

The "Reichsanstalt" Standard Laboratory Photometer. Prices and further particulars furnished upon request.

Catalogue 175.

**Abridged Catalogue of** 

# **Electrical Measuring Instruments**

and other

# **Scientific Apparatus**

ISSUED BY

**JAMES G. BIDDLE**

DEALER, MANUFACTURER'S AGENT AND IMPORTER

DREXEL BUILDING

PHILADELPHIA

October, 1896

# Announcement.

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IT is hoped that this illustrated pamphlet will prove of interest to all who appreciate the best types of Scientific Instruments. No attempt whatever has been made to render it complete or connected, and particular attention is desired to the list of catalogues and circulars on page 23 which should be consulted before extensive purchases are made.

Most of the apparatus which we now describe is made by Messrs. Elmer G. Willyoung & Co., who enjoy excellent facilities for high class instrument work.

Also as Special Selling Agent for The Electric Storage Battery Co., Weston Electrical Instrument Co., Société Genevoise, Elliott Bros. and James White, brief reference is made to goods of their manufacture, for the purpose of drawing notice to our connection with them.

Our constant aim is to establish such relations with reputable manufacturers, that we can *entirely equip* Scientific Laboratories, or supply particular instruments of any design and make. In this connection it will give us pleasure to name as references the considerable number of prominent colleges and schools that have been valued customers during the past year.

We make a particular feature of "Duty Free" importations from Europe and wish to submit propositions for furnishing apparatus from *any Foreign Scientific Instrument Maker*.

JAMES G. BIDDLE.

PHILADELPHIA, October 1st, 1896.

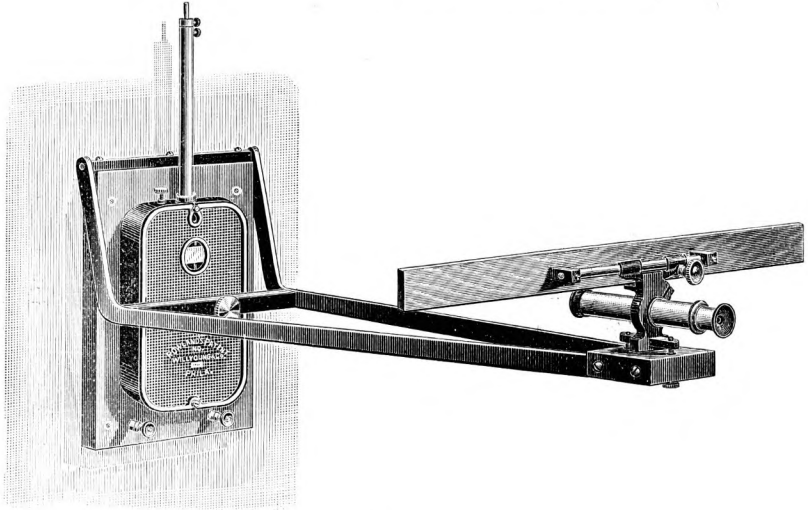
## CHANGE IN PRICES.

Since Catalogue 160 was issued in April, Messrs. Willyoung & Co. have found it possible to *reduce* the prices of certain instruments, while in some cases an *increase* has been necessary.

The revised prices which follow are correct (subject to change without notice), and other instruments not mentioned on this page will remain as listed in the above named Catalogue.

