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Corrispondencia con la Casa GRUBB

1906 - 1908

TELEPHONE No. 1024.

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

Optical and Mechanical Works.

6th of January 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

It is with great satisfaction that I learn from your two letters of the 30th Dec and 2nd Jany that you have at last been successful in obtaining the grant of money required for the construction of your Spectroheliograph. I offer you my congratulations on this fortunate result.

I shall now devote myself to produce the very best possible design.

I sent you in the Autumn of 1905 four rough designs of which I think you preferred the form "B", but to make quite sure and avoid mistakes I would be

glad if you sent me back these rough designs, marking that which you prefer..

I should wish that when you are in possession of this instrument that you ~~will~~ Should be in at least as fovourable a postion as they are at South Kensington, and the only point I am doubtful about is, as to the brilliancy of the image.

You desire to have an image of 2½ inches in diameter with an aperture of objective of about 8 or 9 inches.

At South Kensington, I think, (speaking from recollection only) the image is only 1¼ inches, but I may be wrong in this, and the aperture of the obj-glass is I think 12 inches.

This would give you a very much less brilliant image but perhaps you think this will be sufficient in your Southern skies.

It is evident that it will be desirable at all events to have the object glass as large as possible. What

is the largest size you could make use of ? If necessary, it would not cost very much to mount a larger mirror on your Coelostat.

I should also be glad if you could tell me the class of building in which the instrument is to be used. Will it be in any existing room of the Observatory, or will you build a special pavilion for it ? and if so what height will the roof or ceiling be, and will it be possible to attach counterbalance levers to the ceiling as indicated in the memorandum which I sent accompanying my letter of 24th Oct 1905.

Very truly Yrs H Grubb.

TELEPHONE No. 1024.

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

Optical and Mechanical Works,

3rd of March 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

I have been hoping to hear from you about the Spectroheliograph and whether we might put this in hands for you, as time is going over.

Please remember that it is not necessary to wait to have the actual money in hands for it, as, if you tell me that the order is certainly coming I would be quite prepared to go ahead with the work and it is work which will require some considerable time.

Have you seen the design in the "Astronomische Nachrichten" for utilizing a pair of telescopes as mounted on a photographic equatorial for such a purpose? The design is very similar

to one of those which I sent you but on account of it being mounted upon an Equatorial I do not think they will get anything like as good results with it as what we expect to get with the instrument mounted on solid piers.

Yours truly
W. H. Pickering

Contrato para la construcción y adquisición de una ecuatorial, con destino al Observatorio de Madrid.

D. Francisco Iñiguez é Iñiguez, Jefe del Observatorio Astronómico de Madrid, en nombre del Gobierno español, autorizado al efecto por orden del de febrero 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 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 página 11 del catalogo de 1908.....

El anteojo mencionado irá provisto de una lente ex-tra, apropiada para ~~corregir~~ 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 delante del objetivo visual

El objetivo visual de 16" pulgadas y la lente correctora serán de la cualidad más perfecta ~~i irán montadas~~, irán montados en armaduras anulares de hierro fundido y tendrán próximamente 5 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 corredera escua-

das para las conveniencias de guiar durante la exposición de las placas fotográficas.

El instrumento estará provisto de un círculo de declinación y dos de ascensión recta, divididos sobre plata hasta la graduación que dará el comprador.

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

El círculo de declinación será de 24 pulgadas de diámetro y leído por medio de dos nonios, uno visible desde el otro uno ocular del anteojo por medio de un microscopio especial y ambos nonios estarán ~~la~~ iluminados por lamparas eléctricas. Montaza perfeccionada y movimiento

) lecto en delineación.

Los 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 ~~mando~~ 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, espera y aguja para el ajuste exacto del movimiento.

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

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

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 ruedas 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 ~~polar~~ serán de hierro fundido, semejantes á los empleados en los anteojos ~~de~~ la carta del cielo

Tubo de ~~[illegible]~~ y guarda polvo.

4 oculares negativos.

1 ocular positivo acromático de corto aumento.

Extremidades oculares de recambio para emplearla

en el trabajo fotográfico, para llevar el bastidor inclinado 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.

~~Dos mil doscientas~~

Todo lo mencionado ~~de la~~ construido con los mejores materiales y bien trabajado, embalado y entregado en Liverpool al buque que lo ha de conducir por la suma de

dos mil doscientas cincuenta y cinco libras esterlinas. L. 2255."

Es copia.

El Jefe del Observatorio.

7)

construido con los mejores materiales, bien ter[?] terminado

2ª El aparato completo, ~~instalado~~ para su ensayo en los talleres del ~~comprador~~ 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 ocasione desde Liverpool al Observatorio de Madrid, no serán de cuenta del constructor.

3ª El pago de las dos mil doscientas cincuenta y cinco pesetas se hará en tres plazos 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.

Madrid [?] de febrero de 1911.

Presupuesto presentado por Sir Howard Grubb constructor de instrumentos astronómicos en Dublin, Irlanda, para la construcción de una ecuatorial destinada al Observatorio de Madrid.

" 12 de febrero de 1910.

Para el director del Observatorio de Madrid.

Propongo remitir:

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

Presupuesto presentado por Sir Howard Grubb, fabricante de instrumentos astronómicos, en Dublin.

—

" 18 de abril de 1908.

Para el director del Observatorio de Madrid.

Propongo remitir un Espectroheliógrafo conforme en general con el dibujo "B" ya remitido, con un objetivo exteriores de 30 pulgadas de abertura y 22½ pies de distancia focal; dos objetivos de 4 pulgadas y 7 pies próximamente de distancia focal; dos espejos planos de suficiente tamaño para utilizar el haz completo de luz de los objetivos de 4 pulgadas; dos rendijas de suficiente tamaño para utilizar una imagen del Sol de 2½ pulgadas de diámetro. Todos los accesorios de soporte y movimiento.

El instrumento completo, instalado para su ensayo en estos talleres, cuidadosamente embalado y enviado para su transporte por mar desde Liverpool, por la suma de Cuatro cientos sesenta libras esterlinas, (£. 490)

Los dibujos de los varios detalles serán enviados tan pronto como sea posible y sometidos á la aprobación del Prof. Zúñiga.

En la construcción del instrumento se utilizará el primero de los 5° que se halla en el Observatorio de Madrid actualmente y deberá ser remitido á Dublin.

Es copia

Francisco Zúñiga

Telephone No. 1024.

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

Optical and Mechanical Works,

21st of April 19 8

Prof. F. Iniguez.

Dear Prof Iniguez,

I have been at the design of your Spectroheliograph and there are a few points about which I would like to consult with ~~ygu~~ you.

1....With regard to the rate at which ~~you~~ you would desire the instrument to pass across the 2½ inch image of the Sun.

You willprobably like a considerable variation in the rate and I would be glad to know from you the maximum and minimum rate which you would desire. This is for the purpose of laying off the necessary clock arrangements to be able to obtain such variations ~~xx~~ in speed as you may desire.

2....I should be glad that you would take an early opportunity of despatching to me the large prism as it is necessary for me to know roughly the deviation which this

prism gives for such rays as you will require to utilize for photographing the Sun. In case it is not practicable to despatch the prism to me quickly, perhaps you could get some of your Assistants to measure for me the angle of minimum deviation which this prism gives for such rays as you will be likely to require. This would enable me to proceed with the necessary drawings.

3....I should be glad to know whether you have made any estimate as to the necessary curvature of the slit. The image of the Sun being so large in diameter the curvature will be considerable, but until I get the prism, or have some estimation of this curvature I cannot determine what it should be.

I would hope in a few weeks time to be able to send you some designs for your approval. As we proceed with the design I will probably be obliged to trouble you with further questions, but these are all the points which at the moment occur to me.

With kind wishes

Yours very truly

H. Grubb

1º Marzo 1908

Contrato para la construcción y adquisición de un espectroheliógrafo, con destino al Observatorio Astronómico de Madrid.

Don Francisco Iñiguez é Iñiguez, Jefe del Observatorio Astronómico de Madrid, en nombre del Gobierno español, autorizado al efecto por orden de 9 de Abril de 1908 y

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

de común acuerdo contratan la construcción y adquisición de un espectroheliógrafo con sujeción á las siguientes clausulas:

1ª Sir Howard Grubb se compromete á construir y v vender un espectroheliógrafo de las siguientes condiciones; objetivo exterior de diez pulgadas inglesas de abertura y veintidos pies y medio, tambien ingleses de distancia focal; dos objetivos de cuatro pulgadas y siete pies, próximamente de distancia focal; dos espejos planos de suficiente tamaño para utilizar el haz completo de luz de los objetivos de cuatro pulgadas; dos rendijas de suficiente tamaño para utilizar una imagen del Sol de dos pulgadas y media de diámetro y todos los accesorios de soportes y movimientos.

