

R (415)

CG/A

Correspondence on the Case GRUBB

1909-1912

CONTRATO PARA LA CONSTRUCCION Y ADQUISICION DE UNA ECUATORIAL,
CON DESTINO AL OBSERVATORIO DE MADRID.

Don Francisco Iniguez é Iniguez, Jefe del Observatorio Astro-
nómico de Madrid, en nombre del Gobierno español, autorizado al
efecto por orden del 24 de ~~Febrero~~^{marzo} de 1911 y

Sir Howard Grubb, constructor de instrumentos astronómicos,
de Dublin (Irlanda), en nombre propio,

de común acuerdo contratan la construcción y adquisición de
una una ecuatorial, con sujeción á las siguientes cláusulas

1ª. Sir Howard Grubb se compromete á construir y vender una
ecuatorial de las siguientes condiciones:

El instrumento ecuatorial será de la forma figurada en la pá-
gina 11 del catálogo de 1908, y como los remitidos á los Observa-
torios de Greenwich, Capetown, Melbourne, Dunsink, etc., para la
fotografía internacional del cielo, pero provisto de un anteojo
con objetivo de 16 pulgadas de abertura y de distancia focal aco-
modada á la cúpula de 8 metros del Observatorio de Madrid.

El anteojo mencionado irá provisto de una lente extra, apro-
piada para alterar la aberración cromática del objetivo de 16
pulgadas y corregirlo para rayos fotográficos, de 16 pulgadas de
abertura libre y con los enlaces necesarios para colocarla delan-
te del objetivo visual.

El objetivo visual de 16 pulgadas y la lente correctora se-
rán de la cualidad mas perfecta, irán montados en armaduras anu-
lares de hierro fundido y tendran proxiamamente cinco metros de
distancia focal.

El tubo será de placa fuerte estañada, reforzada y bien diafragmada en toda su extensión y provista de extremo ocular de la mejor forma, conteniendo movimientos rápidos y lentos para ángulo de posición, piezas de amordazar, etc.,

Un buscador de 6 pulgadas de abertura libre, con ocular positivo y cruz filar; esta última dispuesta sobre correderas cruzadas para las conveniencias de guiar durante la exposición de las placas fotográficas.

El instrumento estará provisto de un circulo de Declinación y dos de Ascensión recta, divididos sobre plata hasta la graduación que desee el comprador.

El primer circulo de Ascensión recta será de 16 pulgadas de diámetro, dispuesto para la lectura diferencial y leído con dos nonios opuestos, en la forma usual, y el segundo circulo de ascensión recta se leerá por medio de una linterna eléctrica de mano.

El circulo de Declinación será de 24 pulgadas de diámetro y leído por medio de dos nonios, uno visible desde el extremo ocular del anteojo por medio de un microscopio especial y ambos nonios estarán iluminados por lámparas eléctricas. Mordaza perfeccionada y movimiento lento de Declinación.

Tres movimientos lentos en Ascensión recta producidos:

(a) Por ruedas diferenciales y piñones movibles.

(b) Por un movimiento muy delicado para la corrección de refracción, producido por una corriente eléctrica y un conmutador llevado á la mano.

(c) Por un pequeño motor eléctrico.

Aparato de relojería. Este será de la misma construcción general que los empleados para la Fotografía internacional del cielo con regulador de fricción, poder mantenedor aplicado al tambor, esfera y aguja para el ajuste esmerado del movimiento.

Un regulador eléctrico irá aplicado al aparato de relojería,

incluyendo detectores, correctores, péndulo eléctrico, etc.,.

El Sector será de bronce de cañones y de suficiente amplitud para trabajar dos horas sin necesidad de remontarlo.

Conexiones eléctricas. El instrumento llevará dos circuitos distintos por medio de anillos aislados.

Una lámpara eléctrica de mano acompañará al instrumento para leer los círculos de ascensión recta.

Relevador de fricción del eje polar, obtenido por rulos de fricción en el extremo superior como en los anteojos para la carta del cielo.

El eje polar, la cruz de ambos ejes y el eje de declinación serán de hierro fundido, semejantes á los empleados en los anteojos de la carta del cielo.

Tubo de rocío y guarda polvo.

4 oculares negativos.

1 ocular positivo acromático de corto aumento.

Extremidad ocular de recambio para emplearla en el trabajo fotográfico, para llevar el bastidor metálico y provista de piezas apropiadas para enfocar y amordazar.

Micrómetro bifilar de nuevo tipo ideado en concordancia con las instrucciones recibidas de Sir David Gill para el Observatorio de Johannesburg.

2^a. El aparato completo, construido con los mejores materiales bien trabajado, instalado para su ensayo en los talleres del constructor, cuidadosamente embalado y puesto en Liverpool sobre el barco transporte será entregado por la cantidad de

Dos mil doscientas cincuenta y cinco libras esterlinas, (L. 2255). Los gastos de transporte y cualquier otro que se ocasionen desde Liverpool al Observatorio de Madrid, no serán de cuenta del constructor.

3^a. El pago de las dos mil doscientas cincuenta y cinco libras esterlinas se hará en tres partes iguales, la primera tercera parte en seguida de hacerse el encargo, la segunda durante

la construcción del instrumento y la tercera y última al estar
aquel terminado y ensayado en los talleres.

4ª. El contrato para su validez, deberá ser ratificado por
el Excmo. Sr. Ministro de Instrucción pública y Bellas Artes.

CONTRATO PARA LA CONSTRUCCION Y ADQUISICION DE UNA ECUATORIAL, CON DESTINO
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1ª. Sir Howard Grubb se compromete á construir y vender una ecuatorial de las siguientes condiciones:

El instrumento ecuatorial será de la forma figurada en la página 11 del catalogo de 1908, y como los remitidos á los Observatorios de Greenwich, Capetown, Melvourne, Dunsink, etc., para la Fotografía internacional del cielo, pero provisto de un anteojo con objetivo de 16 pulgadas de abertura y de distancia focal acomodada á la cúpula de 8 metros del Observatorio de Madrid.

El anteojo mencionado irá provisto de una lente extra, apropiada para alterar la aberración cromática del objetivo de 16 pulgadas y corregirlo para rayos fotograficos, de 16 pulgadas de abertura libre y con los enlaces necesarios para colocarla delante del objetivo visual.

El objetivo visual de 16 pulgadas y la lente correctora serán de la cualidad más perfecta, irán montados en armaduras anulares de hierro fundido y tendran proximamente cinco metros de distancia focal.

El tubo será de placa fuerte estañada, reforzada y bien diafragmada en toda su extensión y provista de extremococular de la mejor forma, conteniendo movimientos rápidos y lentos para ángulo de posición, piezas de amordazar, etc.,

Un buscador de 6 pulgadas de abertura libre, con ocular positivo y cruz filar; esta última dispuesta sobre correderas ~~acu-~~ zadas para las conveniencias de guiar durante la exposición de las placas fotográficas.

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El primer circulo de Ascensión recta será de 16 pulgadas de diámetro, dispuesto para la lectura diferencial y leído con dos nonios opuestos, en la forma usual, y el segundo circulo de ascensión recta se leerá por medio de una linterna electrica de mano.

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- (c) Por un pequeño motor eléctrico.

Aparato de relojería. Este será de la misma construcción general que los empleados para la Fotografía internacional del cielo, con regulador de fricción, poder mantenedor aplicado al tambor, esfera y aguja para el ajuste esmerado del movimiento.

Un regulador eléctrico irá aplicado al aparato de relojería, incluyendo detectores, correctores, péndulo electrico etc.

El Sector será de bronce de cañones y de suficiente amplitud para trabajar dos horas sin necesidad de remontarlo.

Conexiones electricas. El instrumento llevará dos circuitos distintos por medio de anillos aislados.

Una lámpara electrica de mano acompañará al instrumento para

V 2 E B V 2

Sir Howard Grubb.F.R.S.= Rathmines.= Dublin.=Trabajos de
óptica y mecánica.= Veintisiete de diciembre de mil nove-
cientos doce.= Recibí del Profesor Iniguez, del Observato-
rio Astronómico Nacional, Madrid, la suma de ciento ochenta
y cuatro libras, diez chelines y cinco peniques(L.184-10s-5d)
como pago de un espectroscopio para la ecuatorial de diez
y seis pulgadas.=Sir Howard Grubb.= Rubricado.= Hay un sello
anulado con fecha veintisiete de diciembre de mil novecientos
doce.= ES COPIA.

TELEPHONE
No 13.

CASTLE HOTEL,
CONWAY,
NORTH WALES.

17 - 2 - 12

Dear Prof. Briguey

I hear from Dublin that you
are enquiring about your telescope
I have been seriously indisposed
for the last 5 weeks from the effects
of an internal chill on the liver
& came over here for a few days to
see if the change of air would
hasten my recovery - I feel much
better the last 2 days & hope to
go on to London for some important
business that is waiting for me
then returning to Dublin at end
of week when I will immediately

Send you a report and I hope
some photos of your new
instrument

Some letters of mine seem
to have gone astray. My Secretary
is looking into this matter and
you copy

With kind regards
from
Howard Crosby

~~Dr Howard Grubb, F.R.S. Optical and Mechanical Works~~
~~Dublin~~

16 junio 1911

40.

He recibido del Profesor F. Lúguera
del Real Observatorio de Madrid, la cuen-
ta del pago de la ecuatorial de
16 pulgadas, según contrato fecha-
do en 24 de marzo de 1911, la
suma de setecientos veintinueve
libras, tres chelines y cuatro peni-
ques (L. 729. 3. 4d)

Firmado: Howard Grubb

Copia del recibo enviado por Sir
Howard Grubb del primer libra-
mito que se le ha girado para
el pago de la ecuatorial.