B1000.	<b>1=3 Micro-farad Condenser</b>	Grade B	\$35 00
B1001.	<b>1=2</b> " " " " " " " " " " " "	" B	40 00
B1012.	<b>Carhart Electrometer</b>	" B	100 00
B1013.	" " " " " " " " " " " "	" B	75 00
B1028.	<b>Kelvin Galvanometer</b>	" A	75 00
B1028.	" " " " " " " " " " " "	" B	60 00
B1029.	" " " " " " " " " " " "	" A	67 50
B1029.	" " " " " " " " " " " "	" B	57 50
B1030.	" " " " " " " " " " " "	" A	72 50
B1030.	" " " " " " " " " " " "	" B	60 00
B1031.	<b>Interchangeable Coils</b>	" A	27 50
B1031.	" " " " " " " " " " " "	" B	18 00
B1032.	" " " " " " " " " " " "	" A	20 00
B1032.	" " " " " " " " " " " "	" B	15 00
B1033.	" " " " " " " " " " " "	" A	22 50
B1033.	" " " " " " " " " " " "	" B	18 00
B1034.	<b>Ballistic Galvanometer</b>	" A	75 00
B1034.	" " " " " " " " " " " "	" B	60 00
B1092.	<b>Improved Meter Bridge</b>	" A	60 00
B1092.	" " " " " " " " " " " "	" B	50 00
B1108.	<b>One One-hundredth Ohm Standard</b>	" B	40 00
B1116.	<b>Resistance Box and Wheatstone Bridge</b>	See page 7	
B1122.	<b>Standard Resistance Box and Bridge</b>	Grade A	130 00
B1122.	" " " " " " " " " " " "	" B	110 00
B1130.	<b>50000 Ohms Resistance Coil</b>		25 00
B1131.	<b>100000</b> " " " " " " " " " " " "		32 50
B1133.	<b>500000 Ohms Resistance Box</b>		125 00
B1134.	<b>Megohm Resistance Box</b>		200 00
B1136.	<b>100000 Ohms Resistance Box</b>	Grade A	100 00
B1136.	" " " " " " " " " " " "	" B	80 00
B1141.	<b>Double Plug Key</b>		6 00
B1142.	<b>Three-Way Key</b>		5 50
B1143.	<b>Single Contact Key</b>		5 00
B1145.	<b>Short Circuit Key</b>		6 50
B1185.	<b>Secohmmeter</b>		60 00
B1201.	<b>Electrodynamometer</b>	Open form	40 00
B1202.	" " " " " " " " " " " "	" "	40 00
B1203.	" " " " " " " " " " " "	" "	50 00
B1204.	" " " " " " " " " " " "	" "	90 00

## Rowland D'Arsonval Galvanometers, WITH READING TELESCOPE AND SCALE.



B1040.

The Rowland D'Arsonval Galvanometer is the invention of Prof. Henry A. Rowland, of Johns Hopkins University, and although placed upon the market only one year ago, it has been sold to a large number of leading colleges and technical schools of the country. A new and improved design has recently been completed, and as now made it is the most convenient, compact and reliable form of D'Arsonval Galvanometer, as well as the lowest in price. It has *proportional scale divisions*, great *deadbeatness*, *short period*, and *high sensibility*; is complete with *telescope and scale*, and all parts are made with standard jigs and are interchangeable. A special illustrated, descriptive circular (No. 135), mailed upon request.

B1040.	<b>Rowland D'Arsonval Galvanometer</b>	. . . . .	\$30 00
	About 1500 ohms resistance and 300 megohms sensibility. Deadbeat, proportional scale, interchangeable coils. <i>Complete with telescope and scale.</i>		
B1041.	Same as B1040, but with low resistance coil for thermal work	. . . . .	32 50
B1042.	Same as B1040, but with ballistic coil	. . . . .	30 00
B1043.	Coil only of B1040, with damper and mirror	. . . . .	5 00
B1044.	“ “ B1041, “ “ “ spec'l suspens'n	. . . . .	7 00
B1045.	“ “ B1042, with mirror	. . . . .	5 00
B1046.	Same as B1040, but <i>without telescope and scale</i>	. . . . .	22 50
B1047.	“ B1041, “ “ “ “	. . . . .	25 00
B1048.	“ B1042, “ “ “ “	. . . . .	22 50

# Rowland D'Arsonval Galvanometers.

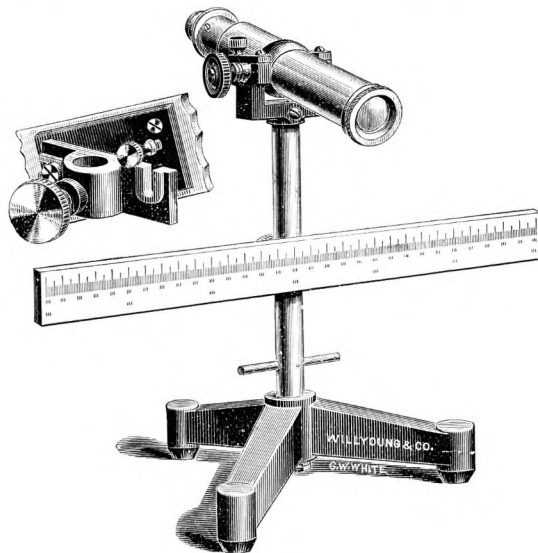
## TABLE FORM.