2ª En la construción se utilizará el prisma de cuarenta y cinco grados de ángulo refringente que posee actualmente el Observatorio Astronómico de Madrid y que será remitido al efecto y en momento oprtuno á Sir H. Grubb á Dublin.

3ª El aparato completo, instalado para su ensayo en los talleres del constructor, cuidadosamente embalado y puesto en Liverpool sobre el barco transporte se entregará mediante la cantidad de cuatrocientas noventa libras esterlinas (L. 490). Los gastos de transporte y cualquier otro que se ocasione desde Liverpool al Observatorio de Madrid no serán de cuenta del constructor.

4ª El pago de las cuatrocientas noventa libras esterlinas en que se contrata el espectroheliógrafo se efectuará á favor de Sir H. Grubb en Londres y en dos plazos iguales; la primera mitad enseguida de hacerse el encargo, y la segunda y última mitad al estar terminado y ensayado el instrumento.

5ª El contrato, para su validez, deberá ser ratificado por el Excmo. Sr. Ministro de Instrucción pública y Bellas Artes.

Madrid 1º de Mayo de 1908.

9 Mayo 1908

Contrato para la construcción y adquisición de un Espectroheliógrafo con destino al Observatorio de Madrid.

Don Francisco Iñiguez é Iñiguez, Jefe del Observatorio Astronómico de Madrid, en nombre del Gobierno Español, autorizado al efecto por orden de 9 de mayo de 1908 y

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

de común acuerdo contratan la construcción de un Espectroheliógrafo, con sujeción á las siguientes cláusulas:

Iª. Sir Howard Grubb se compromete á construir y vender un Espectroheliógrfo de las siguientes condiciones; objetivo exterior de diez pulgadas inglesas de abertura y veintidos pies y medio , también ingleses, de distancia focal; dos objetivos de cuatro pulgadas de abertura y próximamente siete pies de distancia focal; dos espejos planos de suficiente abertura para utilizar el haz completo de luz de los objetivos de cuatro pulgadas; dos rendijas de suficiente tamaño para utilizar una imagen del Sol de dos pulgadas y media de diámetro, y todos los necesarios accesorios de soportes y movimientos.

2ª. En la construcción se utilizará el prisma de cuarenta y cinco grados de ángulo refringente, que posee actualmente el Observatorio Astronómico de Madrid, y que será remitido al efecto y en momento oportuno á Sir Howard Grubb á Dublin.

3ª. El aparato completo instalado para su ensayo en los talleres del constructor, cuidadosamente embalado y puesto en Liverpool sobre el barco transporte, se entrgará mediante la cantidad de cuatro cientas noventa libras esterlinas (L.490). Los gastos de transporte y cualquier otro que se ocasione desde Liverpool al Observatorio de Madrid, no serán de cuenta del cons-

tructor.

4ª. El pago de las cuatrocientas libras esterlinas en que se contrata el espectroheliógrafo, se efectuará á favor de Sir Howard Grubb en Londres y en dos plazos iguales; la primera mitad en seguida de hacerse el encargo, y la segunda y última mitad al estar terminado el ensayo del instrumento.

5ª. El contrato, para su validez, deberá ratificarse por el Sr. Ministro de Instrucción públca y bellas Artes.

Madrid 9 de mayo de 1908.

TELEPHONE No. 1024.

SIR HOWARD GRUBB, F.R.S.

RATHMINES,

DUBLIN.

Optical and Mechanical Works.

9th of June 1908

1 Enc°

Prof. F. Iniguez.

Dear Prof Iniguez,

I now enclose you a blue print giwing a rough design for the steel framework, which I would consider to be suitable for the covering of the Spectroheliograph. You will see that I have made the height of the room considerable. I think that this is desirable in order that the cords from the balancing levers should not be too short.

As regards the actual dimensions of the room. I should like to ask your opinion, and I think you will be able to come to a conclusion in this matter from the drawing I now send, as I have sketched on the

plan the space that the instrument will take up or occupy.

I have placed the instrument, as you will see, nearer to one side of the room than to the other, and also nearer to one end than the other.

I have placed it nearer to one side than the other because I anticipate that there will be very seldom occasion for any person to pass on that side, as we would put all the arrangements for clock winding, starting &c., on the other side. Also, I do not consider it will be necessary to leave more space than just necessary between the slit end of the instrument and the outer wall of the building. I have left just sufficient for an observer to stand or sit there for any purpose necessary in connection with the adjustment of the slit.

It may be, however, that you will desire to make some different disposition of the parts, or alter the sizes of the framework; if so, kindly make notes on the drawing and return it and I shall make out a new drawing.

You will see that I propose

that you should plant the framework upon dwarf or low walls, and that the out side of these walls should, after the framework is in position, be carried up to form the outer coating of the structure, gthe ventilating holes being left atythe bottom.

I estimate that the weight of this steel framework, which will consist of 5 pairs of uprights with girders and rough ribs, stays &c., and also the two horizontal channel irons which form the wall plate and the cohhecting arches will be about 1½ tons, and we could make this for you, erected here for trial over the instrument, connecting and mounting all the levers on the rough girders and supplying balance weights and the necessary cords pullies &c., for the sum of £80 (Eighty Pounds) delivered at these Works.

I propose that all the balahce weights should take the form of cast iron plates which will hang between the outer and the inner coatings of the structure so as to be completely out of the way and immune from shake during observations.

I have just received your kind letter of 4th. Perhaps when you reply you will be able to say when I may expect the remittance due on the signing of the contract ,

Yours truly

TELEPHONE No. 1024.

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

Optical and Mechanical Works,

~~11th~~ of ~~July~~ 190 8

Prof. F. Iniguez.

Dear Prof Iniguez,

I have been away for a fortnight's holiday and on my return find that the instalment of £245 has been duly received for which I thank you heartily.

With regard to the building:- I shall be glad to know whether the design I sent seems to you suitable. My object in mounting the iron framework on dwarf walls instead of carrying the framework right down to the ground was to prevent any possibility of vibration being carried from the floor through the framework of the building to the counterpoising levers which are hung from the roof, as this might interfere with the steadiness of the instrument. Of course it would be possible to carry down the framework right to the ground, if desired, but I think the design I have sent would be preferable.

Yours truly T. Howard Grubb

TELEPHONE No. 1024.

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

Optical and Mechanical Works.

30th of July 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

Your letter of the 26th has arrived and I shall take an early opportunity of letting you have the information you require for the Architect. Our draughtsman has been absent and the drawings cannot be prepared for a week or so but as soon as possible I shall send you the particulars you require.

Yours very truly
H Grubb

TELEPHONE No. 1024.

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

Optical and Mechanical Works,

31st of July 1908

1 enc.

Prof. F. Iniguez.

Dear Prof Iniguez,

I have been planning out an arrangement for a Coelostat and fixed telescope for an Observatory on the Continent and it occurred to me that if you have not already gone too far in the matter of the mounting of your Coelostat that you might consider an arrangementx such as the enclosed sketch. I am sending you this now because if you thought of any such arrangement it might affect the planning of your building.

You will see the arrangement is that of making the secondary mirror a fixture and mounting the Coelostat

on a table which revolves round this so that it can be used either to the E or W as occasionrequires, and by the addition of the second truning table the Coelostat can be kept always truly in the Meridian without adjusting each time.

In both of the designs sent the seondary mirror is mounted upon a stationary pillar in the centre of a revolving disc or table which carries the Coelostat, and the Coelostat itself is kept in the Meridianal line in one case by a set of gearing wheels, or in the other case by a parallel motion arrangement as shown in Fig 2.

The two tables revolve in the same~~xxxxxx~~ direction being connected by a steel band and the Coelostat is compelled to keep in the Meridian by the parallel motion rod.

Very truly yours T. A. Grubb [signature]

TELEPHONE No. 1024.

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

Optical and Mechanical Works.

28th of August 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

I have now the pleasure to send you a blue print of the instrument so far as we have decided up to the présent, but you will kindly understand that this being an instrument of very novel construction we are obliged to experimentalize to a certain extent as we go on, and may have to modify portions before the finishing, however, I think the present sketch will be sufficient to give you the information you require as regards the supporting system of levers.