„ Dublin 16 de junio de 1911.

He recibido - - - -

(L 729. 3. 4d) ¹⁰

Honorary Members.

The President and Secretaries of the Royal Society.
The President and Secretary of the Society for the Encouragement of Arts, Manufactures, and Commerce.
The President of the Royal Society of Edinburgh.
The President of the Royal Agricultural Society of England.
The President of the Highland and Agricultural Society of Scotland.
The President of the Bath and West of England Society for Promoting Agriculture, Commerce, and the Fine Arts, in the West of England.
The Secretary of the Science and Art Department.
The President of the Royal Academy of Arts, London.
The President of the Royal Astronomical Society, London.
The President of the Royal Geographical Society, London.
The President of the Royal Institution of Great Britain.
The President of the Institute of Civil Engineers, London.
The President of the Chemical Society, London.
The President of the Geological Society, London.
The President of the Zoological Society, London.
The Astronomer Royal, London.
The Principal Librarian of the British Museum.
The Director of the Royal Gardens, Kew.
The Director of the Geological Survey of the United Kingdom.
The Director of the Meteorological Office, London.

(All for the time being.)

- 1872 His Royal Highness the Duke of Saxe-Coburg.
- 1859 Clarendon, Frederick Villiers. 36, Mountjoy-square.
- X 1888 Green, Rev. W. S., M.A. 5, Cowper-villas, Rathmines.
- 1870 Huggins, William, D.C.L., F.R.S. Upper Tulse Hill, London.
- 1866 Kimberley (Right Hon. John Wodehouse), Earl of, K.G. 35, Lowndes-square, London, S.W.
- 1852 M'Clintock, Admiral Sir Francis Leopold, C.B., D.C.L., LL.D. United Service Club, London, S.W.
- X 1886 Mendelejeff, D., Professor in the University of St. Petersburg.
- 1875 Spencer (Right Hon. John Poyntz Spencer), Earl, K.G. Althorp, Northampton; and St. James's-place, London.

Corresponding Members.

- 1855 Bland, Edward Loftus, Lieut. R.E. Halifax, Nova Scotia.
1863 Bouché, M., Inspector, Botanic Garden. Berlin.
- 1863 Crüger, W., Director, Botanic Garden. Trinidad.
- 1877 Goode, W. H., Surgeon, Royal Navy.
- 1863 Haughton, John, Lieut. Royal Artillery. St. Helena.
- 1863 Knight, J. G., Secretary, Victorian Department of International Exhibition. Melbourne.
- 1853 Mac Donnell, William. Sydney, New South Wales.
1863 Moore, Charles, F.L.S., Director of Botanic Gardens. Sydney, New South Wales.
- 1863 Ortgies, Edward, Inspector of the Botanic Garden. Zurich.
1863 Otto, Edward, Inspector of the Botanic Garden. Hamburg.
1855 Oxley, Thomas. Senior Residency Surgeon.
- 1863 Power, Richard Eaton, M.D. 1, Anchorgate-terrace, Portsea, Hants.
- 1863 Sankey, William Villiers, C.E. Turin.
- 1854 Traill, William, M.D., Hon. E.I.C.S. Malacca.
1855 Tweedie, James. Buenos Ayres.
- 1863 Van Houtte, Louis. Ghent.
- 1863 Wendland, M., Inspector of Botanic Garden. Herrenhausen, Hanover.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

11th January 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I am much pleased to hear that we may soon expect to have the order to proceed with your Equatorial. I am at present engaged in laying down a diagrammatic drawing showing the position of the instrument under the Dome and the proportion of the various parts in order to work out the best position for the centre of motion of the telescope and ~~from this~~ design out the general Stand. I should be glad to have from you particulars as to the height from the floor level up to any portion of the Dome, either the top of the wall where the cast iron wall plates rest or the bottom of the opening of the shutter. I have from you the height of the centre of motion from the floor and I have the distance that the pier projects above the floor so I think if I had the dimensions I referred to I would have everything I require

to enable me to lay out this.

I have been enquiring about the glass:- We have had considerable trouble lately in procuring optical glass of large size and the discs which I ordered for the 26 inch Equatorial for the Transvaal, South Africa and also for the 24 inch for Santiago De Chili are not yet available although ordered 12 months ago and I cannot get any guarantee from the Paris House as to what time they would take to construct your discs. I am in communication also with Messrs. Chance Brothers of Birmingham and they offer to make them in 8 months so it is evident that this will be the principal delay. I do not think that it would be possible to have the object glass finished within the year, because, 4 months, particularly Winter months, would not be nearly sufficient for the work that is to be done upon it, but I think if there was any object for it we could have the Mechanical portions done in about a year. It is evident therefore, that the sooner we can order these discs the better.

I suppose you will make arrangements with your Government that the payments for the instrument be

made in the usual way, that is, 1/3rd with the Order, 1/3rd when the work is well advanced and 1/3rd on completion.

The moment I hear from you that the Government have given you the authorization I shall order the discs of glass.

With regard to the phrase "maintaining power to barrel" :- This means an arrangement which I think is also on your small ^{clocks} ~~glass~~ by which the motive power of the clock is not arrested during the process of winding and that you can wind your clock without the speed being affected thereby.

In the design now in hands we will show how we propose to carry the clock weights & cords

*With kind wishes for the New Year
Yours sincerely
Harold Galt*

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

2nd March 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I suppose that we shall soon be hearing from you with regard to the Contract for the 16" Telescope, and that I will be able to order the glass for the object glass; meanwhile, I have been going over the drawings and preparing matters and I wish to ask you about the clockwork:- Whether you desire that we should make the clock suitable for electric winding as we are doing in the case of the telescopes for Santiago and Johannesburg. It occurred to me that as you have

electric current in your Observatory that it would be handy for you to have the clock automatically wound by electricity and we can do this for you, I think, with very little, if any, extra expense, for although it involves the use of a motor and stopping and starting gear, we can dispense with

the barrel and one or two spindles. I think in this way we might, as the weight will be very much smaller, be able to have it self-contained in the stand to avoid the necessity for carrying pulleys, cords and weights, etc., down the Pier and under the Floor.

If you think that there would be no objection and that you would like this arrangement, I will make a design and see if it would be possible.

*Very truly
yours
J. S. Gross*

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

14th March 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I am much obliged by your kind letter of the 7th. I quite understand that the instrument is to rest upon a pillar constructed upon a spherical arch, and this undoubtedly would cause a great deal of trouble in providing the necessary accomodation for a falling weight if the weight is large and has to move through any large space, and it was for this very reason that I suggested that we should give you a clock not driven but automatically wound by electricity such as we are supplying now to Johannesburg, Santiago and other large instruments. You need not be at all anxious as regards this affecting the accuracy of rate of going of clock, because the clock will still be driven by a weight,

which weight will be wound up periodically by a small electric motor. The weight in this case will be quite small and the drop required very short so we believe that we can accomodate this weight and provide sufficient fall for it within the main frame or casting. If we can do this and that it works out quite conveniently, I believe it will be a great advantage to you and the extra cost will be small and not exceed £10, which would include the motor.

I am glad to know that we may soon expect to hear from you as regards the Contract, as I am anxious to order the glass at the earliest possible moment.

Trinculo J. H. G. Smith

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

30th March 1911.

2 Enclosures.

Prof. F. Iniguez.

Dear Prof Iniguez,

I have received your kind letter and the 2 copies of the Contract and as you desire it to be returned immediately I have signed both copies and enclose them back to you. I am not sure whether I have done right in sending you back both copies but if you desire one kept for me perhaps you would kindly return one as in any case I should desire to have a copy of it.

I quite understand the position of the matter as regards the Spectroscope and the clock winding.

Howard Grubb

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

6th April 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I have started at the design of your new instrument and there is one point which I would desire to consult you about:- It is with reference to the AR circles, in the arrangement of which I think I can make an improvement.

As at present, and as we have made them for all the former instruments, the arrangement is that the divided AR circle is strung loosely upon the end of the Polar Axis, but is capable of being clamped to an arm which is driven by a pin from the toothed sector which conveys the clock motion to the telescope; the vernier circle is carried on an arm fixed to the Polar Axis; the result of this is that if the circle be set at the beginning of observation to read sidereal time by a

a vernier fixed to the stand, this loose circle is kept moving so long as the clock sector moves; ^{and} ~~the~~ actual ARs can be read off by differential readings between the arm carrying the vernier and the circle itself.

This is considered to be the most convenient arrangement, but it possesses two decided disadvantages, firstly, the circle must be re-set every time the toothed sector is re-wound, and secondly, the vernier from which the circle is read is not in a fixed position but may be anywhere around the circle.

In order to meet these disadvantages, and to make a more convenient arrangement I have devised and would propose to adapt to your instrument, with your consent, the following arrangement:-

The divided circle loose as before, upon the Polar Axis, is so arranged that it can be clamped, in this case, to a second circle strung upon the Polar Axis so that it can be set to any desired position just as in the old arrangement, but this second circle to which the divided circle can be clamped is continuously carried around the Polar Axis in a direction contrary to that of the motion of the telescope by a strong spring clock

clock which is carried on an arm upon the P.axis itself:-
 in other words, the divided circle is always revolving
 on the P.Axis backwards, consequently if the ~~periscope~~ ^{telescope}
 be set upon any star and that this circle is set to read
 the true AR of that star by a fixed vernier ~~it~~ ^{which} can be
 placed in the most convenient position, that circle will
 always read the true AR of that star or any other star
 that it may be set upon, so long as the spring clock
 keeps going. This spring clock can be made to go either
 for the night or evening ~~ing~~ for a longer period if desired
 but I would suggest if it was constructed to go for about
 12 hours that it would be sufficient as there would be no
 trouble in winding it up each evening, and once the circle
 is set in the beginning of the evening there would be
 no further trouble with regard to time as the circle will
 read true ARs all through the night from a fixed vernier.

