	25·18	17 40 06	·88	·09
	202	20 37·39	− ·05	·30	− ·02	·00	·03	37 04	20 51 77	73	− ·06
	ξ^1 Libræ	22 35 01	+ ·05	− ·16	− ·02	·00	·02	35 22	22 50 10	88	·09
W	593	29 54·14	− ·02	− ·14	·02	·00	·02	54 26	30 08 92	66	− ·13
	169	34 08·44	+ ·03	·34	·02	− ·01	·03	08·09	34 22 92	83	·04
	211	38 27 91	− ·03	− ·19	·02	− ·01	·02	27·72	38 42 59	·87	·08
	213	41 30·47	− ·02	− ·09	− ·02	+ ·01	·02	30·37	41 45 17	80	·01
	594	54 24 03	+ ·03	+ ·21	·02	+ ·02	·02	24 25	54 39 04	79	·00

$a = +^s·434$ $c = +^s·015$

Chronometer correction at $15^h\ 20^m$ = + 14ˢ·792 ± ˢ·017

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
W	595	15 59 35 92	+ ·02	− ·18	·03	·02	·02	36 05	15 59 50 92	+ 14·87	·04
	221	16 05 30 75	− ·02	·39	·03	·02	·03	30 30	16 05 45 23	·93	− ·10
	222	09 03·75	+ ·03	+ ·05	·03	·02	·02	03 76	09 18·58	·82	+ ·01
	223	12 59·11	+ ·03	+ ·06	·03	·02	·02	59 43	13 14 19	76	− ·07
	σ Scorpii	15 05·82	+ ·05	+ ·23	·03	·01	·02	06 04	15 20·91	87	·04
	225	17 26·50	+ ·06	·12	·03	·01	·02	26·38	17 41 06	·68	·15
E	232	39 22 19	− ·08	− ·31	− ·04	·00	·03	21 97	39 36 79	82	− ·01
	479	17 00 40·71	− ·08	·07	− ·03	+ ·01	·02	40 74	17 00 55 59	85	·02
	480	04 25 01	+ ·08	·33	+ ·04	+ ·01	·03	24·78	04 39·54	76	− ·07
	239	11 28·15	− ·07	·29	+ ·04	− ·02	·03	27 96	11 42 77	81	·02
	599	15 51·48	− ·07	− ·22	+ ·03	− ·02	·02	51 80	16 06 57	77	− ·06
	σ Ophiuchi	21 29·98	+ ·07	·00	+ ·03	− ·02	·02	30 08	21 45 06	·98	·15
	600	31 50 03	+ ·07	+ ·14	+ ·03	+ ·02	·02	50 27	32 05·15	88	·05

$a = +^s·420$ $c = -^s·030$

Chronometer correction at $16^h\ 40^m$ = + 14ˢ·832 ± ˢ·016

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 23rd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. c : ·06	s.		h. m. s.	s.	s.
E	492 …	14 27 23·72	− ·05	26	05	·09	02	23 35	14 27 41 01	+17 66	+ ·11
	ε² Bootis …	40 29·74	01	·22	·05	08	02	29·41	40 47 22	81	01
	590 …	45 15 56	01	17	01	07	02	15·64	15 33·46	82	05
	.25 …	16 17 23 45	04	14	01	·02	02	23·31	16 17 41 06	75	− 02
	173 …	20 41·38	− ·05	09	·01	·02	02	41·30	20 59 12	·82	05
	596 …	23 12 91	− 01	28	04	+ 02	02	13·19	23 30 97	78	·01
W	τ Scorpii …	29 36 03	·10	30	+ 05	− 03	02	36 39	29 51 13	74	+ ·03
	597 …	31 34·25	·00	·12	− 01	+ 03	02	34 42	31 52 06	64	13
	231 …	37 22 69	− 01	·27	05	+ 04	·02	22 50	37 40·35	·85	08
	232 …	39 19 22	− 02	·37	05	− ·01	·03	18 93	39 36 78	·85	·08
	ε Scorpii …	43 38 20	+ ·02	− ·37	·05	+ ·04	03	38 65	43 56 54	89	12
	233 …	52 49 73	− 02	05	04	− ·05	·02	19 77	53 07 38	64	− ·16

$a = -\cdot501$ $c = -\cdot011$

Chronometer correction at 16h 00m = + 17·767 ± ·019

TRANSIT OBSERVATIONS.

Station: Fanning Island. Date, June 24th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r ·08	s.		h. m. s.	s.	s.
W	205	15 23 32·84	·02	·22	·09	·04	·02	32·57	15 23 52·07	19·50	·03
	206	27 09·74	·02	·35	·11	·03	·03	09·30	27 28·94	·61	·08
	593	29 49·39	·02	·14	·08	·03	·02	49·48	30 08·91	·43	·10
	469	34 03·83	·02	·31	·11	·02	·03	03·39	34 22·89	·50	·03
	211	38 25·24	·02	·18	·09	·02	·02	22·99	38 42·59	·60	·07
E	218	51 41·41	·09	·09	·09	·00	·02	41·51	52 00·93	·42	·11
	595	59 31·04	·09	·18	·09	·04	·02	34·37	59 50·92	·55	·02
	222	16 08 58·79	·09	·06	·08	·02	·02	58·98	16 09 18·57	·59	·06
	σ Scorpii	45 00·98	·09	·23	·09	·03	·02	01·34	45 20·92	·58	·05
	225	17 21·55	·09	·12	·09	·03	·02	21·56	17 41·06	·50	·03

$a = + {}^s430$ $c = + {}^s082$

Chronometer correction at $15^h 50^m$ = $19^s\cdot530 \pm \cdot018$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
E	473	16 20 39·49	·07	·09	·14	·05	·02	39·64	16 20 59·11	19·47	·04
	τ Scorpii	29 31·17	·06	·29	·16	·04	·02	34·70	29 54·13	·43	·00
	597	31 32·39	·05	·12	·14	·04	·02	32·72	31 52·06	·34	·09
	232	39 17·45	·07	·36	·18	·03	·03	17·34	39 36·78	·44	·01
	ε Scorpii	43 36·49	·07	·36	·17	·02	·03	37·08	43 56·54	·46	·03
	478	47 23·09	·07	·10	·15	·02	·02	23·21	47 42·59	·38	·05
	233	52 47·73	·07	·05	·14	·01	·02	47·88	53 07·38	·50	·07
W	234	56 18·39	·03	·26	·16	·01	·02	17·99	56 37·33	·34	·09
	599	17 15 47·23	·02	·26	·15	·02	·02	47·32	17 16 06·59	·27	·16
	σ Ophiuchi	21 25·67	·03	·00	·14	·03	·02	25·51	21 45·05	·54	·11
	241	30 09·56	·02	·07	·14	·04	·02	09·31	30 28·73	·42	·01
	600	31 45·69	·02	·16	·15	·04	·02	45·66	32 05·18	·52	·09
	245	38 24·42	·03	·00	·14	·05	·02	24·24	38 43·77	·53	·10

$a = + {}^s485$ $c = + {}^s140$

Chronometer correction at $17^h 00^m$ = $+19^s\cdot433 \pm \cdot017$

TRANSIT OBSERVATIONS.

Station: SUVA. Date, June 3rd, 1903. Observer, OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. r ·15	s.		h. m. s.	m. s.	s.
E	β Chamaeleontis	12 16 25·58	19	10·62	96	+ ·11	10	13·82	12 12 45·92	3 27·90	02
	δ² Corvi... ..	28 20 92	08	+ ·10	·20	+ 08	02	20·80	24 52 88	·92	00
	ρ Virginis. ..	40 27 45	07	+ 1·16	- 19	+ 05	·02	28·38	36 50·46	·92	00
	35 Virginis. ..	46 24·41	- ·07	+ ·90	·19	+ ·04	02	25 07	42 57·10	·97	+ 05
	31 Comæ.. ...	50 26·52	·06	+ 1·85	21	+ 03	02	28 11	46 60·31	·80	·12
	δ Virginis ...	54 12·39	- 07	+ ·90	- ·19	+ ·02	02	13·03	50 45·11	·92	00
	ε Virginis.. ..	13 00 49 94	- ·07	+ 1·19	·19	·00	02	50 85	57 22 94	·91	10
W	γ Hydræ.. ..	17 09·59	- ·17	·21	+ 20	·04	- ·02	09·35	13 13 41·45	·90	·02
	ι Centauri....	18 40·28	- ·19	·90	+ ·23	- 04	- ·02	39 36	15 11·47	·89	03
	α Virginis.	23 35·05	- ·16	+ 31	+ ·19	- 05	02	35·32	20 07·36	·96	- ·04
	ζ Virginis.	33 14·67	·15	+ 74	+ ·19	- ·08	·02	15 35	29 47 32	28·03	+ 11
	ε Centauri....	37 18 29	·21	- 2·16	+ ·30	- ·09	- 03	16 10	33 48 30	27 80	·12
	m Virginis	40 01·37	·16	- ·40	+ ·19	- ·10	·02	01·68	36 33·67	28·01	- ·09
	τ Boötis......	46 07·89	- ·14	+ 1 47	+ ·20	·11	- ·02	09 29	42 41·33	27 96	+ ·04

$a = -2^s{\cdot}376 \qquad c = -^s188$

Chronometer correction at $13^h\ 1^m = 3^m\ 27^s{\cdot}921 \pm {}^s{\cdot}013$

TRANSIT OBSERVATIONS.

Station: Suva. Date, June 4th, 1903 Observer: Otto Klotz

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	
		h. m. s.	s.	s.	s.	r s. ·17	s.		h. m. s.	m. s.	s.
E	ι Virginis....	13 00 51 52	01	+ 2 50	21	10	02	53 88	12 57 22 93	3 30 95	·06
	θ Virginis....	08 27 89	01	· 1 15	21	09	02	28 89	13 04 57 87	31 02	01
	γ Hydræ......	17 13 06	·01	·15	·22	06	02	12 42	13 41 14	30 98	03
	ι Centauri ..	18 14·67	01	1 90	26	05	02	12 53	15 11 46	31 07	+ 06
	ζ Virginis....	33 16 93	01	· 1 55	21	01	02	18 25	29 47 31	30 94	07
	ε Centauri....	37 24 30	01	4 54	·33	00	03	19·39	33 48 28	31 11	· 10
	m Virginis ..	40 04 03	01	· 85	21	01	02	04 63	36 33 66	30 97	04
W	τ Boötis	46 09 17	00	· 3 10	22	03	02	12 44	42 41 32	31 12	11
	ζ Centauri	53 07 07	·00	3 50	30	05	03	03 79	49 32 87	30 92	09
	τ Virginis. ...	14 00 11 20	00	· 1 70	21	07	02	16 02	56 44 98	31 04	· 03
	π Hydræ.....	04 25·35	00	75	23	08	02	24 73	14 00 53 74	30 99	02
	κ Virginis. ..	11 16·10	·00	75	21	10	02	16 94	07 45 85	31 09	· 08
	α Boötis ...	14 41 06	00	· 3 25	22	10	02	47 41	11 16 43	30 98	03

a · 5s·011 c · ·209
Chronometer correction at 13h 37m 3m 31s·014 · ·014

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	
W	β Libræ	15 15 20·36	· ·03	· 80	· ·18	· 13	02	21 48	15 11 49 99	3 31 49	· ·13
	ζ[1] Libræ..	26 21·09	· 03	· 15	· ·19	: 09	02	21·53	22 50 10	43	· 07
	γ Lupi.	32 17·85	· 03	2 56	· 23	+ ·08	03	15·60	28 44 37	·23	13
	α Coronæ......	34 04·39	+ 02	+ 3 97	· 20	· 07	02	08 63	30 37·31	·32	04
	α Serpentis. ...	43 01 08	+ 02	· 2 11	+ 18	+ 05	02	03 42	39 32·05	·37	+ ·01
	μ Serpentis. ..	48 06 12	· 02	+ 1 41	· 18	+ ·03	02	07 74	44 36 24	·0	· 14
	β Triang. Aust.	50 20·18	+ ·01	7 73	+ ·39	· 03	·04	12 87	46 41·56	·31	·05
E	δ Scorpii....	58 10·82	+ 09	·46	·19	01	02	10 31	54 39 02	29	07
	β[1] Scorpii	16 03 22·51	· ·09	15	19	01	02	22·23	59 50 87	·36	00
	γ[2] Normæ.....	16 14 88	+ 11	4 07	28	03	03	10 58	16 12 39 19	39	· ·03
	γ Herculis	21 09·28	07	· 3 26	19	06	02	12 34	17 11 05	29	07
	α Scorpii...	27 03·17	· ·09	·80	20	·08	02	02·16	23 30 90	26	10
	λ Ophiuchi ..	29 33·83	· ·08	· 1·76	18	08	·02	35·39	26 04 01	38	02
	α Triang. Aust.	42 13·38	· ·15	10·75	49	12	·06	02 11	38 30 67	41	· 08

a 5s·022 c ·178
Chronometer correction at 16h 00m −3m 31s·361 · ·014

TRANSIT OBSERVATIONS.

Station: Suva. Date, June 9th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r s. -·12	s.		h. m. s.	m. s.	s.
E	γ Crucis	12 29 34 71	06	75	·34	·09	04	35·23	12 25 50 20	3 45 03	06
	β Corvi	33 04 73	06	06	21	08	02	01 70	29 19 71	44 99	·02
	ρ Virginis	40 45 83	06	·32	19	07	02	45·13	37 00 40	45 03	·06
	β Crucis	45 50 97	13	85	37	·06	·04	51 60	12 06 70	44 90	07
	δ Virginis	54 30 24	11	25	19	01	02	29 93	50 45 06	44·87	10
	ε Virginis	13 01 08 23	12	33	19	03	02	07 84	57 22 89	44 95	·02
	θ Virginis	08 43 04	15	15	19	01	02	42 84	13 04 57 83	45·01	·04
W	γ Hydrae	17 26 05	11	08	21	01	·02	26 42	13 41 40	45 02	05
	α Virginis	23 52 21	10	11	19	02	·02	52 35	20 07 32	45·03	·06
	ζ Virginis	33 32 36	10	27	19	04	02	32 32	29 47·28	45 04	07
	ε Centauri	37 32 08	43	78	30	05	03	33 21	33 48 21	45·00	03
	τ Virginis	14 00 30 06	09	29	19	09	·02	29 94	56 44 95	44 99	02
	π Hydrae	04 38 31	11	13	21	10	·02	28 64	14 00 53 72	44·92	05
	κ Virginis	11 30 74	10	13	19	12	·02	30 76	07 45 83	44 93	04

a_2 ·855 a_1 ·603 c ·190
Chronometer correction at 13h 14m 3m 44s 971 ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	β Librae	15 15 35 10	11	·12	11	19	02	35 40	15 11 50 00	3 45·40	01
	ξ² Librae	26 35 25	41	·02	14	47	02	35 63	22 50 11	52	13
	γ Lupi	32 28 86	·44	·39	48	46	·03	29 70	28 44·39	·31	08
	β¹ Scorpii	16 03 35 85	·12	02	15	·09	·02	36·21	59 50 90	31	08
	δ Ophiuchi	13 03 79	11	19	·14	07	02	03 90	16 09 18 56	34	05
	γ² Normae	16 23 66	14	63	21	·07	03	24 68	12 39 24	44	05
E	λ Scorpii	17 30 50 00	41	32	17	08	03	50 45	17 27 05 06	39	·00
	η Pavonis	40 02 93	56	1 31	32	40	05	04 33	36 18 95	38	01
	β Ophiuchi	42 29 33	50	·30	11	10	02	29 07	38 43 66	41	02
	μ Herculis	46 28 40	28	63	15	11	02	27 77	42 42·38	39	00
	89 Herculis	55 49 10	28	60	15	13	·02	18 48	51 33 10	38	01
	ν Ophiuchi	57 29 69	35	12	14	14	02	29 62	53 44 19	43	04

a ·777 c ·140
Chronometer correction at 16h 50m 3m 45s 392 ·013

TRANSIT OBSERVATIONS.

Station: SUVA. Date, June 10th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	r ·15 s.	s.		h. m. s.	m. s.	s.
E.	β Chamaeleontis	12 16 30 44	+ ·40	−2 76	1 02	11	·10	32 59	12 12 45 31	3 47 28	−·02
	β Corvi . .	33 06 89	+ ·17	06	·22	07	02	06 95	29 19 70	25	04
	ρ Virginis . .	40 48 00	+ ·14	30	20	05	02	47 67	37 00 39	28	− 02
	55 Virginis . . .	46 44 55	·15	23	·20	·04	02	44·29	42 57 03	26	00
	31 Comae	50 48 14	13	48	23	02	02	47 56	46 00 23	33	· 07
	δ Virginis . . .	54 32 51	15	23	20	01	02	32 22	50 45 04	18	08
	ε Virginis	13 01 10 47	·14	31	20	00	02	10 08	57 22 88	20	06
W	θ Virginis . .	08 44 98	16	11 ·	20	02	02	45 16	13 04 57 82	·34	08
	γ Hydrae . . .	17 28·27	·17	06 ·	21	04	02	28 65	13 11 39	26	00
	ι Centauri .	18 57 96	·19	23 ·	25	05	02	58 56	15 11 40	16	10
	α Virginis	23 54 42	16	08 ·	·20	06	02	54 62	20 07 31	·31	05
	ζ Virginis	33 34 55	15	·19 ·	20	08	02	34 61	29 47 27	34	08
	m Virginis	40 20 74	16	10 ·	20	10	02	20 88	36 33 63	25	01
	τ Bootis	16 28 69	+ 14	38 ·	20	11	02	28 52	42 41·27	25	01

a = · 618 c = · 198
Chronometer correction at 13h 00m = 3m 47s 263 ± 011

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
W	η Bootis. .	14 31 29 05	·05	74	·27	· 10	·03	28 70	14 27 41 16	3 47 5	02
	ι² Bootis.	44 35·12	·05	56	24	· ·07	02	31 91	40 47·33	·54	02
	α Librae.	49 20 86	· 07	03 −	·22	· ·06	02	21·16	45 33 55	·68	05
	ξ² Librae. . .	55 20·46	− 07	·09 ·	·21	+ 04	·02	20 67	51 33 03	61	08
	20 Librae. . .	15 02 13·71	· 08 ·	09 −	23	· 03	02	14 12	58 26 67	44	11
E.	β Librae . . .	15 37·57	+ ·29	·11	21	04	02	37 51	15 14 50 00	51	05
	α Coronae. .	34 25·49	· 23	·55	·23	05	02	24 87	30 37 30	·57	− 04
	α Serpentis.	43 19 95	· 26	·29	21	07	·02	19 62	39 32 07	·55	04
	μ Serpentis.	18 24 01	· ·28	19	21	09	02	2. 78	44 36 27	·51	05
	ε Serpentis.	49 19 42	· ·28	16	·21	09	02	49 22	46 01 53	69	13
	γ Serpentis	55 48 97	· 25	40	22	10	02	48 48	51 60 95	53	03

a = − · 692 c = · 209
Chronometer correction at 15h 13m = 3m 47s 561 ± 020

TRANSIT OBSERVATIONS.

Station: Seva. Date, June 11th, 1903. Observer: Otto Klotz.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.		Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
		h m s	s.	s.	s	r	s. ·11	s.		h m s.	m. s.	s.
E	β Chamæleontis	12 16 33·49	·03	+2 79	1 24		+·15	10	35 06	12 12 45 22	3 49 81	06
	δ² Corvi.	28 42·66	+ ·17	02	·25		+ 12	02	42 66	21 52·79	87	09
	ε Virginis. ...	13 01 13 06	+ 15	31	·25		+ ·05	02	12 68	57 22 87	81	03
	α Virginis. ...	23 57 23	+ 17	08	·25		+ ·02	02	57 07	13 29 07 31	76	02
	ε Centauri. ..	37 37·50	·22 +	57	39		03	03	37 84	33 48 18	66	12
	m Virginis .	40 23 57	+ 17	·11	24		·04	02	23 33	36 33 62	·71	07
	τ Bootis. ...	46 31·57	+ 14	·39	·25		06	02	30 99	42 41 27	72	06
W	ζ Centauri. ...	53 21·72	− 10	44	+ ·35		07	03	22 51	19 32 80	71	07
	τ Virginis. ...	14 00 34·80	− 08	·21	+ 24		09	02	34 80	56 44·91	86	08
	θ Centauri. ..	04 50 80	− 09 +	24	+ ·30		·10	02	51·31	14 01 01 54	77	01
	κ Virginis.	11 35 56	− ·08	·09	− 21		·12	02	35 65	07 45 82	83	05
	α Bootis......	15 06 38	− 07	41	+ 26		·13	02	06 15	11 16 39	76	02
	f Bootis......	25 49 62	+ 07	41	26		15	02	48 77	21 58 90	87	·09

$a = +\cdot 624$ $c = \cdot 242$

Chronometer correction at 13h 21m = 3m 49s 782 ± ·015

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
W	ξ² Libræ.	14 55 22 72	25	09 −	19	+ ·12	02	23 17	14 51 33 03	3 50·14	05
	20 Libræ.	15 02 16 01	·27 −	·09 −	21	− ·10	·02	16 69	58 26 67	02	07
	ψ Bootis	04 09·83	+ ·20	·58 +	21	+ ·10	− 02	09 74	15 00 19 69	·05	04
	ι¹ Libræ.	10 34·00	+ 26 +	·01 +	20	+ 08	02	34·53	06 44 50	·03	·06
	σ² Libræ.	21 29·82	+ ·26	04 −	20	+ ·06	·02	30 28	17 40·08	·20 +	11
	ζ³ Libræ.	26 39 74	− 26	02 +	20	− ·05	·02	40 21	22 50 13	08	01
E	α Coronæ.	34 27·83	− 32	57	21	+ ·03	02	27 [illegible]	30 37 30	08	01
	α Serpentis....	43 22·28	+ 38	30	19	·00	·02	22 [illegible]	39 32·07	08	01
	β Triang. Aust.	50 30 38	− 66	−1 11	42	01	04	31 68	46 41 [illegible]	·09	00
	β¹ Scorpii. ...	16 03 40 84	− 43 −	02	20	04	02	41 03	59 50 91	12	03
	δ Ophiuchi.....	13 08 77	− 40	18	19	06	02	08 72	16 09 18 60	·12 +	03
	λ Ophiuchi.....	29 54 35	− ·39	·25	19	10	02	54·18	26 04 08	10	01
	ζ Ophiuchi.....	35 42·15	− ·41	10	19	12	·02	42 13	31 52 04	09	00

$a = +\cdot 721$ $c = \cdot 191$

Chronometer correction at 15h 45m = 3m 50s 090 ± ·010

TRANSIT OBSERVATIONS.

Station: Suva. Date, June 16th, 1903. Observer Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s. ·10	s.		h. m. s.	m. s.	s.
E	κ Virginis	14 11 48 37	01	08	17	05	02	18 19	14 07 45 82	4 02 37	09
	α Bootis	15 19 27	07	36	18	05	02	18 83	11 16 35	18	02
	f Bootis	26 01 82	·08	36	18	03	02	01 37	21 58 88	49	−03
	ρ Bootis	31 11 25	−07	60	22	02	03	13 49	27 11 11	38	08
	η Centauri	33 26 55	10	11	23	02	03	26 82	29 21 40	12	04
	α Circini	38 17 11	·18	94	39	01	·05	17 83	31 15 34	19	03
	ε² Bootis	44 50 39	09	45	19	00	02	49 82	40 47 28	51	−08
W	α Librae	49 35 88	01	02	17	01	02	35 99	45 33 53	16	00
	ξ² Librae	55 35 51	01	07	17	02	02	35 56	51 33 02	54	08
	20 Librae	15 02 28 83	01	07	−18	03	02	29 02	58 26 65	37	09
	ψ Bootis	04 22 43	·01	45	19	04	02	22 10	15 00 19 66	41	02
	γ Triang. Aust.	13 58 45	02	1 21	48	05	06	60 01	09 57 58	43	03
	β Librae	15 52 56	01	09	−17	05	02	52 56	11 49 99	57	11

a = ·560 c = ·370
Chronometer correction at 14h 43m = 4m 02s 461 ± ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
W	α Serpentis	15 43 31 77	03	26	20	06	02	34 78	15 39 32 07	4 02 71	11
	μ Serpentis	48 38·86	03	17	20	06	02	38 96	41 36 28	68	08
	β Triang. Aust.	50 42 63	05	95	−43	05	01	44 07	46 11 57	·50	10
	γ Serpentis	56 03 70	03	36	20	−·01	02	03 59	52 00 95	·64	04
	δ Scorpii	58 41 37	03	·05	21	04	02	41 68	54 39·07	61	−01
	β¹ Scorpii	16 03 53 35	03	02	21	03	02	53 62	59 50 92	·70	−10
	δ Ophiuchi	13 21 09	03	15	20	−01	02	21 16	16 09 18 61	55	05
E	γ Herculis	21 14 09	26	40	·21	00	02	43·72	17 41 08	64	04
	α Scorpii	27 33 33	34	16	22	01	02	33 52	23 30 99	·53	07
	α Triang. Aust.	42 32 29	51	−1·32	·54	·03	06	33 52	38 30 82	70	−10
	ε Scorpii	47 58 81	36	·20	24	04	02	59 07	43 56 50	57	03
	κ Ophiuchi	57 10 32	25	38	·20	06	·02	02 91	53 07 40	·51	09
	30 Ophiuchi	17 00 02 40	30	16	·20	06	02	02 26	55 59 73	53	07

a = ·617 c = ·126
Chronometer correction at 16h 22m = 4m 02s 605 ± ·016

TRANSIT OBSERVATIONS.

Station: SUVA. Date, June 22nd, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Σ corrs. of transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. ·10	s.		h. m. s.	m. s.	s.
E.	γ Hydræ......	13 17 57 62	04	04	20	+ ·08	02	57 56	13 13 41 27	4 16 29	04
	ι Centauri	19 27 15	04	− 21	23	+ 07	02	27 52	15 11 25	27	− 02
	α Virginis.....	24 23 69	+ 04	07	19	+ 06	02	23 51	20 07 20	31	+ 06
	ζ Virginis.. ..	34 03 73	+ 04	17	19	+ 05	02	03 44	29 47 16	28	+ 03
	ε Centauri. ..	38 03 97	05	+ ·49	30	+ 04	03	04 22	33 47 99	23	·02
	τ Bootis.	46 57 90	+ 03	·34	20	+ 03	02	57 40	42 41 36	21	01
	η Bootis	54 22 70	+ 03	35	20	+ 02	02	22 18	50 06 01	17	08
W.	θ Centauri ...	14 01 18 23	08	71	38	00	04	19 20	57 02 99	21	04
	π Hydræ	05 09 64	06	+ 08	+ 21	·00	02	09 85	14 00 53·62	23	·02
	κ Virginis.....	12 02 02	06	08	+ 19	02	02	02 03	07 45 76	27	02
	f Bootis.	26 15 36	05	35	20	01	02	15 10	21 58 83	27	02
	ρ Bootis	31 57 69	04	58	+ 24	05	·03	57 23	27 11 04	19	06
	ε² Bootis.	45 03 83	04	44	+ ·21	07	02	03 47	40 47 22	25	00
	α Libræ	49 49 81	06	02	20	08	02	19 83	45 33 49	34	09

a = + ·542 c = + ·189

Chronometer correction at 14h 03m = 4m 16s·251 ± ·009

TRANSIT OBSERVATIONS.

Station: Suva. Date, June 24th, 1903. Observer, Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E.	31 Comae	12 51 21 14	12	50	21	r 12	02	20 60	12 46 60 01	4 20 56	16
	δ Virginis	55 05 62	14	24	19	07	02	05 37	50 44 90	47	03
	ε Virginis	13 01 43 57	13	32	19	06	02	43 22	57 22 73	49	01
	θ Virginis	09 18 34	-·14	15	19	05	02	18 16	13 04 57 66	47	03
	γ Hydrae	18 01 68	-·16	06	20	04	02	01 70	13 41 25	45	05
	ι Centauri	19 31 63	-·17	24	23	02	02	31 84	15 11 22	50	09
	α Virginis	21 27 80	-·15	08	19	02	02	27 67	20 07 18	49	01
						01					
W	ζ Virginis	34 07 77	01	20	19	01	02	07 72	29 47 15	57	07
	ι Centauri	38 07 58	01	59	30	02	03	08 41	33 47 95	46	04
	m Virginis	40 53 90	01	11	19	02	02	54 02	36 33 52	50	00
	τ Bootis	47 01 84	01	40	20	04	02	01 57	42 11 13	41	08
	ζ Centauri	53 52 51	01	-·45	27	05	03	53 14	49 32 62	52	-·02
	τ Virginis	14 01 05 49	·01	22	19	06	02	05 37	56 14 85	52	02
	π Hydrae	05 13 85	01	10	21	07	02	14 06	14 00 53 60	·46	01

a = ·643 c = ·187
Chronometer correction at 13h 28m = 4m 20s.501 ± ·009

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v
W	α Bootis	14 15 37 02	-·03	33	-·20	09	02	36 99	14 11 16 27	4 20 72	03
	f Bootis	26 19 66	-·03	33	20	07	02	19 55	21 58 81	71	05
	ρ Bootis	32 01·86	-·02	54	24	06	03	01 61	27 41 02	59	10
	α Circini	39 04 56	-·05	85	14	04	02	05 92	34 45 19	73	04
	ε² Bootis	45 07 99	-·02	41	21	03	02	07 82	40 47 21	61	08
	α Librae	49 53 98	03	02	20	02	02	54 19	45 33 49	70	01
E	ξ² Librae	55 53 79	-·21	07	·19	01	02	53 75	51 32 98	75	-·06
	20 Librae	15 02 47 26	-·23	-·07	21	00	02	47 33	58 26 62	71	-·02
	ψ Bootis	04 40 81	·17	41	21	01	02	40 33	15 00 19 66	73	-·04
	υ Librae	11 05 13	-·22	-·01	20	02	02	05 12	06 14 47	65	04
	β Librae	16 10 83	-·21	08	19	03	02	10 72	11 49 96	76	-·07
	β Triang. Aust.	51 01·57	-·34	-·78	42	10	04	02 13	16 41 53	60	09

a = -·506 c = -·189
Chronometer correction at 15h 00m = 4m 20s.621 ± ·013

TRANSIT OBSERVATIONS.

Station : SUVA. Date, June 25th, 1903. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	·12	s.		h. m. s.	m. s.	s.
E	ι Virginis	13 34 10 27	07	11	16	08	02	10 10	13 29 17 14	4 22 96	01
	ι Centauri	38 10 63	10	11	26	07	03	10 92	33 17 93	99	04
	ω Virginis	46 56 51	07	07	16	06	02	56 42	36 33 51	91	04
	τ Bootis	47 04 50	06	27	17	05	02	04 15	42 41 13	2[illegible] 02	07
	κ Centauri	53 55 34	09	32	23	04	05	55 5[illegible]	49 32 61	2[illegible] 92	03
	τ Virginis	14 01 08 03	07	15	16	02	02	07 79	56 14 84	95	00
	π Hydrae	05 16 54	08	08	18	01	02	16 51	14 00 53 59	92	05
W	κ Virginis	12 08 63	03	08	16	00	02	08 66	07 45 72	94	01
	α Bootis	15 39 41	02	30	17	01	02	39 23	11 18 27	96	01
	θ Bootis	26 21 99	02	30	17	03	02	21 79	21 58 80	93	04
	ρ Bootis	32 01 29	02	17	20	04	03	03 93	27 44 01	92	03
	ε² Bootis	45 10 45	02	37	18	07	02	10 15	40 17 19	96	01
	α Librae	49 56 41	03	02	17	07	02	56 44	45 33 48	96	01

$a = +^{s}.456$ $c = {}^{s}.159$

Chronometer correction at $14^h 12^m = 4^m 22^s.952 \pm {}^{s}.008$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of transit.	R. A.	Chronometer correction.	v.
W	ξ² Librae	14 55 55 93	01	07	20	11	02	56 14	14 51 32 98	4 23 16	00
	20 Librae	15 02 49 38	01	07	21	10	02	49 73	58 26 61	12	01
	ψ Bootis	04 42 85	01	44	22	10	02	42 70	15 00 19 59	11	05
	ι¹ Librae	11 07 36	01	01	20	08	02	07 62	06 44 46	16	00
	β Librae	16 13 02	01	09	19	07	02	13 16	11 49 95	21	05
	δ¹ Librae	27 13 08	01	02	20	05	02	13 28	22 50 09	19	03
E	β Triang. Aust.	51 03 96	28	81	13	00	04	04 61	46 44 51	10	06
	δ Scorpii	59 02 26	19	05	21	01	02	02 26	54 39 07	19	03
	β¹ Scorpii	16 04 14 25	19	02	20	02	02	14 22	59 50 93	29	13
	α Scorpii	27 54 12	19	09	21	07	02	54 10	16 23 31 01	09	07
	λ Ophiuchi	30 27 57	17	19	19	08	02	27 26	26 04 10	16	00
	ζ Ophiuchi	36 15 50	18	08	20	09	02	15 29	31 52 08	21	05
	ε Scorpii	48 19 63	20	18	23	11	02	19 65	43 56 54	11	05

$a = -^{s}.548$ $c = {}^{s}.192$

Chronometer correction at $15^h 52^m = 4^m 23^s.162 \pm {}^{s}.013$

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 11th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s. ·004	s.		h. m. s.	s.	s.
E	η Ophiuchi	17 05 13·94	·14	·02	·23	·06	·02	13·87	17 04 51·94	21·93	·07
	β Herculis	11 27 55	·11	·37	·24	·05	·02	27·08	11 05·23	·85	·01
	ζ Aræ	17 40 55	·19	·52	·39	·04	·01	40·87	17 18·98	·89	[illegible]
	σ Ophiuchi	22 07·02	·12	·19	·22	·04	·02	06·75	21 44·87	·88	·02
	λ Scorpii	27 26·89	·16	·20	·28	·03	·03	26·97	27 05·09	·88	·02
	α Ophiuchi	30 50·82	·11	·25	·23	·02	·02	50·45	30 28·60	·85	·01
	η Pavonis	36 40·09	·13	·83	·52	·01	·05	40·19	36 18·69	·80	·06
W	89 Herculis	51 55·03	·01	·38	·25	·01	·02	54·83	51 33·04	·79	·07
	ν Ophiuchi	54 06·18	·05	·07	·22	·02	·02	06·21	53 44·65	·89	·03
	γ¹ Sagittarii	59 59·96	·06	·12	·26	·03	·02	60·23	59 38·27	·96	·10
	72 Ophiuchi	18 03 09·94	·04	·23	·22	·03	·02	09·80	18 02 47·93	·87	·01
	μ Sagittarii	08 23·00	·05	·02	·23	·04	·03	23·13	08 01·21	·92	·06
	η Serpentis	16 42·33	·04	·13	·22	·05	·03	42·30	16 20·53	·77	·09
	α Telescopii	20 12·60	·06	·33	·32	·06	·02	13·11	19 51·30	·81	·05

a = +·389 c = +·222

Chronometer correction at 17h 43m = 21s·863 ± ·011

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 14th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 08	s.		h. m. s.	s.	s.
E	ε Herculis	16 57 03·70	09	49	21	07	02	02·96	16 56 36·85	26·11	06
	δ Herculis	17 11 32·00	09	42	20	06	02	31·33	17 11 05·18	15	02
	β Aræ	17 14 96	16	59	31	05	04	45·09	17 18·94	18	01
W	η Serpentis	18 16 16·95	15	15	48	03	02	46·78	18 16 20·50	28	11
	α Telescopii	20 17·07	20	38	26	01	03	17·44	19 51·26	18	01
	λ Sagittarii	22 28·87	17	08	20	01	02	28·92	22 02·65	27	10
	α Lyræ	34 08·70	11	60	23	05	03	08·14	33 42·01	13	04
	ζ Aquilæ	37 27·45	16	09	18	06	02	27·21	37 01·08	16	01
	λ Pavonis	43 44·96	25	81	38	07	04	45·82	43 19·72	10	07
	σ Sagittarii	49 44·95	18	09	20	07	02	44·97	49 18·72	25	08

a = ·560   c = ·178

Chronometer correction at 17h 53m = 26·173 ± ·017.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	v.
W	γ Aquilæ	19 42 08·67	04	28	16	08	02	08·65	19 41 42·14	26·51	07
	α Aquilæ	46 32·77	03	34	16	07	02	32·67	46 06·34	33	11
	ι Sagittarii	49 04·35	05	30	22	07	03	04·96	48 38·45	51	07
	α Pavonis	20 18 29·08	06	65	30	03	04	30·08	20 18 03·69	39	05
	ρ Capricorni	23 49·66	04	00	17	02	02	49·87	23 23·33	51	10
	ε Delphini	29 04·57	04	28	46	01	02	04·48	28 38·09	39	05
	α Delphini	35 37·89	03	32	17	01	02	37·76	35 11·33	43	04
E	ε Aquarii	42 55·53	34	08	16	06	02	55·58	42 29·03	55	11
	μ Aquarii	47 55·26	34	08	16	01	02	55·30	47 28·85	45	01
	ι Piscis Aust.	55 50·52	36	17	49	02	02	50·82	55 24·46	36	08
	α Equulei	21 11 28·57	29	22	16	04	02	28·42	21 11 04·95	47	03
	ζ Capricorni	21 37·75	34	05	18	05	02	37·89	21 11·45	11	00
	ε Pegasi	39 55·37	28	27	16	08	02	55·42	39 28·75	37	07

a = ·564   c = ·164

Chronometer correction at 20h 40m = 26·441 ± ·015.

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 17th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
		h. m. s.	s.	s.	s.	s. 08	s.		h. m. s.	s.	s.
E	η Serpentis...	18 46 52 06	06	13	18	07	02	51 86	18 16 20 47	31 29	09
	α Lyrae....	34 13 97	04	51	21	04	03	13 27	33 41 97	30	00
	β Aquilae...	37 32 47	06	08	18	04	02	32 29	37 01 06	23	07
	λ Pavonis	12 50 44	08	76	38	03	01	50 89	13 19 65	21	06
	σ Sagittarii	19 50 13	06	·08	20	02	02	50 07	49 18 70	37	07
W	π Sagittarii	19 04 34 59	16	03	19	00	02	31 63	19 01 03 32	31	01
	α Aquilae	46 37 88	12	31	18	05	02	37 56	46 06 33	23	07
	ι Sagittarii	19 09 45	18	27	24	06	03	09 69	48 38 41	28	02
	δ Aquilae.	51 07 76	14	·21	18	06	02	07 51	50 36 20	31	01
	ρ Sagittarii	57 16 77	17	10	20	07	02	16 81	56 15 49	32	02

a = ·500   c = ·175
Chronometer correction at 19h 06m = 31s·299 ± ·013.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
W	θ Aquilae.	20 06 52 97	14	15	·23	09	02	52 98	20 06 21 41	31 57	11
	α¹ Capricorni...	42 51 19	45	05	23	08	02	51 28	12 19 86	·12	01
	α² Capricorni...	13 45 37	15	05	23	08	02	15 46	12 43 92	51	08
	α Pavonis.....	18 34 19	22	60	41	08	04	35 02	18 03 69	33	13
	ρ Capricorni	23 54 79	16	00	21	07	02	54 92	23 23 31	58	12
	α Indi.	31 20 06	20	38	33	06	03	20 60	30 49 14	16	00
E	β Aquarii.	21 27 02 36	06	11	23	02	02	02 04	21 26 30 68	36	10
	γ Gruis	48 38 71	08	22	29	04	03	38 65	48 07 19	16	00
	α Aquarii.	22 01 23 37	06	16	23	06	02	22 96	22 00 54 56	40	06
	ε Pegasi...	03 05 41	05	39	25	07	02	04 73	02 33 29	44	02
	α Toucani ..	12 27 38	10	73	46	08	04	27 63	11 56 08	55	09
	γ Aquarii.	17 44 00	06	15	23	08	02	13 58	16 42 19	39	07
	σ Aquarii.	26 16 06	07	06	23	09	02	05 73	25 31 27	46	00

a = ·524   c = ·225
Chronometer correction at 21h 15m = 31s·464 ± ·017.

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 19th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	ν.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.		
E	72 Ophiuchi	18 03 22·17	02	22	18	·12	02	22·19	18 02 47·87	34·32	00
	η Serpentis. ...	16 55·09	03	12	18	10	02	54·90	16 20·45	15	13
	α Telescopii ...	20 25·32	03	32	26	·09	05	25·47	19 51·19	28	04
	λ Sagittarii ...	22 36·95	03	07	20	·09	02	36·99	22 02·60	30	02
	α Lyrae	34 16·88	02	54	23	·07	03	16·20	33 41·94	26	06
	σ Sagittarii ...	49 53·05	03	08	20	05	02	52·99	49 18·68	31	01
W	ι Sagittarii .	19 19 12·55	17	26	24	04	03	12·81	19 48 38·43	38	06
	ε Sagittarii . ..	57 19·85	16	09	29	05	02	19·91	56 45·49	42	10
	· Delphini.. ..	20 29 12·70	13	23	18	10	02	12·40	20 28 38·09	31	01
	α Indi..	31 23·01	18	55	26	10	03	23·31	30 49·14	17	15
	α Delphini. ..	35 45·94	12	27	19	11	02	45·62	35 11·33	28	04
	ε Aquarii.	43 03·55	14	07	18	12	02	03·38	42 29·04	34	02

a = ·476 c = ·179

Chronometer correction at 19h 23m = 34s·37 ± ·017

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	ν.
W	θ Capricorni	21 01 07·86	13	01	21	·09	02	08·00	21 00 33·31	34·66	11
	ζ Cygni. .	09 26·76	09	43	23	·08	02	26·53	08 51·99	51	01
	β Aquarii.	27 05·18	12	11	20	05	02	05·18	26 30·69	49	·06
	ε Aquarii	33 13·31	12	09	20	·01	02	13·32	32 38·84	48	·07
	γ Capricorni.	35 21·14	13	01	21	·01	02	21·24	34 46·63	57	02
	ι Pegasi.. .	40 03·43	11	24	20	·03	02	03·29	39 28·78	51	04
	δ Capricorni.	42 49·34	13	02	21	03	02	49·11	41 11·83	58	03
E	σ Aquarii	22 26 08·98	21	06	21	·04	02	08·86	22 25 34·29	57	02
	β Gruis . .	37 30·69	27	37	30	·06	03	30·94	36 56·42	52	03
	η Pegasi.	39 06·08	16	45	23	06	02	05·50	38 30·97	53	02
	λ Aquarii	48 11·33	20	09	20	·07	02	11·15	47 36·63	52	03
	δ Aquarii	50 08·22	21	02	21	·07	02	08·14	49 33·54	57	02
	α Piscis Aust	52 55·17	23	12	24	·08	09	55·48	52 20·95	53	02
	α Pegasi .	23 00 34·20	18	24	21	·09	02	33·77	59 59·19	58	03

a = ·505 c = ·203

Chronometer correction at 22h 00m = 34s·551 ± ·009

TRANSIT OBSERVATIONS

Station: Suva. Date, August 21st, 1903. Observer Otto Klotz.