I send you with the blue print a tracing on which is marked the 4 points from which I propose to suspend the instrument. These are marked A.B.C and D.. Directly over these points should be placed the end of a lever supported from a fulcrum attached to the roof or ceiling, and it

was my intention if I had to make the steel framework of a room for you, to so arrange these levers that the other end of the lever from which a balance weight would hang, would be in such a position that the balance weight itself might be situated between the outer and inner shells forming the walls and in this way it would protect the weights from any contact with a person moving about in the room.

The instrument would be so nearly balanced that it would be undesirable that these balance weights should be interfered with in any way, or set in motion, and I thought that by placing them between the 2 shells of the walls that this would ensure safety.

These levers are not of course yet made and it would be quite possible for us to modify them in order to suit the dimensions of any room which you design. All that is fixed is the positions of the 4 points A.B.C. & D. over which one end of the levers should lie.

In the tracing the green lines represent the levers but I have not shown them fully or to any particular length as this can be modified to suit your convenience.

Yours truly

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.

RATHMINES,

DUBLIN.

Optical and Mechanical Works,

30th October 1908.

Prof. F. Iniguez.

Dear Prof Iniguez,

Many thanks for yours and for the photographs just received.

In order that I may be able to judge as to what size of clock, and what power is required, perhaps you would kindly give me an idea as to the force that is necessary to move the instrument, approximately, as this differs very much in different classes of mountings.

If, when the instrument is fully weighted, you would ask some of your assistants to tie a string to the Decln axis at any given distance from the centre, and ascertain how many kilos it takes to move the instrument round, that will be quite sufficient for my purpose. Quite a rough estimation will do.

I would also like to know whether you

would desire to have the clock mounted to the North or to the South under the Polar axis. It is usually mounted at the N end but it occurs to me that in this telescope which was not originally designed for a clock, that possibly the clock might be inthe way of the telescope when observing stars near the Zenith if it (the clock) were mounted at the N end. If we mounted it at the S end it would be placed upon a bracket underneath the lower end of the Polar axis and a shaft could be carried up along the East side of the polar frame gearing into the screw which works the toothed circle at the head of the Polar axis; so, it would appear to me from the photographs.

If this would answer, I would have to ask you to tell me the number of teeth in that circle in order that I might be able to calculate the rate at which that screw should be made to revolve for driving the telescope to follow a star.

Would it be possible to get a rough estimation of the force that it takes to turn round that screw by mounting a little arm or handle on the square, and at any given radius to find the amount of pull required to revolve that screw?

If I had information on the above points I think I could then give you an estimate at once.

As regards the other matter, that of the Spectroheliograph. I shall look into this and write you further on.

Very truly yours,

H. Grubb

TELEPHONE No. 1024.

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

Optical and Mechanical Works,

8th of October 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

I should be glad to know as soon as convenient whether it is likely that you will construct the room for the Spectroheliograph at Madrid, or whether we are likely to have the framework to make. My reason for asking is, that I have now arrived at a point when I should like to erect the instrument, but I cannot well do this without knowing whether we are to make the framework and girders which support the overhead levers. I do not desire in any way to hurry you but if the Architect has come to a decision I should be glad to know as soon as convenient.

With kind regards

Yours very truly

H. Grubb

TELEPHONE No. 1024.

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

Optical and Mechanical Works,

17th November, 1908.

Dear Professor Iniquez,

I have to thank you for your kindness in writing me re Mr. Escomar's telescope. I have now written to him fully on the subject, and enclose a copy of the letter and estimate I sent to him. I fear that the 10" and 9" and 6" instruments all ~~of~~ at one end on deck axis would overload ~~the~~ an equatorial of the same size as yours.

I have been away from Dublin on business, and have only just returned, but in a few days will be writing you about your own work.

With many thanks

Yours truly

Howard Grubb

Enc.

17th November, 1908.

Senor Antonio G. Escobar,

Madrid.

Dear Sir,

On my return from a short absence I find your kind letter and order of the 5th inst., which I hasten to reply to.

When I suggested a 10" O.G., I was not aware that it was the intention to mount on the same equatoral a 9" refractor of 3.40 focus, and a double lens for photographic work.

I fear that these three telescopes would overload this equatoral, and the result would not give your customer satisfaction, particularly as the focus of the 9" is longer than we usually make them.

If he desiresto have an equatoral of this size only that is the same as we made for the Madrid National Observatory, and carrying these three telescopes I would not recommend him to have a larger lens than the 9", and that this and the 9" he has is to be mounted on one end of the deck axis and the doublet and camera on the other end.

By mounting the doublet and camera on second end of deck axis a considerable saving is effected, for instead of adding the weight of this apparatus plus the necessary additional counterpoise the apparatus itself acts as a counterpoise to the other two

 telescopes

telescopes, and thus double the weight of the apparatus will be saved

Perhaps it would be desirable to call the attention of your customer to the advantages of the type of equatoral figured on pages 9 and 11 of the catalogue and designed specially for stellar photographic work.

As we have made so many of these they can be supplied at a comparitively low price, and as they have been specially designed for the most refined work they possess many more advantages specially for photographic work. The driving arc is of long radius, the clock work very powerful and effective, and they are in short as perfect as is possible to produce at the present day.

I can supply one of these with a 10" telescope extra tube for the 9", and camera for doublet, all mounted on the same end of deck axis complete, packed and delivered in London for £1080, or without the electrical control for £1030. This instrument would carry even still larger o.g., glass, and if your customer desires to have it fitted with a 12" telescope instead of 10" telescope the price would be £1305O with electrical control, or £1300 without same.

As the distance between us is so considerable, and much time is lost in correspondence I have thought it well to give you very full particulars in order that you may have all the information necessary to enable your customer to come to a decision on this question.

As to the accessories required the following are the prices:-

Over

Accessories:-

£ 2:	£:	0.	A total reflection prism eye-piece for Zenith stars.
1:	8:	0.	A rheostat for moderating the light of electric lamps.
8:	8:	0.	A "Dawes" solar eye-piece.
5:	5:	0.	A reticule of lines ruled on silvered glass plate.
£17:	3:	0.	

I trust the above information will enable your customer to arrive at a decision in this matter.

(Sgd) H Grubb

Offices
57, RATHMINES-ROAD.

Goods Entrance
TO
OBSERVATORY & 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.

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.

17th of November, 1908. 189

For . Senor Antonio G. Exobar,

MADRID.

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.

I propose to Supply

An Equatoreal Telescope similar in every respect to that supplied to the Madrid National Observatory including Russell Electrical control to clock, electrical illimination to circles and having a special double cradle to one end of Decn., axis carrying a 9" refractory telescope of best type having breach piece with position circle arrangements, finder and Decn., reader and all necessary arrangements for clamping and slow motion rods.

The second tube of 3.40 metres long, also to be provided for carrying a second 9" O.G., which O. G., is in possession of the customer.

The second tube to be supplied with two breach pieces, one asimple rack and pinion eye end, for visual work, and the other a photographic breach piece similar to that supplied to the Madrid Instrument and suitable for carrying dark frames for plates of 9 x 12 cn.

Also to have provided at second end of decn. axis another cradle carrying a camera suitable for a 6" double lensm which is also in possession of the purchaser and any other apparatus necessary to fulfil the conditions laid down in Professor Iniguez letter.

The whole to be carefully packed and delivered at any port in England for the sum of Seven hundred and eighty pounds. 780 0

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.

RATHMINES,

DUBLIN.

Optical and Mechanical Works,

8th December 1908.

Prof. F. Iniguez.

Dear Prof Iniguez,

I am obliged to you for the information about the small Steinheil equatorial and I shall go into this matter again and let you know if it would be possible to apply clockwork, but I am afraid as the Circle is a fixed one it will not be easy to make a good job of it without considerable expense.

With respect to the Spectroheliograph:- The position at present is this.

We have got the main body or skeleton of of the instrument together. The two tubes carrying

the 4 inch telescopes are mounted in the general frame-work, and all the comlicated work connected with the prism box for setting the arm carrying the optical planes and also for revolving the prism at half the speed of the former, is complete, and we have the new mounting made for the prism.

The slits have been practically completed with the exception of the jaws which I am not completing until I get a photograph through the instrument for the purpose of ascertaining the necessary curvature. I propose to mount temporarily, straight jaws on one of the slits, and take a photograph by placing a photographic plate opposite the other telescope and in this way to get the curvature of the lines, and to form both these slits to half this curvature. This is a matter which will have to be very carefully done and special tools will have to be made for the purpose of grinding up the edges of the slits to a very fine edge.