This arrangement will cause some additional
 work no doubt, but I am so convinced that it will be a
 great convenience that I am willing to add it to your
 telescope without making any alteration at all in the
 price. I may add that in the large instruments which we

we are constructing for Santiago, Johannesburg, and other Observatories under Sir David Gill's advice, we are adapting an arrangement for keeping this differential circle continually revolving, but in those cases the circle is kept revolving by an electrical arrangement which is I think not so much to be depended upon as a mechanical arrangement, besides being much more complicated and it has a further disadvantage that the vernier is not a fixed one.

If I hear from you that this arrangement would be pleasing to you I shall carry it out in your instrument.

Very truly
Yours
J. H. G. Quibb

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

19th April 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

This morning I had the pleasure of receiving from you the Contract signed quite safely. I note that I am to expect the remittance for the first Instalment shortly.

As regards the various matters of which you speak I will write you in a Mail or two. I am at present engaged in planning out the arrangement of the electrically wound clock and shall let you have particulars of this when it is designed.

I note also that you are likely to be able to get the money for the Spectroscope and I shall be glad to have from you particulars of your requirements and conditions in order that I may be able to design out a suitable instrument.

With kind regards

from Howard
Grubb

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

8th May 1911.

Professor F. Iniguez.

Dear Sir,

Just at present Sir Howard Grubb is away from Dublin, and wrote me a few days ago to know if the 1st Instalment upon your Equatorial in accordance with the Contract ^{sent} ~~remitted~~ by you on the 15th April had been received, as he understood from that letter that you would be able to send him a cheque immediately after the Contract had been signed. I write, therefore, to let you know that, up to the present, no communication has been received from your Observatory and it is possible that the letter may have gone astray in the post.

Yours faithfully,

J. E. Ladd
Secretary.

TELEPHONE No. 24 RATHMINES.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

7th June 1911.

1. Enclosure.

Professor F. Iniguez.

Dear Professor Iniguez,

I have been trying to get information with regard to the Alleghany ^{Spectroscope} and just as yet I have not succeeded but I wrote to Sir David Gill who is acting on behalf of the Santiago Authorities as well as those at Johannesburg and who is a very high authority on these matters and I enclose a copy to you of his reply. I am not able myself to make any comments on this just yet as I do not know the principal features of the Alleghany instrument, but as soon as I am in a position to study this I shall write you my ideas and as I shall be discussing very closely these other Spectroscopes with Sir David Gill I shall be able, I think, to advise as to the best design.

Very truly Yrs
Howard Grubb
With kind regards

We have not yet heard anything from your Government about the deposit money

COPY.

34, De Vere Gardens,
Kensington, London.

26th May 1911.

MADRID SPECTROSCOPE.

My dear Grubb,

I do not know where this Spectroscope of the Alleghany Observatory is described but I will try to find out within the next few days. However, I am certain that for accurate Spectroscopic work it is impossible to construct a spectroscope which can be used at pleasure with one, two, or three prisms and which at the same time has all the rigidity and other conditions which are essential for the highest accuracy in line of sight work; and it is also certain that no accurate line of sight work is possible without the most refined methods for maintaining uniform temperature. I would very strongly recommend Professor Iniguez to have nothing whatever to do with a Spectroscope which is " a Jack of all Trades " for it will certainly be " a Master of none of them ". At present I am busy designing a Spectroscope for the Observatory at Santiago to be applied as you know, to the equatorial which you are

and making for Dr. Heston. It is to be
 contained very closely upon the lines of the great
 Gage spectroscopy of which you have a description in
 the proof sheets which I sent to you. The collection
 of the Gage spectroscopy will have an aperture of
 1 1/2". I think for the smaller instrument at least
 it would probably be better to have an aperture of only
 I know so that the spectroscopy might be lighter.

(SGD) DAVID GILL.

BROOK
 SIMMEL & Co Ltd

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

19th June 1911.

Professor F. Iniguez.

Dear Sir,

In the absence of Sir Howard Grubb, I have the honour to acknowledge the receipt of your letter of the 13th inst., enclosing cheque, value £729. 3. 4d for which, on behalf of Sir Howard, I beg to thank you.

On looking up the Contract I find that the total amount is £2255. 0. 0d, one third of which would be:- £751. 13. 4d, so I write to ask whether you intend that the balance should be made with the future Instalments and that we should send you a receipt for the £729. 3. 4d on account of the 1st Instalment.

You will understand that if we sent you a receipt in full for the 1st Instalment we should be £22. 10. 0d out of pocket.

Yours faithfully,

J. E. Ladd
Secretary to SIR HOWARD GRUBB.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

21st June 1911.

Professor F. Iniguez.

Dear Sir,

In looking over the Specification of your 16 inch Equatorial instrument we find one or two points upon which we would like to have a little further information.

FINDER:- The aperture of this Finder is specified as 6 inches, but we have no information as to what focus you would wish this to be. Would you kindly say what focus would be best for your requirements.

PHOTOGRAPHIC BREACH PIECE:- Would you kindly say what size plates you intend to use so that we may design this *part-* in accordance?

Yours faithfully,

J. E. Ladd.

Secretary.

TELEPHONE NO. 24 RATHMINES.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

3rd July 1911.

2 Enclosures.

Professor. E. Iniguez.

Director. Madrid Observatory.

Dear Prof, Iniguez,

I have just got home from
the country and find your letters.

I am sending you the enclosed receipts in accordance with your wishes and please accept my best thanks for the cheque.

I shall be writing to you in about a week on various matters of detail connected with the telescope.

*Yours sincerely
Howard Grubb*

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Professor F. Liquez.

Director

Astronomical Observatory

Madrid

Spain

Many thanks for your letter of
3^d inst, but you do not say
what focus you would like
the 6 inch glass to be. Everything
else is clear & we shall attach a
small finder to the 6 inch.

Yours faithfully,



TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

17th July 1911.

1 enc

Professor F. Iniguez.

Dear Professor Iniguez.

We are at work at present on the design of your instrument which will be a little different to our ordinary form on account of the pier having been already built and built in the centre of the room and not as we usually build them, towards the South side of the room in Northern latitudes. As it is rather complicated to ascertain the exact clearances, I have made a rough model of your instrument to scale and I find that, as at present designed, you would have complete circumpolar motion to within 20 degrees of the Equator, that is, from the Pole to 20 degrees above the Equator. Below that the motion would not be circumpolar, but you

you would have from half an hour to 40 minutes beyond the Meridian both East and West. If we support the telescope as we usually do, at a point midway between the object glass and the focus there will in the present design be only about 15 inches between the focus of the plate and the floor. This appears to me too little and it will be necessary to raise the height of the centre of motion, but I should be glad to hear from you what you think should be the minimum distance of the focus from the floor when the telescope is vertical.

I am sending you a rough pencil drawing of the design as it at present stands, but this can be modified to meet your wishes.

Christopher G. Gubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

22nd July 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

Many thanks for yours of the
17th with the information re. focus of Finder.

I am sorry to hear of the
periodic error in clock driving of Photoheliograph.
Would you kindly send me some particulars as to the
period etc., of the irregularity so that I may, if possible
be able to trace the error and suggest some cure.

Howard Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

31st July 1911.

1. Enclosure.

Professor F. Iniguez.

Dear Professor Iniguez,

Many thanks for yours re. design for Equatorial. I have been laying this out, and enclose a blue print, from which you will see that it will be difficult, with the focus decided upon, to leave as much as 1 metre between eye-piece and floor. You will see also that this does not depend on the position of centre of motion, but it is simply a question of the length of tube and dew cap, plus the 1 metre, being already greater than the height which exists between your floor and Dome.

It will be necessary either to shorten the focus or to reduce the 1 metre distance between floor and eye-piece. I do not like to shorten the focus

focus much below that decided upon.

I propose therefore, to reduce the distance between floor and eye-piece to 0.75 metres and to take, say 3 inches off the dew cap.

Perhaps you will kindly drop me a line and say if you agree to this.

Yours faithfully,

pel. Howard Grubb.



TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

8th September 1911.

1. Enclosure.

Professor F. Iniguez.

Dear Professor Iniguez,

Just a line to tell you that we have not yet received a reply to our letter of the 31st July respecting the question of the distance between the floor and the eye-piece of your Telescope, and for fear you may not have received this letter I enclose a copy.

Of course there is no great hurry about this, and I do not wish to trouble you if you are on your holiday, which I hope you are enjoying and gaining benefit from.

SIR HOWARD GRUBB

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

COPY.

31st July 1911.

1. Enclosure.

Professor F. Iniguez,

Dear Professor Iniguez,

Many thanks for yours re design for Equatorial. I have been laying this out, and enclose a blue print, from which you will see that it will be difficult, with the focus decided upon, to leave as much as 1 metre between eye-piece and floor. You will see also that this does not depend on the position of the centre of motion, but it is simply a question of the length of tube and dew cap plus the 1 metre, being already greater than the height which exists between your floor and Dome.

It will be necessary either to shorten the focus or to reduce the 1 metre distance between

between floor and eye-piece. I do not like to shorten the focus much below that decided upon.

I propose; therefore, to reduce the distance between floor and eye-piece to 0.75 metres and to take, say 3 inches off the dew cap.

Perhaps you will kindly drop me a line and say if you agree to this.

Yours faithfully,
(SGD) HOWARD GRUBB.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

3rd October 1911.

Professor F. Iniguez.

Dear Sir,

Your letter of the 27th ulto., came duly to hand and we are looking up our drawings of your Spectroheliograph in order to see if we can find any fault in the construction of that part of the instrument of which you sent us a sketch, and Sir Howard himself will write you immediately he returns to Dublin, which will be at the latter end of this week.