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	R. c.	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	v
		h. m. s.	s.	s.	s.	s. 11	s.		h. m. s.	s.	s.
E	η² Sagittarii	18 00 15 49	28	15	26	·07	02	15 71	17 59 38 15	37 56	04
	72 Ophiuchi	03 25 51	·02	·8	22	·07	02	25 28	18 02 47 84	44	05
	μ Sagittarii	08 38 47	27	02	24	·06	02	38 56	08 01 11	45	02
	η Serpentis	16 57 98	24	16	22	·04	02	57 86	16 20 43	43	04
	α Telescopii	20 28 19	·32	50	32	·04	03	28 60	19 51 15	45	02
	λ Sagittarii	22 39 89	28	08	24	·03	02	40 12	22 02 [illegible]	45	02
W	α Lyrae	34 19 76	01	64	28	·01	03	19 39	33 41 90	49	02
	2 Aquilae	57 38 34	01	10	22	·03	02	38 16	37 01 02	44	03
	λ Pavonis	43 55 68	02	92	47	·01	04	57 04	43 19 57	47	00
	σ Sagittarii	49 55 88	01	10	25	·02	02	56 20	49 18 66	54	07
	ι Aquilae	55 53 73	01	34	23	·03	02	53 58	55 16 17	41	06
	ζ Aquilae	19 01 37 69	01	14	22	·01	02	37 72	19 04 00 11	61	11
	π Sagittarii	04 40 44	01	03	24	·04	02	40 66	04 03 28	38	00
	5 Aquilae	21 17 23	01	22	22	·07	02	47 15	20 39 69	46	01

a = ·501   c = +·220
Chronometer correction at 18h 40m = 37s·470 ± ·013

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	R. c.	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	v
W	Aquilae	19 51 13 64	09	21	25	·07	02	13 82	19 50 36 18	37 64	01
	Sagittarii	57 22 56	11	10	28	·06	02	23 00	56 45 48	61	02
	θ Aquilae	20 06 58 88	10	15	25	·04	02	59 10	20 06 21 48	70	07
	α¹ Capricorni	12 57 22	10	05	25	·03	02	57 53	12 19 85	68	05
	α² Capricorni	13 21 29	10	05	25	·03	02	21 60	12 43 92	68	05
	α Pavonis	18 40 03	14	50	46	·02	04	41 20	18 03 67	53	10
	ν Capricorni	24 00 67	11	00	26	·01	02	01 03	23 23 33	70	07
E	ε Delphini	29 15 97	35	25	25	·00	02	15 80	28 38 08	72	09
	α Indi	31 26 38	51	37	40	·00	03	26 83	30 49 13	70	07
	δ Delphini	35 49 43	34	29	26	·01	02	48 89	35 11 33	56	07
	ε Aquarii	43 06 72	37	08	[illegible]	·02	02	06 72	42 29 04	68	05
	ι Piscis Aust.	56 01 85	45	15	30	·05	02	02 08	55 24 48	60	03
	θ Capricorni	21 01 10 81	41	04	26	·06	02	10 87	21 00 33 34	53	10
	ι Cygni	09 29 99	30	44	29	·07	02	29 47	08 51 99	48	15

a = ·513   c = ·252
Chronometer correction at 20h 30m = 37s·630 ± ·015

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 22nd, 1903. Observer: Otto Klotz.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 11	s.		h. m. s.	s.	s.
E	β Aræ	17 17 57·21	− ·07	·51	·38	·28	·04	57·65	17 17 18·71	38·91	·05
	σ Ophiuchi	22 23·68	− ·05	·19	·22	·27	·02	23·57	21 41·72	·85	·01
	λ Scorpii	27 43·60	·07	·19	·28	·26	·03	43·81	27 04·91	·90	·01
	α Ophiuchi	31 07·52	·05	·25	·22	·25	·02	07·33	30 28·44	·89	·00
	η Pavonis	36 56·59	·09	·82	·51	·24	·05	57·18	36 18·33	·85	·04
	β Ophiuchi	39 22·58	− ·05	·19	·22	·24	·02	22·44	38 43·54	·90	·01
W	γ Capricorni	21 35 25·56	·00	·01	·23	·19	·02	25·57	21 34 46·64	·93	·04
	ε Pegasi	40 07·83	·00	·23	·22	·20	·02	07·60	39 28·79	·81	·08
	δ Capricorni	42 23·82	·00	·01	·23	·21	·02	23·81	41 44·84	·97	·08
	γ Gruis	48 15·98	·00	·20	·28	·22	·03	46·21	48 07·23	·98	·09
	α Gruis	22 02 49·75	·00	·35	·32	·24	·03	50·15	22 02 11·36	·79	·10
	γ Aquarii	17 21·35	·00	·14	·22	·27	·02	21·14	16 42·23	·91	·02

a = ·485 c = ·217

Chronometer correction at 19h 19m = 38s·894 ± ·012

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	η Aquarii	22 31 04·96	·02	·16	·21	·08	·03	05·04	22 30 25·77	39·27	·04
	β Gruis	37 35·02	·02	·39	·31	·07	·03	35·74	36 56·46	·28	·01
	α Pegasi	23 00 38·60	·01	·30	·21	·03	·02	38·51	59 59·23	·28	·01
	γ Piscium	12 50·81	·02	·19	·21	·01	·02	50·80	23 12 11·62	·18	·09
	τ Pegasi	16 33·17	·02	·33	·23	·00	·02	33·03	15 53·72	·31	·04
E	κ Piscium	22 40·36	·28	·17	·21	·01	·02	40·23	22 00·96	·27	·00
	ι Piscium	35 40·48	·28	·21	·21	·04	·02	40·28	35 01·00	·28	·01
	δ Sculptoris	44 34·79	− ·34	− ·11	·24	·05	·02	34·93	43 55·65	·28	·01
	φ Pegasi	48 16·29	− ·25	·34	·22	·06	·02	15·90	47 36·65	·25	·02
	ω Piscium	55 02·63	·28	·22	·21	·07	·02	02·39	54 23·12	·27	·00
	ζ Ceti	59 28·67	− ·32	·04	·22	·08	·02	28·66	58 49·40	·26	·01

a = ·536 c = ·210

Chronometer correction at 23h 15m = 39s·266 ± ·009

TRANSIT OBSERVATIONS.

Station: SUVA. Date, August 23rd, 1903. Observer, OTTO KLOTZ.

Clamp	Star	Transit over mean of threads.	Level and inequality of pivots.	Azimuth	Collimation	Rate	Aberration	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. 40	s.		h. m. s.	s.	s.
E	θ Capricorni	24 01 13 85	17	01	24	06	02	13 81	21 00 33 34	40 17	01
	ι Cygni	09 32 98	12	46	26	05	02	32 41	08 51 98	13	03
	α Equulei	11 42 74	15	24	23	05	02	12 45	11 01 98	47	0[illegible]
	θ^1 Microscopii	15 17 84	18	29	[illegible]	04	03	18 02	14 37 47	55	09
	ι Capricorni	21 51 96	47	05	25	03	02	51 94	21 11 49	45	01
	β Aquarii	27 11 30	16	12	23	02	02	11 41	26 30 70	11	05
	γ Capricorni	35 27 45	17	01	23	01	02	27 07	34 46 65	42	04
W	[illegible] Pegasi	40 09 45	12	26	23	00	02	09 28	39 28 79	49	03
	δ Capricorni	42 25 27	14	02	24	01	02	25 32	41 44 84	48	02
	γ Gruis	48 17 39	16	23	29	02	03	47 70	48 07 25	45	01
	20 Pegasi	57 05 98	12	29	24	03	02	05 76	56 25 30	46	00
	α Aquarii	22 04 32 14	13	16	23	01	02	32 02	22 00 51 60	42	04
	α Toucani	12 35 66	20	76	47	05	04	36 60	11 56 17	13	03
	γ Aquarii	17 22 94	14	15	23	06	02	22 80	16 42 24	56	10

a = ·543   c = ·227

Chronometer correction at 21h 30m = 40·461 ± ·040

TRANSIT OBSERVATIONS.

Station: SUVA. Date, August 25th, 1903. Observer, OTTO KLOTZ.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. 10	s.		h. m. s.	s.	s.
E	α Toucani......	22 12 37 26	45	60	50	12	04	37 89	22 11 56·19	41 70	03
	η Aquarii.....	34 07 54	·29	13	·21	09	02	07 53	30 25 79	71	07
	ζ Pegasi.....	37 22·77	·27	21	25	08	02	22 64	36 40 96	·68	01
	η Pegasi.......	39 13 00	23	·37	28	08	02	12 64	38 31 02	62	05
	ι Gruis.......	43 26 42	40	·38	39	07	03	27 35	42 45 72	63	04
	λ Aquarii.....	48 18 37	30	07	24	06	02	18·40	47 36·70	70	03
	δ Aquarii......	50 45 17	31	01	25	06	02	15 26	49 33 60	66	01
W	ω Piscium....	23 55 04 89	04	48	21	05	02	04 87	23 54 23 17	70	03
	2 Ceti..	59 30 93	01	00	25	06	02	31 09	58 49 45	64	03
	α Andromedae.	24 04 08 03	00	36	27	06	02	07 86	24 03 26 07	79	42
	γ Pegasi..	08 59 61	01	24	25	07	02	59 52	08 47 86	66	01
	α Phoenicis..	22 13 57	01	24	33	09	03	14 04	21 32 48	·53	14
	δ Andromedae..	34 53 98	01	33	28	14	02	53 79	34 12 10	69	02
	β Ceti	39 27 81	01	00	[illegible]	12	02	27 90	38 46 24	66	01

a = ·131   c = ·243

Chronometer correction at 23h 25m = 41·674 ± ·010

TRANSIT OBSERVATIONS.

Station: Suva. Date, August 27th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 06	s.		h. m. s.	s.	s.
E	μ Herculis	17 43 25 39	- 08	47	27	03	02	24 74	17 42 41 98	42 76	06
	89 Herculis	52 16 19	- 08	45	27	02	02	15 55	51 32 79	76	·06
	ν Ophiuchi	54 27 22	10	69	24	02	02	26 99	53 44 15	84	- 02
	γ²Sagittarii	18 00 20 99	·11	15	28	01	02	20 96	59 38 05	91	- 09
	72 Ophiuchi	03 31 02	09	28	24	01	02	30 58	18 02 47 75	83	04
	μ Sagittarii	08 41 00	10	02	26	01	02	43 85	08 01 03	82	00
W	η Serpentis	17 03 33	·22	15	24	00	02	03 18	16 20 35	·83	01
	α Telescopii	20 33 42	29	39	- 35	01	03	33 83	19 51 05	78	04
	λ Sagittarii	22 45 31	25	08	27	01	02	45 38	22 02·49	89	07
	α Lyrae	34 25 19	16	63	- 31	02	03	24 66	33 41 79	·87	- 05
	2 Aquilae	37 43 86	·23	09	24	02	02	13 74	37 00 95	79	03
	λ Pavonis	41 01 22	·36	- 88	52	03	04	02 49	43 19 41	78	01

a = ·556 c = ·242

Chronometer correction at 18h 13m = 42s·825 ± ·011

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	ε Aquilae	18 55 59 22	18	32	28	04	02	59 02	18 55 16 09	42 93	03
	ζ Aquilae	19 01 43 20	18	34	28	- 04	02	43 01	19 01 00 05	96	06
	ψ Sagittarii	10 22 01	23	08	30	03	02	22 17	09 39·24	96	06
	ω Aquilae	14 01 93	19	28	27	03	02	01 74	13 18 84	90	00
	B.A.C. 6632	20 17 84	29	58	46	02	04	48 57	20 05 72	85	05
	α Vulpeculae	25 26 31	16	42	29	01	02	26 01	24 43 41	90	00
	μ Aquilae	30 07 25	19	25	·27	01	02	07 08	29 24·22	86	04
E	θ¹ Sagittarii	35 56 55	19	02	28	00	02	56 42	35 13 47	95	05
	γ Aquilae	42 25 35	17	28	27	00	02	24 95	41 42 06	89	01
	α Aquilae	46 49 53	15	34	27	01	02	49·04	46 06 26	·78	12
	ι Sagittarii	49 21 16	23	31	36	01	03	21 30	48 38 36	·94	- 04
	β Aquilae	51 19 40	16	23	27	01	02	19 03	50 36 15	88	02
	e Sagittarii	57 28 37	20	41	30	·02	02	28 34	56 45 45	·89	01
	ρ Capricorni	20 24 06 36	49	00	28	04	02	06 21	20 23 23 31	·90	00

a = ·565 c = ·267

Chronometer correction at 19h 40m = 42s·899 ± ·010

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 14th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. ·29	s.		h. m. s.	m. s.	s.
E	λ Scorpii	17 28 01 15	06	09	08	06	02	01 42	17 27 05 04	59 38	03
	241	31 28 00	04	35	07	04	02	27 78	30 28 52	26	09
	600	33 04 37	05	·12	07	- 04	02	04 39	32 05 04	35	00
	η Pavonis	37 16 96	10	70	16	- 02	04	17 90	36 18 60	30	05
	245	39 43 20	·04	28	07	00	02	43 01	38 43 61	40	05
	246	43 41 99	03	49	05	02	02	11 57	42 42 17	40	05
W	250	51 43 83	02	17	08	07	02	43 52	53 44 27	25	10
	253	56 49 81	02	27	07	07	02	49 40	55 50 09	31	04
	601	18 00 37 85	02	02	08	09	02	37 70	59 38 22	·18	13
	254	03 47 74	02	33	07	·11	02	47 23	18 02 47 88	·35	00

a = + ·518 c = + ·067
Chronometer correction at 17h 40m = 59s ·348 ± ·019

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
W	603	18 50 18 47	04	03	05	29	02	18 70	18 49 18 69	1 00 01	03
	270	19 02 00 35	03	39	05	23	02	00 15	19 01 00 14	00 01	03
	604	05 03 28	04	·08	05	22	- 02	03 39	04 03 30	00 09	11
	ζ Sagittarii	10 39 16	01	·01	05	·13	02	39 28	09 39 32	0 59 96	02
	ο Sagittarii	36 13·53	- 04	12	05	07	02	13 45	35 13 55	59 90	08
	τ Sagittarii	49 38·21	- 05	- ·17	06	05	02	38 40	48 38·45	59 95	03
	283	51 36 45	03	·32	·05	01	02	36 08	50 36·18	59 90	08
E	607	20 13 41 13	- ·08	·25	05	11	02	43 88	20 12 43 91	59 97	01
	608	16 37 11	09	·22	05	13	02	37 18	15 37 32	59 86	12
	α Pavonis	19 02·84	- 14	·75	08	14	03	03 64	18 03 69	59 95	03
	609	24 23 61	·09	·18	05	16	02	23 39	23 23 33	1 00 06	·08
	290	29 38 66	- 07	·58	05	19	02	37 99	28 38 06	0 59 93	05
	297	43 29·15	- ·07	29	05	·25	02	29 01	42 28 93	1 00 08	10
	μ Aquarii	48 29 32	07	·30	05	28	·02	28 84	47 28 85	0 59 99	01

a_1 = + ·557 a_2 = + ·875 c = + ·045
Chronometer correction at 19h 50m = 59s ·976 ± ·016

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 17th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
W	σ Ophiuchi ...	17 23 07 82	01	40	12	08	02	08 15	17 21 44 78	1 23 37	00
	η Pavonis ...	37 43 12	03	1 00	29	04	04	11 80	36 18 47	33	04
	245 ...	40 06 66	01	40	12	03	02	06 94	38 43 57	37	00
	246 ...	44 05 07	01	69	14	02	02	05 61	42 42 13	48	11
	250 ...	55 07 17	01	24	12	01	02	07 55	53 44 24	31	06
	253 ...	57 13 21	01	39	12	02	02	13 43	55 50 06	37	00
E	601 ...	18 01 01 17	07	02	14	03	02	01 61	59 38 19	42	05
	251 ...	04 10 57	05	46	12	04	02	11 14	18 02 47 86	28	09
	255 ...	05 10 60	03	70	14	04	02	14 41	03 48 08	33	04
	ι Sagittarii ...	10 11 25	05	69	15	00	02	11 25	17 47 84	41	04

$a = \cdot 733 \quad c = \cdot 122$

Chronometer correction at 17h 50m = 1m 23s·368 ± ·016

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
E	λ Pavonis	18 44 43 16	07	59	31	09	04	43 33	18 43 19 61	1 23 69	09
	603 ...	50 41 90	04	03	- 17	07	02	42 19	49 18 67	52	08
	267 ...	56 39 13	03	- 36	16	06	02	39 72	55 16 19	53	07
	270 ...	19 02 23 22	- 53	35	16	04	02	23 78	19 00 60 13	65	05
	604 ...	05 26 70	- 03	- 08	- 47	03	02	26 99	03 63 27	72	12
	ψ Sagittarii ...	11 02 54	- 03	04	47	01	02	02 77	09 39 30	47	13
	495 ...	11 41 98	03	- 33	16	00	02	12 18	13 18 89	59	01
W	B. A. C. 6632 ...	21 30 12	02	37	27	02	03	29 11	20 05 85	56	04
	α Vulpeculæ	26 06 61	01	- 14	17	03	02	06 82	21 13 24	58	02
	605 ...	32 15 74	02	- 04	17	05	02	15 52	30 51 99	53	07
	ρ¹ Sagittarii ...	36 37 32	02	11	16	06	02	37 17	35 13 52	65	05
	277 ...	43 05 67	02	- 33	16	08	02	05 72	41 42 09	63	03
	279 ...	44 30 54	02	- 39	16	09	02	30 64	43 06 92	72	12

$a = \cdot 50 \quad c = \cdot 156$

Chronometer correction at 19h 15m = 1m 23s·601 ± ·018

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 16th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	β Arae	17 18 57 58	02	35	16	31	03	58 21	17 17 18 79	1 39 42	07
	ε Ophiuchi	23 24 21	00	25	09	47	02	24 18	21 44 77	41	08
	λ Scorpii	28 44 09	00	08	11	15	02	11 38	27 04 97	44	08
	η Pavonis	37 57 14	02	61	21	12	04	58 01	36 18 44	37	08
	245	40 23 25	04	25	09	07	02	23 44	38 43 55	50	10
	246	44 21 98	04	42	10	06	02	21 68	42 42 10	58	09
						03					
W	250	55 24 08	05	15	09	03	02	23 74	53 44 22	52	03
	253	57 29 92	05	24	09	04	02	29 48	55 50 03	45	04
	254	18 04 27 83	04	28	09	08	02	27 39	18 02 17 83	49	00
	255	05 28 20	04	43	10	09	02	27 92	03 48 05	47	02
	602	09 40 89	05	07	10	12	02	40 53	08 01 09	44	05
	α Telescopii	21 30 98	06	19	13	18	03	30 77	19 51 19	58	09

a = ·450 . ·080
Chronometer correction at 17h 50m = 1m 39s·494 ± ·016

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
W	603	18 50 58 76	03	02	10	23	02	58 82	18 49 18 66	1 40 16	10
	267	56 56 48	02	30	09	19	02	50 24	55 16 18	06	00
	270	19 02 40 41	02	29	09	16	12	40 15	19 01 00 10	05	04
	ζ Sagittarii	11 19 44	03	03	09	41	02	19 37	10 39 29	06	00
	B. A. C. 6632	21 45 68	04	31	15	05	03	45 82	20 05 85	39 97	09
	α Vulpeculae	26 23 80	02	37	09	02	02	23 32	24 43 24	40 08	02
E	θ Sagittarii	36 53 57	02	09	09	05	02	53 53	38 13 53	40 00	06
	277	43 22 31	02	27	09	08	02	22 05	44 42 08	39 97	09
	279	44 47 24	02	32	09	09	02	46 02	43 06 91	40 01	05
	ι Sagittarii	50 18 46	02	13	11	12	02	18 58	48 38 43	15	09
	284	52 16 51	01	24	09	13	02	16 22	50 36 46	06	00
	286	56 10 27	00	33	09	15	02	09 86	54 29 79	07	01
	287	20 08 01 81	00	20	09	22	02	01 49	20 06 21 34	15	09

a = ·418 c = ·085
Chronometer correction at 19h 30m = 1m 40s·060 ± ·015

TRANSIT OBSERVATIONS.

Station: N[illegible]s Island. Date, August 21st, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of star transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	286	19 56 25 51	·03	·17	+ ·04	+ ·28	·02	25 37	19 54 29 78	1 55 59	+ ·12
	e Sagittarii	58 40 58	·01	·01	+ ·05	+ ·26	·02	40 90	56 45 48	42	·05
	287	20 08 16 91	·01	·28	·04	+ ·17	·02	16 89	20 06 21 34	55	+ ·08
	60[illegible]	14 39 35	− ·04	·17	·04	+ ·13	·02	39 37	12 43 90	47	·00
	608	17 32 73	·04	·15	+ ·04	+ ·10	·03	32 73	15 37 34	42	·05
	a P[illegible]	19 58 42	·06	·51	+ ·07	+ ·09	·03	59 12	17 63 67	45	·02
	609	25 18 70	·05	·12	+ ·04	·04	·02	18 69	23 23 33	36	·11
W	297	44 23 92	·01	·20	·04	·11	·02	24 54	42 29 00	·54	·07
	a Aqu[illegible]	49 24 73	·00	·20	·04	·15	·02	24 32	47 28 87	45	·02
	307.	52 25 14	·00	·56	·05	·17	·02	24 34	50 28 96	38	·09
	θ Capricorni	21 02 29 29	·02	·12	·03	·26	·02	28 87	21 00 33 34	53	·06
	611	06 18 24	·03	·18	·04	·29	·02	17 74	04 22 48	56	·09
	303	10 48 23	·03	·58	·05	·31	·02	47 30	08 51 96	34	·13

a = ·591 *c* = ·040

Chronometer correction at 20^h 30^m = 1^m 55^s ·468 ± ·022

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of star transit.	R. A.	Chronometer correction.	v.
W	304	21 12 58 05	·06	·17	·23	+ ·22	·02	57 91	21 11 01 93	1 55 98	·08
	θ[1] Microscopii	16 33 57	·16	·08	·30	·19	·02	33 62	14 37 47	56 15	+ ·09
	307.	28 26 88	·07	·12	·23	·11	·02	26 69	26 30 63	06	·00
	ξ Aquarii	34 35 12	+ ·07	·11	·23	·[illegible]	·02	31 88	32 38 85	03	·03
E	615	43 40 61	·13	·07	·24	·02	·02	40 91	41 44 80	11	·05
	γ Gruis	50 02 83	·14	·06	+ ·29	·08	·02	03 22	48 07 22	·00	·16
	311	22 02 17 70	·09	·11	+ ·23	·17	·02	47 69	22 00 51 55	·14	·08
	a Gruis	04 07 00	·11	+ ·14	·34	·19	·03	07 37	02 11 55	·02	·03

a = + ·298 *c* = + ·229

Chronometer correction at 21^h 40^m = 1^m 56^s·062 ± ·020

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date August 22nd, 1903. Observer, F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	[illegible]
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	241	17 32 30 23	05	26	19	13	02	30 32	17 30 28 40	2 01 92	05
	600	34 06 50	07	09	20	12	02	06 78	32 04 93	84	03
	η Pavonis	38 18 98	13	51	44	·10	01	90 12	36 18 33	79	08
	245	40 45 29	06	21	19	09	02	45 40	38 43 51	89	02
	246	44 44 03	04	35	21	05	02	43 98	42 12 04	94	07
	250	55 45 96	07	12	19	02	02	46 20	53 44 17	93	04
	253	57 51 80	06	20	19	01	02	51 84	55 49 99	85	02
W	601	18 01 40 22	05	01	22	00	02	40 04	59 38 12	92	05
	257	18 22 [illegible]	04	17	19	09	02	22 17	18 16 20 38	79	08
	α Telescopii	21 53 13	07	16	27	10	05	52 06	19 51 15	83	01
	2 Aquilae	39 03 27	·05	13	19	19	02	02 79	37 01 02	77	10
	263	43 34 53	04	30	20	20	02	33 8[illegible]	41 32 04	81	06
	λ Pavonis	45 21 63	09	41	41	21	04	21 50	43 19 54	96	09

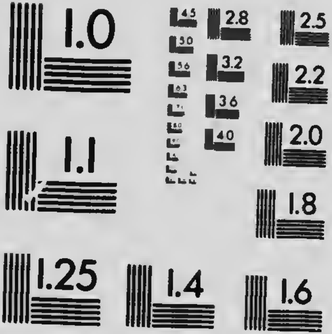
$a = +·376$ $c = +·189$

Chronometer correction at $18^h 00^m = 2^m 01^s·866 ± ·013$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	[illegible]
W	601	19 06 05 59	04	07	07	·16	02	05 63	19 04 03 21	2 02 30	05
	ζ Sagittarii	11 41 51	05	03	07	·14	02	41 58	09 39 26	32	02
	465	15 21 44	05	·31	06	·12	02	21 22	13 18 85	37	·03
	B.A.C. 6632	22 07 73	11	35	11	·08	03	08 13	20 05 80	33	01
	α Vulpeculae	26 45 88	·05	12	07	07	02	45 49	24 43 20	29	05
	275	28 54 31	04	45	07	·06	02	53 87	26 51 57	30	04
	605	32 54 32	08	04	07	·04	02	54 31	30 51 96	35	01
E	277	43 44 54	12	31	06	·01	·02	44 38	41 12 06	32	02
	ι Sagittarii	50 40·37	20	15	08	·05	02	40 73	48 38 40	33	01
	283	52 38 65	14	27	06	06	02	38 50	50 36 11	36	02
	286	56 32 41	12	37	07	·07	02	32 14	54 29 77	37	03
	ν Sagittarii	58 47 55	21	01	·07	·09	02	47 71	56 45 48	23	11
	287	20 08 23 89	18	22	06	·14	02	23 75	20 06 21 34	31	07

$a = +·474$ $c = +·062$

Chronometer correction at $19^h 40^m = 2^m 02^s·338 ± ·010$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4.5
5.0
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1.6

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 23rd, 1903. Observer, F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. r = 30	s.		h. m. s.	m. s.	s.
E	λ Scorpii	17 29 13·89	·09	−·08	−·11	+·16	·02	14 13	17 27 04 89	2 09·24	−·02
	241........ ...	32 37 78	−06	33	09	+·14	02	37 60	39 28·39	·21	−·01
	600.......... ..	34 14 04	·07	−·12	·09	+·13	·02	14 05	32 04·92	·13	·09
	η Pavonis......	38 26 53	14	−67	·20	+·11	·04	27 33	36 18·29	·04	·18
	245	40 52 85	−06	27	09	−·10	02	52 69	38 43·49	20	·02
	246............	44 51·51	·04	·46	+·10	−·08	·02	51 17	42 42·02	·15	·07
	253.......... ...	57 59 42	06	26	−09	+·01	·02	59 18	55 49 98	·20	02
W	601.	18 01 47·70	·10	−01	10	·01	02	47·48	59 38·10	·38	−·16
	254	04 57·55	06	31	−·09	−·02	·02	57 05	18 02 47 77	·28	−06
	602.....	10 10 49	−09	·07	·09	·05	·02	10 17	08 01 03	·14	−·08
	257.	18 30 05	·07	·22	09	·10	02	29 55	16 20 37	·18	−·04
	ε Sagittarii	19 57·43	·10	+·06	11	−·10	−·02	57·16	17 47·77	·39	−·17
	α Telescopii.....	22 00·66	·11	−·21	13	·11	03	00·49	19 51·12	·37	+·15
	λ Sagittarii......	24 12 08	09	−·03	10	·12	02	11 72	22 02·55	·17	·05

a = + ·490 c = + ·088

Chronometer correction at $18^h 00^m$ = − 2^m 09·220 ± ·022

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 25th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. ·35	s.		h. m. s.	m. s.	s.
E	η Pavonis ..	17 38 42 21	·04	54	·04	·36	·01	43 15	17 36 18 21	2 24 94	·01
	245	1 08 21	·02	22	02	·35	02	08 36	38 43 46	90	·05
	246	45 07 06	·01	37	02	·30	02	07 00	42 41 98	25 0[illegible]	07
	250	56 08 95	02	13	02	·26	02	09 10	53 44 13	21 [illegible]	02
	254	18 05 12 66	·04	·25	·02	·20	02	12 62	18 02 17 75	87	[illegible]
W	602	10 25 82	03	06	02	17	02	25 92	08 01 00	92	03
	ε Sagittarii	20 12 57	03	05	02	12	02	12 73	17 47 71	99	·04
	283	19 53 01 75	·02	23	02	45	02	01 07	19 50 36·12	95	00
	286	56 55 50	·02	31	02	44	02	54 73	54 29 74	·99	01
	ζ Sagittarii	59 10 86	·03	01	02	46	02	10 38	56 45 45	·93	02

a = ·398 *c* = ·016
Chronometer correction at $18^h\ 40^m$ = $2^m\ 24^s\cdot954$ ± ·011

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	v.
W	287	20 08 47·07	·02	19	03	19	02	17 04	20 06 21·32	2 25 72	·08
	607	15 09 52	– 03	11	03	·15	·02	09 54	12 43 88	66	02
	608	18 02 79	·03	10	03	·13	02	02 80	15 37·20	·60	·04
	α Pavonis	20 28 81	·05	34	05	12	·03	29 24	18 03 63	61	·03
	290	31 03·92	– 02	26	03	05	·02	03·68	28 38·03	65	·01
	292	35 29·27	·02	28	03	·02	·02	28·98	33 03·33	·65	·01
E	297	44 54·74	·08	13	·03	·03	·02	54 67	42 28·[illegible]9	·68	·04
	μ Aquarii	49 54 55	·08	13	·03	·05	·02	54 46	47 28·86	·60	·04
	507	52 54 96	– ·05	37	·03	07	·02	54·58	50 28 94	64	·00
	ι Piscis Aust	57 50·11	·09	03	·03	·13	02	50 14	55 24·47	·67	– ·03
	θ Capricorni ..	21 02 58 98	·08	08	·03	13	·02	58 86	21 00 33·34	·52	·12
	611	06 47·98	·08	12	– ·03	·14	·02	47 81	04 22·18	·63	– ·01
	304	13 27·91	·07	– ·22	– 03	19	02	27 58	11 01 93	·65	– 01
	θ[1] Microscopii ..	17 03·23	·10	– ·11	·04	·22	·02	03·24	14 37·48	76	– ·12

a = + ·394 *c* = – ·027
Chronometer correction at $20^h\ 40^m$ = $2^m\ 25^s\cdot645$ ± ·013

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, August 27th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R.A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r = ·30	s.		h. m. s.	m. s.	s.
E	λ Sagittarii. ..	18 24 12 76	·68	04	03	48	02	42 83	18 22 02 49	2 40 34	00
	ζ Aquilae.	39 44 14	07	17	03	10	02	41 31	37 00 95	36	·02
	263	44 12 66	05	41	03	08	02	12 29	44 31·97	·32	02
	λ Pavonis ...	45 59·20	·13	60	06	07	04	59 76	43 19 41	35	01
	603....	51 58 96	08	01	08	·04	·02	58 92	49 18 56	36	02
W	267...	57 56 87	07	·36	03	01	02	56 40	55 16 39	31	05
	270...........	19 03 10·96	07	·35	03	02	·02	10 47	19 01 00 05	·12	08
	ψ Sagittarii. ...	12 19 68	40	04	03	06	02	19 43	09 39·21	22	12
	495	15 59·64	·07	33	03	08	02	59 11	13 18·80	·31	·03
	B.A.C. 6632.....	22 46 06	·14	·37	05	12	03	46 09	20 05·72	·37	03
	α Vulpeculae...	27 24 20	06	·45	03	13	02	23·51	24 43·14	37	03

$a = {}^{s}·506 \quad c = ·028$

Chronometer correction at 19ʰ 00ᵐ 2ᵐ 40ˢ·339 ·010

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, September 29th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r = – ·30	s.		h. m. s.	s.	s.
E	615.	21 41 52 68	·04	– ·06	– 15	+ ·19	·02	52 68	21 41 44·68	–08 00	·06
	616.	22 04 23 19	·04	07	·14	+ ·09	·02	23·36	22 01 15 38	07·98	– ·08
	312............	02 41 66	·00	·26	15	+ ·09	·02	41 32	02 33·23	08 09	+ ·03
	314.	05 30 07	·04	– ·16	– ·14	·07	– ·02	29·83	05 21·82	08·01	·05
	α Toucani	12 04 12	·01	+ ·31	·29	+ ·04	·04	04 15	11 56·00	08·15	+ 09
	347.....	16 50 51	·01	– ·13	·14	+ 02	·02	50·25	16 42·21	08 04	·02
	π Aquarii	20 31·25	·01	– ·14	·14	·00	– 02	30 96	20 22·86	08·10	+ ·04
W	σ Aquarii.	25 42 45	03	09	14	·03	·02	12·42	25 34·38	08 04	– ·02
	320.	30 33 94	03	·14	+ ·14	– ·05	– 02	33·84	30 25·79	08·05	·01
	β Gruis.......	37 04 34	04	– ·14	·21	·08	03	04 54	36 56·52	08·02	– ·04
	323.	42 03·54	·02	25	·15	– 11	·02	03·29	41 55·16	08·13	– ·07
	μ Pegasi.. ...	31 34	·02	·25	– ·15	·13	·02	31·07	45 22·96	08·11	·05

$a = +{}^{s}·289 \quad c = -{}^{s}·140$

Chronometer correction at 22ʰ 20ᵐ = –8ˢ·059 ·ˢ014.

TRANSIT OBSERVATIONS.

Station : Norfolk Island. Date, October 1st, 1903. Observer : F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Corrected transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E	θ Capricorni....	21 00 59 77	19	09	08	13	02	59 90	21 00 33 05	26 85	04
	611.......	01 18 73	17	12	08	11	02	18 79	01 21 91	88	·01
	304	11 28 69	15	·23	08	08	02	28 59	11 01 66	93	04
	θ¹ Microscopii...	15 03 87	23	12	11	06	02	01 15	11 37 11	27 01	12
	ι Capricorni ..	17 20 99	·19	09	08	05	02	21 04	16 54 14	26 90	01
	γ Pavonis	18 56 81	·35	+ 60	19	05	01	57·58	18 30 71	81	05
	612	21 37·97	19	05	09	·04	02	38 04	21 11·20	81	·05
W	307	26 57 28	08	16	08	02	02	57 28	26 30 13	85	04
	δ Aquarii	33 05 44	08	15	08	01	02	05·42	32 38 67	75	14
	ε Pegasi......	39 55 71	06	26	·08	01	02	55 73	39 28 61	92	03
	615.	12 11·60	09	09	·08	05	02	11 64	11 11 65	96	07
	γ Gruis	48 33 81	11	08	10	08	02	34 00	48 07 07	·93	04

a = ·412 c = ·079

Chronometer correction at 21h 30m = 26·889 ± ·015

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Corrected transit.	R. A.	Chronometer correction.	
E	616..... ...	22 01 42 55	13	14	·08	+ ·20	02	42 64	22 01 15·36	27 28	06
	α Toucani	12 22 23	+ ·23	+ ·57	16	·15	01	22 98	11 55·95	03	19
	317	17 09 61	·12	– ·24	·8	·13	02	09 52	16 12 19	·33	11
	π Aquarii. .	20 50 21	·12	·26	08	42	02	50 09	20 22 84	·25	03
	β Gruis	37 23·19	– ·19	·25	11	05	·03	23 84	36 56 50	·34	12
	323.	42 22 69	·0.)	– ·45	08	03	02	22·26	41 55 15	11	11
W	μ Pegasi	45 50·39	– ·03	·46	08	·02	·02	50 04	45 22 94	·10	12
	326	48 04 01	05	19	– 08	01	02	03 94	47 36 73	·21	·01
	618	50 00 88	05	·12	·08	00	02	00 87	49 33·65	22	·00
	329.........	23 00 26 93	03	·37	·08	01	02	26·61	59 59 34	27	05
	621	38 12 53	02	·13	08	19	·02	12·29	23 37 45·06	23	01
	ψ¹ Aquarii......	39 41·32	02	10	– 08	·20	02	41 10	39 13 81	·29	07

a = ·527 c = ·076

Chronometer correction at 22h 50m = 27·219 ± ·021

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, October 2nd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 35.	s.		h. m. s.	s.	s.
E	616	22 01 50 88	00	11	·10	16	02	50 81	22 01 15 35	35 46	+ ·07
	312	03 08 93	·00	38	10	− 16	02	08 59	02 33 20	39	00
	314	05 57 51	00	24	09	·14	02	57 30	05 21 80	50	·11
	α Toucani	12 30 94	00	46	·19	+ ·11	04	31 28	11 55 93	·35	04
	317	17 17 74	00	20	·09	− ·08	02	17 48	16 42 18	30	09
	π Aquarii	20 58 19	00	·21	09	− 05	02	58 22	20 22 84	·38	01
W	β Gruis	37 31 68	06	+ 20	·14	·04	03	31 89	36 56·49	·10	+ ·01
	323	42 30 89	·03	·37	− ·10	·07	·02	30·50	41 55 11	·36	·03
	326	48 12 42	·04	·15	+ 09	10	·02	12 20	47 36 72	·48	+ 09
	618	50 09·19	04	10	− ·10	12	·02	09 01	49 33 64	·37	− ·02
	329	23 00 35·11	03	30	− ·10	18	·02	34·68	59 59 33	·35	04
	620	04 55 60	01	06	− ·10	20	− ·02	55 38	23 04 20 02	·36	03

$a = +^s\cdot425 \quad c = -^s\cdot094$

Chronometer correction at $22^h\ 30^m = -35^s\cdot388 + ^s\cdot013$

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, October 3rd, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 38	s.		h. m. s.	s.	s.
W	θ^1 Microscopii..	21 15 18 76	02	·12	·15	22	02	19 21	21 44 37 11	12 10	·19
	ι Capricorni....	17 35 88	·01	09	12	21	02	36 09	16 54 11	41 98	07
	γ Pavonis. ...	19 11 59	02	·62	27	·20	04	12 62	18 30 67	95	04
	612	21 52 92	01	·05	12	18	02	53·14	21 11 18	·96	05
	307	27 12 26	01	16	11	15	02	12 33	26 30 41	92	01
	ξ Aquarii. ...	33 20 56	01	15	·11	11	02	20 60	32 38 65	95	04
E	616	22 01 57 48	05	14	14	07	02	57 22	22 01 15 31	88	03
	312	03 15 61	03	38	·12	08	02	15 04	02 33 19	85	06
	314	06 04 01	04	24	11	10	02	03 61	05 21 79	82	09
	α Toucani	12 37 53	09	- 46	·23	·14	04	37·67	11 55 91	·76	15
	317	17 24 55	04	·19	11	17	02	24 10	16 42 18	·92	01
	π Aquarii	21 05 24	04	·21	11	20	02	04 74	20 22 83	91	00

$a = +^s\cdot423$ $c = {}^s\cdot111$

Chronometer correction at 21^h50^m = $41^s\cdot915$ $\cdot018$

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
E	σ Aquarii ..	22 26 16 59	·06	- ·13	- ·08	- ·28	02	16 70	22 25 34 32	42 38	- 02
	320.	31 08 22	·06	·19	- ·08	·25	·02	08 24	30 25 76	·48	· 08
	β Gruis	37 38 45	- ·09	+ 19	11	·21	·03	38 80	36 56·48	·32	08
	323.	42 37 80	- ·04	- 35	08	·18	02	27·57	41 55 13	·14	· 04
	μ Pegasi.	46 05 49	·04	- ·36	- ·08	+ ·15	·02	05 22	45 22 93	·29	11
	φ Aquarii.	23 10 04 12	- 06	16	- 08	·00	- ·02	03 92	23 09 21·47	·45	· ·05
	γ Toucani.	12 32 45	- 11	+ 39	15	- ·01	·04	32 75	11 50·29	·46	· 06
W	534.	22 43 8	·02	- ·20	- 68	08	·02	43 56	22 01 15	·41	01
	333.	35 44·11	02	- 23	+ 08	16	·02	43 76	34 61·28	48	· 08
	621.	38 27 62	- 02	10	+ 08	18	·02	27·38	37 45 06	·32	·08
	β^1 Aquarii.	39 56 42	02	- ·08	- ·08	18	·02	56 20	39 13 80	40	00

$a = +^s\cdot405$ $c = {}^s\cdot077$

Chronometer correction at 23^h10^m = $42^s\cdot404$ $-{}^s\cdot020$

TRANSIT OBSERVATIONS.