We are at present engaged in planing the upper surfaces of the two large castings which form the

caps of the two piers and when these are complete we shall be able to mount the Spectroheliograph on theme caps for which I am making temporary piers. We are also working at present on the driving gear, that is the pair of screws of unequal pitch and the gearing connecting these with the clockwork.

You wil gather from the above that altho' we shall be able very shortly to get the instrument together and make the preliminary trials, it will not be possible to complete it for delivery by the end of this year. We had originally hoped to do so but there have been so many delays from one cause or another it will not be possible for us to have it ready for delivery until about the month of February. The instrument being so very new & novel we have had many delays from having to modify and alter parts as we go along, and we have had also much delay in getting glass and other materials.

I should have mentioned that the two 4" object glasses are complete and mounted in the instrument.

There are some points regarding the

instrument that I desire to enquire your wishes about.

(1). With regard to the focussing. It was originally arranged that the focussing should be done at the slit end but I found that that was undesirable because every time the focus was altered the distance between the slits and the photo plate would be altered, and also the slit upon which the image of the Sun is formed would be altered in position and of course it is desirable tha t this should be constant, and also that the other slit should be constant because the photo plate should be as close as possible to this latter, and if an alteration in focus were made it would be necessary to follow this motion with the photo plate.

I am therefore making arrangements to effect the focussing from the object end of the telescope, and I wish to enquire whether you think it necessary as this will be some 6 feet from the observer, to carry a long rod or shaft to the slit end in order that the observer may be able to effect a change in focus while working at that end?

2.....It also appears to me that it will be desirable for the purposes of focussing that I should adapt into the same frame as carries the photo plate, a frame carrying a focussing arrangement, and that this focussing arrangement should consist of a magnifying lens with a right angled prism in order that the observer when focussing may be able to stand at one side (not immediately in front) ~~in order~~ So that his own head may not be in the way of the rays falling upon the slit from the 10 inch objective.

3...We shall be glad to have from you now as soon as convenient, a drawing giving particulars of the room and more particularly the roof or ceiling showing how this is constructed, in order that we may be able to make the necessary arrangements for the overhead levers and counterpoising of the instrument.

If you would be kind enough to ask the Architect to send me such a design and that you mark on the design what position in the room you would like the instrument to be placed, I could then make a design for the overhead work and send it to you for your approval.

I am very sorry that it will not be possible to have the instrument ready by the end of the year and in consequence of this you may be put to some inconvenience as regards the payment of the money, owing to the necessary formalities, but if there is any action that I can take which would save you inconvenience such as happened on a former occasion when we sent you signed receipts for the money, which you held until the instalment was due, I shall be happy to do anything of this sort that you indicate.

In your letter just received you speak of an item of £5. 5. Od for a reticule for Mr Escobar's telescope. This estimate was made up while I was away from Dublin and that matter of the reticule was not very clearly understood but I agree with you that the price for a 12 x 9 c/m plate is more than what is necesssary.

There are certain Firms which apply themselves particularly to this kind of work and I shall make enquiries and see what it can be done for consistent with the best work, but before doing so I should be glad to have exact particulars as to the ruling of this reticule. The number of lines, how it is to be numbered &c., A little sketch

would be an advantage, and I would then get a definite price from a Firm devoting themselves to this sort of work.

I have to thank you for the very beautiful photographs you sent me of the comet. I took the opportunity of submitting some of these to Sir David Gill formerly Director of the Capetown Observatory and an old friend of mine, whom I saw lately in London, and he was greatly pleased with the results you have got. I understand they have got some good photos also at Greenwich but I doubt if anything better has been done than the negatives of those which you sent me prints from.

Of course I can quite understand that no silver print will ever reproduce the exquisite details that are shown on these negatives.

With kind regards

Yours sincerely

Howard Grubb

TELEPHONE No. 1024.

SIR HOWARD GRUBB F.R.S.

RATHMINES,

DUBLIN.

Optical and Mechanical Works,

10th December 1908.

Prof. F. Iniguez.

Dear Prof Iniguez,

In continuation of my letter of the 8th inst. I would be glad to know from you as to what portion of the spectrum you will be using the instrument for. My object in making this enquiry is to enable me to determine the best final correction to give to the obj-glasses for chromatic aberration. Of course I am aware that any photos taken with this will be taken with monochromatic light and therefore the correction for chromatic aberration will not affect the sharpness of the images but I have to provide accommodation for focussing on all the different rays that you will require to use, and therefore it would be desirable to give such a correction to the obj-glasses as will cause the least displacement of focus between the extreme rays towards the red and towards

the violet that you have occasion to use.

If, therefore, you would kindly mention roughly the portion of the spectrum it will be necessary to provide for I shall determine the best correction to give to the obj-glasses and the necessary amount of range to give to the focussing. of the telescopes.

Sincerely Yours W. H. Pickering

TELEPHONE No. 1024.

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

1 Enc

Optical and Mechanical Works,

21st December 1908

Prof. F. Iniguez.

Dear Prof Iniguez,

Will the enclosed letter answer your purpose. We are making every possible speed with the instrument and I hope soon to be able to commence some of the trials. The first trials I have to make are with regard to the curvature of the lines as I cannot finish the jaws of the slits until I ascertain as nearly as possible the curvature of the lines. To do this I am fitting up one straight jawed slit and propose to take a photograph of the spectrum in the focus of the second telescope. From this I will be able to estimate the amount of curvature necessary to give to the jaws.

In haste wishing you and all your staff a very happy Xmas

Yours sincerely

Howard Grubb

P.S. I am writing to Prof Whittaker and will let you know if he will undertake to be present at the trials, in a few days.

de
de photographique et le résultat est des photographies de 2" avec expositions de 15s. L'ouverture de l'objectif de South Kensington est 12 pouces et l'image de 2¼ pouces. C'est vrai que dans notre Spectrohéliographe la lumière aura à traverser deux fois le prisme, mais si l'astre la lumière traverse deux prismes et de plus l'image est agrandie. Nous employons à présent tous les jours notre spectroscope, avec notre equatorial visuelle, pour observer la couronne et les protubérances: nous voyons toujours parfaitement la couronne, et dans les jours d'atmosphère tranquille on observe les plus fins détails, avec une définition et une pureté admirable; les images sont toujours éblouissantes. Tout ça semble indiquer que nous avons suffisante intensité lumineuse et que les rayons arrivent à la plaque avec une intensité de force suffisante pour l'impressionner sans avec une exposition pas trop longue, bien inférieure à une minute. Cependant, j'ai mes doutes, et je vous expose les raisons motifs que j'ai pour espérer que nous réussirons avec une image de 2½ pouces. Quelle est votre opinion?

enero 9/08. Enviada en fecha 11

Sir Howard Grubb.

Mon cher Sir Grubb: Je suis en posesión de votre tres estimée lettre du 6 et j'ai le plaisir de repondre à vos questions.

1º Je vous envoye vos <u>designs</u> d'octobre 1905. Effectivement je crois la forme plus acceptable la designée "B". Etant donné le diametre des miroirs de votre heliostat j'estime que le plus grand diametre de l'objec-tif exterior que nous pouvons employer es 9" (neuf pouces). Alors le prix de l'instrument sera de livres sterling quatre cents trente (L. 430).

2º Je desire toujours une image de 2½ pouces sur la première fente (primary slit), et j'espere que nous pourrons obtenir ce resultat. Voici mes motifs. Avec un spectrograf de Pellin de six prismes de 60° employant un objectif de 6" donnant sur la fente une image de quelques 2 centimetres, nous faisons des fotographies de le spectre solaire avec une exposition de cinq secondes. 5s. A Tortosa les P.P. Jesuites ont un spectrohéliographe de Maillat dont le prisme es un prisme à vision directe composé de cinq prismes; de plus la première image est agrandie ~~par~~ moyennant un objec-

2)

Je pourrai employer un objectif de ~~10~~ dix pouces, mais avec votre he-
liostat je crains qu'il ne seriait plus avantageux qu'un autre
de neuf pouces. Alors le prix seriait ~~de~~ £. 490.

3e Nous avons à faire completement l'instalation des les pilliers
de le heliostat et l'objectif jusq' à le pavillon pour l'instru ~~instr~~
ment: en consequence nous pouvons faire ~~nous~~ toutes les construc-
tions de la forme et des dimensions exigées par l'instrument.
et j'espère que vous aurez la bonté de me les indiquez. Seulement je
ai déja l'intention de faire l'instalation de manière que les rayons
lumineux soyent dans le meridian et avec la direction de
nord au Sud.