Meanwhile, we should be greatly obliged if you could let us have a reply to our letter of the 31st July on the question of the distance between the eye-piece and the floor, ^{for 16" telescope} as we could press forward our drawings if we had this information from you.

Yours faithfully,

J. E. Ladd
Secretary.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

12th October 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I have been examining the drawings of the Spectroheliograph, and I find that the wheels are shown on my drawing in the same position as they are in the small sketch you sent over, but if it would be more convenient for your purpose to alter these there is no objection whatever to doing so. I think the proportion of the wheels was arranged, as it is, in order to give the very large range of adjustment which is required according to the information you sent me during the construction of the instrument, and the intermediate ^{rates} ~~ways~~ were supposed to be obtained by an alteration in the position of the friction wheel working on the large disc on top of the clock. There should be no possible objection, however, if you desire it, to the alteration you

you propose.

I was very sorry to give you trouble as regards the information I required for the Equatorial:- It is very curious, but two letters of yours appear to have gone astray, and never to have ~~been sent~~^{arrived} here. We have had great irregularities in the Post here lately, owing to Railway strikes and disturbances, which often caused great delay in the letters, but this is the only case in which we have had letters absolutely lost, as these appear to be. The information, however, which you sent me in your last answers, I think, everything I require to know, and we shall be able now to proceed with the final designs of the frame of the telescope. You will be pleased to hear that we have got a great number of the castings and material necessary for the Mechanical parts of the Telescope ^{and} ~~in~~ very considerable progress has been already made, but I regret to say that we have not yet received the glass for the object glass from Messrs. Chance Brothers. The two discs they intended for us met with an accident and cracked in the oven; another pair have been in the oven for some weeks now and we hope

hope to hear good news of these very shortly. We have been greatly troubled of late with the increasing difficulty of obtaining good optical glass. We have had two discs of 24" in diameter, and two discs of 26" in diameter on order from Messrs. Mantois of Paris for two years now, and up to the present, have had no satisfactory result.

Senor Costa Lobo has ~~written~~ written to me and has mentioned that you were kind enough to give him an introduction and to refer ~~him~~ to me with respect to some instruments. Please accept my best thanks for your kindness in this matter. I hope to be able to arrange to meet this gentleman.

*Very truly
Yours
G. S. Smith*

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.

RATHMINES

DUBLIN.

Optical and Mechanical Works.

21st October 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

Very many thanks for your kind letter of the 17th, and I am very glad to hear that you are getting better results with the Spectroheliograph.

I am glad to be able to tell you that I have this morning got the Advice Note of the forwarding of the two 16 inch Discs from Messrs. Chance Bros., and next week I shall be able to report to you as to whether they appear to be good, although, of course, we cannot finally determine this until we grind and polish them.

Very truly
H. Grubb.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.
8th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

You will be glad to hear that we have at last got one Crown and one Flint Disc from the Glass Makers, and I have been examining them to-day with the following result:-

I have had a preliminary examination of the 16" discs:- It is not possible to examine them very crucially, because the Crown has large patches on the surfaces, which have not been polished and the Flint surfaces are so bad that the errors of the surface are mixed up with errors in the material. I have fairly well satisfied myself that the Crown is a fine Disc and is likely to turn out alright. In fact I have seen nothing in it as yet that is likely to do any harm, and

it is well annealed.

In the Flint there is one long thread or vein which runs from the edge for about 8". Fortunately it appears to me to be very near one of the surfaces so a large portion of it will come away in the hollowing of that side, but I have given orders to have a pair of fairly good surfaces worked on the Flint; and on the Crown to have one side ground slightly convex removing most of the blank spaces so as to enable me to have a critical examination.

On the whole I think it is satisfactory. As soon as these surfaces are worked, I shall send you a further report.

*Very truly
yours
H. Goussier*

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

16th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I have been examining the discs which I have received from Messrs. Chance and am glad to be able to report that so far as the Crown is concerned I can see nothing wrong with it, and I propose starting the working of this immediately.

As regards the Flint:- The surfaces which Messrs. Chance put upon the glass are so poor that it is possible that small faults might exist without our being able to see them, so I have written to them and asked if I may roughly grind and polish the two surfaces of this Flint and get them sufficiently good to be able to detect any faults that might possibly exist, and I will then write you the result of my examination of it, which, I hope, will be satisfactory.

Howard Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works,

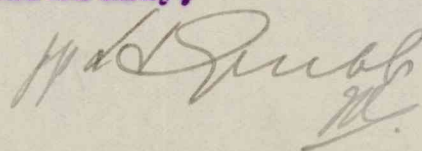
24th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

In connection with the widening of your clock and for the small motor for the quick motion in Right Ascension we find it necessary to trouble you for a little information and would be much obliged if you would let us know whether your main current of electricity is continuous or alternating. If continuous we should require to know the voltage and if alternating the voltage, periodicity, and whether single phase or not. Also we would like to know whether any low voltage continuous current is available for lighting 4 to 6 volt lamps for the illumination of your circles and for driving about $1/40$ th of a Horse Power motor for the Right Ascension Motion.

Yours faithfully,



TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works.

28th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I have now ground the Flint disc approximately to the curves and the greater portion of the slight thread defect which we saw in it has disappeared, leaving a little still towards the edge, and by the time it is fully worked I would expect that it would so far have disappeared as to have no sensible effect upon the image, so I am going to work now upon this pair of discs, and have written to Messrs. Chance to let me have the 3rd disc, that is the 2nd. Crown as soon as possible for the correcting lens.

Very truly
Yours
H. Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.

RATHMINES

DUBLIN.

Optical and Mechanical Works.

29th Novbr 1911.

1 Enclosure.

Professor F. Iniguez,
Royal Observatory. Madrid.

Dear Professor Iniguez,

In reply to your letter of the 25th inst. I quite understand about a Certificate being required in order to conform to the regulations of your Administration, and it so happened that Dr, E.T Whittaker the Astronomer Royal of Ireland was paying us a visit here to-day and he very kindly examined all the parts of your Telescope and made out a list which he has signed and which I now enclose hoping that this will suffice.

Very truly yours,
H. Grubb

MEMORANDUM OF WORK DONE ON THE
MADRID 16" EQUATORIAL TELESCOPE.

OBJECT GLASS:- The Crown and Flint discs for the Visual Objective are in hands. The extra Crown disc for the correcting lens has not yet been received from the Glass Manufacturers.

CLOCK & GEARING PLATE:- These are practically complete.

POLAR AXIS:- With its Sector, clamp, anti-friction necklace and end pressure ball bearings, &c., is now being fitted into its Polar Frame. With the exception of the silvering and dividing of the AR circles the Polar Axis portions are practically complete.

DECLN. AXIS & CROSS HEAD:- With the Anti-friction Necklace and end pressure bearings are complete. Also the Declination Clamp.

DECLN. SLOW MOTION:- Is nearly complete, but not attached.

DECLN. CIRCLE:- Is attached to the Cross Head, but not silvered or divided.

CENTRE CASTING:- For the tube has been turned and ready for adaptation of tubes and the adapting rings have been attached to this centre portion.

OCULAR:- The Visual breech piece is practically complete.

GUIDER BREECH PIECE:- Is in hands and partly finished.

FINDER OBJECT GLASS:- Is in hands.

PENDULUM:- Parts are practically complete.

ELECTRIC HAND READER:- Is finished.

I have seen the above at Sir Howard Grubb's works, 1911 November 29th.

(Signed) E. T. Whittaker

Royal Astronomer of Ireland

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES
DUBLIN.

Optical and Mechanical Works,

14th December 1911

Prof. F. Iniguez.

Dear Prof Iniguez,

I trust that you got my letter
of the 29th Novbr safely and that the Certificate I sent
signed by the Astronomer Royal is sufficient for the pur-
poses of your Administration.

*Yours very truly
Howard Grubb*

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

27th December 1911.

2 Enclosures.

Prof. F. Iniguez.

Dear Prof, Iniguez,

I am very much obliged by your letter of the 21st inst enclosing cheque for £730. 15. 4d, a second instalment on the 16 inch Equatorial which we have now in an advanced state, and in accordance with your request I beg to hand you herewith receipt in duplicate.

I note with great satisfaction that you have applied for the necessary amount to purchase the large Spectroscope and trust that your wishes in this matter may be granted.

*Wishing you & all your staff a very
happy new year
Yours truly
H. Grubb*

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

19th February 1912.

3. Enclosures.

Professor F. Iniguez.

Director, Astronomical Observatory,
MADRID.

Dear Sir,

Your letter of the 13th instant duly arrived, and as Sir Howard Grubb was away from Dublin, I sent him a copy of same. He now writes to inform me that he is writing to you by this post; meanwhile, I have the honour to enclose copies of 3 letters dated respectively, ^{8th} 5th, 16th, and 28th November, which we wrote you, and which may have gone astray in the post.

As far as I can judge from the correspondence, it would appear that no complete drawing of the Equatorial has yet been sent to you, but we shall have full particulars ready to send you in the course of a few days.

Yours faithfully,

F. S. Ladd
Secretary.

COPY.

8th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

You will be glad to hear that we have at last got one Crown and one Flint disc from the Glass makers, and I have been examining them to-day with the following result:-

I have had a preliminary examination of the 16" discs:- It is not possible to examine them very crucially, because the Crown has large patches on the surfaces, which have not been polished and the Flint surfaces are so bad that the errors of the surface are mixed up with errors in the material. I have fairly well satisfied myself that the Crown is a fine Disc and is likely to turn out alright. In fact, I have seen nothing in it as yet that is likely to do any harm and it is well annealed. In the Flint there is one long thread or vein which runs from the edge for about 8". Fortunately it appears to me to be very near one of the surfaces so a large portion of it will come away in the hollowing of that side, but I have given orders to have a pair of fairly good surfaces worked on the Flint; and on the Crown to have one side ground slightly convex removing most of the blank spaces so as to enable me to have a critical examination. On the whole, I think it is satisfactory. As soon as these surfaces are worked, I shall send you a further report.

