Circulars from

The Scientific Shop

The Scientific Shop
ALBERT B. PORTER
324 Dearborn Street, CHICAGO

To Our Customers.

ORDERING. In ordering give catalogue number and name. State to whom the goods are to be charged; if to a corporation or school, use regular order forms whenever possible.

TERMS. Our terms are net cash at 30 days, and monthly accounts are payable on the 10th of each month. Overdue accounts are subject to sight draft. No cash discount is given.

Customers not having a credit already established with us will understand the necessity of sending reliable Chicago references or of enclosing remittance to cover the amount of the purchase. Shipments can be made C. O. D. provided a sufficient sum accompanies the order to pay express charges both ways.

REMITTANCES. Remittances should be made by bank draft on Chicago, or by postal or express money order.

PRICES. The prices given in these circulars are net on orders of ordinary size. On quantity orders small discounts can be granted in a few cases.

Customers who are not entitled to duty-free entry of imported apparatus should bear in mind the fact that the customs duty on instruments made chiefly of metal is 45 per cent., while the duty on apparatus made of glass, whether blown, cut, or engraved is 60 per cent. Information relating to duty free importation will be found on the third page of this cover.

INSPECTION. All apparatus is carefully inspected and tested before leaving THE SCIENTIFIC SHOP, but any defect which has escaped us will be rectified on prompt notification.

PACKING. All goods are carefully packed and safe delivery is guaranteed when the choice of route and method of shipment is left to us; under these circumstances any breakage or damage in transit will be promptly made good. If apparatus is damaged in transit we should be advised at once, and the goods should be held pending receipt of our instructions.

Except where specifically mentioned, no charge is made for boxing and cartage.

SHIPPING. In the absence of definite shipping instructions, small orders and delicate instruments will be forwarded by express and large orders will be sent by freight. Parcels sent by mail are at purchaser's risk.

Instruments which are carried in stock are usually shipped within forty-eight hours of receipt of order, and import orders are filled with unusual promptness.

The Scientific Shop

ALBERT B. PORTER

Scientific Instruments 324 Dearborn St., CHICAGO

CIRCULAR 325 OCTOBER 1905

Frederic E. Ives' Optical Novelties and Specialties

The prices below are net, f. o. b. cars at Chicago. *No charge is made for boxing and cartage.*

Ives' New Process Replicas of Rowland's Diffraction Gratings.

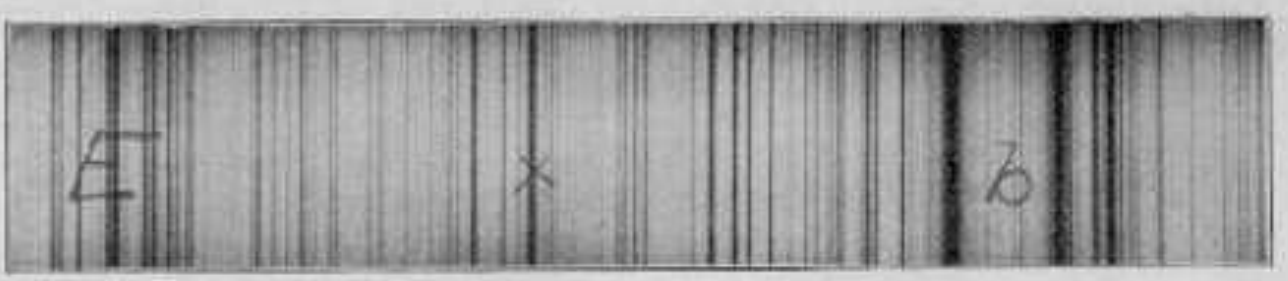
Thorp's method of reproducing Rowland's Diffraction Gratings by making a celluloid cast and mounting it face upward on glass has produced copies good enough for some purposes, but the celluloid film always distorts sufficiently to mar the definition more or less, so that even the best of them define better over some limited portion of their area than over all. They give the best results only when the rays entering the spectroscope are practically parallel, as with direct sunlight without a condenser, and are transmitted through a selected limited portion of the grating. Even then, owing to the scattering of the light, which manifests itself as a pale fringe or halo about the lines in bright-line spectra, the lines of the solar spectrum do not appear as black as with the original Rowland grating. Aside from the stretching of the film, the manner of putting it down and attaching it to the glass causes a slight uneveness of thickness which, by refraction, destroys the perfect parallelism of the emerging rays, and distorts the plane of the diffracting surface, while the difference in refractive index of the celluloid and glass produces disturbing reflections between the two surfaces of the replica. The defects introduced by any one of these sources of error may be slight, but that altogether they are of material importance the result always shows, especially when the grating is used in spectra of the higher orders.

By a remarkable improvement upon this method, Mr. Ives has succeeded in making replicas which give entirely satisfactory definition even when used with high eyepieces in the second order spectrum, and these gratings are so finished that they are no more easily injured than glass prisms.

This improvement is effected (1) by making the cast in a harder and less elastic material than celluloid, (2) by putting it face down upon the glass and forcing it into optical contact therewith, so that the perfect plane of the diffracting surface is preserved, and (3) by sealing it up under another plane glass, with a balsam mixture having the same refractive index as the casting material, so that the perfect parallelism of the transmitted rays is insured, and at the same time the grating is protected from injury.