Station, Norfolk Island. Date, October 8th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	36	s.		h. m. s.	m. s.	s.
E	σ Aquarii	22 27 02 73	07	45	18	38	02	02 63	22 25 34 30	1 28 33	04
	320	31 54 46	07	23	18	35	02	54 45	30 25 73	42	08
	β Gruis	38 24 41	10	23	27	·31	03	24 75	36 56 42	·33	01
	329	23 01 28 02	05	35	19	17	02	27 68	59 59 30	38	04
	620	05 48 36	08	07	19	14	02	48 30	23 04 20 00	30	04
	φ Aquarii	10 49 02	07	19	18	11	02	49 71	09 21·46	25	09
	γ Toucani	43 48 29	43	47	35	10	04	18 60	11 50 24	·36	02
W	531	17 22 38	02	70	20	07	02	22 11	15 53 87	24	10
	622	45 24 40	02	·01	21	00	·02	24 47	43 55 93	54	20
	336	55 52 17	02	35	48	15	02	51 81	54 23 45	36	− 02
	2 Ceti	24 00 18 31	02	12	19	17	02	18 17	58 49 80	37	03
	33 Piscium	01 54 47	02	23	18	19	02	54 19	24 00 25·84	·35	04
	3	09 47 05	02	42	49	24	02	46 54	08 48 21	33	01
	ε Toucani	16 32·92	04	84	43	28	04	33 83	15 05 55	28	06

a_1 = ·189, a_2 = ·587, c = ·480

Chronometer correction at 23h 30m = 1m 28s 345 · 015

TRANSIT OBSERVATIONS.

Station: NORFOLK ISLAND. Date, October 11th, 1903. Observer: F. W. O. WERRY.

Clamp.	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	v.
		h. m. s.	s.	s.	s.	·02	s.		h. m. s.	m. s.	s.
E	γ Gruis	21 50 01 35	12	08	20	15	02	01 48	21 48 06 93	1 54 55	08
	616	22 03 09 85	09	11	·16	10	02	09 75	22 01 15 25	50	03
	312	04 27 81	06	37	17	09	02	27 40	02 33 09	31	16
	314	05 1·0 46	08	23	16	08	02	16 21	05 21 70	51	04
	α Toucani	43 49 79	17	45	32	06	04	50 11	11 55 72	39	08
	π Aquarii	22 17 57	08	21	16	03	02	47 29	20 22 75	54	07
	σ Aquarii	27 28 94	09	13	16	01	02	28 73	25 31 24	49	02
W	β Gruis	38 50 49	05	29	23	03	03	50 81	36 56 37	44	03
	323	43 49 78	02	36	17	05	02	49 50	41 55 07	43	04
	α Pegasi	47 17 09	02	37	17	06	02	17 30	45 22 89	50	03
	326	49 34 28	03	15	16	07	02	31 17	47 36 66	51	04
	618	51 28 18	03	10	16	08	02	28 11	49 33 58	53	06
	329	23 01 53 92	02	30	16	11	02	53 63	59 59 28	35	12
	620	06 14 53	04	06	17	13	02	14 45	23 04 19 98	47	00

$a = + \cdot 415$ $c = + \cdot 176$

Chronometer correction at 22h 30m = 1m 54s ·468 ± ·016

Clamp.	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of corr. transit	R. A.	Chronometer correction	v.
W	620	23 06 14 53	03	09	16	16	02	14 71	23 04 19 98	1 54 73	04
	φ Aquarii	11 16 08	02	24	15	14	02	16 09	09 21 44	65	12
	γ Toucani	13 44 05	04	58	15	14	04	44 84	11 50 18	66	14
	621	39 39 79	·02	12	15	04	02	39 82	37 45 04	78	01
	ψ² Aquarii	41 08 53	·03	15	15	03	02	08 51	39 13 78	73	04
	622	45 50 66	03	01	17	03	02	50 80	43 55 91	89	12
E	2 Ceti	24 00 44 77	06	12	15	·01	02	44 50	58 19 79	71	06
	33 Piscium	02 20 88	06	24	15	04	02	20 49	24 00 25 83	66	11
	ζ Toucani	16 59·76	13	87	·35	10	04	60 27	14 65 53	74	03
	44 Piscium	22 24 80	06	31	15	12	02	24 26	20 29 47	79	02
	339	27 04 24	·06	·25	15	14	02	03 74	25 08 88	86	09
	13 Baleine	32 14 26	06	26	15	15	02	13 74	30 18 95	79	02
	130 Piazzi	34 20 44	07	04	16	16	02	20 13	32 25 27	86	09

$a = + \cdot 609$ $c = + \cdot 146$

Chronometer correction at 23h 50m = 1m 54s ·770 ± ·017

TRANSIT OBSERVATIONS.

Station, Norfolk Island. Date, October 12th, 1903. Observer, F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E.	616	22 03 16 11	14	11	12	14	·02	16 14	22 01 15 24	2 00 90	02
	312	04 34 21	09	39	13	13	·02	33 89	02 33 08	81	07
	314	07 22 76	12	25	12	12	·02	22 61	05 21 69	92	04
	α Toucani	13 56 03	25	47	25	09	·04	56 56	11 55 69	86	02
	317	18 43 12	13	20	12	07	·02	12 98	16 42 09	89	01
	π Aquarii	22 23 86	13	22	12	05	·02	23 62	20 22 74	88	00
	320	32 26 82	13	21	12	01	·02	26 61	30 25 69	92	01
W.	β Gruis	38 56 74	11	20	18	02	·03	57 18	36 56 35	83	05
	326	49 37 57	08	16	12	06	·02	37 53	47 36 61	89	04
	618	51 34 47	08	10	13	07	·02	34 49	49 33 57	92	04
	329	23 02 06 34	06	31	12	11	·02	00 08	59 59·27	81	07
	620	06 20 90	00	06	13	13	·02	20 88	23 04 19 57	91	03

a = ·140 c = ·121.

Chronometer correction at $22^h 35^m$ = $2^m 00^s$·877 ± ·009.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
W.	φ Aquarii	23 11 22 39	03	38	18	30	·02	22 70	23 09 21 43	2 01 27	08
	γ Toucani	13 50 53	06	41	35	29	·04	51 66	11 50 17	49	11
	3	24 10 19 65	03	33	19	04	·02	19 56	24 08 18 21	35	00
	ζ Toucani	17 05 62	07	·65	44	01	·01	06 75	15 05 51	24	11
	44 Piscium	22 30 87	03	23	18	01	·02	30 82	20 29 48	34	01
	339	27 10 32	03	19	18	03	·02	10 29	25 08 88	41	06
E.	45 Balaenae	32 20 54	13	19	18	05	·02	20 23	30 18 95	28	07
	540	40 18 31	15	09	19	09	·02	18 67	38 46 72	35	00
	11	41 17 78	10	40	20	14	·02	17 15	42 15 83	32	03
	342	45 44 57	12	27	18	12	·02	44 30	43 42 74	36	01
	ζ¹ Piscium	25 10 45 56	12	27	18	22	·02	44 90	25 08 43 56	43	08

a = ·461 c = ·182

Chronometer correction at $24^h 20^m$ = $2^m 01^s$·348 ± ·019

TRANSIT OBSERVATIONS.

Station—Norfolk Island. Date, October 16th, 1903. Observer, F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Reduced transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.	m. s.	h. m. s.	m. s.	s.
E	α Tucanae	22 14 23 00	19	45	50	40	·01	23 29	22 11 55 58	2 27 71	01
	217	19 10 08	10	19	24	00	·02	00 82	16 42 05	77	05
	π Aquarii	22 50 69	10	21	24	08	02	50 10	20 2? 70	70	02
	ι Aquarii	28 02 13	11	13	25	06	·02	04 90	25 ?4 19	71	01
	320	32 53 72	10	2?	29	06	02	53 1?	[illegible] 66	7?	07
	β Gruis	39 21 05	15	19	36	05	03	24 09	[illegible] ?6 29	73	01
	323	44 23 29	07	36	27	00	02	22 71	11 55 02	69	03
W	α Pegasi	47 50 51	03	56	27	01	·02	50 15	45 22 81	61	08
	326	50 01 26	05	15	25	02	02	01 37	47 36 62	75	03
	618	52 01 07	05	10	25	02	·02	01 23	49 33 54	69	03
	329	23 02 27 09	01	29	25	06	·02	27 01	59 59 24	77	05
	620	06 47 53	05	06	26	07	·02	47 69	23 04 19 94	75	03
	φ Aquarii	11 19 43	05	16	25	09	·02	49 16	09 24 40	76	04
	γ Tucanae	14 17 00	08	10	17	10	·04	17 8?	11 50 10	71	04

a = ·114 c = ·241

Chronometer correction at 22h 45m = 2m 27s·723 ± ·008

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Reduced transit.	R. A.	Chronometer correction.	v.
W	534	23 24 28 98	06	31	30	11	·02	29 15	23 22 01 40	2 28 05	07
	535	26 46 37	05	42	31	13	02	46 42	24 18 52	27 90	08
	538	50 04 91	05	49	32	05	·02	04 85	47 36 91	27 91	07
	336	56 5? 47	06	37	31	03	·02	51 48	54 23 44	28 01	06
	2 Ceti	24 01 17 60	07	12	32	01	·02	47 86	58 49 78	28 08	10
	33 Piscium	02 53 62	06	21	31	04	·02	53 71	24 00 25 82	27 92	06
	3	40 46 31	05	44	31	02	·02	46 19	08 18 21	27 98	00
E	ε Tucanae	17 33 11	22	89	73	04	·04	33 41	15 05 47	27 94	01
	44 Piscium	22 ? 02	10	32	30	06	·02	57 42	20 29 47	27 95	03
	α Phœnicis	21 [illegible] 2?	15	20	41	06	·03	01 05	21 32 97	28 08	10
	339	27 ? 43	10	26	30	07	·02	36 88	25 08 89	27 99	01
	13 Baleine	32 17 51	40	?6	30	09	·02	46 91	30 18 96	27 99	01
	130 Piazzi	34 53 ?	13	[illegible]	34	10	·02	53 29	32 25 28	28 01	03
	342	46 11 ?	[illegible]	[illegible]	31	14	·02	40 69	43 42 75	27 91	04

a = ·23 c = ·304

Chronometer [illegible] at 24h 05m = 2m 27s·982 ± ·015

TRANSIT OBSERVATIONS.

Station: Southport. Date, September 25th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. ·12	s.		h. m. s.	s.	s.
E	α Aquarii.	20 46 55 57	10	03	25	22	02	55 59	20 47 28 61	33 02	01
	32 Vulpeculae	49 5 83	06	09	28	19	02	55 69	50 28 66	32 97	04
	θ Capricorni	21 00 00 14	10	02	26	14	02	00 08	21 00 33 13	33 05	04
	ι Cygni . .	08 18 91	06	09	29	10	02	18 67	08 51 70	33 03	02
	α Equulei .	10 28 95	08	05	25	00	02	28 80	11 01 79	32 99	02
W	β Aquarii . .	25 57 55	19	04	25	02	02	57 57	26 30 55	32 98	03
	ξ Aquarii.	32 05 74	19	03	25	02	02	05 73	32 38 73	33 00	01
	ι Pegasi	38 55 71	16	06	25	05	02	55 67	39 28 68	33 01	00
	α Toucani	22 11 22 99	·34	10	52	22	04	23 01	22 11 56 06	33 05	04

$a = + \cdot 093 \qquad c = + \cdot 251$

Chronometer correction at $21^h\ 28^m = 33^s \cdot 010 \pm \cdot 006$

TRANSIT OBSERVATIONS

Station — [illegible]. Date, September 2[illegible], 1904. Observer — [illegible].

Clamp.	Star.	Transit over mean thread.	Level (equivalent pivots).	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of [illegible] transit.	R. A.	Chronometer correction.	v
		h. m. s.	s.	s.	s.	s. 40	s.		h. m. s.	s.	s.
E	β Pavonis	20 30 16 66	08	68	32	24	05	17 13	20 36 18 15	01 02	11
	ι Cygni	42 19 60	02	59	18	20	03	18 98	42 20 17	19	06
	α Aquarii.	47 27 58	04	14	13	17	02	27 42	47 28 56	14	01
	ι Piscis Aust.	55 23 00	05	04	15	11	02	22 93	55 24 15	22	09
	θ Capricorni	21 00 32 03	04	08	14	08	02	31 83	21 00 33 08	25	12
	ν Aquarii	04 21 08	04	12	13	05	02	20 82	04 27 94	12	01
	ε Cygni	08 51 14	03	12	15	03	02	50 55	08 51 63	08	05
W	γ Pavonis	18 29 16	43	66	31	01	05	29 61	18 30 81	20	07
	ζ Capricorni	21 10 42	25	04	14	06	02	10 19	21 11 28	09	04
	β Aquarii	26 29 82	21	17	13	09	02	29 46	26 30 51	05	08
	ξ Aquarii	32 37 94	22	15	13	13	02	37 55	32 38 69	14	01
	ε Pegasi.	39 28 08	18	27	13	18	02	27 56	39 28 64	08	05
	δ Capricorni	41 44 09	23	09	13	19	02	43 69	41 44 72	03	10
	γ Gruis.	48 06 45	29	10	16	24	02	05 86	48 07 10	24	11

a = +·437   c = +·129
Chronometer correction at 21h 12m = 1s·132 ± ·015

Clamp.	Star.	Transit over mean thread.	Level (equivalent pivots).	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of [illegible] transit.	R. A.	Chronometer correction.	v
W	κ Piscium	23 22 01 24	13	25	10	29	02	01 23	23 22 01 20	00 03	03
	ι Phoenicis	29 54 97	19	19	13	25	02	55 32	29 55 14	18	12
	ι Piscium	35 04 50	12	28	10	20	02	01 38	35 01 30	08	02
	δ Sculptoris	43 55 99	17	01	11	15	02	56 07	43 56 07	06	00
	ω Piscium.	54 23 76	12	29	10	08	02	23 51	54 22 48	03	03
	2 Ceti	58 49 91	15	09	10	05	02	49 80	58 49 79	01	05
	γ Pegasi	24 08 18 51	14	41	10	01	02	18 09	24 08 18 23	14	29
E	β Hydri.	20 43 77	48	1 85	46	09	09	45 46	20 45 45	01	05
	12 Ceti.	25 09 34	14	21	10	13	02	09 02	25 08 90	12	06
	ε Andromedae	33 30 59	10	49	11	18	02	29 89	33 29 85	14	02
	β Ceti	38 47 04	16	09	10	21	02	46 77	38 46 72	05	01
	δ Piscium	43 43 28	43	30	10	25	02	42 74	43 42 65	09	03
	20 Ceti	48 07 24	14	23	10	28	02	06 75	48 06 61	14	08
	μ Andromedae.	51 27 52	08	60	12	29	02	26 57	51 26 56	01	05

a = +·513   c = +·097
Chronometer correction at 24h 06m = +·056 ± ·015

TRANSIT OBSERVATIONS.

Station : SOUTHPORT. Date, September 30th, 1903. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 17	s.		h. m. s.	s.	s.
E	β Pavonis..	20 36 27 98	04	·68	·17	26	05	28 74	20 36 18 16	10 28	04
	ε Cygni	42 30 80	01	46	08	21	02	30 46	42 20 15	31	01
	α Aquarii	47 38 93	02	14	07	17	02	38 89	47 28 54	35	03
	ι Piscis Aust ..	55 34 45	03	04	08	11	02	31 53	55 24 14	39	07
	ν Aquarii . .	21 04 32 39	02	12	07	01	02	32·21	21 04 21 92	32	00
	ζ Cygni. .	09 02 45	02	12	08	00	02	01 95	08 54 63	32	00
W	γ Pavonis.. .	18 40 77	36	65	16	·07	05	41 10	18 30 78	32	00
	ζ Capricorni ..	21 21 87	20	04	07	09	02	21 59	21 11 27	32	00
	β Aquarii ...	26 11 21	17	16	07	13	02	40 80	26 30 50	·30	02
	ξ Aquarii .	32 49 50	17	15	07	18	·02	19 05	32 38 68	37	05
	ε Pegasi	39 35 51	15	27	07	24	02	38 90	39 28 63	27	05
	δ Capricorni ...	44 55 48	19	09	07	26	02	54 99	44 44 71	·28	04

a · 436 c · 067

Chronometer correction at 21h 09m 10s·319 · 008

TRANSIT OBSERVATIONS.

Station : SOUTHPORT. Date, October 1st, 1903. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 53	s.	s.	h. m. s.	s.	s.
E	ψ² Aquarii. .	23 04 43 82	03	·05	15	·40	02	43 97	23 04 20 06	23 91	·02
	γ Toucani ..	12 13 84	05	40	·26	31	04	11 17	14 50 31	86	·03
	τ Pegasi	16 18·02	02	35	15	28	02	17 76	15 53·91	85	01
	κ Piscium. ...	22 25 22	03	20	·14	24	·02	25 07	22 01 20	87	·02
	ι Phœnicis. ...	30 19 04	·04	15	19	17	03	19 10	29 55 13	·97	08
	ι Piscium ..	35 25 43	03	22	14	12	02	25 14	35 01 32	·82	·07
	δ Sculptoris....	44 26 03	03	00	·46	·04	02	19 86	43 55 96	90	·01
W	ω Piscium . .	54 47 52	04	23	14	04	·02	47 38	54 23 49	·89	00
	γ Pegasi.. ..	24 08 42 45	01	·29	44	15	02	42 11	24 08 18 24	90	01
	ι Ceti	14 56 78	01	13	·44	22	02	56 56	14 32 68	·88	·04
	β Hydri	21 07 52	03	1 48	65	28	02	09 31	20 45 43	88	04
	12 Ceti . .	25 33 21	01	16	14	31	02	32·87	25 08 90	97	08
	ε Andromedæ.	33 54 36	01	39	46	40	02	53 72	33 29 86	86	03

a · 409 c · 137

Chronometer correction at 23h 19m 23s 8·0 · 009

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 2nd, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
						r ·596					
E	μ Aquarii......	20 48 03 00	01	15	16	·37	02	03 03	20 47 28 51	34 52	08
	32 Vulpeculæ.	51 13 22	00	45	·18	·34	02	02 91	50 28 54	37	07
	ι Piscis Aust..	55 58 45	01	05	19	·30	02	58 58	55 24·11	17	03
	θ Capricorni	21 01 07 50	01	09	16	·24	02	07 46	21 00 33 04	42	02
	ν Aquarii	04 56 49	·04	14	16	·21	02	56 37	04 21 89	48	04
	γ Pavonis....	19 01 78	02	73	38	·06	05	05·12	18 30 70	42	02
W	β Aquarii ..	27 05·35	32	48	·16	·02	02	04 97	26 30·48	49	05
	ε Pegasi	40 03·46	19	·30	·16	·15	02	02 96	39 28·60	36	08
	δ Capricorni .	42 19 53	25	10	·16	·17	02	19 15	41 44 69	46	02
	α Aquarii	22 01 26 61	22	·22	·16	·36	02	25 95	22 00 51 50	45	01
	α Gruis ..	02 45·92	35	·24	23	·37	·03	45 54	02 11 25	44	00

a ·484 c ·456
Chronometer correction at 21h 25m 34·442 ·012

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	α Pegasi. .	23 00 34·96	05	·30	07	·54	02	35·30	22 59 59 36	35 94	·01
	ε² Aquarii	04 55 47	07	05	07	·50	·02	56 04	23 04 20 06	98	03
	τ Pegasi	16 29 73	·04	36	08	·38	02	29 85	15 53 91	94	01
	κ Piscium.	22 36 87	06	20	·07	·32	02	37 10	22 01 19	91	04
	ι Phœnicis	30 30 60	·16	16	09	·24	03	31 16	29 55 13	36 03	08
	ι Piscium	35 37 14	06	23	07	·19	02	37 21	35 01·30	35 94	04
	δ Sculptoris. ..	44 31 70	07	00	08	·10	02	31 93	43 56 01	92	03
E	α Andromedæ. .	24 04 02 98	06	40	08	·40	02	02 44	21 03 26 44	36 00	05
	ι Ceti..	15 08 99	09	14	07	·21	02	08 61	14 32 68	35 96	01
	β Hydri..	21 20·24	29	1 53	33	·27	09	21·37	20 45 44	93	·02
	12 Ceti	25 45 35	09	17	07	·31	02	44 87	25 08 90	97	02
	ε Andromedæ...	34 06·62	06	40	08	·40	02	05 78	33 29 87	91	04
	δ Piscium	44 19·39	·08	·25	07	·50	02	48 63	43 42 67	96	01
	20 Ceti.. .. .	48 43·31	09	19	07	·54	02	42 58	48 06 63	95	00

a ·424 c ·369
Chronometer correction at 23h 54m 35·952 ·007

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 3rd, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 49	s.		h. m. s.	s.	s.
E	α Pavonis......	20 18 49·96	·67	·70	·25	−·34	04	50·38	20 17 62·78	47·60	01
	α Indi	31 36·00	·06	17	·20	+·23	03	36·23	30 48·50	73	·12
	α Delphini......	35 58·67	03	21	14	·20	02	58·50	35 10·87	63	·02
	ε Cygni	43 08·01	03	36	16	·14	03	07·63	42 20·09	54	·07
	θ Capricorni....	21 01 20·73	·05	06	14	·01	02	20·55	21 00 33·03	52	·09
	ν Aquarii	05 09·73	04	·10	·14	·04	·02	09·47	04 21·88	59	02
W	γ Pavonis	19 17·62	67	50	·33	·15	05	18·18	18 30·67	51	10
	ζ Capricorni ...	21 58·97	01	·03	−·15	·17	02	58·86	21 11·23	63	·02
	β Aquarii......	27 18·34	03	·12	·14	·21	02	18·10	26 30·46	64	03
	ξ Aquarii ..	33 26·65	04	12	14	·27	·02	26·34	32 38·65	69	08
	ε Pegasi	40 16·71	03	·21	14	·32	·02	16·27	39 28·59	68	07
	δ Capricorni	42 32·65	04	07	14	·34	02	32·32	41 41·68	·64	03

a = −·310 c = +·136
Chronometer correction at 21h 00m 47·615 ±·015

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	σ Aquarii......	22 26 22·71	·01	13	·11	·37	02	23·00	22 25 34·32	48·68	00
	η Aquarii	31 14·31	·01	20	·11	−·33	·02	14·19	30 25·79	·70	·02
	β Gruis	37 41·63	06	−22	16	·28	·03	15·20	36 56·47	·73	05
	η Pegasi......	39 19·82	03	·43	12	·26	·02	19·72	38 30·99	·73	05
	ε Gruis	43 33·77	·06	29	·17	·24	·03	34·38	42 45·78	60	·08
	α Pegasi.......	23 00 48·17	03	31	·11	·09	02	48·01	59 59·36	·65	·03
E	γ Toucani ...	12 38·54	33	43	21	·01	·04	39·04	23 11 50·29	75	·07
	κ Piscium......	22 50·12	17	21	11	·09	02	49·86	22 01·19	67	·01
	ι Piscium......	35 50·35	·17	·24	11	·20	02	49·95	35 01·30	65	03
	δ Sculptoris.....	44 44·81	21	·00	·12	·27	·02	44·61	43 56·01	·60	08
	φ Pegasi	48 26·31	−·14	34	11	·30	02	25·68	47 36·98	70	02
	ω Piscium	55 12·71	·16	25	11	·37	02	12·12	54 23·48	61	04

a = +·139 c = +·108
Chronometer correction at 23h 11m 48·676 ±·012

TRANSIT OBSERVATIONS.

Station : SOUTHPORT. Date, October 6th, 1903. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s. r	s. 10	s.		h. m. s.	m. s.	s.
E	θ Aquilae	20 07 40 87	00	15	10	19	·02	40 79	20 06 20 84	1 19 95	− 01
	α² Capricorni ..	14 03 39	00	·09	10	15	02	03 33	12 43 10	·93	01
	β Capricorni ...	16 56 03	00	08	10	13	02	56 62	15 36 76	86	08
	α Pavonis ..	19 22 45	00	·29	18	11	04	22 63	18 02 69	94	00
	ρ Capricorni ..	24 42 83	00	06	10	08	02	42 73	23 22·83	·90	04
	ε Delphini.. .	29 57 81	00	·21	10	·05	02	57·53	28 37·58	95	− 01
	α Indi	32 08 42	00	− ·16	15	·03	03	08 43	30 48 43	20 00	06
W	β Pavonis ..	37 37 79	·39	·51	25	01	05	38 10	36 48 20	19 90	04
	ε Cygni	43 40 39	·11	·35	12	05	02	39 98	12 20 03	95	− 01
	μ Aquarii ...	48 48 79	·19	11	− 10	08	02	48 49	47 28 45	20 04	− 00
	32 Vulpeculae	51 48 85	13	31	11	10	02	48 40	50 28·48	19 92	02
	4 Piscis Aust....	56 44 26	24	03	12	13	02	41 02	55 24 04	98	− 04
	θ Capricorni	21 01 53·22	·21	06	10	17	02	52 86	21 00 32·99	87	07
	ν Aquarii	05 42 22	20	09	10	19	02	41 82	04 21 84	98	04

a = · 330 c = · 009
Chronometer correction at 20h 36m = 1m 19s 942 ± 010

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	α Piscis Aust ..	22 53 42 04	13	01	10	·29	·02	12 29	22 52 21 09	1 21 20	05
	α Pegasi ..	23 01 20·47	09	25	− 09	− 21	02	20 44	59 59 34	10	05
	γ Toucani	13 10·97	19	− ·35	16	− ·16	·04	11·41	23 11 50 26	15	00
	τ Pegasi	17 15·16	08	·30	09	13	·02	14 98	15 53·90	08	07
	κ Piscium	23 22 42	10	17	08	·09	·02	22·30	22 01 18	12	03
	ι Phoenicis . . .	31 16·22	15	13	− ·11	− ·04	03	16·32	29 55 11	21	06
	ι Piscium	36 22 62	10	20	− ·08	− 01	02	22 39	35 01 29	10	05
E	δ Sculptoris	45 17 12	11	00	09	05	02	17 10	13 56 00	10	05
	ω Piscium	55 44 98	10	29	08	·12	02	44 66	54 23·50	·16	− 01
	2 Ceti	24 00 41·16	− 13	·06	·09	·15	02	40·97	58 49 80	17	− 02
	α Andromedae ..	04 48 23	− 08	34	09	18	02	47 68	24 03 26·45	·23	− 08
	γ Pegasi	09 39 86	− 09	25	·09	21	02	39 38	08 18 24	·11	01
	ι Ceti	15 51 21	− 12	11	08	25	02	53 87	14 32·69	18	03
	β Hydri	22 05 68	·37	± 1·28	39	29	·09	06 56	29 45·43	13	02

a = + ·355 c = + ·083
Chronometer correction at 23h 37m = 1m 21s 148 ± 009

TRANSIT OBSERVATIONS.

Station : SOUTHPORT. Date, October 7th, 1903. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r = ·35	s.		h. m. s.	m. s.	s.
E	ξ Aquarii	21 34 09·63	−·17	·13	·08	+·26	·02	09·83	21 32 38·60	1 31·23	−·02
	ε Pegasi	40 59·74	·14	·23	·08	+·22	·02	59·77	39 28·54	·23	−·02
	δ Capricorni	43 15·61	·18	·08	·08	+·20	·02	15·81	41 41·63	·18	·03
	γ Gruis	49 37·87	·22	·08	·10	+·17	·03	38·21	48 06·97	·24	·03
	α Aquarii	22 02 22·71	·16	·17	·08	+·09	·02	22·69	22 00 51·15	·24	−·03
	ι Pegasi	04 01·72	−·12	·33	·08	+·08	·02	04·29	02 33·14	·15	·06
W	η Pegasi	40 02·65	·07	·36	·09	·13	·02	02·16	38 30·96	·20	·01
	ε Gruis	44 16·85	·16	·24	−·12	·15	·03	16·87	42 45·72	·15	·06
	μ Pegasi	46 54·66	·07	·32	·08	·16	·02	54·17	45 22·90	·27	−·06
	λ Aquarii	49 08·27	·10	·13	+·08	·18	·02	07·92	47 36·71	·18	·03
	δ Aquarii	51 05·19	·11	·08	−·08	·19	·02	01·87	49 33·65	·22	−·01
	α Piscis Aust.	53 52·67	·13	−·01	−·09	·20	·02	52·35	52 21·08	·27	−·06
	α Pegasi	23 01 31·07	·08	·26	+·08	·26	·02	30·53	59 59·34	·19	·02

a = ... 372 c = ... 077

Chronometer correction at 22h 18m 1m 31·215 ± ·010

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	δ Sculptoris	23 45 27·83	·16	·00	+·18	·20	·02	28·03	23 43 55·95	1 32·08	·08
	φ Pegasi	49 09·09	·10	·35	−·16	−·17	·02	08·95	47 36·98	31·97	·03
	ω Piscium	55 55·63	·11	·26	+·16	−·14	·02	55·54	54 23·50	32·04	·04
	2 Ceti	24 00 21·82	·14	·08	+·16	−·11	·02	21·85	58 49·80	32·05	·05
	α Andromedæ	04 58·68	−·08	·43	+·18	+·09	·02	58·42	24 03 26·45	31·97	·03
	γ Pegasi	09 50·42	·10	·32	+·16	−·06	·02	50·20	08 18·25	31·95	·05
	ζ Toucani	16 36·79	·27	−·66	·37	+·02	·05	37·52	15 05·55	31·97	·03
E	β Hydri	22 16·05	−·58	+1·61	·73	·02	·09	17·43	20 45·42	32·01	−·01
	12 Ceti	26 41·17	−·17	·18	·15	·04	·02	40·95	25 08·93	32·02	−·02
	ε Andromedæ	35 02·37	−·12	·43	·18	·09	·02	01·77	33 29·89	31·88	·12
	β Ceti	40 18·97	−·20	·08	·16	·12	·02	18·79	38 46·76	32·03	−·03
	δ Piscium	45 15·23	·14	·26	·16	·15	·02	11·78	43 42·70	32·08	−·08
	20 Ceti	49 39·09	·17	·20	·15	·18	·02	38·71	48 06·65	32·06	−·06
	μ Andromedæ	52 59·45	−·10	·52	·20	·20	·03	58·60	51 26·63	31·97	·03

a = ... 455 c = ... 155

Chronometer correction at 24h 19m 1m 32·005 ± ·012

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 8th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	β Pavonis	20 37 59 55	27	59	27	50					
	ε Cygni.. ...	41 02 43	08	·10	13	35	05	60 44	20 36 18 11	1 12 33	03
	μ Aquarii.	49 10 58	13	12	11	30	12	02 26	12 19 90	27	03
	32 Vulpeculae....	52 10 88	·09	35	12	26	02	10 72	17 28 42	30	00
	ι Piscis Aust...	57 06 03	16	04	13	23	02	10 71	50 28 44	27	03
	θ Capricorni....	21 02 15 16	15	07	11	19	02	06 27	55 24·01	26	04
	ν Aquarii	06 04 07	11	11	11	15	02	15 26	21 00 32 96	·30	00
						12	02	01 09	04 21 81	28	02
W	γ Pavonis	20 12 25	31	57	-26						
	ζ Capricorni....	22 53 66	17	04	-12	00	05	12 72	18 30 49	23	·07
	β Aquarii	28 12 99	15	14	-11	02	02	53 53	21 11 19	34	04
	ξ Aquarii	31 21 17	15	13	-11	07	02	12 72	26 30 40	32	02
	ε Pegasi	41 11 28	13	21	-11	12	02	20 86	32 38 58	28	02
	γ Gruis.	49 49·57	20	-08	-·13	17	02	10 83	39 29 53	30	00
	α Aquarii	22 02 34·32	14	·17	11	21	03	19 31	18 06 96	35	05
						35	02	33·75	22 00 51 14	31	01

a = -·380 c = -·106
Chronometer correction at 21h 20m = 1m 12s·296 ± ·007

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
W	α Toucani ..	22 13 38 20	21	14	-22						
	η Pegasi ..	40 14·21	07	38	13	49	01	39 10	22 11 55·80	1 13 30	·08
	α Pegasi	47 06 21	08	31	12	27	02	14 17	38 30 95	22	·00
	λ Aquarii.	49 19 92	11	13	11	21	02	06 10	45 22 90	20	02
	δ Aquarii.... ..	51 16 81	12	08	11	19	02	19 96	47 36 73	23	-·01
	α Piscis Aust...	54 01 21	14	02	13	17	02	16 87	49 33 64	23	-01
	α Pegasi	23 01 42 76	09	27	11	15	02	01 35	52 21 07	28	06
						09	2	42·58	59 59 33	25	13
E	γ Toucani	13 32 90	35	-32	21						
	ι Piscium	36 44 91	17	22	11	01	·01	33 38	23 11 50 24	14	08
	φ Pegasi	49 20 83	16	30	11	20	02	41 53	34 61 29	·24	·02
	ω Piscium ..	56 07 27	17	22	11	31	02	20 25	47 36·98	27	05
	? Ceti.........	24 00 33·35	22	07	11	37	02	06 72	54 23 19	23	01
	α Andromedae ..	05 10 47	13	37	12	·40	02	32 97	58 49 80	17	05
	γ Pegasi...	10 02 13	16	27	11	11	02	09 65	21 03 26 45	20	02
						·49	02	01 10	08 18 25	15	07

a = -·392 c = -·109
Chronometer correction at 23h 12m = 1m 13s·219 ± ·010

TRANSIT OBSERVATIONS.

Station: SOUTHPORT. Date, October 9th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r s. ·48	s.		h. m. s.	m. s.	s.
E	β Pavonis	20 38 11 49	31	60	27	29	05	12 37	20 36 18 09	1 54 28	06
	ε Cygni...	45 14 40	09	40	15	23	·02	14 17	42 19 97	20	02
	μ Aquarii ...	49 22 54	15	12	11	·20	02	22 61	47 28 44	20	02
	32 Vulpeculæ....	52 22 86	10	36	12	18	02	22 64	50 28 42	22	00
	ι Piscis Aust.	57 17 94	19	04	13	14	02	18 16	55 23 99	·17	05
	θ Capricorni ...	21 02 27 04	16	07	12	10	02	27 09	21 00 32 94	15	07
	ν Aquarii......	06 16 06	16	11	11	06	02	16 04	04 21 79	·25	03
W	γ Pavonis	20 24 15	34	58	27	05	05	24 59	18 30 45	·14	08
	ζ Capricorni	23 05 57	17	04	12	07	02	05 39	21 11 45	24	02
	β Aquarii......	28 24 88	15	15	11	11	02	24 56	26 30 39	17	05
	ξ Aquarii.	34 33 24	15	13	11	16	02	32 89	32 38 57	32	10
	ε Pegasi..	41 23 25	13	24	·11	22	02	22 75	39 28 52	2	01
	δ Capricorni ...	43 30 21	16	08	11	23	02	38 83	41 44 60	23	01
	γ Gruis	50 04 50	20	08	14	29	03	04 20	48 06 95	25	03

a = ·386 c = ·110

Chronometer correction at 21h 14m = 1m 54s·217 ± ·009

TRANSIT OBSERVATIONS.

Station: SOUTHPORT. Date, October 10th, 1903. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r s. ·50	s.		h. m. s.	m. s.	s.
E	β Pavonis	20 38 23·42	·30	56	36	·30	·05	24·17	20 36 18 06	2 06 11	01
	ε Cygni	44 25·29	·09	·38	17	·25	·02	26 06	42 19 95	11	01
	μ Aquarii	49 34 43	·15	·12	·14	21	02	34 51	47 28·40	11	01
	32 Vulpeculæ....	52 34 75	·10	34	16	18	02	34 51	50 28 40	11	01
	ι Piscis Aust..	57 29 90	·18	04	16	14	02	30 08	55 23 97	11	·01
	θ Capricorni .	21 02 38·95	·16	07	14	·10	·02	38 98	21 00 32 93	05	05
	ν Aquarii	06 27 92	·15	10	14	06	02	27 87	04 21 78	09	01
W	γ Pavonis	20 35·98	27	·54	34	05	05	36·49	18 30 41	08	02
	ζ Capricorni....	23 17·36	15	04	·15	07	02	17 23	21 11 14	09	04
	β Aquarii.	28 36 73	13	14	·14	12	02	36 46	26 30·38	08	02
	ξ Aquarii ..	34 41 96	13	·12	·14	17	·02	44·66	32 38 56	·10	00
	ε Pegasi.	41 35 07	11	·22	·14	·23	02	34·63	39 28 50	13	·03
	δ Capricorni ...	43 51 06	14	·08	·14	24	·02	50 67	41 44 59	08	02
	γ Gruis.	50 43 34	17	·08	·18	30	03	13 10	48 06·93	17	07

a = ·362 c = ·138

Chronometer correction at 21h 14m = 2m 06s·102 ± ·005

TRANSIT OBSERVATIONS.

Station : Sotithcote. Date, October 11th, 1903. Observer : Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	e.
		h. m. s.	s.	s.	s.	s. 44	s.		h. m. s.	m. s.	s.
E	ρ Capricorni...	20 25 39 44	00	06	11	23	02	39 57	20 23 22 74	2 16 83	04
	ι Delphini.....	30 54 39	07	23	11	19	02	54 29	28 37 50	79	00
	β Pavonis.	38 31 26	16	56	27	14	05	34 80	36 18 00	80	04
	ε Cygni.. .	41 37 09	05	38	13	10	02	36·71	42 19 92	79	00
	μ Aquarii	49 45 26	08	11	11	06	02	45 16	47 28 38	78	01
	32 Vulpeculae....	52 45 50	05	·33	12	04	02	45 12	50 28 38	74	05
	ι Piscis Aust	57 10 73	10	04	13	00	02	10 72	55 23 95	77	02
W	θ Capricorni. .	21 02 49 83	16	06	11	04	02	49 66	21 00 32 91	75	04
	ν Aquarii.	06 38 83	16	10	11	06	02	38 60	01 21 76	84	05
	ζ Cygni	11 08·70	10	35	12	11	02	08 24	08 51 41	80	01
	α Equulei. .	13 18 72	13	19	11	11	02	18 38	11 01 58	80	01
	γ Pavonis.	20 46 87	31	·54	26	16	05	47 15	18 30 37	78	01
	ζ Capricorni.. .	23 28 23	17	04	12	19	02	27 93	21 11 42	81	02
	β Aquarii. ..	28 47 57	15	14	11	23	02	47 14	26 30 36	78	01
		a ·357				c ·106					
		Chronometer correction at 20h 57m				2m 16s 780 ± 005					
W	ε Pegasi. ...	21 11 15·86	13	·49	09	34	02	45 95	21 39 28 49	2 17 46	01
	δ Capricorni ...	44 01 87	16	06	10	32	02	02 05	41 41 58	47	00
	γ Gruis ..	50 24 17	19	07	·12	28	03	24 42	48 06 91	51	04
	α Aquarii ..	22 03 08 94	14	14	09	19	02	08 89	22 00 51 41	48	01
	ι Pegasi. ...	04 50 62	10	26	10	17	02	50 51	02 33 09	42	05
	α Toucani. ...	14 12 86	26	33	19	·10	04	13·18	11 57 72	46	01
E	ε Gruis	45 03 04	17	19	15	13	03	03 09	42 15 64	·15	02
	δ Aquarii. ..	51 51 28	12	06	10	16	02	51 06	49 33 62	44	03
	α Piscis Aust...	54 38 68	13	·01	11	18	02	38 51	52 21 04	47	·00
	α Pegasi. ..	23 02 17·29	08	21	10	25	02	16 79	59 59 31	48	01
	ν² Aquarii.	06 37·78	12	04	10	27	02	37 47	23 04 20 01	40	01
	γ Toucani.. .	14 07 73	19	30	·18	34	04	07·66	11 50 18	48	01

a = −·298   c = ·093.