Very truly yours,
(Sgd) H. GRUBB.

COPY.

28th November 1911.

Professor F. Iniguez.

Dear Professor Iniguez,

I have now ground the Flint approximately to the curves and the greater portion of the slight thread defect which we see in it has disappeared; leaving a little still towards the edge, and by the time it is fully worked, I would expect that it would have so far disappeared as to have no sensible effect upon the image, so I am going to work now upon this pair of discs, and have written to Messrs. Chance to let me have the 3rd disc, that is the 2nd Crown, as soon as possible for the correcting lens.

Sgd (Howard Subbels)

Copy,

16th November 1911

Professor F. Iniguez.

Dear Professor Iniguez,

I have been examining the discs which I have received from Messrs. Chance and am glad to be able to report that so far as the Crown is concerned I can see nothing wrong with it, and I propose starting the working of this immediately.

As regards the Flint:- The surfaces which Messrs. Chance put on the glass are so poor that it is possible that small faults might exist without our being able to see them, so I have written to them and asked if I may roughly grind and polish the two surfaces of this Flint and get them sufficiently good to be able to detect any faults that might possibly exist, and I will then write you the result of my examination of it, which, I hope will be satisfactory.

Very truly yours,

(Sgd) H. GRUBB.



Would you kindly say whether the electric current used in your Observatory is an alternating current or continuous? Are we right in assuming that the voltage is 150 volts? A card answering these two points would greatly oblige,

Dear Sir,



POST CARD

CARTE POSTALE

UNIVERSAL POSTAL UNION



UNION POSTALE UNIVERSELLE

GREAT BRITAIN & IRELAND

THIS SIDE FOR THE ADDRESS



Prof. F. Iniguez.

Director of Astronomical Observatory.

MADRID

SPAIN.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

28th February 1912.

1. Enclosure.

Professor F. Iniguez.

Dear Professor Iniguez,

I have now got back to
Dublin, and feel very much better.

I am sending you a photograph of the
instrument as it now stands. You will observe it is
fairly complete with the exception of the lower casting
which is the last large piece we have to get.

In a few days, I will write you a more
particular report about the state of the work.

With kind regards
H. Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

1 Smc

Optical and Mechanical Works.

29th March 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

I am sending you enclosed a blue print of your Equatorial showing it as placed under your Dome, and as several letters appear to have gone astray within the last few months, I am registering this letter to be sure that you will receive it. If you will kindly look over this drawing now and let me know what further particulars you want I shall have them furnished to you immediately.

We have not yet received from the Foundry the large casting for the base of the instrument. The delay has been caused by these wretched strikes amongst the workmen and Transport people

people, but as soon as we get this casting I shall have the whole instrument properly mounted and send you a photograph of it.

We are getting on with the object glass, but have not yet got the third lens from Messrs. Chance.

With kind regards
Yours truly
H. Grubb

BLUE PRINTS SENT TO PROF. F. INIGUEZ

26th APRIL 1912.

<u>No. of Drawing.</u>	<u>Description.</u>	<u>Scale.</u>
93	Clock, driving, No.3.	
94	" " Governor for.	
95	Equatorial 16" Madrid. Dec. Axis &c.,	
96	" " " Hour Circle.	
100	" " " Polar Axis.	
104	" " " Dec. Axis lower end.	
111	" " " Sector & AR Clamp.	
125	" " " Necklaces.	
130	" " " Decln. Clamp.	
138	" " " Decln.Circle Vernier.	
150	" " " Tube for.	
377	" " " AR Quick Motion Gear.	
380	" " " Decln. Slow Motion.	

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES,
DUBLIN.

Optical and Mechanical Works.

27th April 1912.

1. Enclosure.

Prof. F. Iniguez.

Dear Prof. Iniguez,

I have the pleasure to send you a number of drawings as per enclosed Memorandum. If these be not sufficient and that you want any more if you will kindly indicate to me what you require I shall have them prepared.

Yours truly,
H. Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

20th May 1912

Prof. F. Iniguez.

Dear Professor Iniguez,

Many thanks for your letter of the 9th instant. I should like to investigate the matter of the period in the clock of the Spectro-heliograph. When you have some more experience about it I shall be glad to have particulars so as to endeavour to trace out any possible cure for this periodicity.

I did not touch upon the matter of the completion of the Equatorial in my last letter, because, we have been waiting for many months for the casting of the base which we should have had long since only for the strikes and labour troubles which caused so much

much annoyance and delay. It is only this morning that I have heard that the Foundry in Scotland have succeeded in getting a good casting of this and have despatched it, so I hope that in a short time now I shall be able to report to you as to when the Mechanical parts of the instrument will be approaching completion, and at the same time, I will probably send you a photograph of the whole instrument.

Also with regard to the Optical parts:- We have been greatly delayed by not having received the second Crown disc from Messrs. Chance, but this we hope to get in another few weeks. My illness in the Spring also delayed this considerably, but I am attending to it closely now and hope to be able to give some satisfactory report of progress in probably about two months time. At the same time, of course, I would remark that this work is very uncertain, and sometimes we have to do the work over and over again before we get completely satisfactory results.

Very truly
Yours
A. R. R. R.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES,
DUBLIN.

Optical and Mechanical Works,

8th July 1912.

2. Enclosures.

proposed to initiate a series of experiments at the
National Physical Laboratory and we hope it will be
possible to do so very shortly, but as usual the

Professor F. Iniguez. We are going to ask our
Government for a grant, but it is probable that the

Dear Professor Iniguez, we will have to subscribe a large

portion themselves. I have the pleasure to send
you a couple of photographs of your instrument so far as
it is now advanced and you will see that the Mechanical
parts are very nearly complete.

Unfortunately we have no news yet of the
extra Crown disc. The difficulties of getting Optical
glass at present are very great and seem to be increasing
so much that a special Committee has been formed in London
under the auspices of the National Physical Laboratory and
the Royal Society to see if something can be done to help
the glass makers in improving the manufacture of Optical
glass and about a week ago I attended a Meeting of that
Committee.

to complete your Sir David Gill is the Chairman. It is
proposed

*Hoping soon to report further progress
must kind regards
Yours very truly
Howard Grubb*

proposed to initiate a series of experiments at the National Physical Laboratory and we hope it will be possible to do so very shortly, but as usual the question is that of money. We are going to ask our Government for a grant, but it is probable that the Opticians of Great Britain will have to subscribe a large portion themselves. It is estimated that the investigations ~~we~~ will cost about £800 a year and we are going to try and raise half of this money ourselves and ask the Government for the other half. I merely mention this to show you that there are at the present time extraordinary difficulties in getting Optical Glass. Why these difficulties should be greater than in the past seems hard to understand, but although I have 6 large pieces of glass on Order from the glass makers, 4 of which have been on Order for $2\frac{1}{2}$ years now, I have not been able to secure a single piece. I think, however, from what Messrs. Chance tell me that there is every probability that we shall get the piece of glass we require from them to complete your Order before long.

*Hoping soon to report further progress
With kind regards
Yours very truly
H. G. G. G.*

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES,
DUBLIN.

Optical and Mechanical Works,

24th August 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

We now have the pleasure to inform you that Messrs. Chance have given us a definite date for delivery of the Crown block of glass in 3 weeks time when we will use our best endeavours to get this work expeditiously turned out.

Yours faithfully,

HW SIR HOWARD GRUBB.

H. Grubb

COPY.

Rathmines,

Dublin, 10th Sept. 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

We have at last the news from the Glass Manufacturers that they have succeeded in removing the vein or fault from the block of Crown Glass which is to be moulded into the disc for which we have been waiting so long, so we have good hopes that in a few weeks we may get this disc and be able to push forward the work of finishing your objective.

As regards the Spectroscope :- I have been talking to Sir David Gill about this, as he is the greatest authority we have here on this subject. He has retired, as you know, from active Astronomical work and given up his position as Government Astronomer

of

of the Capetown Observatory, but he is still actively engaged in designing and planning special instruments for special work, and he has been commissioned by the Government Astronomers of Russia, Transvaal, Chili, Portugal, Germany as well as our Home Government and India to assist in the designing and carrying out of various spectroscopic and other installations for these Observatories; therefore, his experience is very great, and I would strongly advise you to write to him and ask him to advise you on this matter. If you tell him exactly what you want to do he will advise you as to the very best form and design of the instrument and he will examine the instrument when completed, and test it for you and you will have a guarantee that it is correct in every particular and the best procurable for the purpose. For this work he charges a small fee - I think it is about $2\frac{1}{2}\%$ on value of the instrument, but you would, by doing this, have absolute confidence that your instrument would be designed and made the very best possible for its purpose.

If you would
wish

wish to write to him, his address is :-

Sir David Gill, K.C.B., F.R.S., &c.,

34, De Vere Gardens,

Kensington,

LONDON. S.W.

If this course be not pleasing to you, I will design for you the very best I can, and let you have a drawing of what I propose.

With kind regards,

Yours very truly,

(Sgd) Howard Grubb.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

13th September 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

I am finally arranging the eye-end of your telescope with the various attachments and would like your opinion upon one point. We have provided for the attachment of the 6-inch Guider Telescope, the Declination Reader, the supports for the handles for slow motion and clamping in Declination; sliding balance weight and 4 studs for adding additional weight when required for balancing purposes; also, 3 electric switches - one for working the lamp of the Declination Reader, the second for the illumination of the micrometer on the main telescope, and the 3rd for illumination of the lines in Guider telescope.