4e Tant l'objectif exterieur que les deux fentes et le chassis
auront à porter les ~~[illegible]~~ accesoires pour la correction d'
orientation et de foucusement. La longeur focale exacte
de l'objectif exterieur est necesaire pour placer son pillier, et
de plus les corrections de son support sont indispensables pour corri-
ger les deplacements et surtout les variations de distance focale
~~[illegible]~~ causées par des variations de temperature. Mais à present

est un peu prematur s'occuper de ces details.

Il est un autre point. A South Kensington ~~on~~ employe des disques de zinc pour fotographier la cromosfère et les protuberances.

Vous avez eu la bonté de m'indiquer que vous avez des idées originales sur la matière, et que vous munisez l'instrument des accesoires pour ~~faire l'application~~ l'employer dans le but indiqué.

J'ai vu la description de le spectroheliographe de South Kensington dans de le vol LXV, pag. 473 (correspondant à March 1905) des "Monthly Notices of the R. A. S."; la note a été aussi publiée separam
quelque variation [illegible]
ment. Je ne sais si il y a ~~[illegible]~~
je n'ai des ~~[illegible]~~ informations

J'n'ai reçu encore l'autorisation pour vous faire la commande de l'instrument, mais je l'espère brevement.

Veuillez, etc.

Sir H. Crumb — Abril - 13 — 08.

Ha sido ya aprobado el proyecto de adquisición del espectrohelógrafo con las formalidades de un contrato entre varios interesados.

En consecuencia he recomendado ya al Sr. Ministro de J. P. para su aprobación el proyecto de especificación B de su proyecto de 25 octubre 1905 con las modificaciones mencionadas en su carta de 4 de diciembre 1905.

El proyecto definitivo será pues el siguiente:

Un espectrohelógrafo, designo B "con un objetivo externo de 12 pulgadas de diametro; dos objetivos de cuatro pulgadas; dos espejos planos; dos cerrojos; montura completa con los aparatos accesorios necesarios. La imagen será de unas 2½ pulgadas. Se utilizará en la construcción el primer 45° que ya posee el Observatorio, que será para el

remitido oportunamente á los talleres de V.

El precio del instrumento será de cuatrocientas noventa libras esterlinas (£ 490)

Sírvase V. decirme si en efecto son esas las condiciones, como yo creo.

El Sr. Ministro aprobará en seguida el proyecto y entonces se hará oficialmente el encargo.

Como vengo diciendo á V. no dudo de llegar á ello, pero no es posible prescindir de las formalidades legales de nuestra administración.

El instrumento tendrá que estar terminado en el año corriente.

de V. etc.

OBSERVATORIO
ASTRONÓMICO Y METEOROLÓGICO
DE
MADRID
DIRECCIÓN

le 6 jule 1907.

Sir Howard Grubb.

Dublin.

Mon cher Sir Grubb: Je vous envoye ci jointe une léttre de change de cinquante cinq livres sterling, (L. 55) pour le reste du payément des collimateurs.

J'ai reçu vos dessins des collimateurs, et efectivement ils nous seront bien utils pour l'installation de ces instruments; je vous envoye mes remérciements par ces marques d'interest.

J'ai deja bien achevé la question du mouvement de la coupole, en y plaçant un moteur de courent continu, qui porte parfaitement la coupole dans les deux directions avec un simple commutateur; je suis bien satisfait avec cete solution, car je croix que le moteur de courent alternatif, étant plus compliqué dans son installation, il auriat toujours des dificultés de fonctionement, á cause des conditions toutes particuliers de son fonctionement: il á eté pour nous une héureuse circonstance de pouvoir disposer du courent continu, et nous n'aurions eu tant de delays si nous aurions eu le courent continu quand nous vous commandames la coupole, mais allors nous n'avions que le courent ~~continu~~ alternatif.

Veuillez, Monsieur, agréer l'assurance de mes sentiments le plus devoués

F. Iñiguez

P.S. Je vous prie de m'envoyer par duplié l'acus de reception de la léttre, afin de complimenter les exigences de notre comptabilité.

Letra £ 0.419,928
nº 0,55 3/16 / 27304
Sobre Londres — Gr. Lyon.

Octobre - 3 - 907.

Mon cher Sir Gerald: Je suis en retard à vous annoncer la reception du Chronographe: & c'est que j'atendai à pouvoir vous donner des nouvelles sur le spectroheliographe.

Le Chronographe arriva en très bon etat: seulement les porteplumes etaient avec les lames casées, car on avait emballé le char sans l'assujetir dans sa caisette. On a fait la reparation et l'instrument fonctionne bien.

Enfin j'ai le plaisir de vous annoncer que le „Congreso" (la Chambre des Deputés) a voté la quantité necesaire pour la construction des spectroheliographe. A présent il faut que la quantité soit aussi votée au „Senado" (la Chambre des Senateurs) mais je espere que ~~[illegible]~~ a ceci il n'aura des dificultés.

En conséquence je suis en position de vous dire très prochainement je pourrai vous faire définitivement la commande.

J'ai une confiance absolue que vous faites un instrument supérieur à ceux qui à présent existent et qui dans votre nid il donnera des résultats magnifiques.

En vous souhaitant un bonne année 1908, je vous prie, Monsieur, de recevoir mes salutations empressées.

Telephone No. 1024.

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

Optical and Mechanical Works,

11th of March 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

With regard to the matter of the Chronograph about which you wrote me a short time since. I shall be glad to have from you your ideas as to the size and class of instrument which you would desire. If you are anxious to have the best possible instrument, I cannot recommend anything better than what we made for Dr Rambaut of the Radcliffe Observatory, Oxford, which is nearly identical with what we made before for the Perth. W.Australia Observatory; a couple of blue prints of which I enclose.

This instrument was supplied

with the best possible clockwork and a control similar to what we supplied to all the Stellar Photograohic Telescopes, but I would propose in future to replace this by the newer form of control such as we have adopted in the case of the 24 inch telescope at Oxford, which is simpler and easier to work.

This Chronograph has two barrels of 30 inches long and 9 inches in diameter, either or both of which can be worked at the one time. The registration is made by stylographic pens making dots of ink on ordinary white paper. The seconds are represented by spaces of .4".

The price of this chronograph was £170 but it could be made for slightly less by adopting the newer form of control.

Possibly you may require a simpler form of instrument and desire to have only one barrel or smaller sized barrels, but if after examination of the drawings sent you you would kindly let me have your ideas I would give you a special quotation and special description of whatever you may desire.

You will observe in the draw-

ing of the Perth Chronograph that each barrel is mounted upon a frame which can be drawn out towards the operator when not in use. This is a great convenience both in lift- ing out the barrels and re-covering with paper, and also for examination of the records, and there are a number of other contrivances about this which long experience has led us to adopt.

Very truly yours
H Grubb

Telephone No. 1024.

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

Optical and Mechanical Works,

11th of March 079

Prof. E. Iniguez.

Dear Prof Iniguez,

I am sorry to trouble you but it would be a great convenience to me if you could manage to get the Architect to send me the balance due on the Dome. You have always been very kind to me in sending remittances promptly and I quite understand that in this case difficulties have arisen through the money coming through the architect and also the changes in your Government, but this balance has been so long delayed it has somewhat inconvenienced me and I would therefore take it as a personal favour if you could hasten the despatch of it.

Yours truly Howard Grubb

Telephone No. 1024.

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

Optical and Mechanical Works,

25th of March 19 07

4 encs.

Prof. F. Iniguez.

Director, Astronomical Observatory.

Madrid.

Dear Sir,

I am in receipt of your kind letter of the 21st inst enclosing cheque for £100 in payment of account furnished for the balance on 8 metre Dome, electrical motor &c, and have much pleasure in enclosing herewith receipts in duplicate as per your instructions.

Sir Howard is on business in England just at present but will write you immediately after Easter with reference to the matter of the Chronograph.

Yours faithfully,

J. E. Ladd.

Secty.

Telephone No. 1024.

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

Optical and Mechanical Works,

9th of April 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

I was away for a short time at Easter and on my return found your letter of the 21st Mch enclosing cheque for £100 for which our Mr Ladd has I think sent you duplicate receipts as desired.