Chronometer correction at 22h28m = 2m17s 466 ± 005

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 12th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	β Pavonis.	20 38 16 06	06	55	22	49	05	16 59	20 36 17 96	2 28 63	06
	ε Cygni	11 48 72	02	37	10	16	02	48 11	42 19 90	51	06
	α Aquarii	49 56 98	03	44	09	12	02	56 91	17 28·36	55	02
	32 Vulpeculae	52 57 17	02	33	10	41	02	56 85	50 28 36	19	08
	ι Piscis Aust.	57 52 49	01	01	·10	08	02	52 53	55 23 93	60	03
	θ Capricorni	21 03 01 50	03	07	09	01	02	04 39	21 00 32 89	50	07
	ν Aquarii	06 50 18	03	10	09	02	02	50 32	04 21·75	57	00
W	ζ Cygni	14 20 46	15	34	10	01	02	20 08	08 51 42	·66	09
	α Equulei	43 30 41	16	49	09	02	02	30 16	11 01 55	61	01
	γ Pavonis	20 58 53	37	53	24	06	05	58 79	18 30 33	16	14
	ζ Capricorni	23 39 92	20	01	09	08	02	39 67	24 11 10	57	00
	β Aquarii	28 59 27	47	43	·09	41	02	58 93	26 30 35	·58	·4
	ξ Aquarii	35 07 53	48	13	·09	45	02	07 11	32 38 53	·61	04
	ε Pegasi	44 57 56	45	22	09	19	02	57 07	39 28 48	·59	02

a = ·354 c = ·086

Chronometer correction at 21h 10m = 2m 28s·565 ± ·012

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	δ Capricorni	21 41 13·52	16	·06	06	25	02	13 59	21 41 44 56	2 29 03	02
	γ Gruis	50 35 89	49	06	·08	·21	03	36 02	4.. 06 89	13	·08
	α Aquarii	22 03 20·55	·44	·43	06	43	02	20 45	22 00 51·40	05	00
	ι Pegasi	05 02·31	10	·24	+ 07	12	·02	02 14	02 33·07	07	02
	α Toucani	14 24 51	·27	31	13	07	·04	24·71	..4 55·69	02	03
	γ Aquarii	19 11·36	44	·42	06	04	02	41 48	16 42·13	05	00
E	μ Pegasi	17 52 35	08	21	·07	13	02	54 97	45 22 86	·11	06
	λ Aquarii	50 05 92	11	·09	06	45	02	05 71	47 36·70	·04	01
	δ Aquarii	52 02 88	·42	06	06	16	02	02 70	49 33 64	·09	04
	α Piscis Aust.	54 50 16	·14	·01	07	47	·02	50 05	52 21 03	·02	03
	c² Aquarii	23 06 49 20	42	03	07	25	02	48·95	23 04 20·00	28·95	10
	γ Toucani	11 49 27	49	27	42	29	04	19 28	11 50 17	29 11	06

a = ·277 c = ·062

Chronometer correction at 22h 25m = 2m 29s·053 ± ·011

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 13th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r 38	s.		h. m. s.	m. s.	s.
E	ι Gruis	22 45 25 39	16	23	04	13	.03	25 84	22 42 15 57	2 40 27	04
	α Pegasi.	48 03 26	07	31	03	11	02	03 08	45 22 85	23	00
	λ Aquarii .	50 16 83	10	12	03	09	02	16 85	47 36 69	16	07
	δ Aquarii .	52 43 78	11	07	03	08	02	13 85	49 33 60	25	02
	α Piscis Aust	55 01 07	13	01	03	06	02	01 22	52 21 02	20	03
W	α Pegasi.	23 02 39 79	08	25	03	02	02	39 49	59 59 29	20	03
	ε² Aquarii	07 00 44	12	04	03	·01	02	00 25	23 04 19 99	26	03
	γ Toucani	14 30 24	19	35	05	05	04	30 36	11 50 45	21	02
	τ Pegasi .	18 34·58	08	30	03	08	02	34 13	15 53 86	27	04
	κ Piscium .	24 41 79	10	17	03	13	02	41 40	22 04 45	25	02

$a = ·355$ $c = ·025$

Chronometer correct 23h 06m 2m 40s·229 ·001

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 15th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r 44	s.		h. m. s.	m. s.	s.
E	γ Gruis	21 54 10 11	−04	−07	13	35	03	10 41	21 48 06 85	3 03 56	00
	α Toucani . . .	22 14 58 95	06	34	21	18	04	59 28	22 11 55 61	67	11
	γ Aquarii. . . .	19 45 73	−03	13	10	14	02	15 65	16 42 09	·56	00
	σ Aquarii. .	28 37 74	−01	09	10	07	·02	37 64	25 34 20	44	12
	η Aquarii.	33 29 43	03	14	10	04	02	29 46	30 25 68	48	08
W	α Piscis Aust . .	55 24 76	17	−01	12	·13	02	24 57	52 21 00	57	01
	α Pegasi	23 03 03 32	11	·21	−·10	19	02	02 89	59 59 28	64	05
	γ Toucani . . .	14 53 65	25	30	19	27	04	53 58	23 11 50 14	47	09
	τ Pegasi . . .	18 57 99	·10	26	11	30	02	57 42	15 53 84	58	02
	κ Piscium .	25 05 28	13	·15	10	35	02	04 73	22 01 07	66	10

$a = -·305$ $c = ·100$

Chronometer correction + 22h 38m 3m 03s·561 ·019

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 19th, 1905. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	45	s.		h. m. s.	m. s.	s.
E	ϑ Capricorni	20 18 50 73	17	09	11	27	0	95	20 15 56 62	3 14 33	02
	ρ Capricorni	26 36 79	17	7	12	24	02	36 96	23 22 65	31	00
	ε Delphini.	31 51 78	13	21	11	17	02	51·71	28 37 41	30	01
	ϑ Pavonis	39 31 36	33	59	28	12	05	32 07	36 17 73	34	03
	ε Cygni	45 34 45	9	40	13	07	02	34 06	42 19 82	24	07
	μ Aquarii.	50 42 68	16	12	11	03	02	42 62	47 28 30	32	01
	32 Vulpeculæ	53 42 92	11	35	12	01	02	42 55	50 28·29	26	05
W	θ Capricorni	21 03 47 37	16	07	12	07	02	47 17	21 00 32 83	34	03
	ν Aquarii.	07 36 32	16	11	11	10	·02	36 04	04 21 69	35	04
	ζ Cygni	12 06 15	10	37	13	14	02	05 65	08 51 34	31	00
	α Equulei	14 16 28	12	21	11	15	02	15 88	10 61 51	37	06
	γ Pavonis	21 44 11	31	57	27	20	05	44 39	18 30 16	24	08
	ζ Capricorni	24 25 71	17	04	12	23	02	25 37	21 11 04	33	02
	ϑ Aquarii.	29 45 10	15	14	11	27	02	44 63	26 30 29	34	03

a = ·384 c = ·110
Chronometer correction at 20h 51m = 3m 14s 311 ± 009

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	ξ Aquarii.	21 35 53 26	16	13	13	49	02	53 57	21 32 38 47	3 15 10	02
	ε Pegasi	42 43 41	13	21	13	15	·02	43 60	39 28 42	18	06
	δ Capricorni	44 59 31	17	08	13	43	02	59 60	41 44 50	10	02
	γ Gruis	51 21 62	21	09	16	38	03	22 01	18 06 84	17	05
	α Aquarii.	22 04 06·36	15	18	13	28	02	06 42	22 00 51 35	·07	05
	ι Pegasi	05 48 17	11	34	14	27	02	48 11	02 33 01	10	02
	α Toucani	1.. 10 15	29	43	26	20	01	10 71	11 55·58	13	01
E	c² Aquarii.	23 07 35 20	23	05	14	20	02	35 02	23 04 19·97	·05	07
	γ Toucani	15 05 02	36	38	24	25	04	05 23	11 50 10	13	01
	τ Pegasi	19 09 03	15	33	13	28	02	09 02	15 53·84	18	06
	κ Piscium	25 16 71	19	19	13	33	02	16 23	21 61·13	10	02
	ι Phœnicis	33 10 32	28	14	17	39	03	10·15	29 55 03	12	00
	ι Piscium	38 17 02	18	21	13	42	02	16 42	35 01 26	16	04
	δ Sculptoris	47 11 45	25	00	14	49	02	11 05	43 55 96	09	03

a = ·388 c = ·126
Chronometer correction at 22h 41m = 3m 15s 119 ± ·008

The following observations at Sydney, together with their reduction and clock corrections have been furnished by Mr. H. A. Lenehan, Acting Government Astronomer. The method of determining the level, azimuth and collimation errors there, has already been given under 'Sydney Observatory.'

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, September 29th, 1903. Observer: H. A. LENEHAN.

Star.	Transit over mean of threads.	Level and inequality pivots.	Azimuth.	Rate.	Seconds of corr. transit.	R. A.	Chronometer correction.
	h. m. s.	s.	s.				s.
ε Delphini	20 28 21 92	01	2 [illegible]		[illegible]	[illegible] 27 [illegible]	13 50
α Indi	20 30 56 64	02	1 [illegible]		[illegible] 48	[illegible] 48 [illegible]	13 42
ε Aquarii	20 42 13 98	01	[illegible]		[illegible] 28	[illegible] 28 [illegible]	[illegible] 35
α Aquarii	20 47 13 78	01	1 [illegible]		[illegible]	[illegible] 47 28 [illegible]	[illegible] 3[illegible]
32 Vulpeculae	20 50 11 8[illegible]	01	3 [illegible]		[illegible]	20 50 28 [illegible]	[illegible] 40
ι Piscis Aust	20 55 10 67	02	0 [illegible]	[illegible] every 24	[illegible]	[illegible] 24 16	13 38
							13 [illegible]

Chronometer correction at 20h 42m 13s 31

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, October 2nd, 19[illegible]. [illegible] A. [illegible] [illegible]MOND.

Star.	Transit over mean of threads.	Level and inequality pivots.	Azimuth.	Rate.	[illegible]	R. A.	Chronometer correction.
	h. m. s.	s.	s.			h. m. s.	s.
β Capricorni	20 15 58 88	01	1 14	Losing 1s 30 every 24 hours.	[illegible]	20 15 36 8[illegible]	16 82
α Pavonis	20 17 48 67	02	2 53		[illegible] 2	20 17 [illegible]	16 69
ε Delphini	20 28 18 21	01	2 48		[illegible] 68	20 28 37 [illegible]	16 96
α Indi	20 30 33 09	02	1·19		[illegible] 88	20 30 48 [illegible]	16 64
α Delphini	20 34 51 19	01	2 74		53 92	20 35 10 [illegible]	16 97
ε Aquarii	20 42 10 41	01	1 39		11 79	20 42 28 [illegible]	16 89
α Aquarii	20 47 10 25	01	1 44		11 68	20 47 28 [illegible]	16 83
θ Capricorni	21 00 15 09	01	0 98		16 06	21 00 3[illegible]	16 98
γ Pavonis	21 18 18 40	03	1 11		1[illegible] 93	21 18 30 70	16 77
β Aquarii	21 26 11 96	01	1 60		1[illegible] 5[illegible]	21 26 30 47	16 92
						Mean	16 85

Chronometer correction at 20h 44m 16s 85

TRANSIT OBSERVATIONS.

Station: Sydney. Date, October 3rd, 1903. Observer: W. E. Raymond.

Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Rate.	Seconds of transit.	R. A.	Chronometer correction.
	h. m. s.	s.	s.			h. m. s.	s.
α Aquarii	20 47 08 68	04	1 40	Losing 1s 01 every 24 hours.	10 10	20 47 28 50	18 40
32 Vulpeculae	20 50 06 57	03	3 43		9 07	20 50 28 53	18 56
ι Piscis Aust.	20 55 05 55	06	0 00		5 58	20 55 24 09	18 51
θ Capricorni	21 00 13 64	05	0 20		14 55	21 00 33 02	18 47
ι Capricorni	21 16 34 64	05	1 04		35 63	21 16 54 11	18 48
ζ Pavonis	21 18 46 87	10	4 47		12 30	21 18 30 67	18 37
κ Capricorni	21 20 52 09	05	0 73		52 77	21 21 11 24	18 47
β Aquarii	21 26 10 41	04	1 61		41 98	21 26 30 16	18 48
ξ Aquarii	21 32 18 72	04	1 51		90 19	21 32 38 64	18 45
ε Pegasi	21 39 07 05	04	2 39		10 01	21 39 28 59	18 58
δ Capricorni	21 41 25 18	05	1 04		26 17	21 41 44 06	18 49
γ Gruis	21 47 48 85	06	0 31		48 48	21 48 07 04	18 56
						Mean.	18 49

Chronometer correction at 21h 21m 18s 49

TRANSIT OBSERVATIONS.

Station: Sydney. Date, October 6th, 1903. Observer: H. A. Lenehan.

Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Rate.	Seconds of transit.	R. A.	Chronometer correction.
	h. m. s.	s.	s.			h. m. s.	s.
β[1] Scorpii	15 59 27 08	08	0 88	Losing 1s 18 per day.	27 88	15 59 49 61	21·73
δ Ophiuchi	16 08 53 81	06	1·75		55 50	16 09 17 34	21 84
α Scorpii	16 23 07 43	08	0 52		7 87	16 23 29 66	21 79
α Triang. Aust.	16 38 10 66	17	5 16		5 63	16 38 26 88	21 85
ε Scorpii	16 43 33 50	00	0 02		33 39	16 43 55 10	21 71
η Ophiuchi	17 04 28 11	07	1 08		29 12	17 04 51 00	21 88
						Mean.....	21·80

Chronometer correction at 16h 29m 21s 80

α Aquarii	20 47 05 08	07	1 44	Losing 1s 32 per day.	6 45	20 47 28 45	22 00
32 Vulpeculae	20 50 02 98	04	3 40		6 34	20 50 28 47	22·13
ι Piscis Aust.	20 55 02 04	09	0 00		2 04	20 55 24 04	22 00
β Aquarii	21 26 06 81	07	1 66		8 34	21 26 30·43	22·09
γ Gruis	21 47 45 33	09	0 30		44 94	21 48 07 00	22 06
α Aquarii	22 00 27 56	06	1 86		29 36	22 00 51 46	22 10
ε Pegasi	22 02 07 87	04	3 25		11 02	22 02 33 15	22 13
						Mean....	22 07

Chronometer correction at 21h 24m 22s 07

TRANSIT OBSERVATIONS.

Station: Sydney. Date, October 7th, 1903. Observer, W. F. Raymond.

Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Rate.	Seconds of corr. transit.	R. A.	Chronometer correction.
	h. m. s.	s.	s.			h. m. s.	s.
ι Piscis Aust.	20 55 00 49	06	09	Losing 1·43 per day.	0 52	20 55 24 03	23 54
θ Capricorni	21 00 08 56	05	98		9 19	21 00 32 47	23 48
ι Capricorni	21 16 29 61	05	1 01		30 00	21 16 54 06	23 46
ζ Capricorni	21 20 47 06	06	73		17 73	21 21 11 18	23 45
β Aquarii	21 26 05 34	05	1 60		6 80	21 26 30 41	23 52
ξ Aquarii	21 32 13 64	05	1 50		15 00	21 32 38 50	23 50
ε Pegasi	21 39 02 65	04	2 38		1 09	21 39 28 54	23 55
δ Capricorni	21 41 20 12	05	1 04		21 11	21 41 44 62	23 51
α Aquarii	22 00 26 08	05	1 86		27 89	22 00 51 45	23 56
ι Pegasi	22 02 06 28	03	3 26		9 51	22 02 31 14	23 63
θ Aquarii	22 25 09 48	05	1 35		10 78	22 25 34 20	23 51
η Aquarii	22 30 00 19	05	1 86		2 30	22 30 25 76	23 46
						Mean	23 51

Chronometer correction at 21h 30m 23s 51

TRANSIT OBSERVATIONS.

Station: Sydney. Date, October 8th, 1903. Observer, W. F. Raymond.

Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Rate.	Seconds of corr. transit.	R. A.	Chronometer correction.
	h. m. s.	s.	s.			h. m. s.	s.
ε Aquarii	20 42 02 42	06	1 38	Losing 1·32 per day.	3 71	20 42 28 60	24 86
μ Aquarii	20 47 02 29	06	1 13		3 66	20 47 28 42	24 76
32 Vulpeculae	20 50 00 27	04	3 37		3 60	20 50 28 44	24 84
ι Piscis Aust.	20 54 59 23	08	0 10		59 21	20 55 21 01	24 77
θ Capricorni	21 00 07 22	07	0 27		8 12	21 00 32 98	24 84
ι Capricorni	21 16 28 34	07	1 02		29 29	21 16 54 04	24 75
ζ Capricorni	21 20 45 76	07	0 71		46 10	21 21 11 16	24 76
β Aquarii	21 26 04 06	06	1 58		5 58	21 26 30 46	24 82
ξ Aquarii	21 32 12 36	06	1 48		13 78	21 32 38 58	24 80
ε Pegasi	21 39 01 35	05	2 35		3 65	21 39 28 53	24 88
δ Capricorni	21 41 18 84	07	1 02		19 79	21 41 44 61	24 82
γ Gruis	21 47 42 57	08	0 30		42 39	21 48 06 97	24 78
α Aquarii	22 00 21 75	06	1 84		26 53	22 00 51 44	24 91
σ Aquarii	22 25 08 11	06	1 33		9 38	22 25 31 28	24 90
						Mean	24 82

Chronometer correction at 21h 23m 24s 82.

The following observations on November 5, January 22 and 23, were made for determining the differential personal equation between H. A. Lenehan, W. E. Raymond and Otto Klotz. The first two were the observers at Sydney during the longitude campaign, while the last was at Southport:—

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, November 5th, 1903. Observer: W. E. RAYMOND.

Star.	Corrected transit over mean of threads. h.	m.	s.	R. A. h.	m.	s.	Chronometer correction. s.
β Aquarii	21	32	35·22	21	32	38·18	2·96
ε Pegasi	21	39	25·15	21	39	28·12	2·97
δ Capricorni	21	41	41·29	21	41	44·20	2·91
16 Pegasi	21	48	38·76	21	48	41·75	2·99
α Aquarii	22	00	48·17	22	00	51·07	2·90
ι Pegasi	22	02	29·74	22	02	32·70	2·96
ε² Aquarii	23	04	16·87	23	04	19·74	2·87
ε Piscium	0	57	55·42	0	57	58·30	2·88
ζ¹ Piscium	1	08	40·64	1	08	43·61	2·97
				Mean			2·934

Chronometer correction at 23h 25m = 2s·934 ± ·010

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, November 5th, 1903. Observer: OTTO KLOTZ.

Star.	Corrected transit over mean of threads. h.	m.	s.	R. A. h.	m.	s.	Chronometer correction s.
γ Piscium	23	12	08·79	23	12	11·57	2·78
τ Pegasi	23	15	50·90	23	15	53·64	2·74
κ Piscium	23	21	58·11	23	21	60·97	2·86
ι Phoenicis	23	29	52·08	23	29	54·76	2·68
ι Piscium	23	34	58·30	23	34	61·11	2·81
27 Piscium	23	53	43·09	23	53	45·89	2·80
2 Ceti	23	58	46·86	23	58	49·65	2·79
α Andromedae	0	03	23·49	0	03	26·32	2·83
γ Pegasi	0	08	15·24	0	08	18·16	2·92
ι Ceti	0	14	29·89	0	14	32·60	2·71
44 Piscium	0	20	26·51	0	20	29·41	2·90
12 Ceti	0	25	05·95	0	25	08·87	2·92
ε Andromedae	0	33	27·01	0	33	29·86	2·85
				Mean			2·815

Chronometer correction at 23h 25m = + 2s·815 ± ·015

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, November 5th, 1903. Observer: H. A. LENEHAN.

Star	Corrected transit over mean of threads.	R.A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
σ Aquarii	22 25 31·04	22 25 33·95	2·91
η Aquarii	22 30 22·55	22 30 25·45	2·90
ζ Pegasi	22 36 37·66	22 36 40·62	2·96
η Pegasi	22 38 27·70	22 38 30·59	2·89
μ Pegasi	22 45 19·76	22 45 22·58	2·82
λ Aquarii	22 47 33·61	22 47 36·45	2·81
α Sculptoris	0 53 56·47	0 53 59·28	2·81
β Phoenicis	1 03 45·90	1 04 48·58	2·68
θ Ceti	1 19 41·35	1 19 44·11	2·76
		Mean	2·841

Chronometer correction at $23^h 25^m$ $2^s·841 \pm ·019$

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 22nd, 1904. Observer: W. E. RAYMOND.

Star.	Corrected transit over mean of threads.	R.A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
δ Eridani	3 38 08·37	3 38 39·67	31·30
α Tauri	4 29 54·66	4 30 25·89	31·23
53 Eridani	4 33 16·85	4 33 48·00	31·15
π^1 Orionis	4 41 07·61	4 44 38·87	31·26
α Leporis	5 27 59·87	5 28 34·04	31·17
β Canis Majorum	6 47 58·51	6 18 29·82	31·31
ε Geminoris	6 37 32·11	6 38 03·24	31·13
		Mean	31·221

Chronometer correction at $5^h 32^m$ $31^s·221 \pm ·018$

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 22nd, 1904. Observer: H. A. LENEHAN.

Star.	Corrected transit over mean of threads.	R.A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
τ Tauri	4 35 59·13	4 36 30·24	31·11
β Orionis	5 09 25·49	5 09 56·68	31·19
δ Orionis	5 26 36·23	5 27 07·42	31·19
α Columbae	5 35 40·58	5 36 11·81	31·23
ζ Canis Majoris	6 16 08·08	6 16 39·23	31·15
γ Geminorum	6 31 40·34	6 32 11·56	31·22
		Mean	31·182

Chronometer correction at $5^h 32^m$ $31^s·182 \pm ·012$

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 22nd, 1904. Observer: OTTO KLOTZ.

Star.	Corrected transit over mean of threads.	R. A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
μ Eridani	4 40 11·99	4 40 43·23	+31·24
ε Leporis	5 00 53·88	5 01 25·01	31·13
γ Orionis	5 19 28·90	5 19 60·22	31·32
ε Orionis	5 30 50·54	5 31 21·84	31·30
η Geminorum	6 08 35·40	6 09 06·56	31·16
ν Geminorum	6 22 46·16	6 23 17·37	31·21
ξ Geminorum	6 39 24·43	6 39 55·65	31·22
		Mean	31·226

Chronometer correction at 5^h 32^m = $+31^s·226$ ± ·017

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 23rd, 1904. Observer: W. E. RAYMOND.

Star.	Corrected transit over mean of threads.	R. A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
γ¹ Eridani	3 53 01·26	3 53 33·80	+32·54
τ Tauri	4 35 57·74	4 36 30·23	32·49
ε Leporis	5 00 52·32	5 01 25·00	32·68
δ Orionis	5 26 34·66	5 27 07·41	32·75
κ Orionis	5 42 10·91	5 43 13·56	32·65
β Canis Majoris	6 17 57·12	6 18 29·81	32·69
		Mean	32·633

Chronometer correction at 5^h 20^m = $+32^s·633$ ± ·027

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 23rd, 1904. Observer: H. A. LENEHAN.

Star.	Corrected transit over mean of threads.	R. A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
ο¹ Eridani	4 06 39·21	4 07 11·64	32·43
μ Eridani	4 40 10·70	4 40 43·22	32·52
β Orionis	5 09 24·04	5 09 56·67	32·63
ε Orionis	5 30 49·19	5 31 21·83	32·64
η Geminorum	6 08 33·94	6 09 06·55	32·61
ν Geminorum	6 22 44·72	6 23 17·37	32·65
		Mean	32·580

Chronometer correction at 5^h 20^m = $+32^s·580$ ± ·024

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: SYDNEY. Date, January 23rd, 1904. Observer: OTTO KLOTZ.

Star.	Corrected transit over mean of threads.	R. A.	Chronometer correction.
	h. m. s.	h. m. s.	s.
53 Eridani	1 33 15·49	4 33 47·99	32·50
π^4 Orionis	4 44 06·28	4 41 38·86	32·58
γ Orionis	5 19 27·60	5 19 60·22	32·62
α Columbae	5 35 39·12	5 36 11·80	32·68
ζ Canis Majoris	6 16 06·60	6 16 39·22	32·62
γ Geminorum	6 31 38·87	6 32 11·56	32·69
		Mean	32·615

Chronometer correction at $5^h\ 20^m$ 32s·615 ± ·019

PERSONAL EQUATION.

CLOCK CORRECTION.

Date.	Klotz.		Lenehan.		Raymond.		K–L		K–R	
	s.	s.	s.	s.	s.	s.	s.		s.	
Nov. 5, 1903	+ 2·815	·015	2·841	·019	2·934	·010	·026		·119	
Jan. 22, 1904	31·226	·017	31·482	·012	31·221	·018	·044		·005	
" 23, 1904	32·615	·019	32·580	·024	32·633	·027	·035		·018	
Weighted							·048	·015	·067	·027

That is, Klotz anticipates Lenehan, and Raymond anticipates Klotz.

TRANSIT OBSERVATIONS.

Station: BRISBANE. Date, September 29th, 1903. Observer: THOS. D. FRASER.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r + 01	s.		h. m. s.	s.	s.
E	δ Pavonis	19 58 33 55	·02	04	1 16	01	05	32 39	19 59 17 93	+ 15·54	17
	α² Capricorni	20 11 58 09	·02	01	48	01	02	57·59	20 12 43 52	·93	22
	β Capricorni	14 51 55	02	01	48	·01	02	51 05	15 36 88	83	12
	γ Cygni	18 02 16	01	03	60	·01	02	01 87	18 47 56	69	02
	ρ Capricorni	22 37 70	02	00	49	00	02	37·21	23 22 95	74	03
	α Delphini	31 25·75	·01	02	·48	00	·02	25 24	35 10 93	·69	02
	ε Aquarii	41 13 43	·02	01	47	·00	·02	42 95	42 28 73	·78	07
W	θ Capricorni	59 47 05	·02	00	·49	00	02	47 50	21 00 33 08	·58	13
	ζ Cygni	21 08 05 56	·01	02	- ·53	00	02	06 04	08 51 65	·61	10
	γ Pavonis	17 43·89	05	04	1 13	00	05	44 96	18 30 81	85	11
	ζ Capricorni	20 25·05	02	00	50	01	02	25 52	21 11 28	76	·05
	β Aquarii	25 41 47	·02	01	·47	·01	02	44 90	26 30 51	61	·10
	ξ Aquarii	31 52 57	02	·01	17	01	02	53 00	32 38 69	69	- 02
	δ Capricorni	40 58 62	02	00	48	·04	02	59 07	41 44 72	·65	- 06

a = ·024 c = ·462

Chronometer correction at 20ʰ 50ᵐ = 45ˢ 715 ± ·022

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	σ Aquarii	22 24 48 31	·10	02	- ·47	·01	02	48·63	22 25 34 35	+ 45 72	02
	η Aquarii	29 39 76	·09	01	·46	·00	02	40 07	30 25 82	75	01
	ε Poisson	34 34 97	11	00	52	00	·02	35·36	35 21·07	71	03
	η Pegasi	37 44 98	08	·08	- ·53	00	02	45·33	38 31 03	70	04
	ε Gruis	41 59 49	- ·14	- ·06	- 75	·00	03	60 13	42 45·83	·70	04
	λ Aquarii	46 50 69	09	03	- ·46	00	·02	51 01	17 36 79	·78	04
	δ Aquarii	48 47 49	10	02	- ·48	00	02	47 83	49 33 70	·87	- ·13
E	α Pegasi	59 14 26	·01	·06	·47	00	02	13·70	59 59·38	·68	- 06
	c² Aquarii	23 03 34 78	02	·01	50	00	02	34·23	23 04 20 07	·84	10
	γ Toucani	11 05 52	- 02	- 09	89	00	·04	04 66	11 50 33	·67	07
	τ Pegasi	15 08·81	01	07	·50	00	·02	08 21	15 53 92	·71	03
	κ Piscium	21 16 05	01	·04	·45	·00	02	15·52	22 01 20	·68	- 06
	ι Piscium	34 16 07	- 01	05	·46	- ·01	·02	15·54	35 01·30	·76	02

a = + ·086 c = - ·461

Chronometer correction at 22ʰ 57ᵐ = + 45ˢ 737 ± ·014

TRANSIT OBSERVATIONS.

Station: BRISBANE. Date, October 2nd, 1903. Observer: THOS. D. FRASER.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit	R. A.	Chronometer correction.	c.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E	α² Capricorni.	20 11 56 84	01	03	42	02	02	56·10	20 12 13 16	47 06	15
	β Capricorni.	14 50 06	04	03	42	01	02	49 62	15 36 81	22	01
	γ Cygni	18 00 93	02	16	·53	01	02	00 23	18 17 49	·23	05
	ρ Capricorni.	22 36 14	04	02	43	01	02	35 70	23 22 90	20	01
	β Pavonis	35 31 86	07	22	1 01	01	05	31 08	36 18 40	32	11
	ε Aquarii	41 41 96	04	01	41	01	02	41 52	42 28 68	·16	05
	μ Aquarii ...	46 11 76	04	01	11	01	02	41 33	47 28 51	·18	03
W	ζ Cygni	21 08 01 00	02	13	47	00	02	01 30	21 08 51 59	·29	08
	γ Pavonis	17 12 43	06	21	99	06	05	43 53	18 30 70	17	·04
	ζ Capricorni....	20 23 63	03	01	41	01	02	24 02	21 11 24	·22	01
	β Aquarii	25 43 01	03	05	·11	01	02	43 33	26 30 48	15	06
	δ Aquarii	31 51 01	·03	01	11	01	02	51 31	32 38 66	·32	11
	γ Capricorni...	33 58 90	03	03	43	·01	·02	59 26	34 46 47	·21	00
	δ Capricorni....	40 57 13	03	03	12	01	02	57 48	41 14 69	·21	00
						01					

a = ·138 c = ·404

Chronometer correction at 20h 56m 17s·215 ± ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit	R. A.	Chronometer correction.	c.
W	γ Aquarii	22 15 51 75	06	04	·50	·02	02	55·11	22 16 42 21	17 10	10
	η Aquarii ...	29 38 19	05	01	·50	01	02	38 57	30 25·89	23	03
	ε Poisson. ...	34 33 34	06	·00	·57	01	02	33 82	35 21 05	·23	03
	η Pegasi. ..	37 43 35	04	08	·58	·01	02	13 78	38 31 00	·22	02
	ε Gruis ...	41 58 01	08	06	·81	·01	03	58 79	42 45 79	00	20
	λ Aquarii......	46 49 23	05	02	·51	01	02	49·64	47 36·77	13	07
	δ Aquarii	48 16·13	05	02	52	01	02	46 55	49 33 68	·13	07
E	c² Aquarii ...	23 03 33 11	02	01	54	00	02	32 82	23 04 20 06	24	04
	γ Toucani	11 03·92	03	08	97	00	03	02 97	11 50 30	·33	13
	τ Pegasi	15 07 45	01	·07	·55	·00	02	06 78	15 53 91	13	·07
	κ Piscium ...	21 14 47	01	·04	·50	01	02	13 91	22 01 19	·28	08
	ι Piscium	31 14 61	01	05	·51	01	02	14 03	35 01 29	·26	06
	δ Sculptoris ...	43 09·27	02	00	·57	01	02	08 67	43 56·00	·33	13
	27 Piscium.. ..	52 59·36	01	03	·50	02	02	58 82	53 46 02	·20	00

a = ·083 c = ·502

Chronometer correction at 23h 04m 17s·200 ± ·018

TRANSIT OBSERVATIONS.

Station: Brisbane. Date, October 3rd, 1903. Observer: Thos. D. Fraser.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	·01	s.		h. m. s.	s.	s.
E	α^2 Capricorni	20 11 56·03	·00	·02	·51	·01	·02	55·47	20 12 43·15	47·98	·03
	β Capricorni	11 49·33	·00	·02	·51	·01	·02	48·77	15 36·82	48·05	·10
	γ Cygni	17 60·16	·00	·00	·64	·01	·02	59·10	18 47·46	·06	·11
	ρ Capricorni	22 35·49	·00	·01	·52	·01	·02	34·93	23 22·88	47·95	·001
	β Pavonis	35 31·57	·00	·12	1·23	·00	·05	30·41	36 18·36	·95	·00
	ξ Capricorni	39 37·24	·00	·00	·55	·00	·02	36·67	40 24·55	·88	·07
	ε Aquarii	41 11·31	·00	·02	·50	·00	·02	10·77	42 28·69	·92	·03
W	ζ Cygni	21 08 03·24	·02	·07	·56	·00	·02	03·69	21 08 51·58	·89	·06
	γ Pavonis	17 41·46	·06	·11	1·20	·00	·05	42·66	18 30·67	48·01	·06
	ζ Capricorni	20 22·86	·04	·01	·54	·01	·02	23·33	21 41·23	47·90	·05
	β Aquarii	25 42·14	·03	·02	·50	·00	·02	42·57	26 30·46	·89	·06
	ξ Aquarii	31 50·37	·02	·02	·50	·01	·02	50·81	32 38·64	·83	·12
	γ Capricorni	33 57·98	·03	·01	·52	·01	·02	58·45	34 46·48	48·02	·08
	δ Capricorni	40 56·22	·03	·02	·51	·01	·02	56·67	41 44·67	48·00	·05

a = ·079   c = ·491

Chronometer correction at 20h 56m = 47s·954 ± ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	σ Aquarii	22 21 46·04	·05	·00	·45	·01	·02	46·11	22 25 34·32	47·91	·06
	η Aquarii	29 37·50	·05	·00	·44	·01	·02	37·86	30 25·79	·93	·04
	ε Poisson	31 32·59	·06	·00	−·50	·01	·02	33·00	35 21·04	48·04	·07
	η Pegasi	37 42·65	·01	·01	·51	·01	·02	43·10	38 30·93	·89	·08
	ε Gruis	41 57·19	·08	·01	·72	·01	·03	57·78	42 45·77	·99	·02
	λ Aquarii	46 48·39	·05	·00	·45	·01	·02	48·76	47 36·76	48·00	·03
	δ Aquarii	48 45·28	·06	·00	·46	·01	·02	45·65	49 33·67	·02	·05
E	ϵ^2 Aquarii	23 03 32·53	·00	·00	·48	·00	·02	32·03	23 04 20·05	·02	·05
	γ Toucani	11 03·26	·00	·01	·86	·00	·03	02·36	11 50·29	47·93	·03
	τ Pegasi	15 06·32	·00	·01	·48	·00	·02	05·83	15 53·91	48·08	·17
	κ Piscium	21 13·70	·00	·00	−·44	·00	·02	13·21	22 01·48	47·91	·03
	ι Piscium	34 13·84	·00	·00	·45	−·01	·02	13·38	35 01·29	·91	·06
	δ Sculptoris	43 08·55	·00	·00	·51	−·01	·02	08·03	43 56·00	·97	·00
	27 Piscium	52 58·49	·00	·00	·41	·01	·02	58·04	53 46·02	·98	·01

a = ·006   c = ·444

Chronometer correction at 23h 08m = 47s·971 ± ·012

TRANSIT OBSERVATIONS.

Station: Brisbane. Date, October 6th, 1903. Observer: Thos. D. Fraser.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. ·01	s.		h. m. s.	s.	s.
E	ρ Capricorni	20 22 32 64	01	02	46	01	02	32 12	20 23 22 83	50 71	07
	β Pavonis	35 28 42	01	33	1 10	01	05	27 78	36 18 23	65	01
	ψ Capricorni	39 34 43	01	01	49	01	02	33 89	40 24 50	61	03
	ε Aquarii	41 38 55	01	06	44	01	02	38 01	42 28 62	61	03
	μ Aquarii	46 38 45	01	06	44	00	02	37·92	47 28 45	53	11
	32 Vulpeculae	49 38 50	00	19	49	00	02	37 80	50 28 47	67	03
	θ Capricorni	59 42 95	01	·01	46	00	02	42 42	50 32 99	57	07
W	γ Pavonis	21 17 38 86	17	30	1 07	00	05	40 01	21 18 30 56	55	09
	ζ Capricorni	20 20 11	10	02	48	00	02	20 45	21 44 19	74	10
	β Aquarii	25 39 50	08	07	44	00	02	39 77	26 30 43	66	02
	ξ Aquarii	31 47·70	09	07	44	00	02	47 96	32 38 61	65	01
	ε Pegasi	38 37 74	07	12	44	00	02	37 94	39 28 56	62	02
	δ Capricorni	40 53 67	09	04	46	·00	02	53 98	44 44 64	66	02
	ι Pegasi	22 01 42 26	06	17	48	01	02	42·50	22 02 33 45	65	01

a = ·201 c = ·438
Chronometer correction at 21h 12m = 50·636 ± ·012

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	ε Gruis	22 41 54 57	26	02	75	01	03	55 04	22 42 45·74	50 70	06
	α Pegasi	44 32 05	12	·03	50	01	02	32 37	45 22 94	54	10
	λ Aquarii	46 45 86	17	04	47	01	02	46 12	47 36 74	62	02
	δ Aquarii	48 42 77	·18	·01	48	01	02	43 03	49 33 65	62	02
	α Piscis Aust.	54 30 08	20	00	54	·00	02	30 40	52 21 08	68	04
	ψ² Aquarii	23 03 29 13	19	00	50	00	02	29 42	23 04 20 01	62	·02
E	γ Toucani	11 00 80	·22	03	89	00	03	59·69	11 50 26	57	07
	κ Piscium	21 44·19	12	02	46	·00	02	10 57	22 01·48	61	03
	ι Piscium	34 11 27	11	02	47	·50	02	10 65	35 01·29	64	00
	δ Sculptoris	43 06 00	15	00	53	00	02	05 30	43 56 00	71	06
	φ Pegasi	46 46 91	10	02	·49	00	02	46 28	47 36 98	70	06
	27 Piscium	52 55 99	·13	·01	46	01	02	55·38	53 46 03	65	01
	2 Ceti	57 59·80	·14	01	48	01	02	59 16	58 49 80	64	00

a = ·034 c = ·462
Chronometer correction at 23h 19m = 50·638 ± ·010

TRANSIT OBSERVATIONS.

Station: Brisbane. Date, October 7th, 1903. Observer: Thos. D. Fraser.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r ·04	s.		h. m. s.	s.	s.
E	ρ Capricorni...	20 22 31 81	·09	62	53	01	02	34·32	20 23 22 81	51 49	01
	β Pavonis...	35 27 67	17	23	1·26	01	05	26 75	36 48 19	44	01
	ψ Capricorni...	39 33 40	10	01	56	00	02	32 01	40 24 49	58	10
	ε Cygni...	41 29 21	05	46	60	00	02	28 48	42 20 00	·52	04
	α Aquarii...	46 37 51	08	05	51	00	02	37 01	47 28 14	43	05
	32 Vulpeculae...	49 37 70	·06	14	57	00	02	37 03	50 28 46	·43	·05
	θ Capricorni...	59 44 88	09	03	53	00	02	41 39	21 00 32 93	54	06
W	γ Pavonis...	21 17 37 49	14	22	1 22	00	05	38 99	18 30 52	53	05
	ζ Capricorni...	20 19 13	07	·01	55	00	02	19 72	21 11 18	46	02
	β Aquarii...	25 38 51	06	05	54	00	02	39 04	26 30 44	49	08
	ξ Aquarii...	31 46 61	06	05	51	00	02	47 41	32 38 60	49	01
	γ Capricorni...	35 54 39	06	03	53	00	02	54 93	34 46 11	48	00
	δ Capricorni...	40 52 62	06	03	·52	01	02	53 16	41 44 63	47	01
	16 Pegasi...	47 50 28	04	13	56	04	02	50 74	48 42 20	46	02

a = ·153 c = ·503

Chronometer correction at 21h 05m = 51·479 ± ·010

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	δ Aquarii...	22 48 41 60	09	01	43	·01	02	42 08	22 49 33 65	+51·56	05
	α Pegasi...	59 07·37	06	04	43	01	02	07 79	59 59·34	·55	03
	c² Aquarii...	23 03 27·93	·59	·04	45	00	02	28 44	23 04 20 04	·60	08
	γ Toucam...	10 58·01	13	06	·80	00	·03	58·97	11 50·25	·28	24
	τ Pegasi...	15 01 92	06	05	·45	·00	·02	02 36	15 53 89	53	01
	κ Piscium...	21 09·16	07	·03	41	·00	·02	09 59	21 61 17	·58	06
	ι Piscium...	34 09 29	·07	04	·41	00	02	09 71	35 01 29	·58	06
E	δ Sculptoris...	43 04 80	13	00	47	·00	02	·04 44	43 56·00	·56	04
	φ Pegasi...	46 45 88	09	05	44	00	02	45·46	47 36·98	52	00
	27 Piscium...	52 54 81	·11	03	41	00	02	54 46	53 46 03	57	05
	30 Poisson...	56 11 56	11	02	42	00	02	11 21	57 02 72	·54	− ·01
	2 Ceti...	57 58·63	·12	01	43	00	02	58 29	58 49 80	51	− 01
	α Andromedae...	24 02 35·37	08	06	47	01	02	34 91	24 03 26 45	54	02
	ζ Toucani...	14 14 84	·23	09	1 00	01	·04	14 13	15 05 55	42	− ·10

a = ·063 c = ·413

Chronometer correction at 23h 31m = 51·522 ± ·016

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: Southport. Date, October 23rd, 1913. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 1 ·45	s.		h. m. s.	m. s.	s.
E	α Toucani	22 16 35 30	15	54	30	62	01	36 27	22 11 55 37	4 40 90	05
	γ Aquarii	21 22 62	08	21	14	59	02	22 92	16 41 99	93	08
	σ Aquarii	30 14 71	08	14	15	52	02	15 00	25 34 12	88	03
	η Aquarii	35 06 23	08	22	14	48	02	06 41	30 25 59	82	03
	ζ Pegasi	41 21 56	07	30	15	44	02	21 60	36 40 78	82	03
	η Pegasi	43 11 73	05	47	17	42	02	14 54	38 30 78	75	09
	α Pegasi	50 03 71	03	42	16	37	02	03 54	45 22 78	76	09
W	δ Sculptoris	23 48 36 97	11	00	16	07	02	35 88	23 43 55 91	97	12
	φ Pegasi	52 18 32	10	·37	15	10	02	17 88	47 36 92	96	11
	ω Piscium	59 04 67	10	·28	15	15	02	04 27	54 23 43	84	01
	2 Ceti	24 03 30 86	12	09	15	18	02	30 60	58 49 75	85	00
	α Andromedae	08 07·85	07	46	16	22	02	07 24	24 03 26 41	·83	02
	γ Pegasi	12 59·56	08	34	15	25	02	59·02	08 18 22	80	05
	ζ Toucani	19 45 62	21	71	35	30	15	46 12	15 05 37	75	10

a = + ·484   c = − ·44

Chronometer correction at 23h 39m = 4m 40s·848 ± ·015

Observer: Thos. D. Fraser.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
						r ·45					
E	α Pegasi	23 04 39 98	11	·31	14	26	02	39 88	22 59 59 21	4 40 67	09
	ε² Aquarii	09 00 42	16	05	14	23	02	00 60	23 04 19 90	70	06
	γ Toucani	16 30 19	25	44	26	17	·04	30 75	11 49 95	80	04
	τ Pegasi	20 34 82	10	·38	15	14	02	34 51	15 53 78	73	03
	κ Piscium	26 41·57	13	21	·13	10	02	41 84	22 01 08	76	00
	ι Phoenicis	34 35 63	20	16	18	04	03	35 82	29 54 95	87	11
	ι Piscium	39 42 17	13	24	13	01	02	41 91	35 01 22	69	07
W	β Hydri	0 25 24 31	39	−1 60	63	34	09	25 72	0 20 45 01	71	05
	12 Ceti	29 50 41	12	18	13	38	·02	49 84	25 08 92	92	16
	ε Andromedae	38 11 49	08	42	15	41	02	10 68	33 29 91	77	01
	β Ceti	43 28 17	14	08	14	48	02	27 59	38 46 77	82	06
	δ Piscium	48 21 28	11	26	14	52	02	23 51	43 42 74	77	01
	20 Ceti	52 48 22	12	20	13	55	02	47 46	48 06 70	76	00
	μ Andromedae	56 08 41	·06	51	17	58	02	07 41	51 26 68	73	03

a = + ·443   c = − ·134

Chronometer correction at 23h 39m = 4m 40s·765 ± ·014

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: Brisbane. Date, October 29th, 1903. Observer, Otto Klotz.