There is just one other matter which I

think

think would be useful to you. It appears to me that you ought to have - besides the large 6-inch Finder - a small one of very simple construction with a large field for the purpose of easily "picking up" an object. This might be either in the form of a very low power telescope with large field, or what I would prefer myself, a sighting arrangement on the principle which we utilise for Military guns in which a ghost image of cross lines is seen for setting on the object and it is very handy for rough setting inasmuch as the eye need not be placed opposite any eye hole. I could either mount one of these ^{without additional expense} or a simple Finder of say a couple of inches aperture with low power. I think you would find this useful.

One other point I desire to mention and that is :- that although you propose to use 160 m/m. plates I suppose that you will not require a clear field of view of this complete size. The reason I ask this is that the diaphragms at the lower end of the tube

tube are made of $4\frac{1}{2}$ -inches aperture, which, I think, will be as large as you will have occasion to use, but if you think it desirable to be able to use a still larger field I will have these diaphragms opened out.

In your letter of the 31st July you speak of the clock weights. These will certainly be on the inside of your pier when finally arranged.

We hope soon to send you another photograph showing them in their proper position.

Walter S. G. G. G.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

9th October 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

I am greatly obliged by your letter, and I have taken the matter up now and will make out a scheme for such a Spectroscope as I think will suit your purpose and will let you have price and estimates very soon.

As regards the Double Mirror Heliostat :- I will let you have an estimate in a few days.

Howard Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

25th September 1912.

1. Enclosure.

Professor F. Iniguez.

Dear Sir,

In the absence of Sir Howard Grubb, I have the honour to acknowledge receipt of your letter of the 20th inst., from which it would appear that you have not received Sir Howard Grubb's letter of the 10th inst., which dealt particularly with the matter of the Spectroscope.

I hasten to enclose you a copy of this letter and would ask you to be good enough to let us know if this letter ever reached your hands, because, in the event of it not being delivered, we will make enquiries from the Post Office Authorities here and demand an explanation.

Yours respectfully,

J. E. Ladd.

Secretary.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

16th October 1912.

Prof. F. Iniguez.

Dear Prof. Iniguez,

I have gone into the matter of the Heliostat for which you have asked for an estimate. I see that on the 20th March 1903 we furnished you with an estimate for a double Mirror Heliostat with mirrors of 10" diameter at £220. 14-inch Mirrors will weigh nearly 3 times as much as the 10 inch mirrors, but taking into consideration the improvements we have made in the anti-friction arrangements by the adoption of ball bearings &c., I do not think it will be necessary to increase the strength of the clock work and gearing to anything like a proportional extent. I believe we can make you a very efficient instrument to carry 14" mirrors with

a clock similar to what we are supplying to our 8" Equatorials, or for the elaborate 6" Equatorial we are supplying to Mr. Ocharan.

The additional cost for the Optical parts would be £80 and of course all the framework and axes would have to be of much larger diameter for the 14" mirrors, but I think you may assume that we could make you a very efficient and perfect instrument for £400, packed and delivered Liverpool.

I have not got a design for such an instrument, but if you desire it I will make out a design and send it to you, but this would take about 2 weeks, meanwhile, perhaps the particulars I send you in this letter may be sufficient. *for the present*

I am sorry to say that I am still without the Crown disc ~~box~~ from Messrs. Chance, though I am in constant correspondence with them about it.

Wm. Henry G. G. G. G.

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

22nd October 1912.

Prof. F. Iniguez.

Dear Professor Iniguez,

I am glad to be able to tell you that the second Crown disc has at last been delivered, and I shall get temporary polished surfaces on this as quickly as possible and report to you as to whether we are satisfied with the quality. If this be right we will be at last in a condition to go ahead and finish your work.

In a few days I hope to send you a Photograph of the Equatorial as it now stands.

Howard Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

29th October 1912.

Professor F. Iniguez,

Dear Prof. Iniguez,

I have been considering the best design for your Spectroscope and I have been in correspondence with Sir David Gill, who kindly sent me in confidence, the drawings of the large instrument that is now being made for Santiago de Chili in connection with the 24 inch which we are building for them. I propose that the instruments should be made with 4 prisms of highly dispersive glass; the total deviation of the 4 prisms being exactly 180 degrees for a mean ray, that is 45 degrees each. Two of these prisms will be removable and can be replaced by a single prism of reflection bending the rays at 90 degrees. The total deviation however, whether using

four

four prisms or two prisms will be 180 degrees which permits of the strongest and most rigid form of mechanical arrangement for the Spectroscope; the observing telescope being parallel to the collimator.

For visual observations a bent eye-piece is required. For photographic work the plate is placed in the principal focus of the observing telescope I propose also that there shall be two object glasses to the observing telescope of different foci. You will thus be able to obtain 4 different lengths of spectra according to the nature of the object which you are observing, as you will be able to use either 2 or 4 prisms with a longer focus object glass and 2 or 4 prisms with the shorter focus object glass.

The whole instrument would be encased in a double walled chamber after the pattern of those at Mount Wilson and there would be an arrangement in front of the slit for comparison spectra. That is the general arrangement which I propose, but I have not got the designs sufficiently advanced yet to determine on the sizes of the prisms or object glasses or to make

up a fixed estimate. I hope, however, in the course of 10 days to be able to send you a fixed estimate.

We are at work now polishing the new Crown disc. I have had it examined, as far as was possible with the surfaces that the glass makers polished upon it and I can see no fault, but the surfaces which they polished are very rough and it is never possible to be quite certain that the glass is perfect until we get optical surfaces upon it.

I would hope in the course of about a fortnight to be able to report upon this.

Since writing the above your kind letter of the 20th inst has arrived. I think there will be no difficulty in doing what you ask.

We expect to have, as I said, the second Crown disc ready for examination in 10 days or a fortnight and if it proves good I could then ask someone (I suppose out present Royal Asyronomer of Ireland ^{Mr Plummer} would be best) to come and examine the instrument and give a certificate that all parts are complete. I suppose it would suffice if you got this certificate sometime within the month of November?

Wm. Teague

SIR HOWARD GRUBB F.R.S.
RATHMINES,
DUBLIN.

Optical and Mechanical Works.

25th November 1912.

Professor F. Iniguez.

Dear Professor Iniguez,

We had arranged for the Astronomer Royal to visit us to-day and inspect your Telescope, but the morning was so stormy it was not possible for him to get in from the Observatory, and it is now arranged for him to be here on the 27th, and I hope on that day to send you his Certificate.

Carefully You will be glad to hear that I have to-day accordingly examined the second Crown Disc which has now been polished, and I can find no fault in it. I think it is a very beautiful disc. I shall be therefore able now to go on and figure this lens.

Alfred Henry Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

27th November 1912.

Professor E. Iniguez,

I have to-day inspected the 16" Equatorial which has been made by Sir Howard Grubb for the National Observatory of Madrid and is now erected at his Works, Rathmines, Dublin.

The instrument is complete with its additional Crown lens for photographic correction of the visual objective and awaits the completion of the Spectroscope in order that the necessary attachments and adjustments of same be made upon the Equatorial to which it is to be applied.

H.C. Plummer

(Royal Astronomer of Ireland)

*Dunaink Observatory
Co. Dublin, Ireland.*

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES,
DUBLIN.

Optical and Mechanical Works.

27th November 1912.

1. Enclosure.

Professor. F. Iniguez.

Dear Prof, Iniguez,

Professor Plummer, Royal Astro-
nómer of Ireland was here to-day and inspected your tel-
escope and I enclose a certificate which he wrote here
at my Works in order to save time.

I hope that this will suffice for your pur-
pose.

I am working away at the plans of the Spectro-
scope and hope to write you very shortly.

*Very truly Yours
H. Grubb*

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

4th December 1912.

1. Enclosure.

SPECTROSCOPE.

Professor F. Iniguez.

Dear Professor Iniguez,

I am sending you herewith a
blue print of ^{an} incomplete design showing the proposed
arrangement and dimensions for the Spectroscope.

I may mention that the Spectros-
cope is a very special design and that practically none
have been made in this country except that which was made
for the Capetown Observatory, and that which is now being
made under Sir David Gill's permission for attachment to
the Equatorial which we are building for Santiago de Chili
both of which have been made by the Firm of "Hilger" of
London who have paid much attention to this work.

For this reason I thought it
well to ask this Firm of "Hilger" if they would make a
purely

purely Spectroscopic part and thermostatic part of this instrument for you on the same lines as those made for Capetown and Santiago, but on getting on the design I find that this would cost up to nearly £300 0s 0d, which exceeds the grant which you have got, and therefore I have had to re-design the instrument myself, and propose to make it at my Workshop for the £200 0s 0d which you say has been allotted for it. I have consulted Sir David Gill on various points connected with it, and I feel satisfied that as designed it will fulfil your requirements. I shall be glad to know if you have any suggestions to offer.

I will send a photo of your Equatorial
in a few days

With Kind regards

Yours truly

Howard Nubb

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

7th December 1912.

1. Enclosure.

Professor F. Iniguez.

Dear Professor Iniguez,

I am sending you a photo of your Equatorial as now erected, you will see that all the chains connected with the driving weight of the clock are inside the metal stand. Unfortunately, in the photo there happened to be some loose cords connected with the electric wires. These should not have been there and have nothing to do with the winding, but you will easily distinguish the chains from the cords in the photograph. The clockwork itself is to the right, and the winding apparatus is that to the left. The weights that are hanging in the centre are the driving weights of the clock but at the present moment these are only temporary weights and of a clumsy form. They will be much smaller in diameter

diameter when supplied to you.

The photograph of the breech piece is shown on a stool at the right hand side.