Respecting the Chronograph. It was a mistake showing only the one pen ~~xxxxx~~ in the engraving as we always use two with these large chronographs.

We have recently made a simple form of Chronograph for a London University, of which I enclose a photo. Curiously enough it so happens that only one pen was placed in the holders in this case also, but of course two are supplied each with its set of electric magnets. This is

a simple but efficient form of Chronograph and might perhaps answer your purpose. The price is £55, see enclosed memorandum (A).

I have also on the same memorandum noted what the cost would be for making the instrument double which is a great convenience as the records on one barrel need not be disturbed if a second is required for some other work.

Possibly either of these two forms would suit and I have added a memorandum showing the cost for adding the "Russell" electrical control to either of them.

I hope very much that you will be successful in getting the money for the Spectroheliograph. I would very much like to make one of these for you and have it working in the clear atmosphere of Madrid.

Yours truly

Offices
57, RATHMINES-ROAD.

Goods Entrance
TO
OBSERVATORY & ASTRONOMICAL WORKS,
BY
OBSERVATORY-LANE, RATHMINES.

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.

9th of April 1907.

For Prof. F. Iniguez.

Director Astronomical Observatory.

Madrid.

I propose to Supply

(A).

A single barrel Chronograph with good strong ball governor clock, supplied with a barrel of 9 inches diameter and 16 inches long, giving about 1¼ hours run.

The spaces for the secs to be about ½" and two pens of stylographic form to be supplied one for recording secs and the other observations.

Interchangeable barrel also to be supplied & the instrument arranged so thatone barrel can be taken out & the other put into gear without trouble or loss of time.

The instrument similar in every respect to the one lately made for The University Gower St London. See photo enclosed.

Packed & d/d f.o.b. S.S.Dublin..... £55 0 0

(B).

The same as above but supplied with stronger clock working 2 barrels simultaneously, each with their double set of pens; or if desired one barrel independently of the other. The length of barrels to be such as to give 1¼ hrs run on each.

Packed & d/d f.o.b. S.S.Dublin..... £85 0 0

The (A) instrument supplied with the "Russell" form of control but no pendulum for controlling..... Extra £10.

The (B) instrument supplied with the Russell form of control but no controlling pendulum..Extra £12.

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.

Telephone No. 1024.

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

Optical and Mechanical Works,

12th of April 19 07

1 enc.

Professor F. Iniguez.

Dear Prof Iniguez,

I enclose a piece of paper showing a record given by the Chronograph we have just completed for a London University and which is the same instrument as that which we sent you a photograph of a few days ago. No control in this instrument

Yours truly Howard Grubb

Telephone No. 1024.

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

Optical and Mechanical Works,

18th of April 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

I am obliged by yours of the 15th re:- Chronograph and I note that you expect to be able to send an order for one of these. I also note that you require 3 barrels instead of two. The price for the extra barrel would be £3. 10. Od

I am not quite certain of the meaning of the next sentence in your letter but I may mention that the barrel can be lifted out by taking hold of the spindle at the two ends the ends of the spindle being provided with buttons to prevent the fingers slipping.

Before lifting out the barrel the whole frame

containing the barrel is drawn out away from the pens, and then it can be lifted straight up out of its bearings very conveniently.

If you require a separate stand altogether to rest upon a table for carrying the barrel while reading off and reducing the registrations, this would best be made in wood and could be supplied for about £1. 10. 0d.

As regards the character of the registrations:- Whether they be dots (as in the one I sent you) or broken lines thus 
or what we call "crenolated" 
lines thus 
We can make the instrument to give any of these registrations, whichever you think best; it is only a question of altering the position of the electro magnets, which in the 1st case as above would be underneath the armatures; in the 2nd above the armatures, and in the 3rd case at one side of the armatures. This will make no difference in the cost. If you will kindly tell me whichever you desire we will make it accordingly.

I hope that you will be able to obtain the necessary grant for the Spectroheliograph about which we corresponded last year. I shall be very pleased to put this instrument in hands for you as I think we shall be able to make an instrument superior to anything that has yet been produced.

Sincerely yours, H. Grubb

Telephone No. 1024.

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

Optical and Mechanical Works,

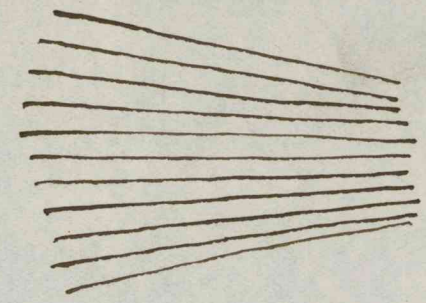
11th of May 1907

Prof. F. Iniguez.

Dear Prof Iniguez,

I have beem away for a few days and on my return find your letter of the 7th inst.

Firstly, with regard to the "Releveur". From your letter of the 21st April I take this to mean an instrument which can be applied against the cylinder and by which the registrations are read off inportions of seconds. I have not seen an instrument of this class before. Here it is usual to read off the registrations after the sheet of paper is removed from the cylinder and we generally provide a scale divided upon glass with 11 lines slightly tapering, forming 10 spaces, whose scale is slightly diff-



erent at one end than at the other. This scale is then drawn across the paper until the two end divisions correspond with the registrations of the seconds and in this way the decimal portions of a second can be read off from the registrations of the transits or observations.

If however you ~~xxfxxxx~~ prefer to have the little instrument such as you have sketched in your letter we can easily make this for you and the price would be 50/- 50/

I quite understand the nature of the registrations you desire.

As regards the Motor. I have been in communication with the General Electric Company who supplied the motor and I have had a consultation with their Engineer. He has promised me particulars of a frictional clutch the adaptation of which he said would get over the difficulty, and I have also another proposition to make of a simple nature which might also suffice; but although we have written directly and telephoned we have not been able as yet to get these particulars from the Engineer but shall

use further endeavours to get them within the next few days and will then write you fully on this point.

It is, as you say, unfortunate that we did not know that a continuous current would be available as this of course would have simplified the problem very considerably.

Congratulations on the auspicious birth of your prince

Yours sincerely

[illegible]

Telephone No. 1024.

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

Optical and Mechanical Works,

17th of May 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

We are every day telephoning or communicating with the General Electric Co with regard to the motor of your Dome but we are as yet without any definite information. I am very sorry for the delay but we are really doing all we can.

Yours truly T. H. Grubb

Telephone No. 1024.

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

2 encs.

Optical and Mechanical Works,

19th of July 19 07

Prof. F. Iniguez.

Dear Sir,

In the temporary absence of Sir Howard Grubb I beg to acknowledge your esteemed letter of the 15th inst and cheque for £55.

Herewith please find receipt in duplicate as requested.

Awaiting your further esteemed commands.

Yours faithfully

J. E. Ladd

Secty.

Telephone No. 1024.

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

Optical and Mechanical Works,

21st of June 19 07

Prof F. Iniguez.

Dear Prof Iniguez,

I am now sending you drawings showingthe method of placing the supports for the Collimators, which may be useful to you when you come to erect the instruments.

You will see that the pedestals for the supports of these collimators have flanges upon one side, and these flanges we propose to place inwards so that you may get the greatest possible distance between the two supports with the given length of the piers.

We are sending stone bolts for attaching these pedestals to the pier.

With regard to the adjustment of the wires. Both collimators have adjustable wires on cross

slides; the one is so arranged that the screws are completely inside the mounting, and in order to get at these screws it is necessary ti trun round through a small quantity a ring which has 4 holes in it. This will enable you to get a screw driver at the screws for adjusting the wires

When the adjustment is made this ring can be turned back again to keep out dust.

The other collimator is, according to your instructions supplied with micrometer heads.

The level we have packed in a cardboard tube and I trust it will reach you safely. There can be no difficulty I think it putting this together. The advice notes sent you give the contents of the packages, but we omitted to put on them Case 5 containing the Personal Equation machine, but it has gone with the other 4 packages.

I have already written you with regard to the Personal Equation machine. I think you will find the addition I have made to it an advantage.

I hope you are getting out of the difficulties with regad to the Dome. It is much to be regretted that you did not know at the time that a continuous current would be available as this would have very much simplified matters and saved you much trouble.

Hoping to hear from you soon and that you will be able to get the vote for the Spectroheliograph.

Very truly yours

FC

Telephone No. 1024.

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

Optical and Mechanical Works,

18th of June 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

I am glad to be able to announce to you the despatch of the cases containing the Collimators and the Personal Equation machine. I am preparing a few drawings to send you of the collimators which will be useful to you in putting together and mounting on the piers.