Clamp	Star	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Corrected transit.	R. A.	Chronometer correction.	v
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
						02					
E	α Pegasi	22 44 16 22	02	02	13	02	02	15 79	22 45 22 67	1 06 88	01
	λ Aquarii	46 29 93	0[illegible]	01	10	02	02	29 53	47 36 53	07 00	08
	δ Aquarii	48 26 88	0[illegible]	01	11	02	02	26 48	49 33 44	06 96	04
	α Pegasi	58 52 61	0[illegible]	02	41	01	02	52 22	59 59 14	92	00
	c² Aquarii	23 03 13 31	0[illegible]	03	4[illegible]	01	02	12 89	23 04 19 83	94	02
	γ Toucani	10 13 19	08	02	76	01	03	12 93	11 19 81	88	01
	ι Pegasi	14 47 28	07	02	43	01	02	46 87	15 53 71	84	05
W	12 Ceti	24 24 01 55	03	01	39	02	02	01 92	24 25 08 91	99	07
	β Ceti	37 39 34	03	00	41	02	02	39 72	38 46 76	07 04	12
	δ Piscium	42 35 42	03	01	40	02	02	35 80	43 42 73	06 93	01
	20 Ceti	46 59 39	03	01	34	02	02	59 76	48 06 69	93	01
	ε Piscium	56 51 05	03	04	40	03	02	51 44	57 58 32	88	04
	β Phoenicis	25 00 41 31	06	01	50	03	03	41 84	25 01 48 64	80	12
	θ Ceti	18 06 85	04	01	40	03	02	07 23	19 14 11	88	01

a = +·025   c = ·394

Chronometer correction at 23h 35m = 1m 06s·918 ± ·013

Observer, Thos. D. Fraser

Clamp	Star	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Corrected transit.	R. A.	Chronometer correction.	v
					r	02					
E	α Aquarii	21 59 44 44	03	08	50	03	02	44 00	22 00 51 17	1 07 17	04
	ι Pegasi	22 01 26 06	02	16	55	03	02	25 64	02 32 81	17	04
	α Toucani	10 49 27	06	[illegible]	1 03	03	04	48 02	11 55 17	15	02
	γ Aquarii	15 35 29	03	[illegible]	50	03	02	34 76	16 41 92	16	03
	π Aquarii	24 27 38	03	05	51	02	02	26 91	25 34 05	14	01
	η Aquarii	29 18 86	03	08	50	02	02	18 43	30 25 51	11	02
	ζ Pegasi	35 34 04	03	12	51	02	02	33 64	36 40 71	07	06
W	ι Piscium	23 33 53 66	03	04	51	00	02	54 14	23 34 61·17	03	10
	δ Sculptoris	42 48 03	04	00	57	00	02	48 68	43 55 86	18	05
	φ Pegasi	46 29 28	02	05	53	00	02	29 76	47 36 89	13	·00
	27 Piscium	52 38 41	03	03	50	01	02	38 90	53 45·95	05	08
	2 Ceti	57 42 11	03	01	53	01	02	42 65	58 49 71	06	07
	α Andromedae	24 02 18 57	02	07	57	01	02	19 08	24 03 26 38	30	17
	β Hydri	19 34 98	10	26	2 37	+ 01	09	37·63	20 44 77	14	01

a_1 = +·188 a_2 = +·072   c = +·500

Chronometer correction at 23h 35m = 1m 07s·134 ± ·014

Hence the weighted personal equation of the two values, Fraser anticipates Klotz +·153 ± ·014

TRANSIT OBSERVATIONS.

Station: NORFOLK ISLAND. Date, December 8th, 1903. Observer, F. W. O. Werry.

Clamp	Star	Transit over mean of threads	Level and diurnal aberration	Azimuth	Collimation	Rate	Corrections	Corrected transit	R. A.	Chronometer correction	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	s.
E	β Phoenicis	1 02 06 26	03	30	70	28	13	09 06	1 01 48 14	17 89	01
	ζ² Piscium	09 02 07	03	34	48	23	02	01 38	08 43 16	17 92	01
	21	19 22 49	03	23	48	16	02	31 89	19 13 95	17 94	03
	ζ Phoenicis	24 30 57	05	2	66	13	03	30 18	24 12 18	18 00	00
	22	26 40 20	03	17	49	10	02	39 29	26 21 44	17 85	06
	α Eridani	31 26 98	06	59	89	04	03	26 63	34 08 89	17 74	17
	ε Piscium	36 45 53	03	39	48	03	02	44 64	36 26 75	17 89	02
W	542	39 54 81	08	14	49	01	02	55 10	39 37 01	18 09	18
	544	47 01 76	08	21	18	05	02	01 88	46 43 87	18 01	10
	37	2 23 22 30	02	40	18	32	02	22 02	2 22 64 00	17 93	02
	ε Eridani	27 50 85	02	16	14	35	02	50 79	27 32 95	17 84	07
	ζ Ceti	31 09 18	02	26	48	38	02	08 98	30 50 90	17 90	08
	555	33 41 43	02	54	51	40	02	44 66	33 22 89	17 77	14
	39	34 52 75	02	32	48	41	02	52 26	34 34 49	17 77	14

a = .657 c = .175
Chronometer correction at 1h 10m = 17s.905 ± .023

Clamp	Star	Transit over mean of threads	Level and diurnal aberration	Azimuth	Collimation	Rate	Corrections	Corrected transit	R. A.	Chronometer correction	
W	547	2 39 52 15	02	13	16	23	02	52 67	2 39 33 97	18 70	12
	β Fornacis	45 23 12	02	04	53	19	02	23 84	45 05 22	62	04
	16	52 03 36	02	17	15	11	02	03 71	51 45 07	67	09
	ε Arietis	54 02 82	02	10	47	12	02	02 97	53 44 10	57	01
	47	57 34 87	02	27	11	10	02	35 10	57 16 51	56	[illegible]
	α Horologii	3 01 39 45	03	54	89	07	01	40 85	3 01 22 10	45	
E	549	08 19 59	02	00	51	02	02	19 10	07 60 44	66	08
	53	19 59 23	02	31	45	06	02	58 41	19 39 83	58	00
	55	25 51 88	01	33	45	11	02	53 98	25 35 39	59	01
	B.A.C. 1106	30 03 19	03	29	70	15	03	02 93	29 44 24	60	11
	10 Tauri	32 18 75	02	24	41	17	02	17 90	31 59 45	[illegible]	13
	550	38 59 22	02	16	45	21	02	58 40	38 39 98	42	16

a = +.192 c = +.413
Chronometer correction at 3h 40m = 18s.580 ± .021

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, December 9th, 1903. Observer: F. W. O. Werry.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s. r	s. ·29	s.		h. m. s.	s.	s.
E	47.	2 58 02 16	02	24	53	11	02	01 49	2 57 16 54	44 95	07
	α Horologii.	3 02 07 68	03	47	1 06	13	04	07 45	3 01 22 32	83	05
	359.	06 55 19	01	36	56	10	02	54 34	06 09 41	93	05
	549.	08 45 76	− 02	00	61	09	02	45 20	08 00 43	77	11
	γ Arietis	10 09 92	04	37	56	09	02	09 65	09 24 10	95	07
	ε Eridani	16 52 42	02	45	73	06	03	51 55	16 06 68	87	01
	53.	20 25 52	02	28	53	04	02	24 71	19 39 81	90	02
	54.	22 44 72	02	29	53	03	02	43 89	21 59 03	88	00
W	55.	25 20 16	08	34	·54	02	02	20 31	25 35 39	92	04
	B.A.C. 1406.	30 28 22	16	26	83	00	03	29 12	29 44 21	91	03
	10 Tauri	32 44 09	09	22	53	04	02	41 28	31 59 45	83	05
	64.	42 32 75	07	39	57	06	02	32 78	41 47 85	93	05
	g Eridani.	46 37 22	13	07	65	07	03	37 71	45 52 94	80	08
	552.	54 18 70	11	12	44	10	02	18 79	53 34 02	77	11

a = ·453   c = ·527

Chronometer correction at 3h 30m = 44s·876 ± ·012

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, December 10th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Sidereal time of transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. ·23	s.		h. m. s.	s.	s.
E	c¹ Piscium	1 00 35 22	01	42	49	12	02	34 52	1 08 43 42	51 10	01
	ζ Phoenicis	05 03 61	01	19	67	05	03	03 16	21 12 40	06	03
	22	25 13 40	01	38	50	05	02	12 56	26 21 40	16	07
	ε Piscium	37 18 62	01	72	18	01	02	47 82	36 26 74	08	01
	512	40 28 68	01	12	50	00	02	28 05	39 36 97	08	01
	25	41 12 03	01	33	49	00	02	14 20	40 29 07	13	04
	513	12 01 04	01	04	54	01	02	00 44	41 00 37	07	02
W	χ Balenae	45 43 52	05	17	49	02	02	43 74	41 52 72	02	07
	514	47 34 62	06	17	49	02	02	23 84	46 43 83	01	08
	ζ Phoenicis	50 38 68	09	24	55	04	03	39 47	49 48 25	22	13
	515	56 20 44	06	08	52	06	02	29 44	55 29 43	01	08
	33	2 02 37 79	04	15	52	08	02	37 72	2 01 46 57	15	06

a = ·538 c = ·483
Chronometer correction at 1h 40m = 51s·489 ± ·016

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Sidereal time of transit.	R. A.	Chronometer correction.	v.
W	39	2 35 25 03	05	27	52	09	02	25 90	2 34 31 48	51 42	
	41	39 11 56	05	20	52	07	02	11 78	38 29 42	36	
	547	40 25 03	05	14	54	07	02	25 43	39 33 95	48	
	β Fornacis	45 56 06	06	04	62	05	02	56 69	45 05 49	70	
	46	52 56 16	05	19	55	03	02	36 16	51 45 06	40	
	θ Eridani	55 28 87	06	15	69	02	02	29 65	54 38 31	34	05
	τ⁴ Eridani	59 01 25	05	05	57	00	02	01 70	58 10 41	26	13
E	359	3 07 01 88	01	41	55	03	02	00 88	3 06 09 41	47	08
	549	08 52 36	02	01	60	03	02	54 74	08 00 43	31	08
	ρ Arietis	10 16 52	01	46	56	04	02	15 45	09 21 40	35	04
	ε Eridani	16 58 67	02	19	72	00	03	58 07	16 06 68	39	00
	53	20 32 17	01	35	53	07	02	31 21	19 39 81	40	01
	55	26 27 82	01	38	53	09	02	26 81	25 35 40	41	02
	B.A.C. 1106	30 36 27	02	32	83	11	03	35 64	29 44 21	43	04

a = +·557 c = −·524
Chronometer correction at 3h 00m = 51s·393 ± ·013

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TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, December 11th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	[illegible]ation.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.		s.
E	21	1 20 11 81	02	23	[illegible]	13	02	14 27	1 19 13 90	57 37	01
	γ Phœnicis	25 09 80	03	21	[illegible]	11	03	09 29	24 12 08	41	05
	22	27 19 52	01	43	47	10	02	18 71	26 21 39	·32	04
	α Eridani	35 06 20	·04	55	85	06	04	05 96	34 08 72	24	12
	ε Piscium	37 24 82	02	37	45	05	02	24 05	36 26 73	32	04
	542	40 34 91	02	14	47	04	02	34 34	39 36·06	28	02
	25	41 18 29	02	38	46	04	·02	17 39	40 20 06	43	07
	543	42 07·28	02	04	50	04	02	06 78	41 09 36	42	06
W	544	47 40 85	02	20	46	01	02	41 08	46 43 83	25	41
	β Phœnicis	50 44 83	03	28	66	·00	03	45 74	49 48 23	48	42
	545	56 26 40	02	09	49	03	02	26·73	55 29 43	50	06
	33	2 02 43 98	02	52	48	06	02	43 84	2 01 46 56	28	08
	546	09 38 50	02	02	53	09	02	38 92	08 41 41	51	15
	φ Eridani	14 01 73	04	·39	73	11	03	02·67	13 05 42	·25	11

a = ·618 c = ·450

Chronometer correction at 1h 50m = 57·375 ± 017

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	[illegible]ation.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	ε Arietis	2 54 42 09	02	52	51	11	·02	42 15	2 53 44 40	57 75	00
	47	58 13 98	02	·34	·47	10	02	44 47	57 16 55	64	11
	α Horologii	3 02 48 52	03	65	95	08	04	20 13	3 01 22 28	·85	10
	359	07 07 47	01	50	50	06	02	07 20	06 09 41	79	04
	549	08 57 45	00	01	54	05	02	58 03	08 00 42	61	14
	ε Eridani	17 03 59	00	21	65	01	03	04 43	16 06 67	76	01
E	53	20 38 41	06	39	48	00	02	37 58	19 39 81	77	02
	54	22 57 62	05	10	48	01	02	56 76	21 59 04	75	00
	55	26 34 15	06	43	48	03	02	33 25	25 35 39	86	11
	B. A. C. 1106	30 42 28	10	·36	75	·05	03	41·91	29 44 20	74	04
	10 Tauri	32 58 04	06	31	·47	06	02	57 24	31 59 45	·79	04
	550	39 38 39	07	21	48	09	02	37 66	38 39 98	68	07
	551	43 42 44	07	06	52	11	·02	41 80	42 44·07	73	02

a = ·629 c = ·473

Chronometer correction at 3h 20m = 57·749 ± 015

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, December 17th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 27	s.		h. m. s.	m. s.	s.
E	544	1 48 20 71	13	19	50	10	02	20 23	1 46 13 78	1 36 45	03
	ζ Phoenicis	51 24 84	19	28	73	09	03	24 61	49 48 14	50	02
	545	57 06 18	14	08	52	06	02	05 76	55 29 37	39	09
	33	2 03 23 93	09	51	52	03	02	23 00	2 01 46 52	48	00
	546	10 18 39	16	02	57	00	02	17 98	08 41 35	63	15
	φ Eridani	14 12 03	20	38	78	02	03	41 78	13 05 33	15	03
W	δ Hydri	21 37 27	16	1 09	1 36	05	05	39 78	20 03 30	48	09
	37	24 40 37	06	37	49	07	02	40 46	23 04 05	41	07
	ε Ceti	32 27 32	07	24	49	10	02	27 52	30 50 96	56	08
	355	34 59 44	05	50	52	11	02	59 58	33 22 85	53	05
	39	36 40 89	07	29	19	12	02	14 02	34 34 45	57	09
	41	39 56 70	07	32	19	13	02	56 79	38 20 39	40	08
	547	41 10 09	08	16	50	14	02	10 35	39 33 91	41	04

a = ·603   c = ·486
Chronometer correction at 2h 10m = 1m 36s·185 ± ·015

TRANSIT OBSERVATIONS.

Station: Norfolk Island. Date, December 18th, 1903. Observer: F. W. O. Werry.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 27	s.		h. m. s.	m. s.	s.
E	α Hydri	1 57 28 73	15	59	1 27	28	01	28 11	1 55 41 84	1 43 60	11
	353	2 13 56 27	08	19	60	20	02	55 74	2 12 12 31	43	06
	κ Fornacis	19 53 48	07	05	65	18	02	53 01	18 09 58	43	06
	α Baleine	29 19 73	09	12	62	14	02	16 20	27 32 88	32	17
	355	35 07 31	05	41	61	11	02	06 40	33 22 84	56	07
W	51	3 23 12 26	01	32	60	11	02	42 45	3 21 59 01	44	05
	B.A.C. 1106	31 26 49	08	29	91	11	03	27 03	29 11 12	51	02
	550	40 23 22	05	17	60	18	02	23 50	38 39 99	51	02
	61	43 31 12	03	41	65	0	02	31 44	41 47 87	57	08
	552	55 17 26	07	14	61	25	02	17 51	53 34 04	47	02
	66	57 06 32	01	34	61	26	02	06 35	55 22 80	57	06
	δ Reticule	58 57 00	09	58	1 25	27	04	58 70	57 15 27	43	06

a = ·505   c = ·591
Chronometer correction at 3h 00m = 1m 43s·486 ± ·016

TRANSIT OBSERVATIONS.

Station: NORFOLK ISLAND. Date, December 19th, 1903. Observer: F. W. O. WERRY.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 25	s.		h. m. s.	m. s.	s.
W	21	1 24 03·22	05	18	·55	16	02	03 78	1 19 13 82	1 49 96	03
	22	28 10 95	04	37	56	13	02	11 29	26 21·32	97	02
	α Eridani.	35 56 79	09	48	+ 02	10	04	58·44	34 08 .51	93	06
	ν Piscium ...	38 16 37	64	32	55	09	02	16 71	36 26 67	50 01	05
	542	41 26 34	06	12	57	08	02	26 91	39 36 88	03	04
	25	12 0.) 70	05	33	55	07	02	10 02	40 20 00	02	03
E	α Hydri. ...	57 35 17	24	61	1 16	01	04	31 83	55 44 80	03	01
	37	2 24 54 85	11	32	55	10	02	53 97	2 22 64 03	49 94	05
	σ Baleine	29 23 15	14	13	57	12	02	22 75	27 32 8?	88	11
	ν Ceti.........	32 11 85	13	21	55	13	02	41 07	30 50 91	50 13	14
	355	35 13 82	10	43	·58	15	02	12 74	33 22 83	49 91	08
	39	36 25 26	12	25	55	15	02	24 41	34 34 45	96	03
	41......	40 11·30	12	28	55	17	02	10 40	38 29 38	50 02	03

$a = \cdot 528$ $e = \cdot 546$

Chronometer correction at $2^h 00^m$ = $1^m 49^s \cdot 986$ ± ·015

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
E	53	3 21 30 95	06	·34	49	12	02	30 28	3 19 39 80	1 50 48	04
	54	23 50 13	06	·35	49	11	02	49 44	21 59 00	44	00
	55	27 26 59	06	– 38	50	10	02	25 85	25 35 39	46	02
	40 Tauri....	33 50 57	07	27	49	– ·07	02	49 93	31 59·45	·48	04
	550	40 30 93	08	18	50	– ·04	02	30 35	38 39 98	37	·07
	551	44 34 98	09	06	53	+ 02	·02	34·48	42 11 06	42	02
W	552	55 21 26	01	15	– ·50	02	·02	24 58	53 31 03	·55	·11
	66	7 13 13		37	– 50	·03	02	13 22	55 22 80	42	02
	366	4 09 02 13		33	– 49	08	02	02 20	4 07 11 83	37	·07
	α Horologii ...	12 40 25		8	– 66	09	03	41 61	10 50 60	·41	03
	71	19 15 62		2	– 54	12	·02	15 58	17 25 12	46	·02
	d Eridani ...	22 17 08		06	– ·59	13	·02	17 61	20 27 14	17	03

$a = \cdot 556$ $e = \cdot 488$

Chronometer correction at $3^h 50^m$ = $1^m 50^s \cdot 444$ ± ·018

TRANSIT OBSERVATIONS.

Station: Doubtless Bay. Date, December 5th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r s. ·49	s.		h. m. s.	s.	s.
E	ω Piscium	23 51 39 77	01	·30	11	42	02	39 45	23 51 23 07	16·38	01
	2 Ceti	59 05 89	02	14	42	36	02	05 65	58 49 32	33	04
	γ Pegasi	24 08 34 73	01	35	42	30	02	34 23	24 08 17 86	37	00
	ζ Toucani	15 20 54	01	55	·97	25	04	20 29	15 04 01	28	03
	β Hydri	20 58 90	06	1 41	1·91	20	08	58 49	20 42 09	40	03
	12 Ceti	25 25 56	01	23	4	16	02	25·96	25 08 63	43	06
	β Ceti	39 03 40	01	13	12	05	02	02 87	38 46 45	42	05
W	α Sculptoris	54 15 46	36	04	·46	07	02	15 13	53 59 00	43	06
	ε Piscium	58 11 76	23	30	41	11	02	14 51	57 58 14	37	00
	β Phoenicis	25 02 04 41	15	14	59	14	02	01 53	25 01 45 15	38	01
	[illegible] Ceti	19 30 69	30	20	41	28	·02	30 30	19 13 97	33	01
	γ Phoenicis	24 28 65	13	09	56	32	02	28 53	24 12 18	35	02
	η Piscium	26 38 29	21	35	42	33	02	37 80	26 21 47	33	04
	α Eridani	34 25 20	51	32	75	42	03	25 28	34 08 89	39	02

a ·448 c ·403

Chronometer correction at 24^h 15^m 16s·371 ·009

TRANSIT OBSERVATIONS.

Station: Doubtless Bay. Date, December 6th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	r s. ·49	s.		h. m. s.	s.	s.
E	2 Ceti	23 59 19 81	17	14	·51	44	02	19 75	23 58 49 31	30 44	05
	γ Pegasi	24 08 48·70	11	35	·50	35	02	48 29	24 08 17 86	43	06
	ι Ceti	15 03·09	15	19	·49	31	02	02·85	14 32 32	53	04
	β Hydri	21 12 57	59	1 43	2 31	26	·08	12 46	20 42 00	46	03
	β Ceti	39 17 36	·17	13	51	11	02	16 98	38 16 46	52	03
	δ Piscium	44 13 65	13	·30	·50	·07	02	13·03	43 42 50	53	04
	20 Ceti	48 37 58	15	·24	49	04	02	37 02	48 06 47	55	06
W	α Sculptoris	54 29 30	·23	05	56	·01	02	29 55	53 58 99	56	07
	ε Piscium	58 28 64	15	·30	49	·04	02	28·62	57 58 13	49	00
	β Phoenicis	25 02 18 21	29	14	72	07	02	18 69	25 01 48 13	56	07
	δ Piscium	09 13 98	15	·30	19	13	·02	13 87	08 43 45	42	07
	α Eridani	34 38 81	31	32	91	33	04	39 33	34 08 87	46	03
	ο Piscium	40 50 93	15	31	49	38	02	50·56	40 20 12	44	05
	ζ Ceti	47 14 66	19	19	59	44	·02	14 32	46 43 92	·40	09

a ·445 c ·488

Chronometer correction at 24^h 53^m 30s·486 ·011

TRANSIT OBSERVATIONS.

Station : Doubtless Bay. Date, December 7th, 1903. Observer : Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s. r	s. 44	s.		h. m. s.	s.	s.
E	β Hydri.	0 21 25 08	11	1·23	1 93	29	08	25 00	0 20 41 91	43 09	00
	12 Ceti	25 51 92	10	20	11	·26	02	51 65	25 08 40	05	04
	β Ceti	39 29 73	·12	11	33	16	02	29 45	38 46 15	00	09
	δ Piscium	44 26 10	09	·26	41	12	02	25 62	43 42 49	13	04
	20 Ceti	48 49 97	10	21	·11	09	02	49 52	48 06 46	06	03
	α Sculptoris	51 42 45	14	04	47	05	02	12 11	53 58 98	13	04
	ε Piscium	58 41 81	09	26	41	02	02	41 26	57 58 12	14	05
W	ζ³ Piscium	1 09 26 60	15	26	41	06	02	26 52	1 08 13 44	08	01
	θ Ceti	19 57 13	18	17	44	13	02	57 04	19 43 95	09	00
	γ Phœnicis	24 55 12	27	08	·57	17	02	55 32	24 12 15	16	07
	η Piscium	27 04 75	13	30	42	19	02	04 53	26 21 44	09	00
	α Eridani	34 51 47	·31	28	76	·24	04	51 89	31 08 84	05	04
	ν Piscium	37 10 14	15	25	41	26	02	09 87	36 26 75	12	03
	ο Piscium	41 03 52	15	27	41	29	02	03 20	40 20 11	19	00

a = ·383   c = ·407

Chronometer correction at 1h 01m = 43s·091 ± ·009

TRANSIT OBSERVATIONS.

Station : Doubtless Bay. Date, December 9th, 1903. Observer : Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s. r	s. 42	s.		h. m. s.	m. s.	s.
E	β Ceti	0 39 52 42	13	15	47	57	02	52 48	0 38 46 42	1 06.06	10
	δ Piscium	44 18 76	10	33	45	52	02	48 58	43 12 47	11	·05
	α Sculptoris	55 05 47	15	05	51	45	02	05 19	53 58·95	24	08
	β Phœnicis	1 02 54 22	·18	15	66	41	02	51 28	1 01 48 07	24	05
	α Eridani	35 15 11	·22	·35	·84	17	03	14 98	34 08·79	19	03
	ο Piscium	41 26 76	09	34	45	13	02	26 17	40 20·10	07	09
W	κ Fornacis	2 19 15 74	16	10	49	·13	02	15 82	2 18 09 66	·16	00
	δ Hydri	21 08 25	35	·77	1 25	15	05	09 72	20 03 63	09	07
	ξ² Ceti	24 10 41	11	33	45	17	02	10 23	23 04 10	·13	03
	θ Eridani	55 44 48	18	06	·59	39	02	44 54	54 38 32	22	06
	α Ceti	58 23 28	11	31	45	41	·02	22 88	57 16 55	29	13
	ο Tauri	3 20 46 60	41	34	45	57	02	46 01	3 19 39 82	19	03

a = ·489   c = ·416

Chronometer correction at 2h 60m = 1m 06s·054 ± ·016

TRANSIT OBSERVATIONS.

STATION: DOUBTLESS BAY. Date, December 10th, 1903. OBSERVER: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	42	s.		h. m. s.	m. s.	s.
E	β Hydri	0 21 59·41	45	1 06	1 83	31	08	59 32	0 20 44 64	1 17 68	02
	β Ceti	40 04 25	13	10	41	18	02	04 03	38 46 41	62	04
	δ Piscium	45 00 54	10	22	39	14	02	00 15	43 42 46	69	03
	20 Ceti	49 21 44	11	18	39	11	02	24·07	48 06 43	64	02
	α Sculptoris	55 16 88	45	03	45	07	02	16 69	53 58 93	67	01
	ε Piscium	59 16 23	10	22	39	04	02	15 74	57 58 09	65	01
	β Phoenicis	1 03 05 95	18	10	57	01	02	05 65	1 01 18 05	60	06
W	θ Ceti	20 31 60	13	45	39	10	02	31 59	19 13 93	66	00
	ζ Phoenicis	25 29 52	19	07	54	15	02	29 77	24 12 10	67	01
	η Piscium	27 39 23	10	26	40	15	03	39 09	26 21 43	66	00
	α Eridani	35 25 94	26	24	72	21	02	26 41	34 08 76	65	01
	ν Piscium	37 44 57	10	21	39	22	02	14 41	36 26 75	66	00
	ε Ceti	48 01 73	14	14	39	30	02	01 52	46 43 89	63	03
	β Arietis	50 39 01	09	29	41	34	02	38 71	49 21 01	70	04

α = ·330   c = ·387
Chronometer correction at 1h 05m = 1m 17s·657 ·005

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
W	σ Arietis	2 47 30 97	13	32	41	34	02	34 25	2 46 12 49	1 18 76	08
	θ Eridani	55 56 23	25	05	52	29	02	56 82	54 38 30	52	16
	α Ceti	58 35 05	15	25	[illegible]	27	02	35 30	57 16 58	72	04
	α Horologii	3 02 40 04	34	34	[illegible]	24	04	41·03	3 01 22 30	73	05
	ο Tauri	20 58 48	14	28	40	11	02	58 55	19 39 82	73	05
	ε Eridani	29 44 01	17	17	40	05	02	44 10	28 25 41	69	01
E	δ Eridani	39 59 19	08	17	10	02	02	58 66	38 39 98	68	04
	γ Hydri	50 05 76	26	97	1 48	40	07	05 34	48 46 64	70	02
	γ¹ Eridani	54 53 36		45	41	13	02	52 75	53 34 05	70	02
	λ¹ Tauri	4 00 22 01		36	43	17	02	21 08	59 02 41	67	01
	o¹ Eridani	08 31 21		19	40	22	02	30 16	4 07 11 82	64	04
	ε Tauri	21 21 64	06	35	42	34	02	20 57	22 61 89	68	00

α = ·405   c = ·395
Chronometer correction at 3h 36m = 1m 48s·683 ± ·013

TRANSIT OBSERVATIONS.

Station: Doubtless Bay. Date, December 11th, 1903. Observer: Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	ι Ceti	0 16 00·99	·26	·15	·36	−·27	·02	00·99	0 14 32·27	1 28·72	·00
	β Hydri	22 09·74	−·99	−1·10	1·70	−·23	·08	10·28	20 41·55	·73	·01
	η Ceti	26 37·31	·25	·17	·36	−·21	·02	37·22	25 08·56	·66	·06
	β Ceti	40 15·16	·29	·10	·38	·11	·02	15·06	38 46·40	·66	·06
	δ Piscium	45 11·54	·21	·23	·36	·08	·02	11·22	43 42·45	·77	·05
	α Sculptoris	55 27·81	·33	·03	·41	·02	·02	27·70	53 58·92	·7·	·06
	ε Piscium	59 27·30	·21	·23	·36	·02	·02	26·88	57 58·08	·80	·08
W	β Phœnicis	1 03 16·40	·06	−·11	·53	·04	·03	16·73	1 01 48·03	·70	·02
	ζ[1] Piscium	10 12·06	·03	·23	−·36	·09	·02	12·11	08 43·41	·70	·02
	θ Ceti	20 42·61	·03	·15	·36	·15	·02	42·68	19 13·91	·77	·05
	γ Phœnicis	25 40·45	−·05	·07	·50	·18	·02	40·87	24 12·08	·79	·07
	η Piscium	27 50·25	·02	·27	−·37	·20	·02	50·15	26 21·42	·73	·04
	α Eridani	35 36·74	−·06	·25	·67	·26	·04	37·42	34 08·73	·69	·03
	ν Piscium	37 55·51	−·03	·22	−·35	·27	·02	55·39	36 26·72	·67	·05

$c = +\cdot341$ $e = +\cdot360$

Chronometer correction at 0h 57m = 1m 28s·725 ± ·010

TRANSIT OBSERVATIONS

Station: Doubtless Bay. Date, December 12th, 1903. Observer: Otto Klotz

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of cor. transit	R. A.	Chronometer correction	
		h. m. s.	s.	s.	s.	s. 40	s.		h. m. s.	m. s.	s.
E	γ Pegasi	0 09 58 46	13	27	11	34	02	58 23	0 08 17 88	1 10 35	08
	ι Ceti	16 42 80	18	15	10	·29	02	12 70	14 32 25	15	02
	β Hydri	22 21 76	69	1 13	1 88	25	08	21 87	20 41 45	12	01
	12 Ceti	26 49 19	17	18	10	22	02	48 98	25 08 55	43	00
	β Ceti	40 26 98	20	11	12	13	02	26 76	38 46 39	37	06
	δ Piscium	45 23 36	15	21	10	10	02	22 95	43 42 44	51	08
	α Sculptoris	55 39 65	·23	04	16	02	02	39 38	53 58 91	47	04
W	β Phoenicis	1 03 28 01	16	11	59	02	03	28 50	1 01 48 00	50	07
	ζ¹ Piscium	10 23 82	09	23	40	07	02	23 84	08 43 39	42	04
	γ Phoenicis	25 52 23	16	07	55	18	02	52 49	21 12 06	43	00
	η Piscium	28 01 97	08	28	11	19	02	01 84	26 21 40	44	·02
	α Eridani	35 48 64	20	25	74	21	01	49 42	34 08 71	44	02
	ν Piscium	38 07 31	09	22	19	26	02	07·12	36 26 71	44	02
	ξ Ceti	48 24 46	11	15	11	34	02	24 25	46 43 87	38	05

a = ·350   c = ·398
Chronometer correction at 0h 59m = 1m 10s·426 ± ·009

Clamp	Star	Transit over mean of threads	Level and inequality of pivots	Azimuth	Collimation	Rate	Aberration	Seconds of cor. transit	R. A.	Chronometer correction	
W	α Horologii	3 03 02 71	42	34	·92	31	03	03 83	3 01 22 26	1 41·57	02
	δ Arietis	08 50 73	14	·35	·49	·27	02	56 98	06 09 43	55	·00
	τ¹ Arietis	47 23·52	14	35	·19	22	02	23·72	15 42 18	51	04
	f Tauri	27 16 81	16	30	47	15	02	16 95	25 35 41	51	01
	ε Eridani	30 06 70	21	17	46	13	02	06·89	28 25 44	48	07
	τ⁵ Eridani	31 15 07	·21	10	·50	12	02	15·33	29 33 76	57	02
	η Tauri	43 29 18	13	37	50	04	02	29 50	41 47 90	60	05
E	λ¹ Tauri	4 00 14 79	09	·36	50	07	02	43 93	59 02 12	54	04
	ω¹ Tauri	05 18 08	− 08	35	49	10	02	17 20	4 03 35 58	62	07
	ν¹ Eridani	08 53 99	− 13	18	46	13	02	53 33	07 11 82	54	04
	α Reticuli	14 55·45	− ·29	− 41	1·00	·17	04	51 94	13 13 36	·58	·03
	ε Tauri	24 44 46	09	35	49	23	·02	43·46	23 01·90	56	01
	α Tauri	32 08 47	10	33	48	29	02	07 45	30 25 95	50	·05
	53 Eridani	35 30·51	·45	44	47	·31	02	29 72	33 48 13	59	[illegible]

a = ·102   c = ·460
Chronometer correction at 3h 49m = 1m 41s·551 ± ·010

TRANSIT OBSERVATIONS.

Station, Doubtless Bay. Date, December 17th, 1903. Observer: Otto Klotz.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 33	s.		h. m. s.	m. s.	s.
E.	β Hydri...	0 23 19 89	42	1 00	1 74	30	08	19 79	0 20 40 98	2 38 81	07
	δ Piscium...	46 21 68	10	21	37	18	02	21 36	43 42 39	97	09
	α Sculptoris...	56 37 93	14	03	42	13	02	37 73	53 58 81	89	01
	ε Piscium...	1 00 37 10	·0	21	37	10	02	37 00	57 58 03	97	09
	β Phœnicis.	04 27 10	·7	10	54	08	02	26 89	1 01 47 91	98	10
	ζ¹ Piscium..	11 22 70	10	24	37	04	02	22 24	08 13 35	89	01
	θ Ceti..	21 53 19	11	14	37	01	02	52 76	19 13 85	91	03
W	o Piscium...	42 58 92	42	22	37	13	02	58 80	40 20 03	77	11
	ζ Ceti..	49 22 64	16	13	38	17	02	22 54	46 43 83	71	17
	β Arietis...	52 00 06	·10	27	39	18	02	59 88	49 20 96	92	04
	α Hydri...	58 23 40	32	·30	79	21	04	23 92	55 14 87	39 05	17
	α Arietis...	2 04 25 62	10	29	40	·25	02	25 36	2 01 46 55	38 81	07
	67 Ceti...	14 51 12	15	15	·37	30	02	51 17	12 12 33	81	04
	κ Forn	20 48 63	18	06	41	33	02	48 45	18 09 59	86	02

a = ·310 c = ·369

Chronometer correction at 1ʰ 19ᵐ = 2ᵐ 38ˢ·883 ± ·018

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	δ Eridani	3 41 19 62	·25	18	37	25	02	19 79	3 38 39 98	2 39 81	07
	γ Hydri...	51 24 65	·79	98	1 36	19	06	26 33	48 16 40	93	05
	o¹ Eridani...	56 13 85	26	15	37	17	02	13 96	53 34 06	90	02
	γ¹ Tauri...	4 01 42 31	16	·37	·39	14	02	42 29	58 62 44	85	03
	A¹ Tauri...	06 15 50	17	35	38	11	02	15 45	4 03 35 60	85	03
	ω¹ Eridani...	09 51 68	21	19	·37	09	02	51 69	07 11 84	85	03
E.	α Doradûs..	31 37 41	·01	24	64	04	03	36 90	31 57 17	73	15
	π¹ Orionis...	47 19 67	02	·27	37	12	02	18 87	44 38 92	95	07
	ε Leporis...	5 04 05 79	02	09	39	21	02	05 06	5 01 25 12	94	06
	β Eridani...	05 49 82	02	20	36	22	02	49 00	03 09 06	94	06
	α Leporis..	11 19 17	02	13	·38	25	02	18 37	08 38 39	98	10

a = ·408 c = ·363

Chronometer correction at 4ʰ 26ᵐ = 2ᵐ 39ˢ·885 ± ·018

TRANSIT OBSERVATIONS.

Station: Doubtless Bay. Date, December 18th, 1903. Observer: Otto Klotz.

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	β Hydri	0 23 29 87	65	1 17	1 76	37	08	30 12	0 20 40 88	2 49 24	01
	β Ceti	41 35 66	19	11	30	27	02	35 48	38 46 31	17	06
	δ Piscium	46 32 00	14	25	38	15	02	31 61	43 42 37	21	04
	25 Ceti	50 55 87	16	26	37	12	02	55 54	48 06 35	19	04
	α Sculptoris	56 48 29	21	01	43	10	02	48 07	53 58 82	25	02
	ι Piscium	1 00 47 73	14	25	38	06	02	47 26	57 58 01	25	02
	θ[illegible] Piscium	11 33 17	14	24	38	04	02	32 64	1 08 43 36	28	05
						03					
W	θ Ceti	22 03 06	12	16	·37	10	02	63 03	19 13 84	19	04
	ζ Phoenicis	27 00 20	18	08	52	13	02	61 17	24 11 95	22	01
	η Piscium	29 10 78	09	29	38	11	02	10 62	26 21 35	27	04
	α Eridani	36 57 29	22	26	70	18	03	57 82	34 08 54	28	05
	ν Piscium	39 16 06	10	23	37	20	02	15 88	36 26 67	21	02
	ο Piscium	43 09 49	09	25	38	23	02	09 28	40 20 02	26	03
	ι Ceti	58 18 76	13	09	10	32	02	18 60	55 29 39	21	02

a = +·362   c = +·373

Chronometer correction at 1h 10m = 2m 49s·234 ± ·007

Clamp	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	f Tauri	3 28 25 48	08	27	13	25	02	25 79	3 25 35 42	2 50 37	01
	ε Eridani	31 15 37	10	15	42	23	02	15 75	28 25·40	35	04
	τ[illegible] Eridani	32 23 70	12	09	15	22	02	21 44	29 33 77	37	01
	δ Eridani	41 29 99	11	15	43	17	02	50 31	38 39 93	38	02
	γ Hydri	51 34 58	33	85	1 56	54	06	36 71	48 46 56	35	01
	γ[1] Eridani	56 24 46	11	13	13	07	02	24 10	53 34 06	31	02
E	λ[1] Tauri	4 01 52 75	07	32	45	04	02	52 83	59 02 44	39	03
	α Reticuli	16 01 02	35	·36	·01	05	04	63 75	4 13 13 29	44	08
	ε Tauri	25 53·03	11	31	44	10	02	52 27	23 01 93	34	02
	α Doradûs	34 17 82	29	21	73	16	03	17 40	31 57 16	24	12
	53 Eridani	36 30 12	17	13	43	17	02	38 54	33 48 16	38	02
	τ Tauri	39 21 55	10	32	45	19	02	20 67	36 30·32	·35	01
	μ Eridani	43 34 36	15	19	42	22	02	33 66	40 43·32	·34	02
	π[1] Orionis	47 30 14	13	24	42	25	02	29 31	44 38 92	39	03

a = +·356   c = +·417

Chronometer correction at 4h 18m = 2m 50s·530 ± ·009

TRANSIT OBSERVATIONS.

Station, Doubtless Bay. Date, December 19th, 1903. Observer, Otto Klotz.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s. ·10	s.		h. m. s.	m. s.	s.
E	θ Eridani	2 57 39 41	40	04	54	33	02	39 32	2 54 38 21	3 01 11	29
	α Ceti	3 00 18 03	06	18	41	31	02	17 79	57 16 56	23	08
	5 Arietis	09 11 22	05	24	43	25	02	10 83	3 06 09 43	40	19
	ι Tauri	28 37 27	06	21	42	13	02	36 81	25 35 42	39	08
	ε Eridani	31 27 05	07	12	41	11	02	26 68	28 25 39	29	02
	τ Eridani	32 35 44	08	07	44	10	02	35 09	29 33 76	33	02
	δ Eridani	41 41 65	07	12	42	04	02	41 20	38 39 93	27	04
W	ζ Hydri	51 45 88	51	67	1 54	03	06	47 49	48 46 31	18	13
	ν¹ Eridani	56 35 26	37	10	42	06	02	35 33	53 34 06	27	04
	λ Tauri	4 02 03 82	40	25	44	10	02	03 79	59 02 44	35	04
	ω¹ Tauri	06 37 07	11	21	43	13	02	37 00	4 03 35 60	40	09
	o¹ Eridani	10 13 21	15	13	41	15	02	13 16	07 11 84	32	01
	ε Tauri	26 03 48	14	21	43	26	02	03 28	23 01 94	34	03
	53 Eridani	36 49 77	17	40	42	33	02	49 57	33 48 16	41	10

a = −0·281 c = +·410

Chronometer correction at 3h 47m = 3m 01s·308 ± ·020

TRANSIT OBSERVATIONS.