The Ives Replicas are made from selected, quality A, Rowland Gratings, and will be found equal for most purposes to average originals, besides being more convenient to use in the spectroscope, less liable to injury, and comparatively very low priced. They are sold for less than one-fifth the cost of quality A originals.

A photograph of the E b region of the solar spectrum made with a C 140 replica will be forwarded on application. The b-group lines are well defined, and the print shows more than one hundred lines between E_1 and b_1, i. e., more than two thirds of the lines shown in the same region on Rowland's map made with a six inch concave grating. A half-tone reproduction of this photograph is given on page 2.



Photograph of the E-b region of the solar spectrum, taken with Ives Grating C 140.

Much detail has, of course been lost in reproduction. In the original print the line marked **x**, midway between E and b at wave length 5227 is clearly resolved into a triplet. In testing the gratings all are rejected which do not resolve this line in the second order spectrum. As the D lines are about 20 times as far apart as the adjacent lines in this triplet, it will be seen that these replicas have a resolving power in the second order spectrum 20 times as great as that needed to resolve the D line and ten times that required to show the nickel line between the D's. This is the guaranteed minimum resolving power of the smallest of these gratings. To secure full advantage of this resolving power it is of course necessary to use a good slit, a high eyepiece, and to focus the image of the sun on the slit.

At the apertures for which they are rated, the Ives replicas bear high eyepiecing in the second order spectrum. Gratings No. C. 141 are either made from a special original which yields remarkably "strong" replicas, or present something more than one square inch of ruled surface from a larger original. Minute defects which, like the minute air bubbles always present in the best modern anastigmatic photographic lenses, only cut off an insignificant amount of light, are ignored in No. C. 140 and No. C. 145 replicas.

It should be noted that these gratings throw much more light into the second order spectrum on one side than on the other. Also that, as the price of the replicas precludes the use of glass with surfaces worked with telescopic accuracy, there is usually a right side up and right way around for placing them in the spectroscope in order to obtain the finest definition. Let the label be right side up and facing the eyepiece.

There is a very slight but even shrinkage of the cast replicas, increasing the number of lines to the inch as compared with the originals, which are ruled 15,000 lines to the inch. Conditions have been established which insure a very close approximation to 15,050 lines to the inch, which number may be assumed to be about correct when the exact number is not marked on the binding strip.

Ives' new process replicas of Rowland's diffraction gratings were first offered for sale in December, 1904, and their remarkable quality, freedom from liability to injury and low price, met with an immediate and gratifyng appreciation. Several months' practical experience has developed a still more precise and economical system of manufacture, and more rigid methods of testing have been applied, with the result that a new rating and price list is now given, as follows:

C 140-C141

C 142

C 140. Ives Grating, with about one square inch of ruled surface, sealed between glass plates 2x1½ inches, rated for spectroscopes of 1 inch aperture..... **$5.00**

C 141. Ives Grating, same dimensions as No. C 140 but passing a more rigid test, i. e., high eyepiecing at full aperture..... **6.00**

out is cemented between two 1⅝ inch square 7° prisms. Obviously, the spectra with prism mounts are not perfectly "normal", but this is of no importance except for accurate measurements of wave lengths, and this mounting possesses the advantage that less light is lost by reflection in the second order spectrum, and a faint duplication of the spectra (by reflection) which is apt to appear with strong light when plane glasses are used is eliminated. As the prisms are generally more perfect optically than the most carefully selected plate glass, these replicas give exquisite definition..... **7.50**

C 145. Ives Grating, ruling 1⅜x1⅜ inch, sealed between glass plates 2½ x2 inch, rated for spectroscopes of 1¼ inch aperture..... **9.00**

C 146. Ives Grating, same as C 145, but bearing highest eyepiecing at full aperture..... **12.00**

These gratings all have approximately 15050 lines to the inch.

Cheap Grating Replicas

Owing to the fact that there is a large demand for low priced gratings for purposes which do not call for the high quality which is represented by Mr. Ives' tested standards, and because a percentage of those turned out in the regular course of manufacture have heretofore been destroyed, it has been decided to mark all such which are not used up in the Simplex Spectroscopes "Second Class", and to offer them at half the price of the cheapest standard Ives Replicas. The only guarantee given with these second class replicas is that they can be made to show the nickel line between D_1 and D_2 with direct sunlight without a condenser, and the only advantage claimed for them over average Thorp process replicas is that they are protected from injury by careless handling. The supply is limited.

C 150. Second Class Grating Replica with about one square inch of ruled surface..... **$2.50**

C 151. Second Class Grating Replica with ruled surface 1⅜x1⅜ inches..... **4.50**

Photographic Diffraction Gratings

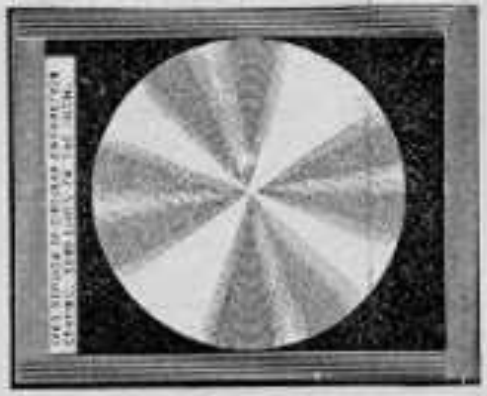
The following photographic diffraction gratings are mounted between plate glasses and sealed after the fashion of lantern slides. They possess great brilliancy and are sufficiently accurate for rough spectroscopic use, measurement of wave lengths by Kelvin's simple method, etc. They are also excellent for projection of spectra with the lantern.