I am still working away at the completion of the design for the Spectroscope.

Your kind letter just arrived Many thanks

Your truly
W. G. Grubb

TELEPHONE No. 24 RATHMINES

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works,

28th December 1912.

2. Enclosures.

Professor F. Iniguez.

Dear Professor Iniguez,

I have the pleasure to acknowledge the receipt of your cheque for £734-6-11, for which I enclose formal receipt in duplicate. I hope that the form I have put it in will be satisfactory.

We are at work at the design for the Spectroscope and will let you have more complete Drawings in a couple of weeks. We will be able to arrange for a bent eye-piece that will enable you to view the visual parts of the spectrum in a convenient manner.

Very truly
Yours,
H. Grubb.

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

21st December, 1909.

Professor F. Iniguez.

Dear Professor Iniguez.,

I am much obliged by your letter of the 17th inst., asking me to give you an estimate for a Visual Equatorial of 16" aperture and of about 16 feet focus suitable for placing under the 8 metre Dome which we lately constructed for you.

I note also that you desire me to give you an additional estimate for a Star Spectroscope with a lens for correcting for photographic purposes.

As regards the equatorial itself:- I see from your letter that you referred to page 12 of my 1899 Catalogue, which looks as if you had not received one of my later catalogues of 1908. I understand that one of

1710
10
200
1920
1920ms

these was sent you about a year ago, but in case you have mislaid it I am sending you another by this post, registered, on page 8 of which you will see a very similar specification to that which you have mentioned in your letter.

We could give you a Visual telescope of 16" aperture and about 16 ft. focus, mounted upon an Equatorial very similar to that shown on page 9 of my 1908 catalogue, with a 3" finder, packed and delivered F.O.B. Liverpool for £1710.

Now as regards the correcting lens for use with the Spectroscope:- I am not quite sure what your ^{ideas} ~~ideas~~ may be on this point, but the plan usually adopted in U.S.A. Observatories is to place in front of the Visual Objective, another lens which will correct for the photographic part of the Spectrum which will of course shorten up the focus and necessitate our making a special adapter at the eye-end of the Telescope to make a Spectroscope in place of the Visual eye-end.

Another plan would be to use one of my reversible Object Glasses similar to the 28" object glass which I supplied many years ago to the Greenwich Observatory, ~~and~~ which would not cost as much as a

separate correcting lens. This reversible form would also shorten up the focus and necessitate a special adapter at the eye-end. I am inclined to recommend this form, because the Greenwich 28" Object Glass proved to be very successful for double Star work, and would I think also be suitable for Spectroscopic work.

The particular Reversible Object Glass which I speak of and which was first suggested by the late Sir George Stokes is as follows:-

It is possible to change ^{the} chromatic aberration ~~of~~ a Visual Object Glass to that suitable for photographic work by separating the lenses, but in doing so the correction for Spherical aberration is destroyed. The suggestion made by Sir George Stokes, and which I carried out in the case of the 28" Object Glass at Greenwich was to make the Crown Lens less convex on the front side than on the second or inside when used as a visual Telescope. When it was required to correct for photographic purposes the lens ^{so} were separated at the required distance to alter the correction ^{to} of the necessary amount and then the Crown lens was reversed around with the more ^{convex} focussed side out so as to bring the Spherical aberration right.

The 3rd ^{plan} point, and perhaps this is the one to which you refer is to have the correcting lens placed a few feet inside the focus of the main Object Glass specially calculated so as to make the necessary correction.

Sir W.H.Christy, Astronomer Royal, *England*, calculated out such a lens as this, but I am not able to say if the results were very satisfactory. Of course this would be very much the cheaper method of correcting; if it be satisfactory.

As regards the Spectroscope:- This would very much depend upon the work you propose to put the Telescope to, but if you could point out to me any form of Spectroscope which is figured or described in any *of the* public Annals of the American or other Observatories, I would then be able to give you a rough estimate as to the cost. I think it would be well to allow at least £200 for this.

In order that you may be able to judge the relative costs of correcting the object glass in the various ways, I may mention, that to put an extra lens of the full aperture of the Object Glass would of course

be just one half the price of the Object Glass viz. £375 extra.

To carry out the correction on the reversible principle would be as you see by the price list 20% on the price of the Object Glass extra; that is to say £150.

To carry it out with a small lens at the eye-end would be insignificant, say £10.

When you have read this you may have some other questions to ask & if you desire it I shall draw out formal estimates

Yours sincerely
H. J. Webb

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Optical and Mechanical Works.

21st January 1910.

Dear Professor Iniguez,

Very many thanks for your kind letter of 15th inst., I think I understand, now, what you require but before I can make any rough design of the instrument I should want to know from you the height of centre of motion of the present instrument above the floor, which, I assume, will be the same in the case of the new instrument; also the height from the same centre of motion to the top of the pier, in case the top of the pier is not level with the floor, and also I should be glad to know from you what is the form and dimension of the top of the pier, I assume it is fixed in the centre of the building, and in consequence of this, as you say in your letter the ordinary form which I make my cast-iron framing for, would not be suitable in ^{Your case} Works, but if I had the above dimensions I could send you a rough design of what I think would suit.

My truly
Yours,
H. Grubb

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

25/2/15

Optical and Mechanical Works,

12th February 10.

Professor. F. Iniguez.

Dear Prof Iniguez,

I am now sending you an Estimate and rough sketch of the form of mounting which I would suggest as most suitable to fulfill the conditions you have laid down.

You will observe that the cast iron stand is of a peculiar form, rendered necessary by the fact that your stone pier is already erected and it is not possible to alter its dimensions or position; and that I have made this stand in practically 3 pieces, the first carrying the Polar axis which we call the Polar Axisframe, and the remainder which we usually cast in one piece is, in your case cast in 2 pieces bolted together, for greater convenience in erecting. Otherwise the instrument will be very similar to those which we have supplied for the Stellar Photographic Survey.

The increase in the price over the

£1710, which I estimated in my letter of the 21st Decbr is due to the following additions.

- 1... The additional lens for correcting for photographic rays which costs just half the price of an object glass of the same size, inasmuch as the work on it and the material is precisely the same as one of the two elements of an object glass.
- 2....Special form of stand for which we have to make special models.
- 3... The arrangements necessary for converting the Telescope from a Visual to a Photographic instrument.

This will necessitate a portion of the tube at the lower end being detachable and a breech piece arranged for photographic work with focussing arrangements of its own, and adaptations for dark slides &c.,

- 4....As the 3 inch Finder specified before would not be sufficiently powerful to "guide" with accuracy, I propose to supply this instrument with a 6 inch instead of a 3 inch. This Finder will also have to be

supplied with a "guiding" eye-piece moving on slides in both directions so that a convenient star may be chosen at a moderate distance from the axis for guiding with.

5....I also propose to add to the instrument a small electric motor working the slow motions in AR which gives what we call a "quick fine" motion and which is very much liked for photographic work.

As regards the Micrometer. I suggest giving you one similar to what we made lately to a design which was made to satisfy Sir David Gill, for the Observatory at Johannesburg of which I shall send you a drawing. The price of this is £35.

As regards the Spectroscope:- I should like some more information before I furnish you with an Estimate but I suggest that you allow about £200 for this.

With kind regards

Walter G. Phillips

(Membrete al margen) Oficinas, 57 calle Rathmines.
Ensayos para Observatorios y trabajos con instrumentos as-
trónomicos por el Observatorio Lane. Rathmines. = (A la ca-
bera) "Trabajos de óptica y mecánica". Rathmines.
Dublín 27 de Diciembre de 1912. = El Profesor F.
Triguera, Observatorio Nacional, Madrid. A Sir
Howard Grubb. Debe: Anteojos de dioptría y seis pul-
gadas. Cantidad total según contrato por el men-
cionado instrumento £ 2255 (dos mil doscientas cin-
uenta y cinco libras esterlinas) = Cantidad recibida en
13 de Junio de 1911 £ 729-3-4 (setecientas veintinueve
libras, tres chelines y cuatro peniques); cantidad reci-
bida en 24 Diciembre de 1911 £ 730-15-4 (setecientas
treinta libras, quince chelines y cuatro peniques);
(Suma) £ 1459-18-8 (mil cuatrocientas cin-
uenta y nueve libras, dieciocho chelines y ocho
peniques); (diferencia) £ 795-1-4 (setecien-
tas noventa y cinco libras, un chelín y cuatro pe-
niques); Cantidad recibida en esta fecha 27
de Diciembre de 1912; £ 738-6-11 (setecientas treinta
y ocho libras, seis chelines y once peniques); (di-
ferencia en menos) £ 56-14-5 (cincuenta y seis

libras, catorce chelines y cinco peniques). —

He recibido del Profesor Trigueros, Director
del Observatorio Nacional, Madrid, la anterior
suma de (£ 738 - 5 - 11) setecientas treinta
y ocho libras, seis chelines y once peniques.

Recibi' Sir Howard Grubb, 27 Diciembre
de 1912 - (Hay un timbre morit de un peni-
que) = Es copia.

N.º 11

El Jefe del Observatorio

Francisco Trigueros



A. SERRA S

Estimate

FROM

SIR HOWARD GRUBB,

ASTRONOMICAL INSTRUMENT MAKER

To the British and Colonial, German, Austro-Hungarian, Belgian, Russian, Mexican, Italian, and Spanish Governments, and to the Principal Public and Private Observatories of Great Britain and Colonies.

DUBLIN.

Offices:

57 RATHMINES ROAD

Goods Entrance

TO

OBSERVATORY AND ASTRONOMICAL WORKS

BY

OBSERVATORY LANE, RATHMINES.

GOLD MEDAL, PARIS EXHIBITION, 1867.

CUNNINGHAM GOLD MEDAL, 1881.