As regards the Equation machine. I have made practically the same as the American one with this exeption that besides using it with the naked eye you can put on an adapter that I have supplied and use it with an eye-piece and it appears to me that this gives a result far more comparable with the spider lines in the transit than when viewed with the naked eye. I shall be glad to have your opinion about this, but in any case you can use it either as the Americans use it or with the addition which I have put.

Very truly yrs H Grubb

ADVICE OF GOODS.

Offices:
57, RATHMINES-ROAD.

Goods Entrance
TO
OBSERVATOR
AND
ASTRONOMICAL WORKS
BY
OBSERVATORY-LANE,
RATHMINES.

From

SIR HOWARD GRUBB,
RATHMINES.

Dublin 18th June 1907.

Sent to Prof F. Iniguez.
Astronomical Observatory.
Madrid.

Mark	Date of Dispatch	Number and Description of Parcels	How Sent	Particulars
G 1	18/6/07	One Case	Per City of Dublin S Packet Co to The "Serra & Tintore" S.S.Co with instructions to consign to Sen.Don.Zulaica Agent de Aduanas BILBAO Carriage Forward.	Containing two 5 inch tin plate tubes with their eye-ends complete cross wires & adjusting screws for same.
G 2		One Case.		Containing two 5 inch achromatic object glasses each packed in an inside separate case with their dust caps. 1 long delicate spirit bubble packed in cardboard tube.
G 3		One Case		Frame for supporting level and handles for lifting same.
G 4		One Case		4 adjustable cast iron supports for the 5 inch tubes. 1 dozen stone bolts 2 small capstan bars.
G 5		One Case.		Containing Personal Equation Machine complete with eyepiece & adapter.

Observatory Madrid

Telephone No. 1024.

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

Optical and Mechanical Works,

28th of May 19 07

Professor.F.Iniguez.

Dear Prof Iniguez,

After a long delay and much correspondence and telephoning I have at last had a final interview with a representative from the General Electric Company.

In a former interview he told me that the best arrangement in such as case as yours would be, to apply a frictional governor of such a type that the motor would start without load and a coupling between the motor and the worm wheel would not be coupled until the speed attained was normal.

He now tells me that it is impossible to

obtain one of these governors for so small a motor and it is only to-day that I have ascertained this and I lose no time in writing.

There are two possible solutions of the difficulty one of which has occurred to myself and it would be very simple to try, and that is, to disconnect the attachment between the worm wheel and the spur wheel so that the worm wheel would be loose upon its spindle, and then to have a pin placed in such a position that the worm wheel could go nearly a turn before it drives the spur wheel. Under these circumstances when the motor is started it could run 50 or 60 turns before it comes into contact with the pin and begins to drive the dynamo round, and during thee 50 or 60 turns the normal rate would be attained.

There would be this disadvantage that if the motor were stopped and then started again in the same direction, it would not start without load and it would be necessary to reverse the action for a few turns and then start forward again when it would start without load until the pin comes in contact.

If this would answer it would be a

very simple way out of the difficulty, but if not, I fear there is nothing for it but a frictional clutch.

As we cannot obtain a frictional clutch for so small a motor we shall have to make one ourselves and I think one made on the principle of the enclosed sketch would be a simple and efficient form. If this be necessary I would ask you to send me particulars of this portion of the two shafts where they meet one another, that is to say, the shaft of the motor and the spindle of the endless screw, and I will them make a clutch for you of this class.

The disc which would be mounted on the screw spindle would be made or covered with raw hide, and the weighted levers would have on the end next to the raw hide disc and serrated or toothed piece which would grip in the raw hide but this grip or clutch would not take place until the motor had attained its speed.

With respect to other matters:- We

have the Personal Equation machine complete and could send it to you at any time. The collimators are almost complete and unless we hear from you to the contrary weshall await the completion of these before sending all.

Chronograph. We have to thank you for the order for this and shall have it put in hands at once.

Shortly I shall send you some drawings showing the modified arrangements of the pens. With such a registration as you desire I agree with you that the syphon pens will be best.

Yours truly

Telephone No. 1024.

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

Optical and Mechanical Works,

17th of September 19 07

Prof. F. Iniguez.

Dear Prof Iniguez,

I am home again now after my summer holidays and I will very soon have your Chronograph ready for despatch. I assume that I am to send it in the ordinary way by Bilbao, through the Serra & Tintore S.S.Co. I shall put it to a few trials and let you have a sheet of records. All portions are now complete with the exception of the "releveur".

I shall be glad at your leisure to hear from you regarding the Spectroheliograph and when it will be likely you will be able to obtain the necessary vote for this instrument.

With Kind Regards

Yours Truly

H Grubb

Telephone No. 1024.

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

Optical and Mechanical Works,

2nd of November 19 07

2 encs.

Prof. F. Iniguez.

Dear Prof Iniguez,

I have the pleasure to acknowledge receipt of your kind letter enclosing cheque for £71 in payment of the Chronograph. I hope that you will receive this instrument in good order and without any damage.

I note what you say about the Spectroheliograph and we hope to hear from you nefore very long that we may put the work in hands. I am very anxious to make this instrument for you and to supply you with a spectroheliograph which will be at least equal to if not superior to anything that is in existence elsewhere.

Yours truly, H Grubb

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

Optical and Mechanical Works,

8th of February 19 06

Prof. F. Iniguez.

Dear Prof Iniguez,

I write a line as you were expecting about this time to be able to come to some decision as regards the ordering of the Spectroheliograph.

As I mentioned in my last, if you tell me that the Government have decided to order it, I shall go to work at it without asking for any money until it is convenient.

I have designed out the two slits and I have indeed commenced some of the work on them as there is more almost to be done on these than on some of the other parts.

Perhaps youwill let me know when you think it likely that the matter will be arranged.

Yours very truly

Telephone No. 1024.

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

Optical and Mechanical Works,

18th of June 1906

Professor F. Iniguez.

Dear Prof Iniguez,

Regarding the matter of the Order of Isabella la Catolica. I was at the Foreign Office in London to try and get them to send an official intimation of the King's permission to the Spanish Embassy in London but this proved to be very difficult. The fact really is, that the Foreign Office officials are annoyed at my having gone directly to the King and got his permission without the matter passing through their office, and they say that as the matter has not passed through their office it is not their business to make this intimation to the Spanish Embassy.

The whole matter is very foolish and surrounded with what we call here "red tape", that is to say that the various Offices are jealous of one another and determined

to do nothing outside what they are compelled to do according to the Official regulations.

By the advice however of officials at the Foreign Office I saw one of the Secretaries of the Spanish Embassy who promised to write to the Marquis De Villalabor, Councillor of the Embassy who is at present in Madrid, and he will explain to the Marquis that he has himself seen with me the official letter from the King giving me permission to accept the Order, and possibly this may be considered sufficient.

I am also writing to the English Ambassador in Madrid (Sir Maurice W.E.De Bunsen) and sending him a copy of the King's permission, so that if he is referred to he will understand the matter, and I trust that this may suffice.

Yours truly W.H.Webb

Telephone No. 1024.

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

Optical and Mechanical Works,

18th of June 19 06

enc.

Prof. F. Iniguez.

Dear Prof Iniguez,

I have just now returned home to Dublin and I expect that by the end of this week we shall have the shutter of the Dome complete and then we will be in a position to dismount and pack everything except the motor which we hope to have in time to send with the other things, and the bronze rings, insulators and the papier mache covering.

As you are anxious to receive the Dome, I would suggest that we do not delay the framework for these matters, but that we pack up all the wall plates, sole plates and framework and despatch it to you. Probably by the time the packing is complete these other articles will be ready.

I shall be glad to receive from you

instructions for transmission and any directions you may have regarding the packing &c.,

I suppose there is no better way of sending than what we did on former occasions.

I also enclose the account for the Dome as requested.

On other matters I write on a separate sheet.

Yours truly W. H. Gubb

Offices.
57. Rathmines Road.

Goods Entrance.
TO
Observatory
AND
Astronomical
Instrument Works
BY
Observatory Lane.
Rathmines.

Optical and Mechanical Works.

Rathmines. Dublin 18th of June 1906.

The Director. Astronomical Observatory. Madrid.

To Sir Howard Grubb, Dr.