C 153. Photographic Diffraction Grating, ruled surface 2½x2½ inches, 2925 lines to the inch..... **$1.50**

C 154. Photographic Diffraction Grating, ruled surface 1x1 inches, 2925 lines to the inch..... **.75**

Circular Diffraction Grating For Lantern Projection

These photographic gratings have a ruled surface three inches in diameter, with five thousand lines to the inch. By projecting an image of the electric arc upon the screen and then placing the circular grating centrally over the objective a circular rainbow is obtained. These circular gratings are mounted between selected plate glasses, and finished like lantern slides; they show considerable periodic error, which does not, however, injure them for demonstrations with the optical lantern.



C 152

C 152. Circular Diffraction Grating, 3 inches diameter, 5000 lines to the inch..... **$3.00**

Ives Spectroscopes

New, Inexpensive and Efficient Diffraction Spectroscopes for Schools, Students and Amateurs.

The Simplex Spectroscope

A Small Diffraction Spectroscope of Original Design and Construction.

C 133

C 133

The Simplex Spectroscope measures 2x2x8 inches, and weighs eight ounces. It has a sliding focus, an adjustable slit, and is fitted with a small Ives grating replica having 15050 lines to the inch. It is designed to use as a hand spectroscope, with the spectrum spread out vertically instead of horizontally, and the spectra are viewed at an indicated angle from the axis of the tube—about 15° to 25° with the first order spectrum, and 30° to 50° for the second order. The spectrum may also be viewed in the horizontal position if preferred.

With the slit closed enough to show the D, E, b, and F Frauenhofer lines, it gives a brilliant first order spectrum in diffused daylight, suitable for testing the absorption of colored glasses, liquids, photographic color screens, etc. The slit is long enough to permit of covering one half only with colored glasses etc., when testing their absorption.

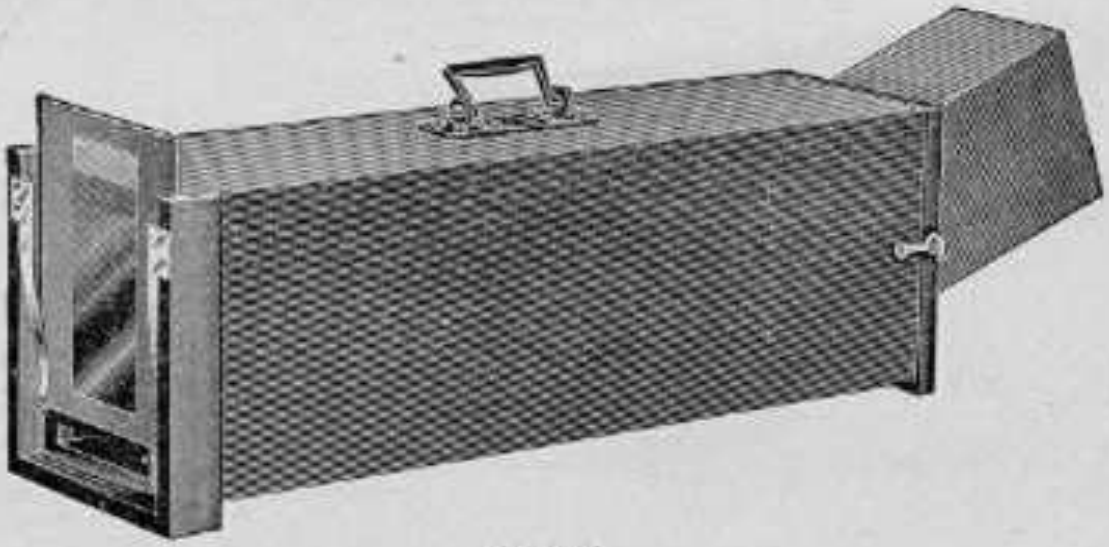
With direct sunlight or electric arc the second order spectrum is equally brilliant when the slit is sufficiently closed to resolve the D line.

A pocket diffraction spectroscope has been placed on the market in England which shows marked inferiority to those made with direct vision prisms because grating replicas give much less brilliant spectra than prisms under similar conditions. Within the limits of size of a pocket spectroscope it is necessary to open the slit very much wider in order to obtain the same amount of light, and the definition is then much less satisfactory. In Ives' Simplex Spectroscope this defect is obviated by using a lens of much longer focus and larger aperture than could be used in a pocket spectroscope so that, with sufficiently open slit to give equally brilliant spectra with diffused daylight, the definition is quite as satisfactory as with the small prismatic pocket spectroscopes, and the following advantages are secured: (1) the spectrum is normal, (2) the second order spectrum is available with direct sunlight or electric arc, with increased resolving power, (3) the cost is about one-half that of the prismatic pocket spectroscopes.