Station: Wellington. Date, December 6th, 1903. Observer: Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corrected transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	·25			h. m. s.	s.	s.
E	δ Piscium	0 43 47 32	20	39	37	23	02	48 03	0 43 42 50	5 53	0
	β Phoenicis	1 01 52 80	43	08	54	15	02	53 52	1 01 48 13	39	14
	ε¹ Piscium	08 48 20	20	39	37	12	02	49 02	08 13 45	57	07
	θ Ceti	19 18 53	24	28	37	09	02	19 31	19 13 96	35	15
	η Piscium	26 26 30	15	45	38	06	02	27 20	26 21 46	74	24
	τ Eridani	34 13 14	5.	28	63	01	03	14 31	34 08 87	47	03
W	ζ Ceti	46 49 16	17	49	40	04	02	49 41	46 43 92	52	02
	α Hydri	55 51 32	65	39	79	08	03	50 85	55 45 20	65	15
	ξ¹ Ceti	2 07 00 56	22	10	37	13	02	00 92	2 07 55 47	45	05
	κ Fornacis	18 14 79	36	17	41	17	02	15 06	18 09 68	38	12
	ν Ceti	30 55 93	23	38	37	22	02	56 37	30 50 99	38	12

a = ·522 · ·370
Chronometer correction at 1h 37m 5s·496 ·031

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corrected transit.	R. A.	Chronometer correction.	
W	γ Hydri	3 48 52 86	+1 25	88	1 22	22	06	51 73	3 48 46 76	1 97	13
	λ¹ Tauri	59 07 00	18	49	35	17	02	07 22	59 02 39	83	01
	ω² Eridani	4 07 16 49	31	29	33	14	02	16 60	4 07 11 80	80	04
	γ Tauri	14 25 30	21	46	34	11	02	25 50	14 20 95	55	29
	ε Tauri	23 06 53	20	47	35	07	02	06 76	23 01 86	90	06
	α Tauri	30 30 34	21	46	31	04	02	30 61	30 25 91	70	14
E	ι Aurigae	50 19 73	10	59	39	04	02	50 83	50 15 92	91	07
	ε Leporis	5 01 29 24	31	18	35	05	02	30 11	5 01 25 01	5 07	23
	δ Orionis	10 00 70	26	28	33	12	02	01 67	09 56 59	08	24
	β Doradûs	32 53 71	02	49	71	22	03	54 86	32 50 29	4 57	27

a = ·512 · ·326
Chronometer correction at 4h 40m 4s·840 ·040

TRANSIT OBSERVATIONS.

Station, Wellington. Date, December 7th, 1903. Observer, Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	09	s.		h. m. s.	s.	s.
E.	[illegible] Piscium	1 26 24 11	19	23	35	07	02	24 79	1 26 21 45	3 34	14
	ε Eridani	34 11 04	60	14	61	06	03	12 05	31 08 84	21	01
	β Arietis	49 23 16	18	25	57	04	[illegible]	24 20	49 21 03	17	03
	[illegible] Ceti	55 31 94	34	10	37	03	[illegible]	32 70	55 29 17	23	[illegible]
	β Trianguli	2 03 53 33	10	31	12	02	02	54 12	2 03 51 01	11	09
W.	[illegible] Ceti	30 54 19	23	19	34	02	02	51 27	30 50 99	28	08
	[illegible] Ceti	38 23 43	24	19	34	03	02	23 53	38 20 43	10	10
	[illegible] Arietis	46 15 54	19	25	35	05	02	15 64	[illegible] 12 50	14	06
	[illegible] Arietis	53 47 56	17	25	37	06	02	47 65	53 44 41	21	04
	α Horologii	3 01 25 69	65	17	69	07	03	25 52	3 01 22 36	16	04

a = ·265 c = ·343

Chronometer correction at 2h 14m = 3s·196 ± ·024

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W.	ε Persei	3 54 29 30	08	48	39	06	02	26 30	3 51 26 27	3 12	05
	λ Tauri	59 05 37	20	36	32	05	02	05 51	59 02 40	11	0[illegible]
	ω¹ Tauri	4 03 38 57	21	34	32	04	02	38 74	4 03 35 56	18	04
	α Reticuli	13 16 82	82	30	65	03	03	16 64	13 13 11	22	05
	ε Tauri	23 04 82	21	31	32	01	02	05 02	23 01 87	15	10
E.	α Doradus	31 59 12	58	46	52	00	02	60 34	31 57 20	14	03
	μ Eridani	40 45 70	27	23	30	02	02	46 50	40 43 26	21	07
	π⁴ Orionis	44 44 21	17	28	30	02	02	41 99	44 38 85	14	03
	ε Aurigæ	54 48 33	14	43	35	03	02	49 23	54 45 93	30	13
	β Orionis	5 09 58 83	20	25	30	06	02	59 67	5 09 56 64	06	11

a = ·373 c = ·298

Chronometer correction at 4h 30m = 3s·165 ± ·022

TRANSIT OBSERVATIONS.

Station, Wellington. Date, December 11th, 1903. Observer, Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	09			h. m. s.	s.	s.
E.	α Eridani	1 34 06 72	53	10	55	07	03	07 60	1 34 08 71	1 14	12
	ο Piscium	40 18 73	26	11	36	06	02	19 32	40 20 08	0 76	26
	β Arietis	49 19 40	15	18	31	05	02	19 97	49 21 00	1 03	01
	ξ¹ Ceti	2 07 53 80	19	15	30	02	02	54 40	2 07 55 45	1 05	03
W.	ν Ceti	30 49 79	23	14	29	01	02	49 86	30 50 98	1 12	10
	γ Ceti	38 19 30	26	14	29	02	02	19 41	38 20 42	1 01	01
	θ Eridani	54 37 11	17	00	39	05	02	37 22	54 38 29	1 07	05
	α Horologii	3 01 21 36	68	43	79	06	03	21 35	3 01 22 28	0 93	09
	δ Arietis	06 08 26	19	18	34	07	02	08 37	06 09 44	1 07	05

a = ·196 c = ·293.

Chronometer correction at 2h 20m = 1s·021 ± ·031

TRANSIT OBSERVATIONS

Station—Wellington. Date—December 12th, 1903. Observer—Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and equality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Reduced transit.	R.A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	s.	
E	ι Ceti	1 46 40·04	·20	·16	·57	·09	·02	40·56	1 46 43·87	3·31	·05
	α Hydri	55 41·04	·46	·24	·55	·07	·03	41·74	55 45·02	·31	·04
	α Arietis	2 01 42·56	·11	·31	·28	·06	·02	43·15	2 01 46·59	·44	·08
	ξ₁ Ceti	12 08·46	·19	·18	·26	·04	·02	09·06	12 12·36	·35	·03
	κ Fornacis	18 05·56	·24	·10	·29	·03	·02	06·14	18 09·63	·49	·13
W	ν Ceti	30 47·44	·24	·23	·26	·00	·02	47·65	30 50·97	·34	·02
	γ Ceti	38 16·89	·25	·22	·26	·01	·02	47·09	38 20·41	·32	·04
	σ Arietis	46 08·90	·24	·27	·27	·03	·02	09·12	46 12·48	·36	·00
	α Horologii	3 01 18·89	·67	·20	·52	·06	·03	18·87	3 01 22·26	·39	·03
	ε Arietis	15 38·57	·15	·30	·28	·09	·02	38·88	15 42·18	·32	·01

ω = ·317 ε = ·261

Chronometer correction at 2h·31 = 3s·362 ± ·017

Clamp.	Star.	Transit over mean of threads.	Level and equality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Reduced transit.	R.A.	Chronometer correction.	
W	ε Tauri	4 22 58·47	·24	·15	·30	·00	·02	58·42	4 23 01·90	3·48	·9
	α Doradus	31 53·52	·67	·07	·49	·07	·03	53·53	31 57·19	·66	·02
	α Eridani	40 39·54	·31	·10	·28	·05	·02	39·60	40 43·28	·68	·00
	ι Aurigæ	50 42·34	·13	·18	·33	·03	·02	42·27	50 45·98	·71	·03
	ι Leporis	5 01 21·22	·40	·06	·30	·01	·02	21·35	5 01 25·08	·73	·05
E	β Orionis	09 52·19	·31	·09	·28	·04	·02	52·86	09 56·64	·78	·10
	Bellatrix	19 55·74	·25	·12	·28	·03	·02	56·40	20 00·12	·72	·04
	B.A.C.1740	27 28·11	·53	·02	·41	·04	·02	29·38	27 32·90	·52	·16
	κ Orionis	43 09·07	·30	·08	·28	·07	·02	09·78	43 13·42	·64	·04
	α Orionis	49 55·24	·25	·12	·28	·09	·02	55·96	49 59·67	·71	·03

ω = ·147 ε = ·280

Chronometer correction at 5h·06 = 3s·684 ± ·034

TRANSIT OBSERVATIONS.

Station: Wellington. Date, December 17th, 1903. Observer: Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 01	s.		h. m. s.	s.	s.
E	ξ¹ Ceti	2 07 51 17	19	·31	26	03	02	51 88	2 07 55 41	3 53	03
	φ Eridani	13 00 97	17	12	41	03	02	01 68	13 05 33	65	09
	ξ² Ceti	22 59 94	19	31	26	02	02	60·66	23 04 66	40	16
	ν Ceti	30 46 69	20	29	25	04	02	47 40	30 50·95	55	01
	γ² Ceti	38 16 07	− 21	28	25	01	02	16 78	38 20 39	61	05
W	σ Arietis	16 08 57	25	34	26	00	02	08 88	46 12 47	59	03
	μ Horologii	3 01 18 57	85	26	51	01	03	18 63	3 01 22 15	·52	04
	τ¹ Arietis	15 38 30	− 21	38	27	02	02	38·62	15 42 18	56	00
	ο Tauri	19 35 49	− 29	31	·26	02	02	36 33	19 39 82	49	07
	11 Tauri	34 59 49	22	40	28	03	02	59 81	35 03 51	67	11

a = ·399   c = ·254

Chronometer correction at 2h 51m = 3s·559 ± ·027

Station: Wellington. Date, December 18th, 1903. Observer: Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 04	s.		h. m. s.	s.	s.
E	ξ¹ Ceti	2 07 50 27	− 21	32	24	·02	02	51 00	2 07 55 41	4 41	·07
	φ Eridani	13 00 03	− 51	13	·39	·02	02	00 76	13 05·31	55	07
	ξ² Ceti	22 58·89	− 24	− ·32	·24	·01	·02	59 63	23 01·06	13	− 05
	δ Ceti	34 29 32	− 21	− 28	24	·01	02	30·05	34 34 50	45	− 03
	γ² Ceti	38 15 14	23	29	·24	·00	02	15 88	38 20 39	51	03
W	γ Arietis	16 07 73	21	36	25	·00	02	08 03	16 12 47	44	− 01
	ε Arietis	53 39 61	18	39	26	·01	02	39 94	53 14 39	15	03
	μ Horologii	3 07 17 79	− 09	27	48	·01	03	17 71	3 01 22 13	42	06
	τ¹ Arietis	15 37 40	17	·40	26	·02	02	37 71	15 42 18	47	− 01
	ο Tauri	19 34 81	23	32	24	·03	02	35 13	19 39 82	69	·21

a = ·420   c = ·239

Chronometer correction at 2h 43m = 4s·479 ± ·029

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	α Reticuli	4 13 08 89	76	21	73	·03	03	08 65	4 13 13 29	4 64	05
	ε Tauri	22 57 33	20	− 25	36	·02	02	57·38	23 01 93	55	14
	α Tauri	30 21 16	− 21	23	35	·02	02	21 21	30 25·99	78	09
	τ Tauri	36 25 56	− 18	26	36	·01	02	25 61	36 30 33	72	03
	α Eridani	40 38 47	− 29	16	34	·04	02	38 55	40 43·32	77	08
E	ι Aurigae	50 40 05	·09	− 31	·40	·00	02	41 44	50 46 04	·60	09
	ε Leporis	5 01 19 67	− 30	40	36	·01	02	20 42	5 01 25 12	70	01
	β Orionis	09 51 20	25	·15	34	·01	02	51 93	09 56 70	77	08
	β Bellatrix	19 54 80	20	− 20	34	·02	02	55 54	20 00 18	·64	05
	β Doradus	32 11 56	20	21	73	·03	03	45 67	32 50 36	69	00

a = ·268   c = ·336

Chronometer correction at 1h 53m = 4s·687 ± ·023

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: Wellington. Date, January 10th, 1904. Observer: Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. ·012	s.		h. m. s.	s.	s.
E	o^1 Eridani	4 06 29 16	07	58	17	·01	02	29 63	4 07 11 76	42 13	01
	ε Tauri	22 18 96	05	61	18	·01	02	19 69	23 01 92	42 23	09
	α Doradûs	31 15 00	·15	28	30	·01	03	14 85	31 56 83	41 98	16
	π^4 Orionis	43 56 04	06	50	17	·01	02	56 64	44 38 95	42 31	17
W	κ Orionis	5 42 31 39	02	·35	17	00	02	31 53	5 43 13 60	42 67	07
	1 Geminorum	57 36·16	01	·65	·19	·01	·02	36 58	58 18 65	42 07	07
	α Argus	6 21 09 83	03	22	28	·01	03	09 26	6 21 51 57	42 31	17
	γ Geminorum	31 29 16	04	·59	48	·01	02	29 53	32 11 52	41·99	15

a = ·665 c = ·173

Chronometer correction at 5h 18m = 42s·135 ± ·050

PERSONAL EQUATION

TRANSIT OBSERVATIONS.

Station: Wellington. Date, January 11th, 1904. Observer: Thos. King.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	r.
		h. m. s.	s.	s.	s.	s. ·024	s.		h. m. s.	s.	s.
E	ε Geminorum	6 37 20 13	02	83	14	02	02	21 12	6 38 03 20	42 08	14
	ε Canis Majoris	51 10 46	08	20	14	01	02	10·87	54 52 89	42·02	08
	δ Geminorum	7 13 42 19	05	80	13	01	02	43 16	7 14 24 99	41 83	11
	Q Carinae	32 37 73	11	25	20	00	03	37 76	33 19 64	41 88	06
W	ζ Argûs	59 32 86	·20	02	16	01	·02	32 89	8 00 14 68	41 79	·15
	ε Argûs	8 19 54 36	·29	49	24	02	03	53·87	20 35 89	42 02	08

a = ·817 c = ·122

Chronometer correction at 7h 28m = 41s·935 ± ·014

TRANSIT OBSERVATIONS.

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: WELLINGTON. Date, January 10th, 1904. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
			s.	s.	s.	r − ·012	s.		h. m. s.	s.	s.
E	η Tauri	3 41 05·34	·04	68	23	01	02	06·20	3 41 47·80	41·60	01
	γ[1] Eridani	52 51·95	08	32	− 22	01	·02	52·40	53 33·95	55 −	04
	ω[1] Tauri	4 02 53·18	05	63	− 23	− ·01	02	53·98	4 03 35·55	·57	02
	α Reticuli	12 31·44	·18	55	− 16	− ·01	·03	31·15	13 12·73	58	01
	τ Tauri	35 47·83	04	67	− ·23	·00	·02	18·67	36 30·33	66	07
W	ι [illegible]is	5 00 43·65	·06	25	·23	00	·02	43·59	5 01 25·11	52 −	07
	[illegible]is	19 18·63	01	·38	22	00	·02	18·73	20 00·27	·51 +	05
	[illegible]adüs	32 09·65	·12	54	16	01	03	08·49	32 50·12	63 −	04
	[illegible]onis	49 18·02	04	·52	22	01	·02	18·25	49 59·91	66 −	07
	η Geminorum	6 08 24·61	03	67	23	01	02	24·99	6 09 06·55	56 −	03

a = ·689 c = − ·213
Chronometer correction at 4h 54m = 41·586 ± ·014

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: WELLINGTON. Date, January 11th, 1904. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. r − ·012	s.		h. m. s.	s.	s.
E	γ Geminorum	6 31 29·21	− 03	56	10	− 01	02	29·99	6 32 11·52	−41·53	·01
	α Pictoris	46 34·34	10	56	20	00	03	34·05	47 15·57	52	00
	δ Canis Majoris	7 03 49·06	05	·22	10	·00	02	49·41	7 04 30·96	·55	03
	β Canis Minoris	24 16·04	− ·03	− 58	09	·00	·02	16·72	21 58·21	·49	03
W	ξ Argûs	44 35·25	− 22	24	10	00	02	35·59	45 17·11	52	00
	γ Argûs	8 05 55·34	− ·31	11	14	01	02	55·37	8 06 36·89	·52	00

a = − ·754 c = + ·093
Chronometer correction at 7h 15m = 41·521 ± ·008

Hence the weighted mean, King anticipates Klotz ·257 ± ·045

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station : OTTAWA. Date, June 22nd, 1904. Observer : F. W. O. WERRY.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
E	201	15 15 24 42	06	03	55	r ·14					
	203	24 40 21	05	·18	1 50	07	02	23 89	15 44 39 88	3 44 01	02
	205	27 38 81	01	04	·53	06	05	38·49	20 54 52	43 97	02
	206	31 15 42	01	·01	61	04	02	38·33	23 54 26	44 07	08
	593	33 56·24	- ·01	11	47	03	02	14 81	27 30 80	44 01	05
	212	43 18 88	- 04	- ·08	46	03	02	55·87	30 41 87	44 00	01
						00	01	18 53	59 34 62	43 91	08
W	217	51 12 67	07	- ·38	+ 2 23	01	07	15 13	47 31 16	43 97	02
	221	16 09 30·30	04	00	65	06	02	30 91	16 05 46 90	44 04	02
	222	13 05 02	02	14	46	07	04	05 31	09 21·35	43·96	·03
	223	17 00 56	- 03	·11	46	07	01	00 86	13 16 98	43 88	11
	225	21 27 09	- ·05	07	·49	08	02	27 46	17 43 39	44 07	08
	473	24 45 19	- 05	08	47	00	02	45 52	21 01 47	44·05	06

a_1 - ·421 a_2 - ·146 c - ·460

Chronometer correction at 15h 45m 3m 43s ·993 ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	229	16 31 55 52	15	02	1 07	07	04	56 75	16 28 42 76	3 43 99	·10
	230	34 46 33	·08	00	52	- 06	02	46·97	31 02 78	44 19	10
	231	41 25 98	- 07	00	45	01	02	26·52	37 42 44	44 08	01
	232	43 22 17	·08	00	50	04	02	22 77	39 38 59	44 18	09
	478	51 28 [illegible]	05	01	40	02	02	29 06	47 45 00	44 06	·03
	233	56 53 4[illegible]	05	- 01	- 39	01	01	53 89	53 09 87	44 02	07
E	234	17 00 23·71	15	00	45	00	02	23 39	56 39 36	44 03	06
	598	08 39 67	07	01	40	02	02	39 34	17 04 55 12	44 19	10
	236	12 18·13	31	01	·24	·03	04	17 42	08 33·37	44 05	04
	238	14 52 23	- ·14	00	42	03	02	51 90	11 07 73	44 17	08
	241	34 15 59	12	01	39	08	02	15 23	30 31 18	44 05	04

a - ·045 c - ·384

Chronometer correction at 17h 00m 3m 44s ·095 ± ·016

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station : OTTAWA. Date, June 22nd, 1904. Observer : OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads	Level and inequality of pivots.	Azimuth	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
		h. m. s.	s.	s.	s.	s. ·14	s.		h. m. s.	m. s.	s.
E	201	15 15 23·01	·00	- 16	42	97	·02	23·64	15 11 39·88	3 43 76	09
	203	24 38·22	08	1 01	1 15	· 06	05	38·45	20 54 52	93	08
	205	27 37 37	04	· 22	·40	04	02	38 05	23 54 26	79	06
	206	31 13 94	05	· 07	47	· ·03	·02	14 54	27 30·80	74	11
	593	33 54·74	· ·03	· 61	·36	· ·03	02	55 75	30 11 87	·88	·03
	212	43 17·73	04	· 43	· ·36	00	01	18 55	39 34 62	93	08
W	217	51 19 60	99	1·79	1 71	·01	·07	15 03	47 31 16	87	02
	221	16 09 31·58	35	· ·01	50	06	02	30 66	16 05 46 90	·76	· ·09
	222	13 05 37	16	51	35	·07	01	05 29	09 21·35	·94	· 09
	223	17 00·95	16	· 53	35	07	01	00·89	13 16 98	·91	+ 06
	225	21 27 68	23	32	37	08	·02	27 30	17 43 39	91	+ ·06
	473	24 45 63	21	36	36	·09	02	45·31	20 01 47	84	·01

a = ·685 c = ·352

Chronometer correction at $15^h\ 45^m$ = $3^m\ 43^s\ 855 \pm ·016$

Clamp.	Star.	Transit over mean of threads	Level and inequality of pivots.	Azimuth	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	c.
W	229	16 31 59 09	·53	67	99	· ·07	04	56·93	16 28 12 76	3 44 17	·14
	230	34 47 44	·32	04	·48	· ·06	02	46·72	31 02 78	43 94	09
	231	41 26·80	27	· 17	41	04	02	26·31	37 42·44	43 87	16
	232	43 23 23	30	· 08	·46	04	·02	22·57	39 38·59	43·98	05
	478	51 29 28	*	- ·32	37	· 02	·00	29·04	47 45·00	44 04	01
	233	56 54 *		·36	·36	·01	- ·01	53 93	53 09 87	44·06	- ·03
E	234	17 00 22·72	08	,	· ·41	·00	·02	23 37	56 39 36	44·01	02
	598	08 38 33	04	·55	+ ·37	·02	- ·02	39 25	17 04 55 12	44 13	· 10
	236	12 16 95	16	52	+ 87	·03	04	17·39	08 33·37	44 02	01
	238	14 51 07	07	·24	· ·39	03	·02	51·72	11 07 73	43·99	04
	241	34 14 58	06	· ·34	- ·36	08	02	15·24	30 31·18	44·06	03
	600	35 51 41	04	· ·55	- ·37	08	·02	52 27	32 08 19	44 08	·05

a = ·607 c = ·354

Chronometer correction at $17^h\ 00^m$ = $3^m\ 44^s\ 033 \pm ·017$

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: OTTAWA. Date, June 23rd, 1904. Observer: F. W. O. WERRY.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 14	s.		h. m. s.	m. s.	s.
E	182	13 53 55 41	06	·10	·10	07	02	55 40	13 50 08 45	3 46 95	03
	183	14 00 34 36	06	15	09	06	04	34 41	56 47 49	46 92	·06
	184	05 35 98	·09	17	21	04	04	35 51	14 01 48 40	47 44	13
	458	09 49 88	·03	08	10	04	02	49 85	06 02 91	46 94	·04
	185	11 35 40	02	19	09	03	02	35·49	07 48 72	46 97	01
	186	14 47·63	03	17	09	·02	01	47·69	11 00 80	46 89	09
	188	16 32 66	01	01	13	02	02	32 51	12 45 53	46 98	00
W	191	27 04 14	02	16	09	00	01	04 46	23 17 14	47 00	02
	192	31 30 19	·02	07	10	02	02	30·34	27 43 27	47 07	09
	194	40 01 55	03	11	09	03	·02	01 73	36 14 78	46 95	03
	196	41 48 98	02	17	09	·04	·04	49 21	38 02 18	47 ·03	05
	197	45 12 65	02	·15	·09	·05	02	12 84	41 25·77	47 07	09
	198	54 47 24	·10	11	34	07	06	47 11	51 00·20	46 91	07

a = ·223   c = ·09

Chronometer correction at $14^h 25^m$ = $3^m 46^s·983$ ± ·014

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	465	15 04 08 92	·06	01	10	07	·02	09 12	15 00 21 83	3 47 29	08
	201	15 26 91	08	04	41	04	02	27 15	11 39·87	21	03
	203	24 41 10	22	05	30	02	05	41·64	20 54 47	17	04
	205	27 41·34	·08	04	·11	02	02	41 49	23 54 25	21	03
	206	31 17 88	12	·00	·11	01	02	18 10	27 30·80	·30	09
E	212	43 21 80	11	02	09	01	·01	21 78	39 34 61	17	04
	213	45 34 84	·13	01	10	03	02	34 81	41 47 60	·21	00
	215	48 14·47	13	01	10	03	02	14 44	44 27 29	15	06
	217	51 18 23	57	08	45	04	07	18 32	47 31·10	22	01
	221	16 09 34 50	·21	00	·13	08	02	34 08	16 05 46 89	19	02
	222	13 08 58	10	02	·09	08	01	08 48	09 21 34	14	07

a = ·030   c = ·093

Chronometer correction at $15^h 30^m$ = $3^m 47^s·215$ ± ·012

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: OTTAWA. Date, June 23rd, 1904. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	14	s.		h. m. s.	m. s.	s.
E	183	11 00 33 77	·04	52	03	06	01	34·41	13 56 47 49	3 46 92	05
	184	05 35 71	11	·59	07	·04	·04	35 30	11 01 48 40	90	03
	458	09 49 35	06	29	03	04	02	49 75	06 02 91	84	03
	185	14 31 71	03	03	03	03	02	35 44	07 48 52	·89	02
	186	14 47 07	·04	59	03	·02	01	47 71	11 00 80	94	07
	188	16 32 24	10	02	04	02	02	32 33	12 45·53	80	07
W	191	27 03 85	12	·55	·03	00	01	04 24	23 17·40	84	03
	192	31 30 20	22	23	·03	·01	02	30 15	27 43 27	88	·01
	194	40 01·39	16	38	03	03	02	01 53	36 44 78	·75	12
	196	41 48·72	11	·59	03	04	·01	49 12	38 02 18	·94	·07
	197	15 12·38	13	51	03	·05	·09	12 66	41 25 77	·89	·02
	198	54 49 27	·57	1 37	41	07	06	47 09	51 00 20	89	·02

$a = ·755$ $c = ·027$

Chronometer correction at 14h 25m = 3m 46s·872 ± s·013

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	199	15 02 08 65	−·23	−09	·02	·07	02	08·58	14 58 24 56	−3 47·02	05
	465	04 08·70	18	·29	·02	07	02	08·88	15 00 21·83	·05	02
	201	15 26 88	20	·20	·02	04	02	26·92	11 39·87	·05	·02
	203	24 43 30	·51	−1·23	·05	·02	·05	11·58	20 54 47	11	01
	205	27 11 20	19	·27	·02	−·02	02	41 39	23 54 25	·05	02
	206	31 17·98	·23	08	·02	·04	02	47·84	27 30 80	·04	·03
E	212	43 21 14	·11	·52	02	01	·01	21 73	39 34 61	12	05
	213	45 21 20	−·12	·42	·02	03	02	31·67	41 47 60	07	03
	215	48 13·87	·13	·40	·02	03	·02	11·33	44 27·29	01	·03
	217	51 19 96	·55	2 18	08	·04	·07	18 11	47 31·10	04	·00
	222	16 13 07 91	·09	62	02	·08	·01	08 51	16 09 21 34	·17	10

$a = ·834$ $c = -·016$

Chronometer correction at 15h 30m = −3m 47s·073 ± s·010

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station: OTTAWA. Date, June 24th, 1904. Observer: F. W. O. WERRY.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
		h. m. s.	s.	s.	s.	s.	s.		h. m. s.	m. s.	s.
						·14					
E.	182	13 53 58·65	·08	·07	·00	·07	·02	58·60	13 50 08·44	3 50·16	·10
	183	14 00 37·60	·05	·10	·09	·06	·01	37·70	56 47·48	·22	·04
	184	05 39·18	·12	·11	·24	·05	·04	38·75	14 01 48·36	·39	− ·13
	458	09 53·22	·02	·06	·10	·04	·02	53·18	06 02·90	·28	− ·02
	185	11 38·66	·02	·12	·09	·03	·02	38·68	07 48·51	·17	·09
	186	14 51·00	·01	·11	·00	·02	·01	51·02	11 00·80	·22	·04
W.	192	31 33·55	·08	·04	·16	·01	·02	33·58	27 13·26	·32	− ·06
	194	40 04·91	·06	·07	·09	·03	·02	04·96	36 14·78	·18	·08
	196	41 52·38	·03	·11	·09	·04	·01	52·50	38 02·17	·33	− ·07
	197	45 15·97	·03	·10	·09	·05	·02	16·06	41 25·76	·30	+ ·04
	500	49 26·65	·02	·13	·09	·06	·02	26·77	45 36·38	·39	− ·13
	198	54 50·50	·00	·27	·34	·07	·06	50·35	51 00·14	·21	·05

$a = \cdot146$ $c = \cdot088$

Chronometer correction at 14h 25m = 3m 50s·266 ± ·016

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	
W.	465	15 04 12·25	·02	·06	+ ·11	− ·09	·02	12·47	15 00 21·82	3 50·65	− ·06
	201	15 30·2[illegible]	·01	·04	− ·10	·07	·02	30·43	11 39·86	·57	− ·02
	467	17 24·26	·00	·18	− ·23	·06	·01	21·33	13 33·81	·52	·07
	202	24 44·19	·00	− ·03	− ·11	·01	·02	44·35	20 53·73	·62	− ·03
	205	27 44·58	·00	− ·06	− ·10	·04	·02	44·76	23 54·24	·52	·02
	206	31 21·36	·00	+ ·02	·11	·03	·02	21·50	27 30·79	·71	− ·17
E.	212	43 25·15	− ·07	·12	·09	·00	·01	25·24	39 34·61	·63	− ·04
	213	45 38·15	− ·08	·09	·09	·00	·02	38·21	41 47·60	·61	− ·02
	215	48 17·85	·08	+ ·00	·00	·01	·02	17·90	44 27·28	·62	− ·03
	217	51 22·22	+ ·37	·48	·42	·02	·07	21·60	47 31·03	·57	·02
	567	16 35 15·46	− ·06	− ·15	·09	·12	·02	15·14	16 31 54·98	·46	·13
	232	43 29·27	·15	·03	·14	·14	·02	29·18	39 38·58	·60	− ·01

$a = -\cdot184$ $c = \cdot087$

Chronometer correction at 15h 40m = 3m 50s·589 ± ·015

PERSONAL EQUATION.

TRANSIT OBSERVATIONS.

Station : OTTAWA. Date, June 24th, 1904. Observer: OTTO KLOTZ.

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
		h. m. s.	s.	s.	s.	s. 11	s.		h. m. s.	m. s.	s.
E	182	13 53 58 05	16	39	06	07	02	58 59	13 50 08 44	3 50 15	05
	183.	11 00 37·02	·13	57	06	06	01	35 71	56 17 48	23	·02
	184..	05 38 91	11	65	13	·05	04	38·58	14 01 18 36	·22	01
	158.	09 52 58	22	32	06	01	02	53 08	06 02 90	18	03
	185.	11 37 99	12	69	06	+ 03	02	38 75	07 48 51	21	03
	186.	11 50 28	14	65	06	+ 02	·01	51 02	11 00·80	22	01
W	192.	31 33 29	·16	·25	·07	01	02	33 42	27 43 26	16	05
	191.	40 01 59	13	42	06	03	02	04·89	36 11 78	11	·10
	196.	11 51 87	·09	65	06	01	01	52 44	38 02·17	·27	06
	197.	45 15 55	·11	57	06	05	·02	16 00	41 25 76	24	03
	198.	54 52 26	17	1·51	·21	07	06	50 36	51 00 14	·22	01
	199.	15 02 11 92	·19	·09	07	·08	02	11 79	58 21 55	21	·03

a = ·831 c = ·057
Chronometer correction at 11h 25m 3m 50s 206 ± ·011

Clamp.	Star.	Transit over mean of threads.	Level and inequality of pivots.	Azimuth.	Collimation.	Rate.	Aberration.	Seconds of corr. transit.	R. A.	Chronometer correction.	v.
W	465...	15 04 11·94	·10	·30	03	+ ·09	·02	12 24	15 00 21 82	3 50·42	·00
	201.	15 30 12	·11	21	01	+ 07	·02	30 31	11 39 86	·45	+ ·03
	467..	17 25 28	·24	·86	·08	+ 06	·04	24 28	13 33 81	47	05
	202..	24 44·02	12	·15	·04	+ 04	02	14 11	20 53 73	·38	04
	205.	27 44 40	11	·27	·03	+ ·04	02	44·61	23 54 21	87	·05
	206.	31 21 19	·13	·09	01	+ ·03	02	21 20	27 30·79	·41	01
E	212.	43 24·42	+ ·18	·51	03	00	·01	25·10	39 34·61	49	07
	213.	45 37 46	+ 21	·44	03	·00	·02	38 06	41 47 60	·46	04
	215.	48 17·29	+ ·21	·41	03	01	02	17 56	11 27 28	·48	·06
	217...	51 23 00	·53	2 25	·15	02	07	21·14	47 31 03	·41	01
	597.	16 35 44 70	+ ·13	·72	·03	12	02	45 38	16 31 51 98	·40	·02
	232.	43 28 68	·29	12	04	14	02	28 89	39 38 58	·31	11

a = ·858 c = ·030
Chronometer correction at 15h 40m 3m 50s 426 ± ·012

PERSONAL EQUATION.

Klotz Werry.

Date.	Clock Correction. Klotz.		Clock Correction. Werry.		K W
1904.	m. s.	s.	m. s.	s.	s.
June 22	3 43 855	016	3 43 893	014	138
" 22	44 033	017	44 095	016	062
" 23	46 872	013	46 983	014	111
" 23	47 073	010	47 210	012	137
" 24	50 206	011	50 266	016	060
" 24	50 426	012	50 589	015	163

	s.	s.
Weighted mean	116	± 011
Klotz transit west of Werry's	008	
Klotz anticipates Werry..	121	± 011

DIFFERENCE OF LONGITUDE.

From the preceding observations and their clock corrections combined with the times of exchange, we obtain the following differences of longitude between the successive stations, and subsequent final values.

The Canadian longitude values are based on the longitude of

Montreal.. .. .. $4^{h.}$ $54^{m.}$ $18{\cdot}634^{sec.}$ ± $\cdot 049^{sec.}$

Ottawa was connected in 1896 with Montreal, the observers, Dr. King and Prof. McLeod, exchanging stations and the value obtained

Ottawa.. .. .. $5^{h.}$ $02^{m.}$ $50{\cdot}022^{sec.}$ ± $\cdot 049^{sec.}$

In 1900 Vancouver was connected by a direct circuit of 3,000 miles with Ottawa. The observers, Dr. King and Dr. Klotz, exchanging stations also.

Vancouver.. .. .. $8^{h.}$ $12^{m.}$ $28{\cdot}368^{sec.}$ ± $\cdot 050^{sec.}$

This last value is the initial one for the Transpacific longitudes.

DIFFERENCE OF LONGITUDE.

VANCOUVER—FANNING.

Date.	Direction.	Sidereal Time. Bamfield.	Sidereal Time. Vancouver.	Difference.	Relative rate per hour.	Transmission time.	Chronometer Correction. Vancouver.	Chronometer Correction. Fanning.	Difference from Bamfield Chronometer.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	m. s.	h. m. s.
April 15	B. to V. ...	12 13·98	12 11·80	0 02 10·585					
	V. to B.	12 15·59	12 13·11	10·672		·039			
	Mean ..	12 14·79	12 12·61	0 02 10·629					
	B. to V.	12 48·70	12 46·50	0 02 10·771					
	V. to B.	12 49·90	12 47·70	10·891		·056			
	Mean	12 49·30	12 47·10	0 02 10·831					
	General Mean	12 32·05	12 29·85	0 02 10·730	·351				
		* 12 28·55		0 02 10·716			17·253	... ...	0 02 57·963
		Bamfield.	Fanning.						
	B. to F.	12 27·40	9 58·10	2 29 19·073					
	F. to B.	12 29·70	10 00·40	19·771	·110	·311			
	Mean..	12 28·55	9 59·25	2 29 19·422				1 15·780	2 28 13·612

Difference of longitude, Vancouver-Fanning.......... h. m. s. +2 25 05·679

* NOTE.—As explained in the text, Bamfield was simply used as an exchange station and no observations were made there. The exchange Bamfield-Vancouver was over a land line, while Bamfield-Fanning was over the cable. The difference of the two exchanges Bamfield-Vancouver, made before and after the Fanning exchange, was reduced to the mean time of exchange with Fanning by applying the rates of the Bamfield and Vancouver chronometers, the latter was known from the observations, while the former was obtained from the differential rate, shown by the two exchanges, and the Vancouver rate.

Date.	Direction.	Sidereal Time. Bamfield.	Sidereal Time. Vancouver.	Difference.	Relative rate per hour.	Transmission time.	Chronometer Correction. Vancouver.	Chronometer Correction. Fanning.	Difference from Bamfield Chronometer.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	s.	h. m. s.
April 16	B. to V. .	12 12·78	12 10·46	0 02 19·029					
	V. to B.	12 14·50	12 12·30	19·132 ..		·047			
	Mean	12 13·64	12 11·38	0 02 19·081					
	B. to V.	12 50·50	12 48·20	0 02 19·211					
	V. to B.	12 51·94	12 49·62	19·310 ..		·046			
	Mean......	12 51·22	12 48·91	0 02 19·261					
	General Mean	12 32·43	12 30·15	0 02 19·171	·286				
		12 42·33		0 02 19·218 .		..	45·624	... ...	0 03 04·842
		Bamfield.	Fanning.						
	B. to F..	12 41·25	10 11·79	2 29 29·688					
	F. to B.	12 43·40	10 13·90	30·372	·419	·335			
	Mean....	12 32·33	10 12·80	2 29 30·030	....	.. ..	.....	1 19·622	2 28 10·408

Difference of longitude, Vancouver-Fanning .. .. h. m. s. +2 25 05·566

Date.	Direction.	Sidereal Time. Banfield.	Sidereal Time. Vancouver.	Difference.	Relative rate per hour.	Transmission time.	Chronometer Correction. Vancouver.	Chronometer Correction. Fanning.	Difference from Banfield Chronometer.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	m. s.	h. m. s.
April 18	B. to V.	12 13 95	12 11 40	0 02 33 577					
	V. to B.	12 15 60	12 13 05	33 677		047			
	Mean	12 14 78	12 12 23	0 02 33 627					
	B. to V.	12 45 85	12 43 30	0 02 33 709					
	V. to B.	12 47 11	12 44 55	33 801		039			
	Mean	12 46 48	12 43 93	0 02 33 755					
	General Mean	12 30 63	12 28 08	0 02 33 691	241				
		12 36 55	...	0 02 33 744			43 340		0 03 17 063
		Banfield.	Fanning.						
	B. to F.	12 35 50	10 04 80	2 30 48 373					
	F. to B.	12 37 60	10 06 80	49 046	434	329			
	Mean	12 36 55	10 05 80	2 30 48 710				2 26 102	2 28 22 608

Difference of longitude, Vancouver–Fanning ... h. m. s. 2 25 05 545

Date.	Direction.	Sidereal Time. Banfield.	Sidereal Time. Vancouver.	Difference.	Relative rate per hour.	Transmission time.	Chronometer Correction. Vancouver.	Chronometer Correction. Fanning.	Difference from Banfield Chronometer.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	s.	h. m. s.
April 23	B. to V.	12 28 90	12 25 70	0 03 11 912					
	V. to B.	12 30 30	12 27 10	12 027		054			
	Mean	12 29 60	12 26 40	0 03 11 970					
	B. to V.	12 50 30	12 47 10	0 03 12 025					
	V. to B.	12 51 80	12 48 60	12 127		048			
	Mean	12 51 05	12 47 85	0 03 12 076					
	General Mean	12 40·33	12 37 13	0 03 12 023	297				
		12 40 35	....	0 03 12 023			34 541		0 03 46 564
		Banfield.	Fanning.						
	B. to F.	12 39 40	10 09 80	2 29 37 971					
	F. to B.	12 44 30	10 11 70	38 682	386	348			
	Mean	12 40 35	10 10 75	2 29 38 328				46 272	2 28 52 05

Difference of longitude, Vancouver–Fanning ... h. m. s. 2 25 05 492

Date.	Direction.	Sidereal Time — Bamfield.	Sidereal Time — Vancouver.	Difference.	Relative rate per hour.	Transmission time.	Chronometer Correction — Vancouver.	Chronometer Correction — Fanning.	Difference from Bamfield Chronometer.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	s.	h. m. s.
April 26	B. to V.	13 05·97	13 02·12	0 03 33·040					
	V. to B.	13 07·30	03·74	33·137		·045			
	Mean	13 06·64	13 03·08	0 03 33·089					
	B. to V.	13 29·50	13 25·94	0 03 33·157					
	V. to B.	13 30·90	27·31	33·228		·032			
	Mean	13 30·20	13 26·64	0 03 33·193					
	General Mean	13 18·12	13 14·86	0 03 33·111	·265				
		13 19·00	...	0 03 33·143			29·290		0 04 02·433
		Bamfield.	Fanning.						
	B. to F.	13 18·00	10 47·90	2 30 06·793					
	F. to B.	13 20·00	10 49·90	07·519	·531	·357			
	Mean	13 19·00	10 48·90	2 30 07·156				59·110	2 29 08·046

	h. m. s.
Difference of longitude, Vancouver–Fanning	2 25 05·483

VANCOUVER–FANNING.

1903.		h. m. s.	s.
April 15	Difference of longitude	2 25 05·679 ±	·019
16	"	5·566 ±	·016
18	"	5·545 ±	·025
23	"	5·492 ±	·010
26	"	5·483 ±	·015
	Weighted Mean	2 25 05·530 ±	·021
	Personal Equation	·121	
	Difference of Longitude	2 25 05·406 ±	·021
	Vancouver	8 12 28·368 ±	·050
	Longitude of Fanning	10 37 33·774 ±	·054

FANNING—SUVA.