HIGHEST AWARDS AT ALL EXHIBITIONS TO WHICH EXHIBITS WERE SENT.

Packing and delivery in Dublin charged 5 per cent. Mechanical, and 2½ per cent. Optical Goods
Tin-lined Cases for India, &c., extra.

No allowance for returned Empties.

All Optical Work must be tested before leaving the Works in Dublin.

12th of February 1910.

For

The Director.

Astronomical Observatory. Madrid.

I propose to Supply

An Equatorial instrument of the form figured on page 11 of Catalogue 1908., and as supplied to the Observatories of Greenwich, Capetown, Melbourne, Dunsink &c., for the International Photographic Survey of the heavens, but furnished with a 16" visual Refracting Telescope of such a focus as to be suitable for the 8 metre Dome at the Madrid Observatory.

The above Telescope to be supplied with an EXTRA LENS so designed and made as to alter the chromatic aberration of the 16 inch obj-glass and correct it for photographic rays, of 16 inches clear aperture and with suitable attachments for placing in front of the visual objective.

The 16 inch Visual Obj-Glass and Correcting Lens to be of the very best quality mounted in cast iron cells and to be of about ft focal length.

The TUBE to be of strong tin plate enamelled and well diaphragmed throughout, and supplied with eye-end and very best form of breech piece, containing quick and slow motions for position angle, clamping arrangements &c.,

A FINDER of 6 inches clear aperture with positive eye-piece and cross lines; the latter carried upon cross slides for convenience of "guiding" during exposure of photographic plates.

The instrument to be supplied with one DECLINATION and two AR CIRCLES, divided on silver to such graduation as purchaser desires.

CONTRACT TERMS.

In the case of orders of £100 and upwards payment is required in instalments—one-third with order, one-third when work is well advanced, and one-third on completion.

The first AR CIRCLE to be of 16 inches in diameter, arranged for differential readings and read by opposite verniers in the usual manner, and the 2nd AR CIRCLE read by Electric Hand Reader.

The DECLINATION CIRCLE to be of 14 inches in diameter and read by 2 Verniers, one being visible from the eye end of the telescope by bent Microscope and both verniers of the Circle to be illuminated by electric lamps.

Improved Clamp and Slow Motion in Decln.

Three SLOW MOTIONS in AR to be supplied:-

- (a) By differential wheels & mouse pinion.
- (b) By a very fine motion for correction of refraction worked by electric current and hand commutator held in the hand.
- (c) By a small electric motor.

CLOCK.

The Clock to be of the same general construction as those supplied for the Photographic Survey Telescopes, with Governor driving directly into the countershaft; maintaining power applied to the barrel; dial and hand for adjusting the clock rate accurately.

ELECTRICAL CONTROL to be supplied to the CLOCK, including detectors, correctors, electric pendulum, &c.,

The SECTOR to be of Gun Metal and to be long enough to afford two hours work without re-winding.

ELECTRICAL CONNECTIONS. Two distinct circuits to be carried all through the instrument by wipers & insulated rings.

One ELECTRIC HAND READER to be supplied for reading the AR Circles.

RELIEF of friction of POLAR AXIS to be effected by friction rollers at the upper end as in the Photo SURVEY Telescopes.

The POLAR AXIS, CROSS HEAD, and DECLIN AXIS to be of cast iron and similar in form to those supplied to the SURVEY Telescopes.

DEW CAP and DUST CAPS.

- 4 Negative Eye-pieces.
- 1 Low power achromatic positive eye-piece.

Alternative Breech Piece for use in Photographic work, carrying Metallic Dark Frame and supplied with suitable focussing and clamping arrangements, &c.,

The whole of the above of the best Materials and Workmanship, packed & delivered f.o.b. Liverpool for the sum of

TWO THOUSAND TWO HUNDRED & TWENTY POUNDS. £2,220.

BIFILAR MICROMETER of new pattern, designed in accordance with instructions from Sir David Gill for the Observatory at Johannesburg..... £35.

Handwritten signature: Samuel G. ...

Equatorial L 2.220
 Micrometro 35
 Spectroscopio 200
 Total L. 2.455
 Francos 61.375

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

Grubb

Optical and Mechanical Works,

7th March 1910.

Dear Professor Iniguez,

Very many thanks for your kind letter of the 4th inst., and for the very acceptable information which you were good enough to give me in your letter.

I quite understand that the arrangements of your Government are such as will only allow of money being paid in the year 1911, and I think we can arrange satisfactorily if you can give me the order this year, and I will take the responsibility myself of ordering the glass, because, if this be not done it will be almost impossible to have the instrument complete in the year 1911 (I assume that this means before March 1912)

The Mechanical part we can, I think, complete without difficulty, but we sometimes have to wait 6 months

for a pair of discs. I shall write to you further on with regard to the relative advantages of using the Boro Silicate glass instead of the ordinary Crown and Flint.

As regards the Micrometer. I am sending you a blue print showing the construction of the Micrometer we have lately made for Johannesburg under the directions of Sir David Gill. It was made on plans drawn up by myself and Sir David Gill and he had a careful examination of the instrument before it was sent abroad and expressed his high approval of it.

You will observe that it is peculiar in one or two points, firstly, there is only one movable wire, but the whole box of the Micrometer which carries the second wire has also a motion, so it is equivalent to a Bifilar Micrometer with certain advantages. You will also observe that there are no slides;

the frame carrying the movable web being strung upon the actual screw itself. The result is very good, I never saw any Micrometer with less "Loss of time" and the means for setting the Zeros of the heads and counting the divisions is also very satisfactory.

The illumination is of the bright line type and gives a perfectly black field with bright wires.

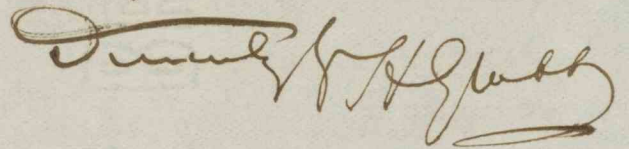
As regards the Spectroscope:- If you would kindly draw out for me a Memorandum as to the uses to which you propose to put this Spectroscope to and any particular points that you desired to have attended to I shall consult with Sir David Gill and also with the Astronomical People at South Kensington in London, for whom I am just erecting an instrument, and I will give you the best advice I can procure as to the construction.

I am, in fact, at the present moment discussing a similar matter with the Astronomers at South Kensington as they want a Spectroscope of a smaller size than yours to work with the Equatorial I have just made for them.

As regards the perfection of the object

glass:- I think we will be able to satisfy you, and on this point I am sending you enclosed Extract from the report of the Transvaal Observatory at Johannesburg, for which we made sometime ago, a 9" object glass, and who have now ordered the 26" from me.

You will see what Mr Innes says there about the performances of this 9" object glass.

A handwritten signature in dark ink, appearing to read "James H. Glubb". The signature is written in a cursive style with a long horizontal flourish at the end.

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.

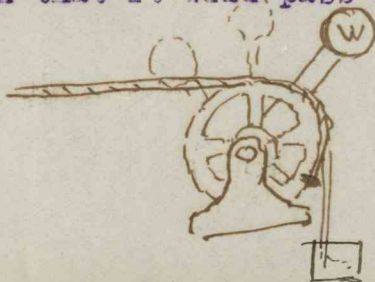
Optical and Mechanical Works,

1st April 1910.

Professor F. Iniguez.

Dear Professor Iniguez,

I have been away for a few days during the Easter holidays and returned last night, and hasten to apologise to you for the omission in not answering your query before about the suspension cords of the Spectroheliograph. I think that the length you mention will be sufficient, but if, when the instrument is installed, you find that there is an inclination to swing back into the central position owing to the cords being too short, I shall send you a plan of a small device by which I think this can be obviated. It will be done by attaching a cord to a pulley, which pulley will describe an arc of 90 degrees in the travel of the instrument, and a weight attached to this pulley on an arm in such a position that it will pass over the centre in the central



position of the instrument and will have the effect of counteracting this inclination of the instrument to run back to the central position. I will send you a sketch of this, if necessary but I do not myself think that you will find it to be so.

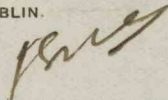
As regards the Boro Silicate Crown. The question of utilizing this with the large object glasses that I am now making for Johannesburg and Santiago has been very carefully considered, but owing to the great difficulty of obtaining Boro Silicate Discs free from air bubbles and other impurities it has been decided not to employ this glass as it is considered that the disadvantages would more than counterbalance any slight advantage that might be obtained as regards perfection of chromatic correction. The cost too would be increased, but if you still consider that it would be desirable to use Boro Silicate Crown, I will make further enquiries and possibly it may not be so difficult to get a 16" disc perfect as it appears to be to get one of 26".

With kind regards

Very truly yours
J. J. G. Smith

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.
RATHMINES.
DUBLIN.



Optical and Mechanical Works,

14th April 1910.

Professor Iniguez

Dear Professor Iniguez,

Many thanks for your letter of the 9th inst., I quite understand your position as regards the Contract for the 16" Telescope, and the Government regulations, and I shall wait your convenience in the matter.

You mentioned at the end of your letter about Mr. Ocharan's Telescope. I suppose that this refers to the Telescope which was ordered ^{for} from him by Mr. Escobar. I never heard Mr Ocharan's name before. I cannot understand the position of this affair, because, I have written Mr. Escobar many times stating that the work was well advanced and the second Instalment due, but I cannot get any reply whatever, and in consequence of this the work has been arrested for the last 12 months. I am

enclosing you a Memorandum of the various letters I wrote to him and his replies. I do not ask you to take any trouble in the matter at all, but as you mentioned it I should like you to be aware of the state of the case, and that the delay is altogether due to Mr Escobar.

Very truly yours
M. H. G. G. G.