The Simplex Spectroscope is sold at a remarkable low price because it utilizes grating replicas which, while entirely satisfactory for this purpose, are for one reason or another not up to the standard for use in more powerful spectroscopes. It is believed that many teachers in the smaller schools, and many students and experimenters, who might not wish to pay the price of a more costly spectroscope, will appreciate the opportunity thus afforded to obtain a serviceable spectroscope at a very low price. It will also be found to be a very "handy" accessory instrument for those who have large spectroscopes.

C 133. Ives Simplex Spectroscope as illustrated and described..... **$5.00**

Ives' Simplex Spectrograph

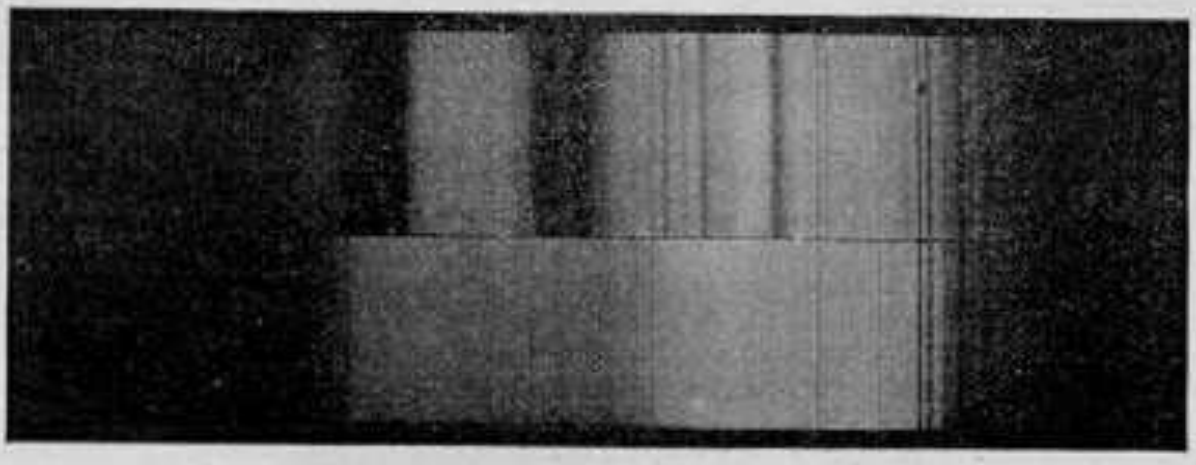


C 134

A substantial fixed focus camera to which a Simplex Spectroscope can be instantly attached for the purpose of making photographs of the spectrum to test photographic sensitive plates and color screens, make records of absorption experiments, etc. Comparison spectra can be readily photographed by covering one-half of the slit during the first exposure, and the other half during the second.

The half-tone cut below was made from a photograph taken in this manner with the Simplex Spectrograph. One-half of the slit was covered by a cell containing a solution of didymium chloride and the exposure was made in diffused daylight. The lower half of the cut shows the solar spectrum while the upper half gives the absorption bands of the salt. The chief Frauenhofer lines are lettered, and the absorption bands are marked thus *. A copy of the original photograph will be sent on application.

* ** *** **



D Eb F G H

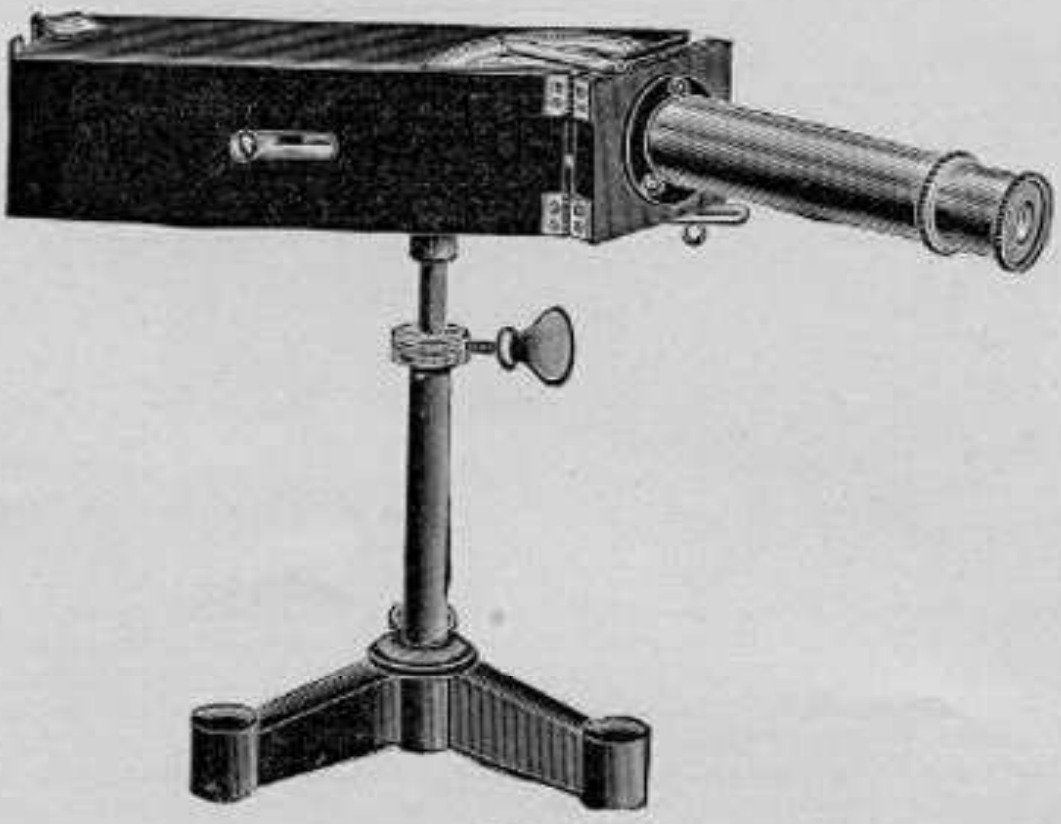
Fig. 134a. Solar spectrum and absorption spectrum of didymium