8 metre Dome as estimated for in my letter of 24/1/05 delivered f.o.b. Dublin	£650	0	0
Electric Motor, driving gear, bronze rings &c., for above Dome as estimated in my letter of 6/11/05.....	48	0	0
Packing charges on above.....	2	8	0
	£700	8	0
16/9/05..By cheque received..£200 11/11/05.. .. ..£200	£400	0	0
Balance	£300	8	0

Optical and Mechanical Works.
RATHMINES.
Offices.
57. RATHMINES ROAD.
Goods Entrance.
TO
OBSERVATORY
AND
ASTRONOMICAL
INSTRUMENT WORKS.
BY
OBSERVATORY LANE.
RATHMINES.

Dublin 18th of June 1906.

The Director. Astronomical Observatory. Madrid.

To Sir Howard Grubb, Dr

Freight Charges &c., connected with the despatch of small instrument for attachment to polar axis of Coelostat as per receipt herewith.....		8	2
Re-placing broken steel pinions in clock barrel of Coelostat.....		10	0
Postal and packing charges.....		1	10
	£1	0	0

Telephone No. 1024.

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

Optical and Mechanical Works,

25th of October 1906

1 Enc.

Prof. F. Iniguez.

Dear Prof Iniguez,

Yesterday we sent you the duplicate receipts for the £200 Bill of Exchange, for which very many thanks.

The electric motor itself with the bronze rings &c., were sent off to you on the 31st August, not with the main portions of the Dome, so it is possible that when you wrote your last letter that these parts had not arrived, but before you get this letter you should certainly have them. If there is any portion missing kindly let me know, but please check the articles received by the advice notes which we sent you.

It is good news to hear that you are likely

to get the money for the Spectroheliograph in next year's estimates.

As regards the two 5" collimators. I think we will have sufficient room to mount the collimators with all their adjustments without asking you to lower the pier.

The plan of mounting that I would suggest as most suitable would be what we have used in some other cases of large collimators, of which I enclose you a rough blue print.

You will see that the vertical adjustment is given at one end, and the horizontal adjustment at the other end, and it is capable of being well clamped and made very permanent.

I understand that you want 2 of these collimators, both provided with micrometer eye-ends, but you do not mention if it be necessary to have the vertical as well as the horizontal adjustments to the wire plates of the micrometers of both collimators.

If you have not got vertical adjustment to the wires of the micrometer it will be evidently necessary to have an adjustment between the spirit level and the collimator, but if you have this vertical adjustment in the micrometer, this may not be necessary. I think you will

find it advisable to have this vertical adjustment as well as the horizontal.

As regards the cost:- Small matters such as above will not greatly affect the cost. 5 inch obj-glasses of about 6ft 6 inches focus cost £35 each. It will be desirable I think in this case to make them of a special focus. I shall be glad to know what your ideas about focus are, that is to say how much room you have.

We could readily make them only 5 feet in focus, but if you wanted them of any shorter focus we would then I think have to make the obj-glasses of the triple form.

Assuming however that the obj-glasses will be "doublets" that is to say of the usual form, the price would be £35 each. The mountings, including the adjustments in azimuth and altitude, the micrometer eye-pieces with double slides (vertical and horizontal) and the usual micrometer heads, also delicate spirit level attached to one of the collimators, would cost about £40. Total price for the two 5 inch collimators delivered f.o.b. S.S.Dublin say £115.

We are getting out

a design now for the Personal Equation machine, the order for which I thank you. As soon as the design is complete I shall send you a drawing.

With kind regards

Yours very truly

Howard Gould

Telephone No. 1024.

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

Optical and Mechanical Works,

2nd of November 19 06

2 Sketches

Prof. F. Iniguez.

Dear Prof Iniguez,

Many thanks for yours of the 30th ulto.

I understand your difficulty about the motor and I ought perhaps to have written to you particularly about it before this. The difficulty arises in this way.

We ordered a certain motor from the General Electric Company and in order to save time we got them to send us a very accurate drawing to which we worked and made all our connections. When the motor was delivered to us it was quite different to the specification and drawing. Meanwhile as there was a great delay in the delivery of the motor we had sent off the piece of the Dome on which this motor was to be mounted, keeping a templet so that we might

make the necessary connections, but the fact that the motor when delivered was quite different to the drawing gave us a great deal of trouble.

I could have insisted on the Company making me a new motor exactly according to drawing but this would have caused a still further delay, consequently we adapeted the motor they sent to the templet as well as we could.

This explains the reason why no holes were bored in the casting which you send a sketch of.

You are quite right in saying that the motor when in position will overhang the part A, but you will find in the same box a piece of iron of the shape of the enclosed sketch. This piece when attached to the foot of the motor, which overhangs, provides the necessary support for attaching it to the part A. It will, I fear, be necessary to cut a little off the high rib in your sketch which I have marked X.X., but this, I think, will not give very much trouble.

If you find the piece of which a

sketch is enclosed, in the box, which my men assure me was duly sent, you will have no difficulty in understanding exactly what way the motor is to be attached to the part A.

As regards the Collimators. I agree with you as to the arrangement of the reticules.

May we expect the order for these collimators soon or will it also have to be deferred for next year's estimates?

As regards the Personal Equation Machine.. I am at present designing this and I require a little information.

It is desirable that the appearance of the reticule or threads should be as nearly as possible the same as they appear in your own transit instrument.

I would be glad therefore if you would send me such information as would enable me to judge of the appearance and size of the threads and the intervals in your transit.

It would be sufficient if you sent me the number of threads, vertical & horizontal, their distances apart in angular quantity; or their distances apart in millimetres and the focus of the transit obj-glass, and finally the magnifying power with which you view them. This would enable me to get the requisite information.

Yours truly G. M. Gill

Telephone No. 1024.

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

Optical and Mechanical Works,

17th of December 1906

4 encs.

Prof. F. Iniguez.

Dear Prof Iniguez,

I am much obliged by your kind and courteous letter of the 13th and remittance for £90 which is very acceptable.

I quite understand the exigencies that arise owing to the changes of Ministry and all the formalities consequent on this, and I shall be perfectly satisfied to leave the matter in your hands and will do whatever you direct me to do in the way of sending receipts and dating them &c.

If you will clearly indicate to me what you require done when the time comes I shall carry out your instructions and do exactly whatever is necessary so as to cause you the least possible inconvenience.

With every kind wish for a happy
Xmas & New Year

Yours Truly
Howard Grubb

A Trubb le 30 Octobre 06.

Je ne me suis bien expliqué sur le moteur électrique de la coupole; nous avons reçu le moteur et les accessoires en Septembre et notre difficulté est sur la maniere de l'instaler.

Nous voyons une piece en fer, dont je vous envoye ci joint un croquis. nous croyons avoir bien compris que le moteur doit etre placé sur la plaque A, la transmision sur B et la piece en bois portant les boules en C. mais sur A nous ne voyons les trous pour les vis des pieds du moteur, et d'autre part la base du moteur est elle plus extense que la plaque A, de sorte que deux des pieds doivent etre placés exterieurement à la plaque A. Est qu'il a quelque piece intermediaire que nous ne voyons? Est que nous devons faire les accessoires indispensables au placement, s'il fait quelqu'un? En fin ce qui plus nous importe est de bien savoir si effectivement le moteur nous a etse place en A, et nous ferons les pieces necesaires, s'il y a besoin. Plus clairement: la base du moteur repose sur la plaque A ou repose sur quelque une des pieces qui montent verticalement sur A et que nous n'avons vu jusqu'a present, puis que nous n'avons pas mis ensemble les

pièces de la coupole ? C'est ce que je veux bien savoir, puisque immédiatement nous aurons besoin de procéder à l'installation, puisque les ouvrages en maçonnerie sont à sa terminaison, et il est très convenient d'avoir bien présentes toutes les dispositions. Je vous prie d'être bien bon pour m'informer sur ces détails.

Quant aux collimateurs. Les lunettes peuvent avoir les cinq ou six pieds de longueur focale que vous désirez afin de faire les objectifs doubles, pas triples: seulement les bases des sustentation des lunettes ne peuvent elles être plus longues que les pierres qui sont destinées à les supporter et dont les dimensions je vous ai données.

Je vois que l'un des collimateurs doit porter uniquement une mire fixe à l'oculaire, avec les corrections générales pour la bien centrer sur l'axe optique de la lunette, l'autre collimateur devant porter les corrections verticale et horizontale des fils avec des vis micrométriques. C'est notre opinion, mais peut être vous avez une autre que nous serions heureux de connaître.

J'ai informé à M. le Ministre de

prix de ces instruments et j'espère avoir
l'autorisation pour les commander.