Date.	Direction.	Sidereal Time, Fanning.	Sidereal Time, Suva.	Difference.	Relative error per [illegible]	Transmission Time.	Chronometer Correction, Fanning.	Chronometer Correction, Suva.	Difference of Longitude.
1903		h. m.	h. m.	h. m. s.		s.	s.	m. s.	h. m. s.
June 2, 3	F. to S.	15 43.5	14 18.0	1 25 29.641					
	S. to F.	15 44.9	14 20.1	30.196	.007	.281			
	Mean	15 44.7	14 19.2	1 25 29.919			14.333	3 28.[illegible]	1 28 13.671
3, 4	F. to S.	15 49.9	14 24.5	1 25 24.60[illegible]					
	S. to F.	15 51.8	14 26.4	25.[illegible]	.008	.269			
	Mean	15 50.85	14 25.45	1 25 24.870			12.328	3 31.132	13.674
8, 9	F. to S.	15 56.6	14 31.6	1 25 02.034					
	S. to F.	15 58.7	14 33.7	02.585	.008	.280			
	Mean	15 57.65	14 32.65	1 25 02.310			3.601	3 45.1[illegible]	13.743
9, 10	F. to S.	15 36.4	14 11.4	1 24 58.577					
	S. to F.	15 38.2	14 13.2	59.157	±.006	.293			
	Mean	15 37.3	14 12.3	1 24 58.867			2.541	3 47.425	13.751
10, 11	F. to S.	16 06.5	14 40.6	1 24 54.401					
	S. to F.	16 07.[illegible]	14 42.6	54.962	.007	.284			
	Mean	16 06.5	14 41.6	1 24 54.682			0.926	3 49.954	13.710
15, 16	F. to S.	16 46.1	15 21.5	1 24 34.187					
	S. to F.	16 48.6	15 24.0	34.766	.004	.284			
	Mean	16 47.35	15 22.75	1 24 34.477			6.716	4 02.519	13.712
21, 22	F. to S.	16 47.1	15 22.9	1 24 12.284					
	S. to F.	16 48.9	15 24.7	12.812	.004	.265			
	Mean	16 48.0	15 23.8	1 24 12.548			−14.836	4 16.375	13.720
23, 24	F. to S.	16 [illegible]	15 35.8	1 24 04.826					
	S. to F.	17 [illegible]	15 37.6	05.400	.006	.290			
	Mean	17 00.8	15 36.7	1 24 05.11[illegible]			17.842	4 20.767	13.722

FANNING—SUVA.

1903.		h. m. s.	s.
June 2, 3	Difference of longitude	1 28 13.671 ±	.016
" 3, 4	"	13.674 ±	.013
" 8, 9	"	13.743	.019
" 9, 10	"	13.751 ±	.017
" 10, 11	"	13.710 ±	.014
" 15, 16	"	13.712 ±	.016
" 21, 22	"	13.720 ±	.017
" 23, 24	"	13.722 ±	.021
	Weighted mean	1 28 13.713 ±	.008
	Personal equation	.124	
	Difference of longitude	1 28 13.837 ±	.008
	Fanning	10 37 33.774 ±	.054
	Longitude of Suva	12 05 47.611 ±	.055
	or east	11 54 12.389 ±	.055

SUVA—NORFOLK.

Date	Direction	Sidereal Time. Suva.	Sidereal Time. Norfolk.	Difference.	Relative rate.	Transmission time.	Chronometer Correction. Suva.	Chronometer Correction. Norfolk.	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	m. s.	m. s.
Aug. 11	N. to S. ...	19 15 7	18 34 2	0 41 28 261					
	S. to N. ..	19 17 5	18 36 0	27 994	006	137			
	Mean. ..	19 16·6	18 35·1	41 28 128			26 307	59 614	42 01 435
" 17	N. to S. ..	19 09 0	18 27 8	41 09·356					
	S. to N.	19 11·0	18 29 9	9 060	003	149			
	Mean....	19 10 0	18 28 85	41 09 208	.	..	31 304	1 23 475	01·379
" 19	N. to S. ..	19 14 8	18 33 9	40 56 028					
	S. to N.	19 17 1	18 36 5	55 767	051	136			
	Mean. ...	19 16 1	18 35 2	40 55·898	..	......	34 307	1 36 750	01 341
" 22	N. to S.	19 38 7	18 58 1	40 38 245					
	S. to N. ..	19 40 7	19 00 1	37 978	006	137			
	Mean.....	19 39 7	18 59 1	40 38 112	...	.	38·877	2 02 145	01 380
" 23	N. to S. .	20 03 8	19 23 3	40 32 221					
	S. to N. ..	20 05·7	19 25 2	31 951	008	139			
	Mean....	20 04·75	19 24·25	40 32·086	....		10 377	2 09 653	01·362
" 27	N. to S. ..	20 14 5	19 34 4	40 03 871					
	S. to N.....	20 16 5	19 36 4	03 581	009	149			
	Mean....	20 15 5	19 35 4	40 03 726	..	.	12 931	2 40 528	01·323

Suva Norfolk.

		h. m. s. s.
1903.		
Aug. 14.	Difference of longitude	0 12 01 135 ± 017
" 17	"	01·379 ± 018
" 19	"	01 341 ± 019
" 22	"	01·380 014
" 23	"	01 362 ± 024
" 27	"	01 323 ± ·013
	Weighted mean	0 42 01 367 ± ·011
	Personal equation	124
	Difference of longitude	0 42 01·243 ± 011
	Suva	11 53 42 389 ± ·055
	Longitude of Norfolk	11 11 41 146 ± 055

NORFOLK—SOUTHPORT.

Date.	Direction.	Sidereal Time. Norfolk.	Sidereal Time. Southport	Difference.	Relative rate.	Transmission time.	Chronometer Correction. Norfolk.	Chronometer Correction. Southport	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	m. s.	m. s.	m. s.
Oct. 1	N. to S.	23 21·4	22 23 3	0 58 05 322					
	S. to N.	23 23 8	22 25·7	05 506	010	095			
	Mean	23 22 6	22 21 5	58 05 414			27 353	23 474	58 01 235
3	N. to S.	22 54·9	21 57 0	57 55 332					
	S. to N.	22 56 5	21 58 6	55 524	003	098			
	Mean	22 55 7	21 57 8	57 55 428			42 317	48 083	01 194
11	N. to S.	23 20 0	22 22·4	57 38 363					
	S. to N.	23 21 6	22 23 95	38 567	006	·105			
	Mean	23 20 8	22 23 18	57 38 465			1 54 659	2 17 430	01 236
12	N. to S.	23 26 7	22 29·2	57 33 158					
	S. to N.	23 28 12	22 30·56	33 362	·003	104			
	Mean	23 27 41	22 29 88	57 33 260			2 01 112	2 29·084	01 232
16	N. to S.	23 34 5	22 37 3	57 13 983					
	S. to N.	23 35 9	22 38 7	14 165	006	094			
	Mean	23 35 2	22 38 0	57 14 074			2 27 886	3 15 089	01 277

NORFOLK SOUTHPORT.

1903.			h. m. s.	s.
Oct.	1	Difference of longitude	0 58 01 235 ±	018
"	3	"	194 ±	019
"	11	"	236 ±	013
"	12	"	232 ±	014
	16	"	277 ±	013
		Weighted Mean	0 58 01 210 ±	008
		Personal Equation	− 124	
		Difference of Longitude	0 58 01 364 ±	·008
		Norfolk	11 11 41 146 ±	056
		Longitude of Southport	10 13 39 782 ±	056

SOUTHPORT—SYDNEY.

Date.	Direction.	Sidereal Time. Southport.	Sidereal Time. Sydney.	Difference.	Relative rate.	Transmission time.	Chronometer Correction. Southport.	Chronometer Correction. Sydney.	Personal Equation. K-R	Personal Equation. K-L	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	m. s.		s.	s.	m. s.
Sept. 29	Sy. to S..	22 19·4	22 40·6	0 08 50·208	·041	·142		Sydney Observatory applied its clock correction to time of exchange, and included in column 'Difference'.			
	S. to Sy..	22 44 0	22 35·2	49 883							
	Mean .	22 46·7	22 37·9	8 50 046			- 0 485		...	·018	8 50·513
Oct. 2	Sy. to S..	22 40 2	22 30 8	9 25 887	050	137					
	S. to Sy..	22 35·6	22 26·2	25·563							
	Mean	22 37 9	22 28·5	9 25 725	.	.	− 35·181		· 067		50 611
" 3	Sy. to S..	22 52·42	22 12·76	9 39·158	- 012	146					
	S. to Sy..	22 47·85	22 38·20	38·824							
	Mean..	22 50 14	22 40·48	9 38·991			48 506		· 067	....	50 552
" 6	Sy. to S .	23 11·11	23 00 95	10 11 567	- 061	126					
	S. to Sy..	23 03·00	22 52 80	11·254							
	Mean..	23 07 06	22 56 87	10 11 410			1 20 948		..	018	50 444
" 7	Sy. to S..	23 11 0	23 00 64	10 22 141	·041	145					
	S. to Sy .	23 05·6	22 55·24	21 811							
	Mean..	23 08 3	22 57 94	10 21 976	......	...	1 31·543		- 067	...	50·500
" 8	Sy. to S .	23 22·15	23 11 60	10 33 821	018	·111					
	S. to Sy..	23 16 88	23 06·32	33·492							
	Mean..	23 19·52	23 08·96	10 33·657	.....	.....	1 43 281		067	.....	50 443

SOUTHPORT SYDNEY.

1903.			h. m. s.	s.
Sept.	29	Difference of longitude	0 08 50 513 ±	·029
Oct.	2	"	611 ±	024
"	3	"	·552 ±	015
"	6	"	·441 ±	016
"	7	"	·500 ±	013
"	8	"	·443 ±	013
		Weighted Mean	0 08 50 495 ±	016
		Southport	10 13 39 782 ±	056
		Longitude of Sydney	10 01 49·287 ±	058

SOUTHPORT BRISBANE.

Date.	Direction.	Sidereal Time. South-port.	Sidereal Time. Brisbane.	Difference.	Relative rate.	Transmission time.	Chronometer Correction. South-port.	Chronometer Correction. Brisbane.	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	m. s.	s.	m. s.
Sept. 29	S. to B.	21 57·63	21 55·33	0 02 18·607					
	B. to S.	22 02·10	21 59·80	18·609	·031	neg.			
	Mean ...	21 59·87	21 57·57	2 18·608	...	...	·805	− 45·726	1 33·688
Oct. 2	S. to B. ...	22 07·60	22 04·66	2 55·699					
	B. to S.	22 09·30	22 06·40	55·715	·017	·000			
	Mean	22 08·45	22 05·53	2 55·707 ...		...	34·882	47·207	33·6
3	S. to B.	22 08·30	22 05·15	3 09·733					
	B. to S. ...	22 10·33	22 07·15	9·763	·016	·007			
	Mean ...	22 09·32	22 06·15	3 09·748	...	...	48·176	17·963	33·609
" 6	S. to B. ...	22 20·40	22 16·70	3 44·796					
	B. to S.	22 25·78	22 22·03	44·829	·035	·000			
	Mean ...	22 23·09	22 19·37	3 44·813	...	...	1 20·656	+ 50·637	33·520
" 7	S. to B. ..	22 33·86	22 29·92	3 56·396					
	B. to S. ...	22 36·60	22 32·70	56·431	·019	·008			
	Mean ...	22 35·23	22 31·31	3 56·414		....	1 31·328	51·504	33·582

SOUTHPORT-BRISBANE.

1903.			h. m. s.	s.
September	29	Difference of longitude	0 01 33·688 ±	·018
October	2	"	·618 ±	·015
"	3	"	·609 ±	·013
"	6	"	·520 ±	·011
"	7	"	·582 ±	·013
		Weighted Mean	0 01 33·585 ±	·018
		Personal Equation	·153 ±	·044
		Difference of Longitude	0 01 33·738 ±	·047
		Southport	10 13 39·782 ±	·056
		Longitude of Brisbane	10 12 06·044 ±	·073

NORFOLK—DOUBTLESS BAY.

Date.	Direction.	Sidereal Time. Doubtless Bay.	Sidereal Time. Norfolk.	Difference.	Relative rate.	Transmission time.	Chronometer Correction. Doubtless Bay.	Chronometer Correction. Norfolk.	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	m. s.	m. s.	m. s.
Dec. 5	N. to D.B.	2 23 7	2 01 5	0 22 14 386					
	D.B. to N	2 25 4	2 03 2	14 255	004	·067			
	Mean	2 24·55	2 02 35	22 14 321			17 342	18 073	22 15 052
9	N. to D.B	2 34 9	2 12·3	22 37 132					
	D.B. to N	2 36·4	2 13 8	37 027	005	055			
	Mean	2 35·65	2 13 05	22 37 080			1 06·160	14 527	15 147
" 10	N. to D.B.	2 35 1	2 12 4	22 42·160					
	D.B. to N	2 36 6	2 13 9	42 101	004	032			
	Mean	2 35·85	2 13 15	22 42 131			1 18 271	51 215	15 072
" 11	N. to D.B.	2 55 5	2 32 7	22 47·251					
	D.B. to N.	2 57 4	2 34 3	47·131	005	062			
	Mean	2 56 3	2 33 5	22 47 191			1 29 662	57·545	15 074
" 17	N. to D.B.	3 15 8	2 52 5	23 18·124					
	D.B. to N.	3 17 3	2 54 0	18 018	002	054			
	Mean	3 16 55	2 53 25	23 18 071			2 39 513	1 36 667	15·225
" 18	N. to D.B	3 12 1	2 49 0	23 21 872					
	D.B. to N	3 13 8	2 50 4	21 738	003	068			
	Mean	3 13 1	2 49 7	23 21·805			2 50 020	1 43 113	15·228

NORFOLK DOUBTLESS BAY.

1903.		h. m. s.	s.
December 5.	Difference of longitude	0 22 15 052	± ·020
" 9.	"	147	± ·020
" 10.	"	072	± ·014
" 11	"	071	± ·015
" 17	"	·225	± ·020
" 18.	"	·228	± ·017
	Weighted Mean	0 22 15 124	± ·021
	Personal Equation	·121	
	Difference of Longitude	0 22 15 000	± ·021
	Norfolk	11 11 41 146	± ·056
	Longitude of Doubtless Bay	11 33 56 146	± ·060

DOUBTLESS BAY—WELLINGTON.

Date.	Direction.	Sidereal Time. Wellington.	Sidereal Time. Doubtless Bay.	Difference.	Relative rate.	Transmission time.	Chronometer Correction. Wellington.	Chronometer Correction. Doubtless Bay.	Difference of Longitude.
1903.		h. m.	h. m.	h. m. s.	s.	s.	s.	m. s.	m. s.
Dec.	6 W. to D.B.	3 20 67	3 15 96	0 04 42 675	347	019			
	D.B. to W.	2 44 47	2 39 74	43 039					
	Mean ...	3 02 57	2 57 85	4 42 847					
							5 189	34 573	5 09 231
"	7 W. to D.B.	3 27 24	3 22 77						
	D.B. to W..	3 16 17	3 11 70	1 28 059	096	018			
	Mean ...	3 21 70	3 17 23	28 191					
				4 28 125					
							3 180	44 255	09 200
"	11 W. to D.B.	3 31 66	3 28 02	3 38 167	076	026			
	D.B. to W..	3 23 39	3 19 76	38 296					
	Mean....	3 27 53	3 23·89	3 38·232					
							1 119	1 29 874	09 225
"	12 W. to D.B.	3 41 72	3 38·32	3 21·142					
	D.B. to W.	4 01·58	3 58·18	24 018	171	024			
	Mean. ...	3 51 65	3 48·25	3 21 080					
							3 530	1 41·546	09 156
"	17 W. to D.B..	4 05 70	4 03 27	2 25 720	111	041			
	D.B. to W..	4 26 16	4 23 73	25 659					
	Mean....	4 15 93	4 13 50	2 25 690					
							3 702	2 39·818	09 240
"	18 W. to D.B..	3 52 85	3 50 61	2 11 365	083	010			
	D.B. to W..	3 42·20	3 39 95	14 428					
	Mean	3 47 53	3 45 28	2 14 397					
							4 582	2 50 220	09 199

Doubtless Bay Wellington.

		h. m. s.	s.
Dec. 6..	Difference of longitude		
" 7..	"	0 05 09 231 ±	·027
" 11..	"	200 ±	018
" 12..	"	225 ±	032
" 17.	"	156 ±	021
" 18.	"	210 ±	032
	Weighted mean	199	020
	Personal equation	0 05 09·198 ±	007
	Difference of longitude	257 ±	045
	Doubtless Bay	0 05 08 941 ±	045
	Wellington	11 33 56·146 ±	·060
		11 39 05 087 ±	075

CLOSING ERRORS.

Fanning. Reducing the longitude given on Admiralty Chart 2971, for 'Observation Spot' at English Harbour, by scaling to that of the observatory we obtain for the latter:

	159° 23′ 27″
The Canadian value is..	159° 23′ 26″·61

that is, the values are practically identical, which speaks volumes for the accuracy of the hydrographic survey, which is principally dependent upon the transport of chronometers for the determination of longitude.

Captain Fanning writes, p. 225, in the work cited, 'These islands are situate in latitude 3° 51′ 30″ north, longitude 159° 12′ 30″ west.' The description is rather vague, but the position in longitude by a trading vessel, as Fanning's was, is pretty good for the year 1798.

Suva.—On Admiralty Chart 1660 of Suva Harbour, the longitude of 'Observation Spot,' south end of Walou bridge, is given as 178° 26′ 00″ E.; the observatory at the Cable station is 44″·21 west thereof, so that the longitude of the latter, based on the former becomes:

	178° 25′ 15″·79 E.	
The Canadian value is	178° 25′ 35″·81	
Difference. ..	9″·95	·663$^{s.c.}$ or 960 feet = 320 yards.

It may be interesting here to quote a paragraph of the opening address by the late Rear-Admiral, Sir W. J. L. Wharton, president of Section E., Geography, at the British Association meeting in South Africa last August. After speaking of the great merit of the sextant and chronometer for the determination of longitude at sea, he says: 'To give an idea of the comparative accuracy of the chronometer (transport of) method, I may mention that in taking at hazard eleven places distributed all over the world at great distances from England, the longitudes of which have been recently determined by means of the electric telegraph and elaborate series of observations, I find that the average difference between the chronometer and the telegraphic positions is 700 yards.'—So that the accordance at Suva is quite satisfactory.

Norfolk.—On Admiralty Chart 1110, 'Norfolk and Philip Islands' the longitude of 'Observation Spot' at the foot of Boat Harbour, Sydney Bay, is given as 167° 58′ 06″. Reducing this to the position, by scaling from the chart of the observatory at the Cable station, Anson Bay, at the northwestern part of the island we obtain for the longitude of the observatory:—

	167° 55′ 47″
The Canadian value is..	167° 55′ 17″·19
Difference..	29″·81 = 1·99$^{s.c.}$

This is undoubtedly a large difference. The Admiralty determination is an old one, having been made by Captain Denham, R.N., in 1855, and measured through Lord Howe island from Garden island, Sydney, the latter being then not well determined.

Southport.—Southport, Queensland, is undoubtedly of the three Australian longitudes obtained by the Canadian connection, the best determined. In the first place the other two Australian stations—Sydney and Brisbane—are dependent upon it, and hence must necessarily have less weight, being an additional link in the chain: in the next place the personal equation is more thoroughly and satisfactorily eliminated for Southport than for the other two stations. As already stated the number of stations across the Pacific is an odd number—five—and as the observers occupied alternate stations from Vancouver to Southport, the personal equation even as an unknown quantity, which it is not, disappears in the value for Southport. And furthermore, the longitude work up to Southport (and Doubtless Bay also) was homogeneous in every respect, the instruments, apparatus, methods of the two observers were identical, so that the value for Southport deserves *a priori* a high degree of confidence.

There is however, no value for Southport, based by triangulation on the Brisbane longitude, available for comparison with the Canadian value. A comparison with Australian values we obtain, however, at Sydney and at Brisbane.

Sydney.—We have for Sydney, six independent determinations for difference of longitude with Southport, together with observations for personal equation between the observers, Mr. Lenehan and Mr. Raymond at Sydney, and Dr. Klotz at Southport.

In the following table is given the comparison between the longitude of Sydney as brought from Madras and Singapore and that *via* Canada and the British Pacific Cable.

In the reduction (1885) of the Australian longitudes, the longitude of Madras was accepted as:—

$$5^{h.}\ 20^{m.}\ 59^{s}\ 42,^{*}$$

and the derived value of Sydney was:—

$$10^{h.}\ 04^{m.}\ 49^{s}{\cdot}54.$$

In making the comparison, the best and most recent available data are utilized for the longitude of Madras. The values for the various links or arcs between Madras and Sydney have not been re-determined since 1882-84, so that they will be adopted now as then.

For arriving at the longitude of Madras, we have the following data:—

Arc.	Difference of Longitude.	Probable Error.	Authority.
	h. m. s.	s.	
Greenwich–Potsdam	0 52 16·051	± ·0030	Professor Albrecht.[1]
Potsdam–Tehran	2 33 24·228	± ·0068	Major Burrard.[2]
Tehran–Bushire	0 02 21·443	± ·0083	
Bushire–Karachi	1 04 44·787	± ·0073	
Karachi–Bombay	0 23 12·196	± ·0129	"
Bombay–Bolarum	0 22 48·801	± ·0061	"
Bolarum–Madras	0 06 54·615	± ·0085	"

Station.	Longitude East.	Probable Error.
	h. m. s.	s.
Potsdam	0 52 16·051	± ·0030
Tehran	3 25 40·279	± ·0074
Bushire	3 23 18·836	± ·0111
Karachi	4 28 03·623	± ·0133
Bombay	4 51 15·819	± ·0185
Bolarum	5 14 04·620	± ·0195
Madras	5 20 59·235	± ·0213

* Report on the Telegraphic Determination of Australian longitudes, 1886, p. 51
[1] Bestimmung der Langendifferenz Potsdam-Greenwich, 1903.
[2] Great Trigonometrical Survey of India, Vol. XVII, p. XIV.

Applying now the published values for the arcs between Madras and Sydney, we obtain the following series:—

Arc.	Difference of Longitude.			Probable Error.†	Authority.
	h.	m.	s.	s.	
Madras	5	20	59·235	± ·0213	
Madras–Singapore	1	34	25·58	± ·0270	Davis and Norris (U. S. Navy).*
Singapore–Flagstaff	0	00	01·50		
Flagstaff–Capt. Darwin's Station	0	00	01·51		
Capt. Darwin's Station	6	55	24·825	± ·0314	
Darwin's Station–Port Darwin	1	47	57·48	± ·0310	
Port Darwin	8	43	22·305	± ·0463	
Port Darwin–Adelaide	0	30	57·81	± ·0277	
Adelaide	9	14	20·115	± ·0530	
Adelaide–Melbourne	0	25	33·84	± ·0337	
Melbourne	9	39	53·955	± ·0636	
Melbourne–Sydney	0	21	55·40	± ·0614	
Sydney	10	01	49·355	± ·0884	
Canadian value	10	01	49·287	± ·058	
**Difference			·068		
	1″.02				
	84 feet.				

† The probable errors given for difference of longitude are taken from Appendix, Table I, p. 23 of P. Baracchi's report 'On the most Probable Value and Errors of Australian Longitudes,' 1895.

* Telegraphic Determination of Longitude in the East Indies, China and Japan, 1881–2.

** Since the above result was obtained, Astronomische Nachrichten, No. 3993, has appeared, containing 'Ausgleichung des Zentraleuropäischen Längennetzes' by Professor Th. Albrecht. The adjustment of the net involved 176 differences of longitude between 79 stations. In the final values Potsdam is given as 52m 16s·062 ± s·0135 for the same meridian as given in the above table as 52m 16s·051 ± s·003. That is, the adjusted longitude of Potsdam is greater than the direct measure of Prof. Albrecht and Mr. Wanach in 1903 by s·011. If we adopt the adjusted value for Potsdam, the longitude of Madras will be increased by s·011, that is, becomes 5h 20m 59s·246, and similarly that of Sydney, 10h 01m 49s·366. Differing from the Canadian value by s·079.

In the above-mentioned Astron. Nach. pp. 153-154, are given the results of the 1902 campaign for the arc Greenwich-Paris. The two Greenwich observers (with exchange of stations for eliminating personal equation) obtained the value of 9m 20·976sec ± ·011sec in the spring, and in the autumn 9m 20·911sec ± ·004sec, giving a difference of ·065sec between the two independent determinations. Similarly the French observers obtained the values of 9m 20·932sec and 9m 21·029sec, showing a difference of ·097sec.

That is, the first girdle of the world closed within 84 feet. Apparently the weakest link in the girdle is the arc, Madras-Singapore, since no observations for personal equation were made at the time by Lieut. Commander C. H. Davis and Lieut. S. A. Norris, the observers respectively at Madras and Singapore.

However in the United States Navy Report quoted, Lieut. Commander F. M. Green says, p. 18, 'By means of the repeated use of the personal equation machine of Professor Eastman, at the Naval Observatory, it was found that the habitual errors of the observers engaged in this measurement had all the same sign; that is, they habitually observed the transit of a star a few hundredths of a second after its occurrence, but their respective differences were so small that it seemed evident that to introduce results so minute as corrections would not increase the trustworthiness of the result.'

This is important testimony and written at the time with reference to the Madras-Singapore arc. If it does not wholly dispose of the differential personal equation involved, it gives assurance of its very small magnitude.

In Mr. Barrachi's report quoted, he is slightly in error when speaking of the above arc; he says: 'Their personal equation was continuously tested by absolute personal equation instruments, each observer being provided with one.'

The difference of longitude Madras-Singapore as determined by Davis and Norris was, after due consideration and discussion, accepted by the Australian astronomers—Ellery, Todd and Russell—for the determination of Australian longitudes.

Brisbane.—The position of the observatory here is given in the Nautical Almanac as 10h. 12m. 06·40sec. The derivation of this value becomes apparent from the following extract from the Annual Report of the Department of Public Lands for the year 1891, Queensland.

Under sub-division 'Trigonometrical Survey' the Surveyor General under date of April 8, 1892, p. 10, says: 'Additional care was bestowed upon the determination of Burketown, as opportunity was taken there, with the kind permission of Mr. Russell, the Government Astronomer of New South Wales, of bringing Sydney Observatory into the telegraphic circuit, and of thus determining, not only the longitude of Burketown, but the difference of longitude between Sydney and Brisbane, both by direct and indirect means. The results so obtained, together with a previous determination made in 1884, and a subsequent one in the present year, have been investigated both by Mr. Russell and ourselves, and are as follows:—

	m.	s.	
1884.	7	16·81	diff. Brisbane-Sydney.
1891.	7	16·87	
1891.	7	16·88	
1892.	7	16·88	

'Considering that different observers and different methods were employed upon these determinations, the resulting mean of 7m. 16·86sec. must be looked upon as possessing a very high degree of accuracy, and as Brisbane is on the initial meridian from which all our differences of longitude have been reckoned, the result is very gratifying. Assuming the longitude of Sydney Observatory to be 10h. 4m. 49·54sec., and the difference of longitude between Sydney and Brisbane observations to be 7m. 16·86sec., the resulting longitude of Brisbane Observatory is 10h. 12m. 6·40sec.'

Through the longitude determinations of Professor Albrecht and Major Burrard, Madras has suffered a correction of −·185sec., as already shown. Hence the value of Brisbane, dependent upon Madras and Sydney becomes:—

	10h.	12m.	06s·215
The Canadian value is	10h.	12m.	06s·044
Difference.			s·171 = 2″·565 = 231 feet.

Taking the Canadian values for Sydney and Brisbane we find the difference of longitude between these two places:—

	7m.	16s·757
While the Australian value is.	7m.	16s·86
Difference.		s·103

It must be remarked that the above comparison is not quite as satisfactory as desired, on account of the value of the differential personal equation obtained three weeks after the longitude campaign.

Mr. T. D. Fraser laboured considerably under a mental and physical strain, on account of very serious illness in his family during the observations. He obtained little rest during the 24 hours for several weeks, and was conscious when observing that he was not in normal condition. He gave little weight to his observations at Southport, although when computed the probable error of the time determination was satisfactory, ±·014sec., the same as that for his Brisbane observations.

A chain of triangles extends southward from Brisbane to the vicinity of Southport, some fifty miles, so that it will be easy to effect a geodetic connection between the observation stations at Brisbane and Southport, and free from any uncertainty in the differential personal equation.

Doubtless Bay.—The connection between the observatory at the Cable station and the trigonometrical survey of New Zealand was made by Government Surveyor Vincent J. Blake, under instructions of the Surveyor General. The triangulation was extended from Station 20 on the west side of the mouth of Mangonui river westward about two and a half miles to Station A (the magnetic station), and thence to the nearby observatory.

The geographic position of station 20 was furnished by Mr. J. W. A. Marchant, Surveyor General.

We have then:—

Longitude Station 20	173°	31′	37″·1
Station 20—Sta. A		− 2′	24″·1
Station A.. ..	173°	29′	13″·0
Sta. A—Observatory. .		−	3″·66
Observatory. . .	173°	29′	09″·34
	= 11h.	33m.	56·623sec.
Canadian value is.	11h.	33m.	56·146sec.
Difference. . . . . . =			·477sec. = 7″·15 = 595 feet.

It may be remarked that the position of Station 20 is dependent upon the initial station, Mt. Cook at Wellington, through a chain of triangles about seven hundred miles long. From the roughness of the country it was expedient to carry on a network of triangulation for land survey and settlement purposes, and the refinements of a primary triangulation were not aimed at.

In the closing for Wellington it will be found that the difference is ·038sec. or ″·57, and of the same sign as the above, making thereby the difference between the telegraphic determination Wellington-Doubtless Bay, and the one obtained by triangulation ·439sec., equivalent to 549 feet at the latitude of Doubtless Bay.

What was said with reference to Southport of the relative value of the longitude determination there, is equally applicable to Doubtless Bay, as the latter station occupies the same position in the series of stations with reference to personal equation as does the former.

Wellington.—The derivation of the value for the longitude of the Wellington Observatory has already been shown as:—

11h. 39m. 05·31sec.

This requires the correction of − ·185sec., the same as applied to Sydney for the adopted value of Madras, dependent upon the work of Prof. Albrecht and Major Burrard.

We have then for the value of Wellington via Madras and Sydney:—

	11h.	39m.	05·125sec.
Canadian value is.	11h.	39m.	05·087sec.
Difference.			·038sec. = ″·57

It will be noticed that the difference between the closing at Sydney and at Wellington is ·030sec., the Canadian values being in each case less than the ones via Madras. This quantity, ·030sec., apparently represents the accordance between the direct determination of the Sydney-Wellington arc in 1883 and the indirect one via Southport and Doubtless Bay in 1903.

Although observations were made for personal equation by the two observers, yet the conditions under which they were made were not the most favourable. It was impracticable to mount the portable transit at the Wellington observatory, so that the observations were all made with the Wellington instrument, Mr. T. King observing by 'eye and ear,' as is his custom, and Dr. Klotz recorded, as is his custom, electrically, in this case, however, with a specially made make-circuit key for embossing, by means of the style, the paper fillet of the Morse register—the chronograph of the Wellington observatory. Retardation and parallax of the two styles of the register—the one for the clock and the other for the transits—were carefully determined and applied.

FINAL LONGITUDE VALUES.

Station.	Longitude. Time.	Probable Error.	Arc.	Probable Error.
	h. m. s.	s.		
Vancouver	8 12 28·368	± ·050	123 07 05·520 W	± ·75
Fanning	10 37 33·774	± ·054	159 23 26·610 W	± ·81
Suva ...	11 53 42·389	± ·055	178 25 35·835 E	± ·82
Norfolk...	11 11 41·146	± ·055	167 55 17·190 E	± ·82
Southport..	10 13 39·782	± ·056	153 24 56·730 E	± ·84
Sydney. ...	10 04 49·287	± ·058	151 12 19·305 E	± ·87
Brisbane .	10 12 06·044	± ·073	153 01 30·660 E	±1·09
Doubtless Bay	11 33 56·146	± ·060	173 29 02·190 E	± ·90
Wellington .	11 39 05·087	± ·075	174 46 16·305 E	±1·12

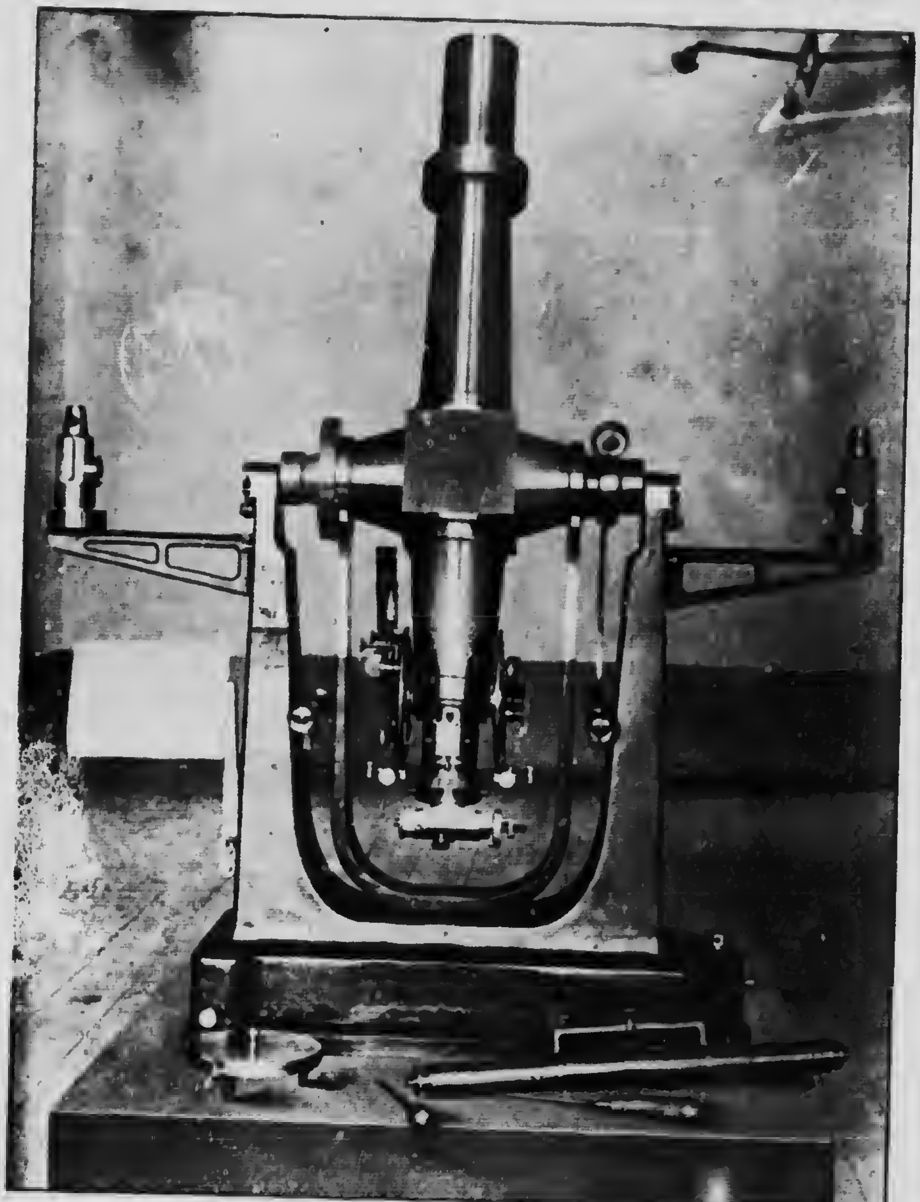


Fig. 1.—Transit.

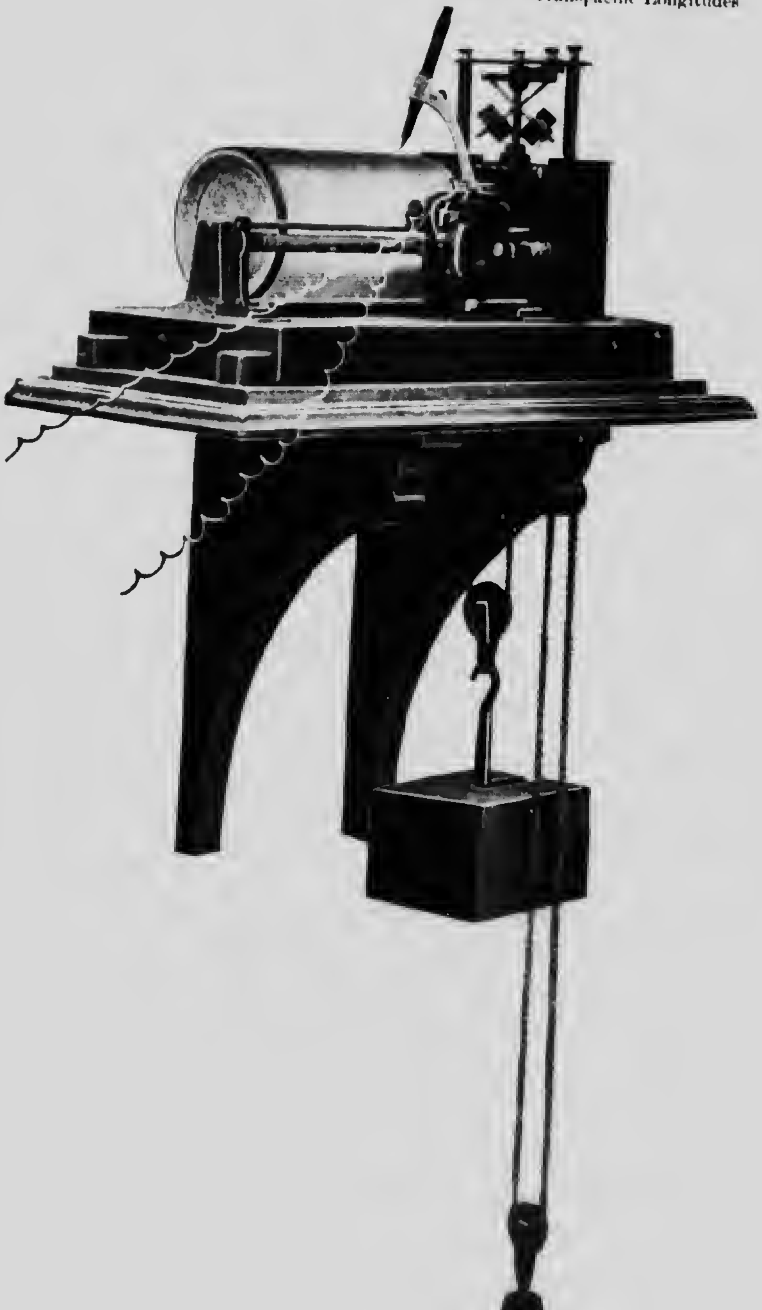


Fig. 2.—Chronograph.

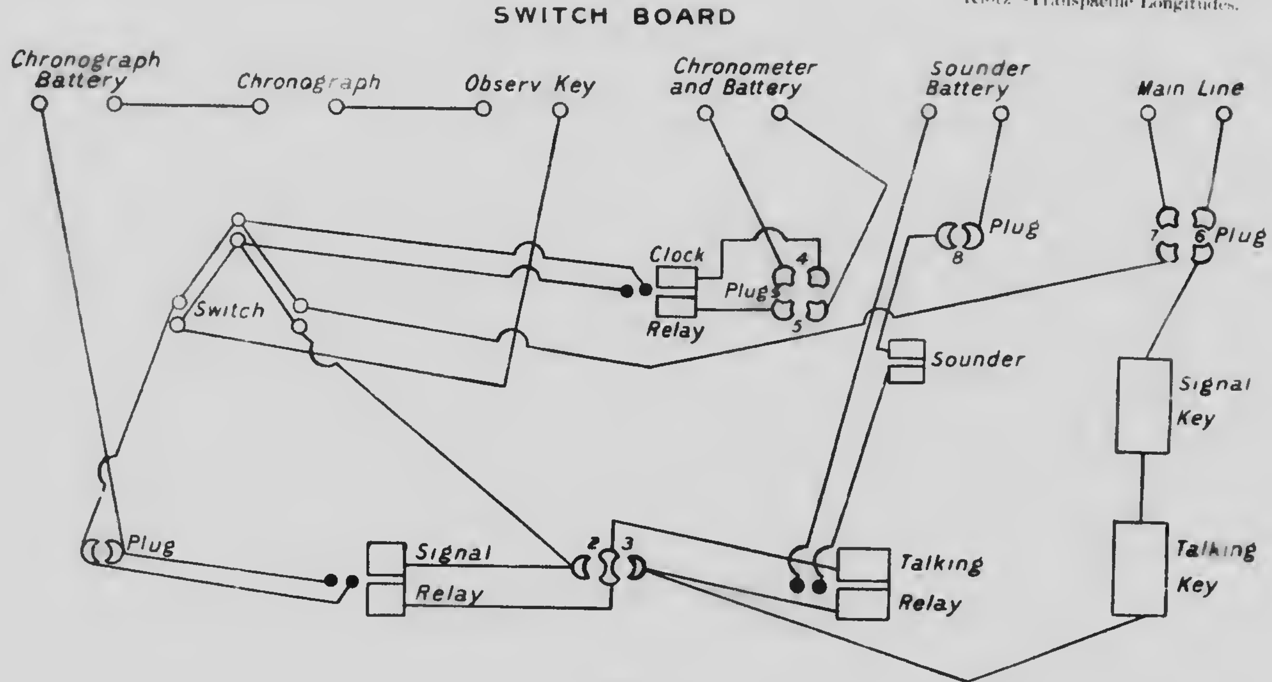

SWITCH BOARD
Chronograph Battery
Chronograph
Observ Key
Chronometer and Battery
Sounder Battery
Main Line
Clock
Plugs
Relay
4
5
Plug
8
7
6
Plug
Switch
Sounder
Signal Key
Talking Key
Plug
Signal
Relay
2
3
Talking
Relay

Fig. 3.