All Simplex Spectroscopes will give good results with this camera, but when camera and spectroscope are ordered together a special selection of grating replica will be made to secure the very best photographic results.

Made in hardwood, ebonized, with achromatic lens, double plate holder, and ground glass screen.

C 134. Simplex Spectrograph. the camera with plate holder and focusing screen, but without spectroscope..... ..... **$7.50**

Ives' Duplex Diffraction Spectroscope No. 1



C 135

This is essentially a Simplex Spectroscope with the addition of a stand and telescope.

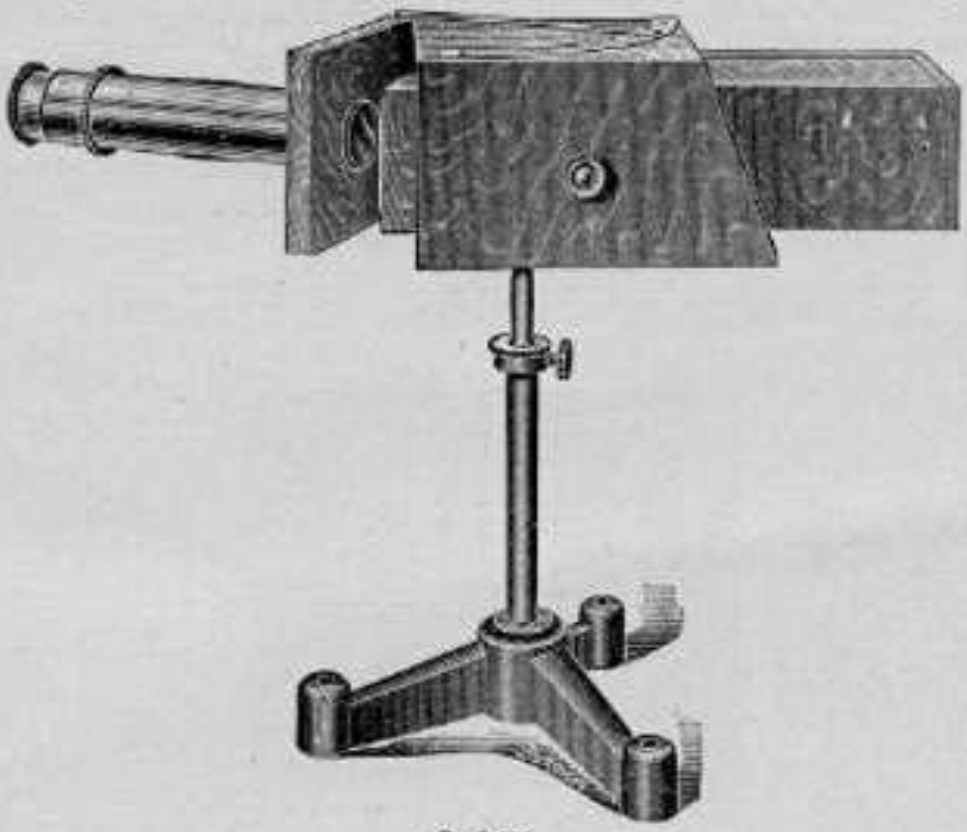
The first order spectrum is all shown at once across the large field of a well-made 2 inch Huygenian eyepiece, and with narrow slit and direct sunlight the D line is shown handsomely resolved. The second order spectrum can be made to show the nickel line between D^1 and D^2, although a higher power eyepiece should be used for this purpose.

This spectroscope is therefore more efficient for many purposes than one of the Bunsen pattern costing from $25 to $50. Its low price is due to the fact that the body is of wood instead of metal, the divided circle is small and simple, being merely intended as a rough index, while the telescope is swung from a convenient point which involves a small optical compromise. By this construction a high degree of efficiency and durability is obtained at low cost.

The Duplex Spectroscope is supplied with an iron tripod stand and a small adjustable mirror for comparison of spectra.

C 135. Ives' Duplex Diffraction Spectroscope No. 1. $15.00

Ives' Duplex Diffraction Spectroscope No. 2

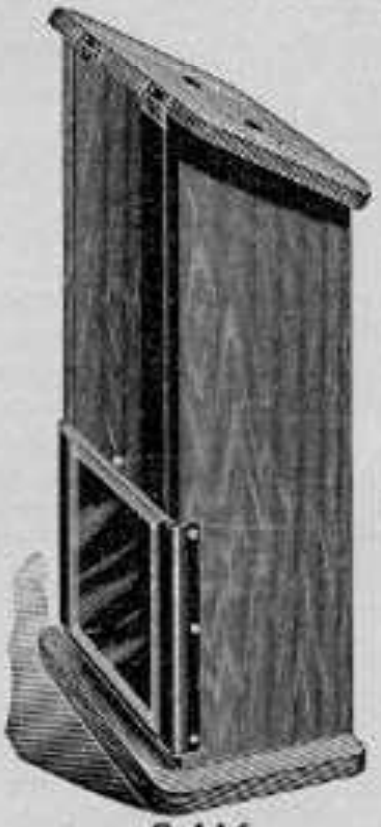


C 136

This instrument differs from the Duplex Spectroscope No. 1 chiefly in being provided with a larger circle, and in having the part corresponding to the Simplex Spectroscope (C 133) made so that it can be readily removed for use as a hand spectroscope or in connection with the Simplex Spectrograph (C 134).

C 136. Ives' Duplex Diffraction Spectroscope No. 2 $20.00

The Ives Fluoroscope



C 116

This is a specially designed dark box with a deep blue glass window, and having viewing apertures faced with pale yellow glass.

Placed near a window in daylight, objects enclosed in the box are almost invisible unless they show green, yellow, orange, or red fluorescence, in which case they appear beautifully self luminous. If direct sunlight is allowed to fall through the blue window, the effect is gorgeous.

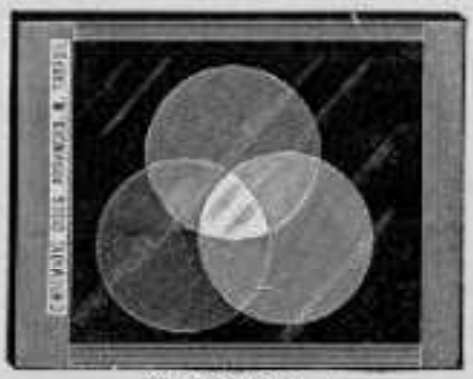
The bottom is hinged so that it can be readily opened to receive the objects. With each Fluoroscope is included a fluorescent photograph, a "jewel" of uranium glass, and three corked tubes of fluorescent dyes.

With some objects, the beauty of the display is enhanced by removing the yellow glass, thus making the objects appear dichroic.

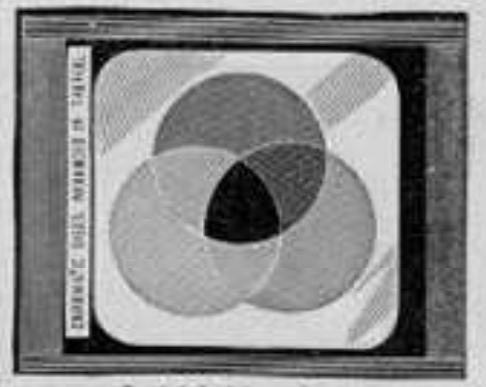
C 116. Ives' Fluoroscope, with fluorescent photograph, jewel of uranium glass, and three tubes of fluorescent dyes **$5.00**

Ives' Color Preparations

C 118



C 120 No. 1



C 120 No. 2

C 118. Set of Coal-Tar Dyes for Absorption Experiments. Eight selected colors in gelatine, in rectangles separated by white spaces, on a 3¼ x 4 inch plate, mounted like a lantern slide. Each rectangle of color is divided into two parts, showing different depths of color. The arrangement is such that with a 1¼ inch slit in the optical lantern, divided spectra can be projected, showing at one time two shades of the same color and white, or either shade of two adjacent colors and white. In most ordinary spectroscopes spectra of any one color and white, or of two shades of any one color, can be seen at one time..... **$2.50**

C 119. A Simpler Preparation of the same colors, in even shades, surrounded by black..... **1.00**

C 120. Chromatic Discs, Arranged in Trefoil. In form of lantern slides. No. 1, illustrating mixture of colored lights, red, green and blue-violet on a black ground, overlapping to make white and the minus colors, peacock-blue, crimson pink, and yellow. No. 2, illustrating superposition of films of transparent color. Minus red (peacock blue), minus green (crimson pink), and minus blue (yellow) overlapping to make black and the plus colors, red, green, and blue-violet. Per pair..... **5.00**

Ives' Parallax Stereogram

A Most Remarkable and Beautiful Optical Novelty

Awarded the only medal in the scientific section of the Royal Photographic Society's annual exhibition.

The Parallax Stereogram is a photographic transparency which, without the use of a stereoscope or any other optical aid, shows the objects photographed in in perfect stereoscopic relief, apparently as solid objects seen through and beyond the glass, or standing in the air in front of the glass. It is an admirable demostration of the principles of stereoscopic vision.

Fig. 454 a

The parallax Stereogram consists of (1) a photographic transparency, which is a line composite of the two images of an ordinary stereoscopic photograph, as shown in Fig. 454a, and on a larger scale, in Fig. 454b, and (2) a cover screen ruled with opaque lines, mounted over the photograph at a suitable distance.