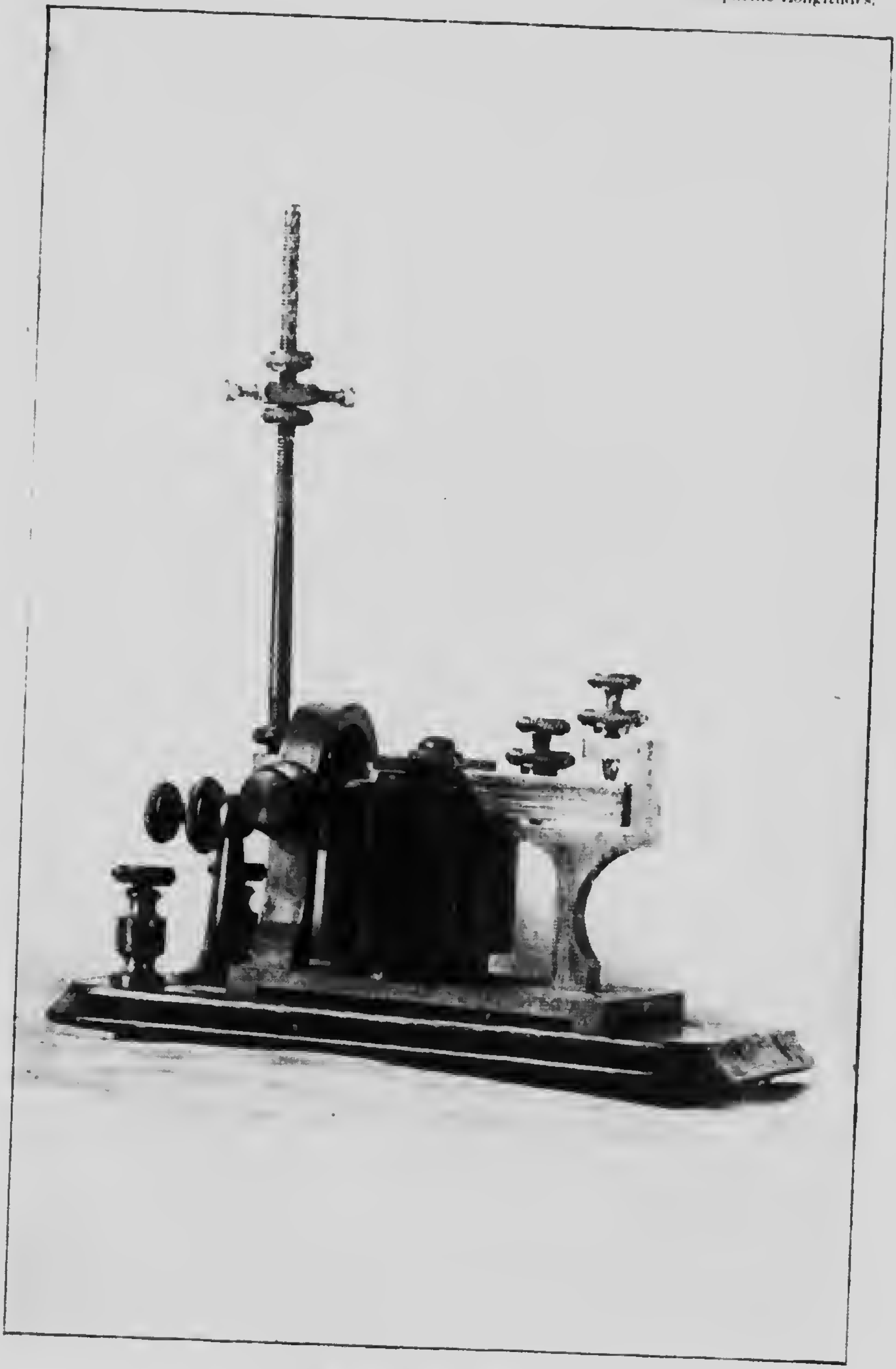
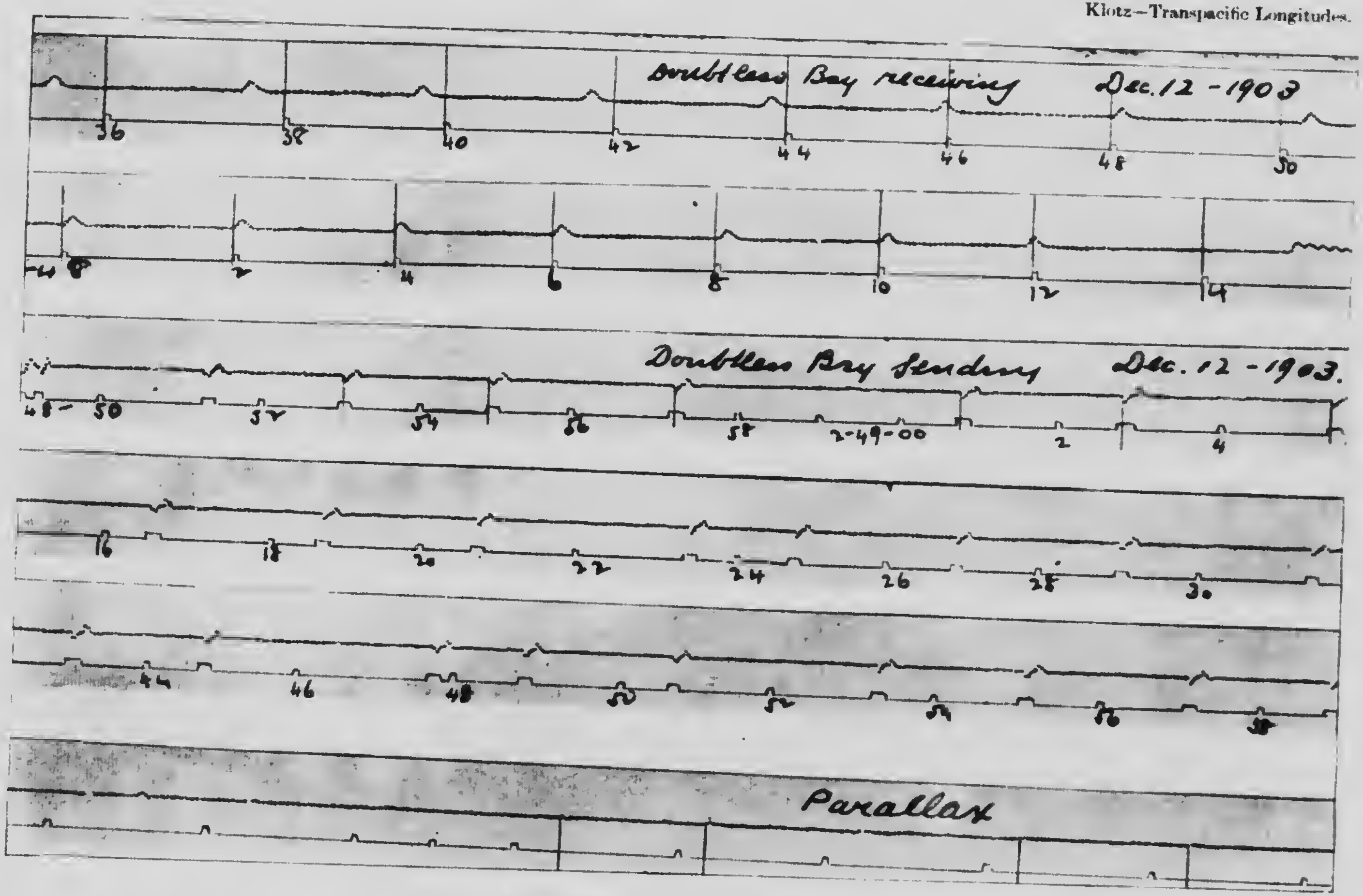


Fig. 4.—Sounder for Clock Cable Siphon.



. Fig. 5.—Comparison of, Chronometers by Cable.

ELECTRICAL CONNECTIONS AT WELLINGTON OBSERVATORY

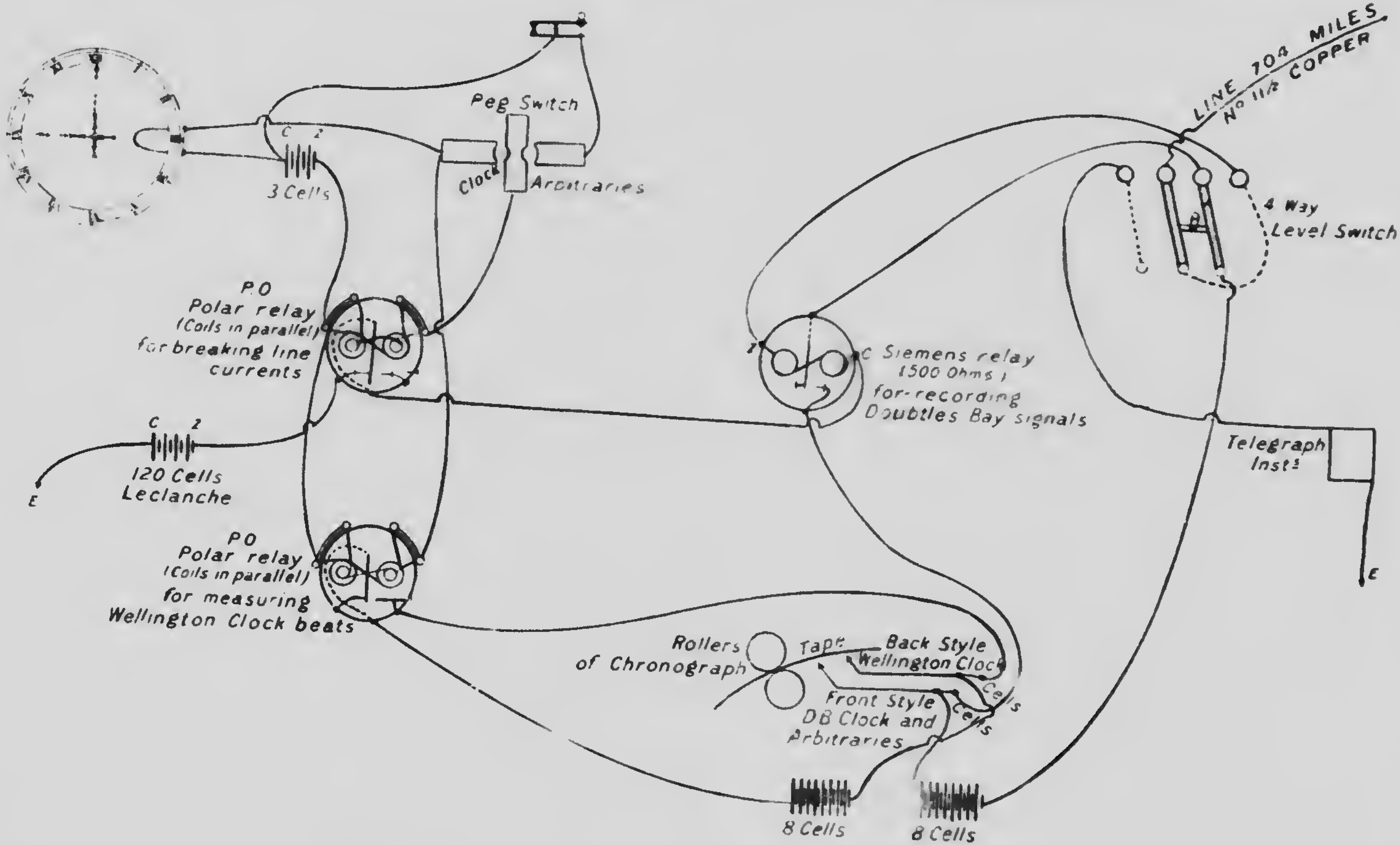


Fig. 6.

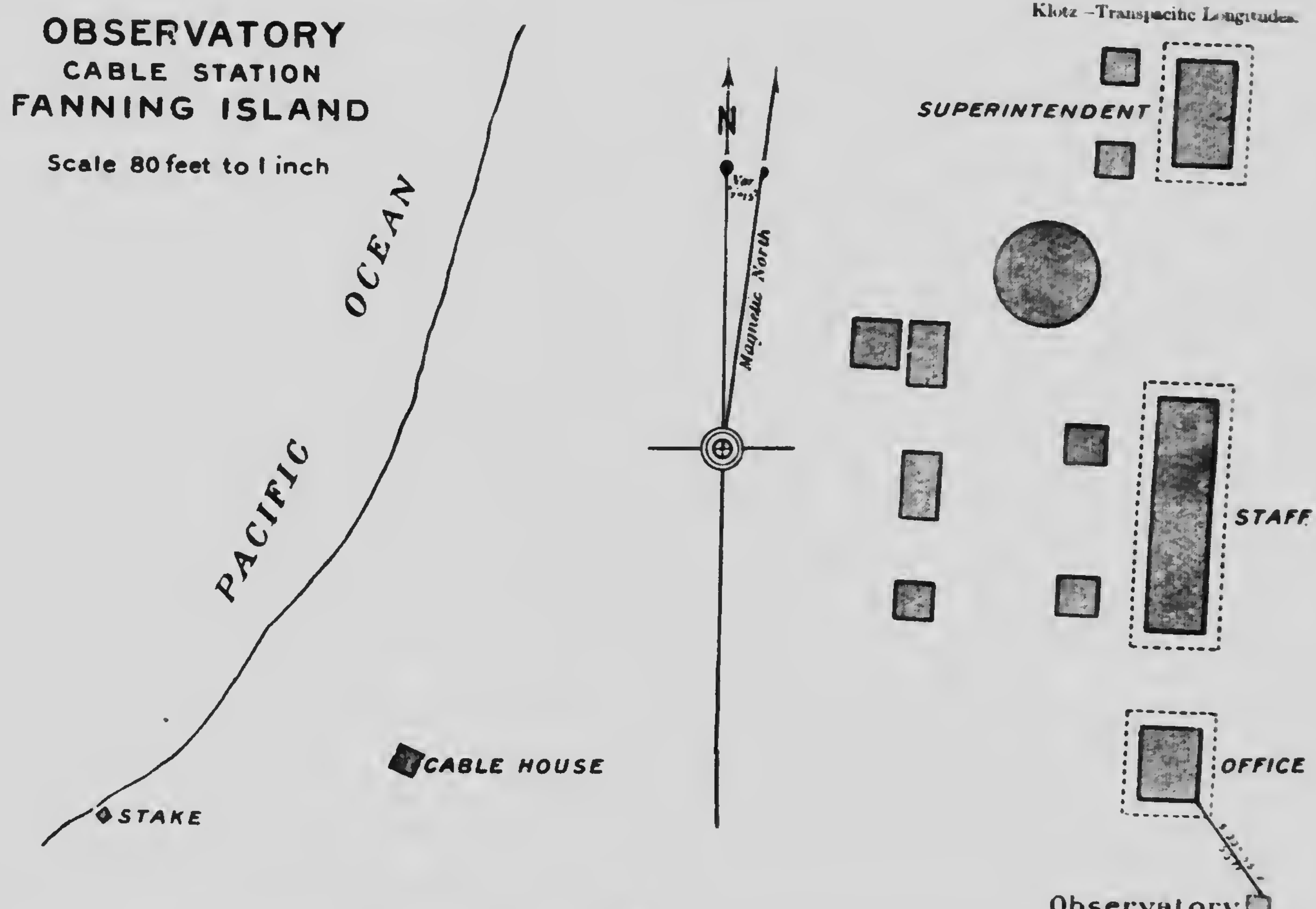

OBSERVATORY
CABLE STATION
FANNING ISLAND
Scale 80 feet to 1 inch
PACIFIC
OCEAN
STAKE
CABLE HOUSE
N
Magnetic North
SUPERINTENDENT
STAFF
OFFICE
Observatory

Fig. 7.

Fig. 8.—Observatory at Suva, Fiji.

Photo by Otto Klotz

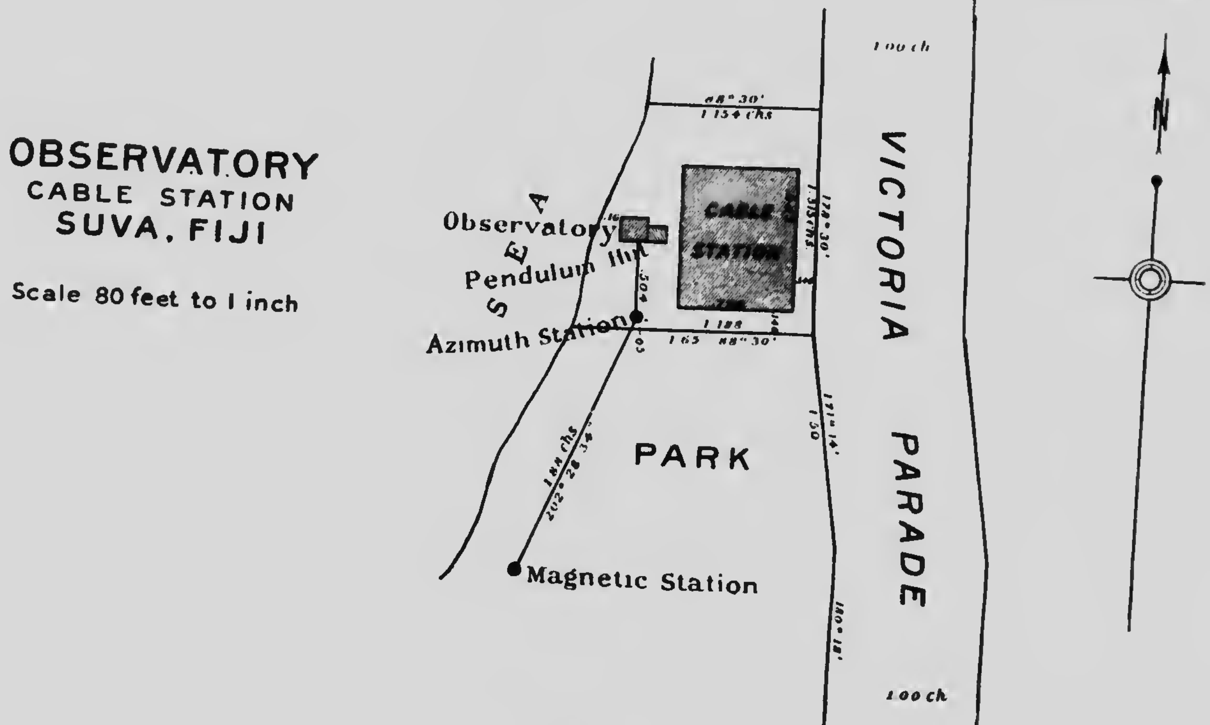

OBSERVATORY
CABLE STATION
SUVA, FIJI
Scale 80 feet to 1 inch
VICTORIA PARADE
N
1.00 ch
1.00 ch
88° 30'
1.154 chs
178° 30'
1.315 chs.
CABLE STATION
1.188
1.65
88° 30'
171° 14'
1.50
180° 18'
.504
SEA
Observatory
Pendulum Hut
Azimuth Station
PARK
1.88 chs
202° 28' 34"
Magnetic Station

Fig. 9.

Fig. 10 Pacific Cable Station, Suva, Fiji.

Photo by Otto Klotz.

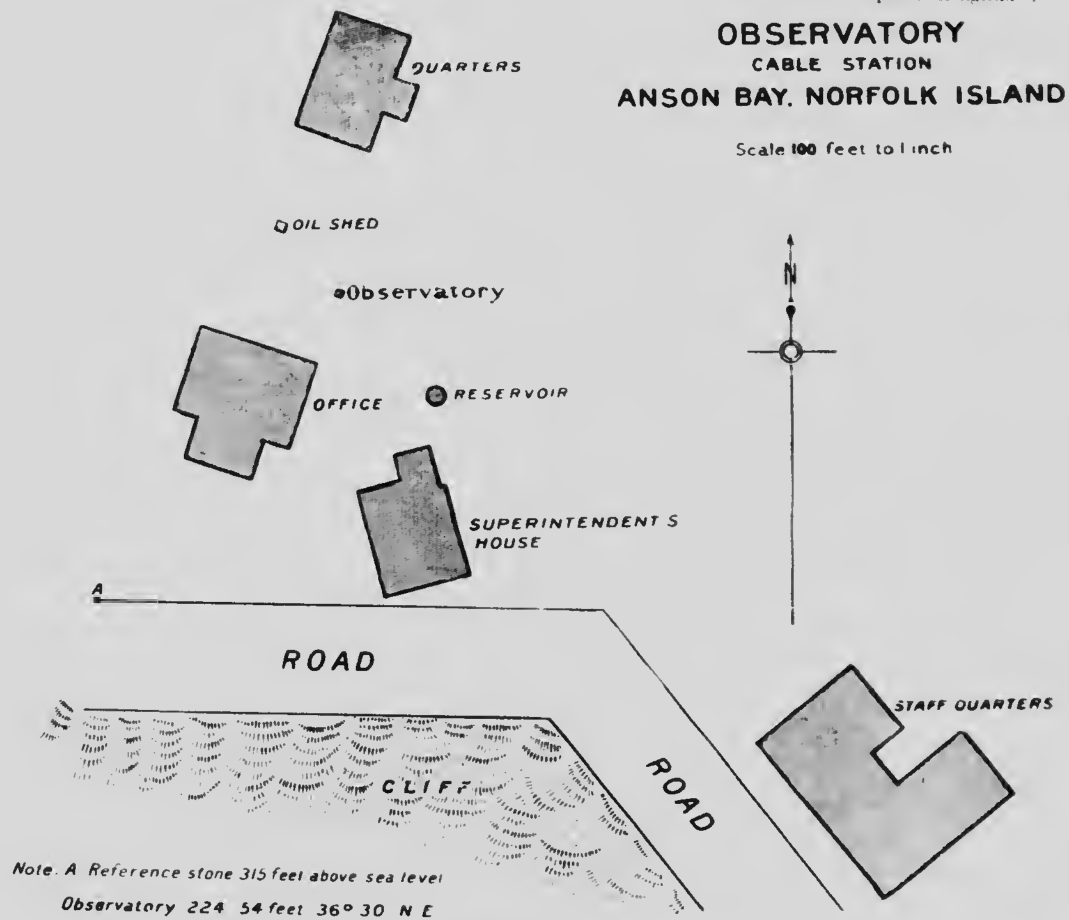

OBSERVATORY
CABLE STATION
ANSON BAY, NORFOLK ISLAND
Scale 100 feet to 1 inch
QUARTERS
OIL SHED
Observatory
OFFICE
RESERVOIR
SUPERINTENDENT'S HOUSE
N
A
ROAD
ROAD
STAFF QUARTERS
CLIFF
Note. A Reference stone 315 feet above sea level
Observatory 224.54 feet 36° 30' N E

Fig. 11.

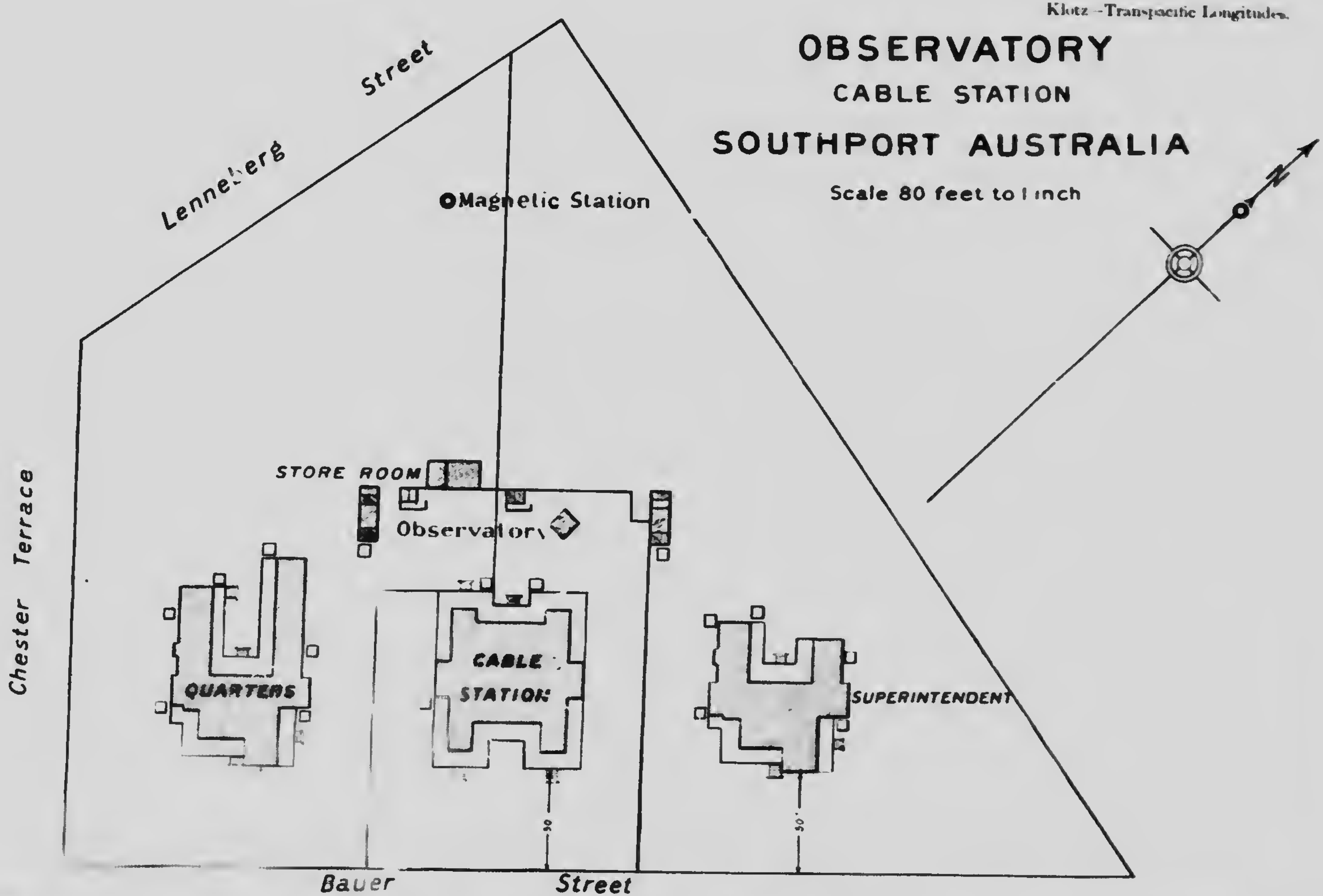

OBSERVATORY
CABLE STATION
SOUTHPORT AUSTRALIA
Scale 80 feet to 1 inch
N
Lenneberg Street
Magnetic Station
STORE ROOM
Observatory
QUARTERS
CABLE STATION
SUPERINTENDENT
Chester Terrace
Bauer Street
90'
90'

Fig. 12.

25b—14c

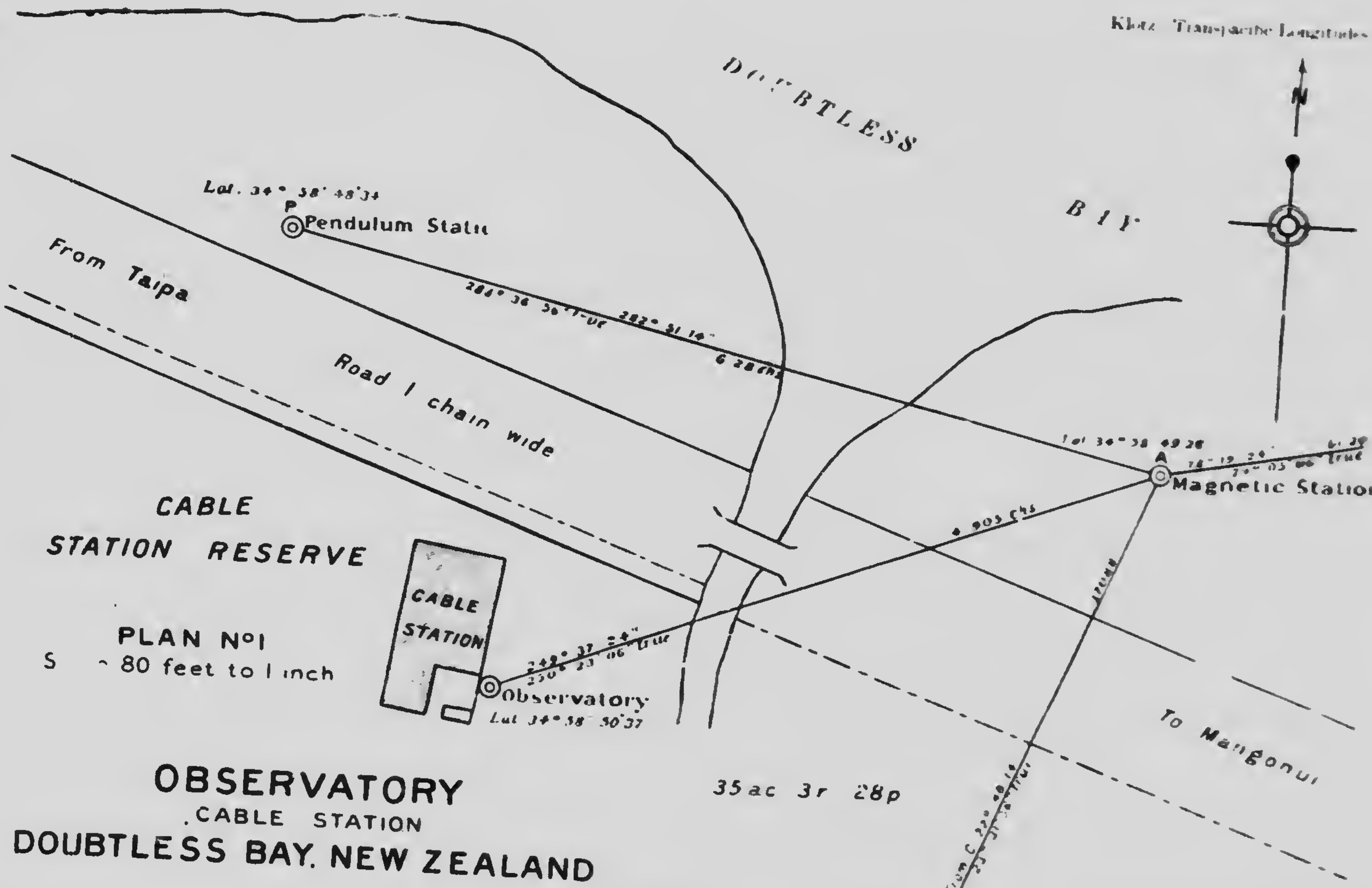
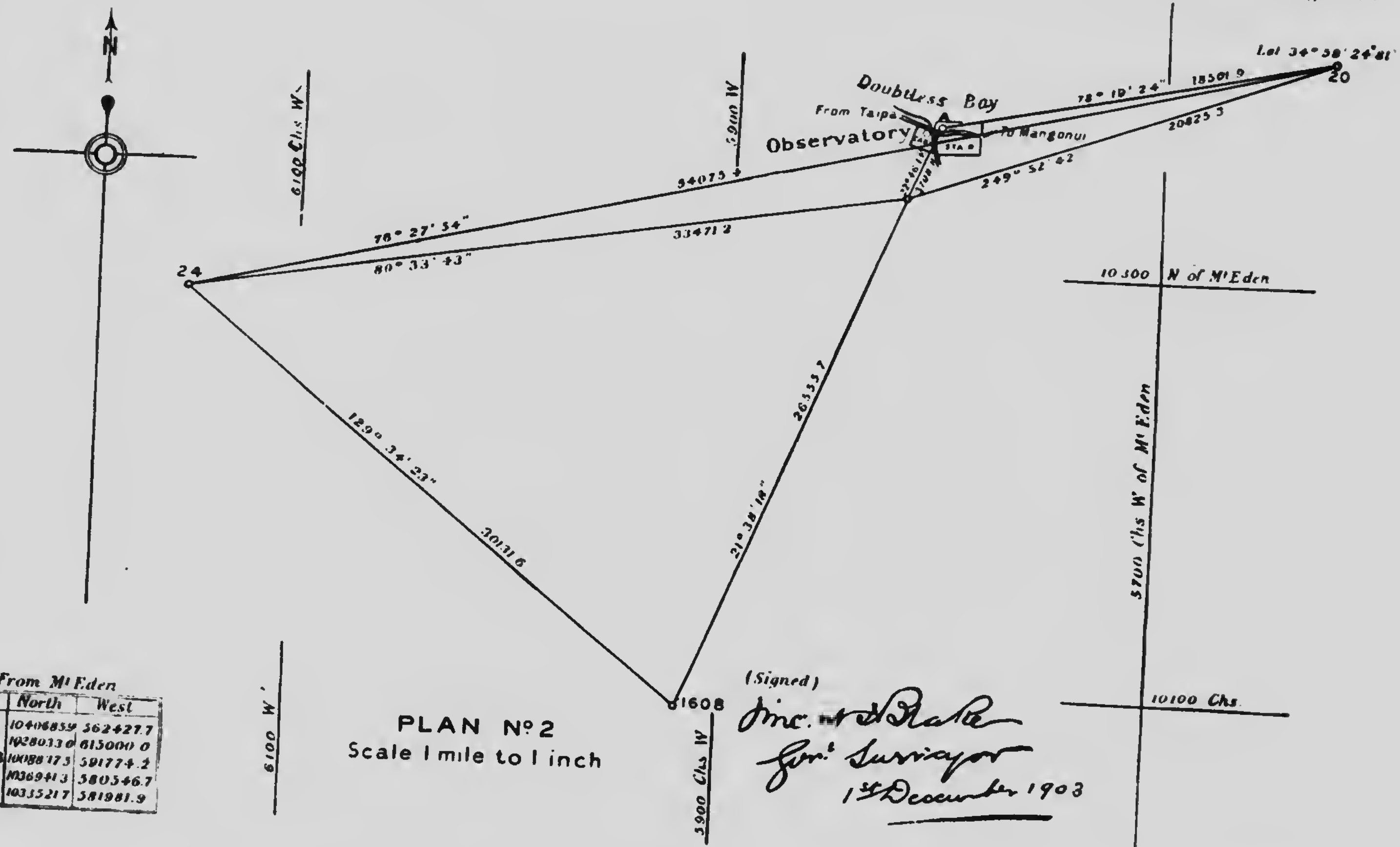


Fig. 13

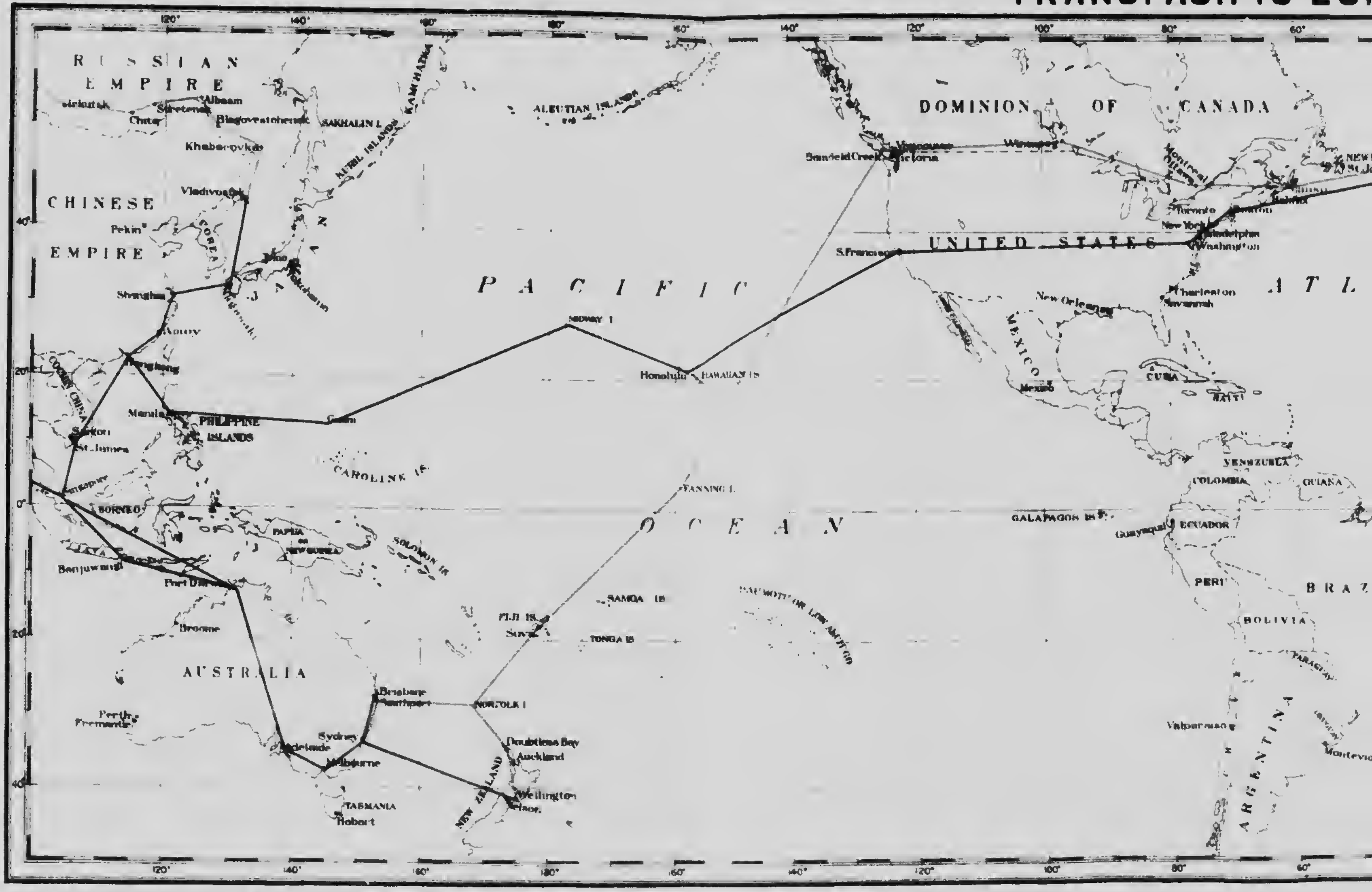


From Mt Eden

Sta	North	West
20	10406859	562427.7
24	10280330	615000.0
1608	10088173	591774.2
A	10369413	580546.7
C'	10335217	581981.9

Fig 14.

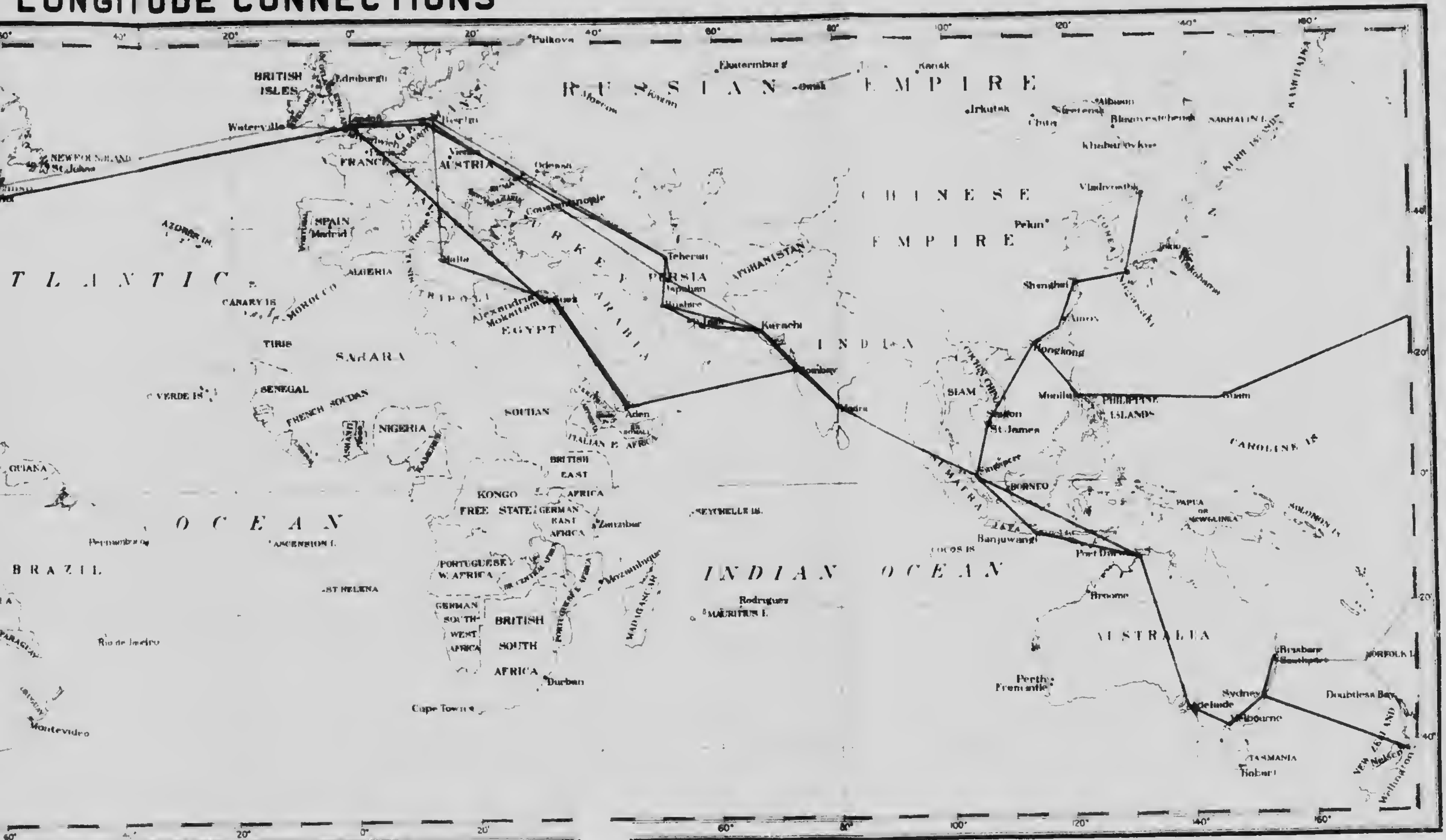
TRANSPACIFIC LON



James White F.R.G.S. Geographer

CANADIAN ARCS
ENGLISH ..
INDIAN ..
AUSTRALASIAN ..

LONGITUDE CONNECTIONS



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...CS
...NITED STATES ARCS
...USSIAN
...ERMAN