The Photographs are made through a screen ruled with one hundred lines to the inch, the opaque lines being broader than the clear spaces, and a similar screen is used for the cover. The photograph itself has two hundred lines to the inch, the alternate lines belonging respectively to the images intended for the right and left eye. It will be seen that if the cover screen is placed in contact with the photograph, it can be so disposed as to cover all the lines belonging to

one eye, and a single image, like one half of an ordinary stereoscopic photograph will then be seen; and that if the screen is slightly raised above the photograph, either set of lines may be seen at will by looking through the lines at different angles from the perpendicular. In order to obtain stereoscopic vision, the screen is so disposed that from one point of view, owing to parallax of vision, the lines forming the right eye image are seen only by the right eye, and the lines forming the left eye image are seen only by the left eye, as is indicated in Fig. 454c. Under these conditions the flat photograph appears to vanish and to be replaced by a solid object, which may appear to be situated at some distance on the other side of the frame, or suspended between the frame and the eyes. Photographs of large size can be made in this way and, owing to the angle of vision subtended and the absence of any visible optical aid, the results are far more realistic and impressive than by any other means of stereoscopic representation.

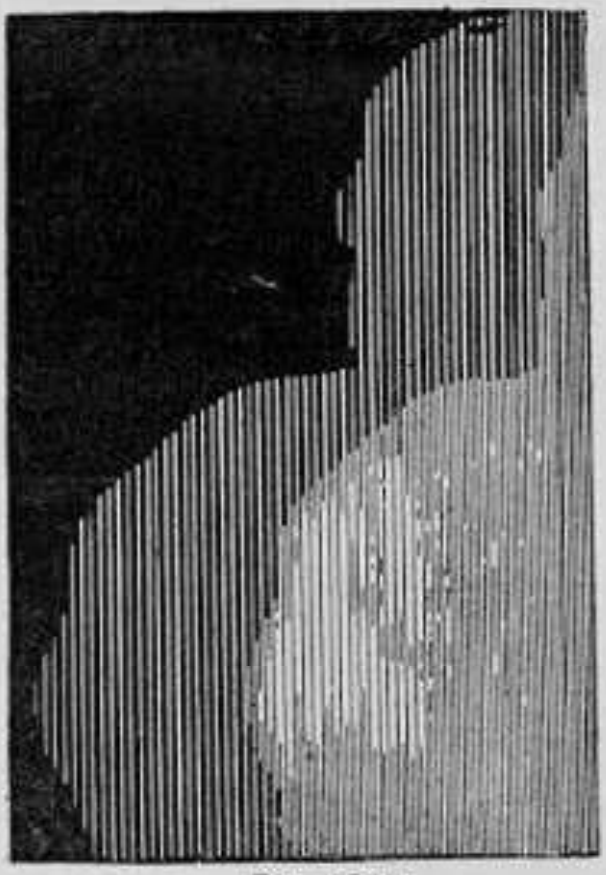


Fig. 454b

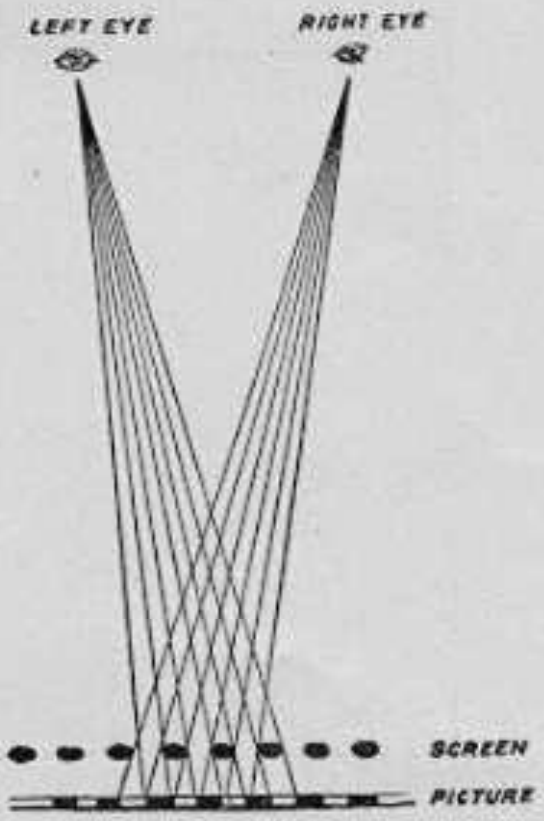


Fig. 454c

The following selections from our list of stock subjects are of a popular character and are particularly well adapted to illustrate the invention.

Those marked * are "retreating" effects; those marked ** "advancing." The view of the moon is not only a striking and interesting subject, but beautifully illustrates pseudoscopic vision by appearing as a hollow hemisphere when the right eye occupies the correct position for the left eye, and vice versa.

Stock Subjects, 6½ x 8½ inches, in oak frame, packed in grooved lid wooden box.

C 450	**President Roosevelt** *	**$5.00**
C 451	**Girl with Violin** *	**5.00**
C 452	**The Moon*** and **	**5.00**
C 453	**The Brigand** (man holding pistol), head*, pistol**	**5.00**
C 454	**Statuette of Girl's Head***	**5.00**
C 455	**Statuette of Girl's Head****	**5.00**
C 456	**Statuette of Man's Figure** with Camera*	**5.00**

Ives' Straight Line Monochromatic Light Apparatus

Collimator with adjustable slit and 10 inch focus lens, direct vision double prism Ives' grating replica, aperture ¾x1 or 1x1 in., 10 in. focus lens on swinging arm to focus parallel rays on slit, all mounted on adjustable iron stand.

This apparatus is of quite novel construction, making it not only simpler and cheaper than anything of the kind heretofore produced, but incomparably more convenient to use, and at the same time capable with sunlight of projecting upon the slit of another spectroscope a large amount of light which is confined to wave-lengths less separated than D_1 D_2.

The replicas used are Ives' second class special, giving remarkably brilliant first order spectra, with resolution and definition quite good enough for this purpose. They are cemented between 16° prisms, thus giving direct vision without lateral displacement of the spot of light, and with straight line adjustments the part of the spectrum utilized is changed by sliding the mount of the collimating lens, which is made of large diameter for this purpose. The convenience and efficiency of this novel method of shifting along the spectrum must be seen to be appreciated. The condensing lens, which swings into and out of position, comes automatically to the exact position necessary to focus parallel rays axially upon the slit, and the focusing lens may be swung out when a broad parallel beam is required for filling the condenser of a microscope or other similar purpose.

A most interesting experiment with this apparatus consists in projecting the parallel rays (preferably of sunlight from a heliostat) through the condenser of a microscope and then observing the comparative resolving power with rays from different parts of the spectrum by slowly sliding the collimating lens in its mount. A 1-5 in. objective, with central light, very handsomely resolves a dry pleurosigma with the blue rays, focusing black and white dots with great crispness, but as the spectrum is shifted, the resolution becomes first woolly, in the yellow green, and finally, in the orange, altogether absent.

This apparatus is ordinarily made with non-achromatic lenses, which are efficient for this purpose, but can be made to order with achromatic lenses, at an advanced price, and can also be made to order in larger sizes. The best replica for critical work is the ¾x1 in., but the 1x1 in. gives an equal amount of light with only slightly less purity, and may be preferred for monochromatic illumination in the microscope.

Prices on application.

In preparation:

Ives' Simplex Clockwork Heliostat.

A Convenient Slide Wire Bridge by Siemens & Halske A.-G.

C 815

C 815. Circular Slide Wire Bridge for rapid measurement of resistances, in closed protective case, with switch-controlled comparison resistances of 0.1, 10, 100, and 1000 ohms, double successive contact key, and terminals for galvanometer and battery. Resistances are read directly on the slide-wire scale. Duty free **$77.50**

A complete price list of Siemens & Halske's electrical measuring instruments will be sent post-free on application.

Duty Free Importation.

The customs duties on scientific instruments of foreign manufacture range from 45 to 60 per cent. The Tariff Act of 1897, however, permits scientific apparatus to be imported free of duty for schools, colleges, and societies incorporated for educational or scientific purposes provided the apparatus is imported in good faith for the use and by the order of the institutions, and not for sale, subject to certain regulations prescribed by the Secretary of the Treasury. The Treasury regulations, which are intended to guard against false entries, are somewhat complicated, and include a tangle of red tape which is exasperating to one who is not in daily touch with the Customs House.

If import orders are placed with THE SCIENTIFIC SHOP these annoyances are borne by us, and but two Government papers reach the customer. The first of these is an oath stating that the apparatus is ordered for the sole use of the institution as its permanent property; the second is a receipt acknowledging delivery of the apparatus. These papers are to be signed by one of the executive officers of the institution or of its Board of Trustees.

Moreover, much expense is saved by placing import orders with THE SCIENTIFIC SHOP; this for several reasons. Handling as we do the entire foreign purchases of many institutions, the volume of our business enables us to secure low freight rates. Our shipments come in by weekly steamers and it is not unusual for one consignment to be larger than the annual purchases of any one institution. In this way the entry fees and other incidental expenses are divided among many orders instead of being borne by but one. Most foreign mechanicians list in their catalogues many pieces of apparatus made by others. We study the sources of supply and, when we are given liberty to do so, we attempt to place the orders with the actual makers and thus give our customers better prices. Our profits come from trade discounts or commissions which are not granted to the consumer.

Our offices are within three minutes walk of the Custom House and the Appraisor's Stores so that we can personally oversee the examination of shipments of delicate instruments. All boxes from abroad are delivered to our shipping room and are there inspected and repacked. We are thus in position to guarantee delivery of imported apparatus in good order.

We have in our files some hundreds of catalogues which cover the entire field of foreign and domestic apparatus. These files are carefully indexed and kept up to date. The information in these catalogues is at the disposal of our customers, and we shall be glad to quote prices on any apparatus from any maker.

Foreign Physical Apparatus.

Among the many foreign instrument makers whose products are imported by THE SCIENTIFIC SHOP, the following representative firms may be mentioned.

W. Apel
Georg Bartels
Brin's Oxygen Co.
Paul Bunge
Cambridge Scientific Instrument Co.
Dr. M. Th. Edelmann
Elliott Bros.
F. Ernecke
R. Fuess
F. O. R. Goetze
L. Golaz
Sir Howard Grubb
Emil Gundelach
Hartmann & Braun A. G.
Hans Heele
H. Hensoldt & Soehne
W. C. Heraeus
Jas. J. Hicks
Adam Hilger
Keiser & Schmidt
Kelvin & Jas. White
Fr. Klingelfuss & Co.
Max Kohl
A. Kruess
Leppin & Masche
E. Leybold's Nachfolger
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