B1051.

B1051.	<b>Rowland D'Arsonval Galvanometer</b> , table form . . . . .	\$25 00
	Resistance of coil 1500 ohms; sensibility about 300 megohms.	
B1052.	Same as B1051, but with low resistance coil for thermal work . . . . .	27 50
B1053.	Same as B1051, but with ballistic coil . . . . .	25 00
B1054.	Coil only of B1051, with damper and mirror . . . . .	5 00
B1055.	“ “ B1052, “ “ “ spec'l suspens'n . . . . .	7 00
B1056.	“ “ B1051, with mirror . . . . .	5 00

## Laboratory Reading Telescopes.



B1074.

These Telescopes have been recently designed to fill the demand for an optically good instrument, simple in its adjustment, capable of giving good results even for the most exact purposes, and at a reasonable price. The clearness and definition in every case will be found very perfect.

B1073. **Student's Reading Telescope** . . . . . Grade B \$15 00

Has altitude and azimuth adjustments and lateral rack and pinion adjustments of scale; aperture 15 mm; magnifying power, 12 to 15. Reads down to 60 cms distance from galvanometer. Of metal throughout. Complete with 50 cm scale.

B1074. **"Universal" Reading Telescope** . . . . . \$25 00

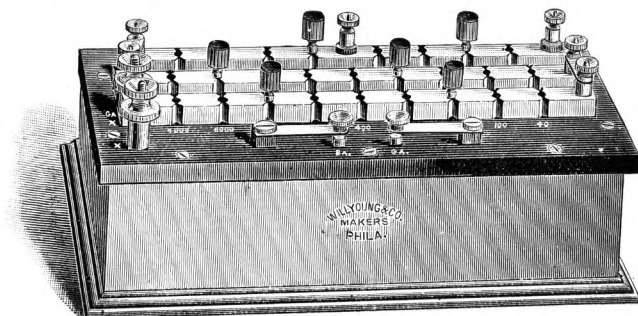
Constructed of brass; lacquered throughout, except base, which is japanned. Adjustments for altitude and azimuth, vertical rise and fall of scale, rack and pinion adjustment of telescope, and independent movement of eye-piece to secure distinct focus of cross hairs. Magnifying power 20; aperture 25 mm. Complete with 50 cm scale.

B1075. Same as B1074, but without rack and pinion draw, Grade B 20 00

B1075½. **Unmounted Reading Telescope** . . . . . 6 00

As furnished with Rowland D'Arsonval Galvanometer B1040, but without support of any kind.

## Resistance Boxes and Wheatstone Bridges.



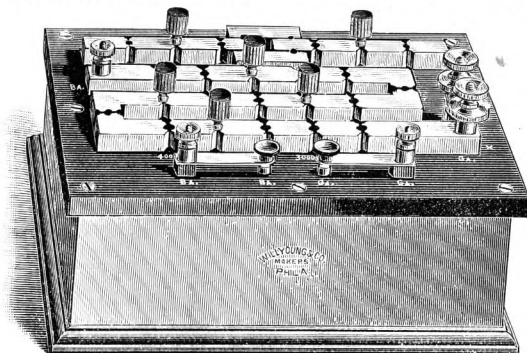
B1117.

B1116. **Resistance Box and Wheatstone Bridge** . . . Grade B. \$50 00

Fourteen coils of platinoid wire—0.5, 1, 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300 and 400 ohms; total resistance 1111.5 ohms. Also Bridge Arms 1, 10, 100 and 1000 ohms on each side, and keys for battery and galvanometer. In mahogany box with brass segments mounted on hard rubber. Accurate to within  $\frac{1}{5}$  of 1%.

B1117. **Resistance Box and Wheatstone Bridge** . . . Grade B. 65 00

Same as B1116, with addition of four rheostat coils—1000, 2000, 3000 and 4000 ohms, making eighteen coils with total resistance of 1111.5 ohms.



B1122.

B1122. **Standard Resistance Box and Bridge** . . . . Grade A \$130 00

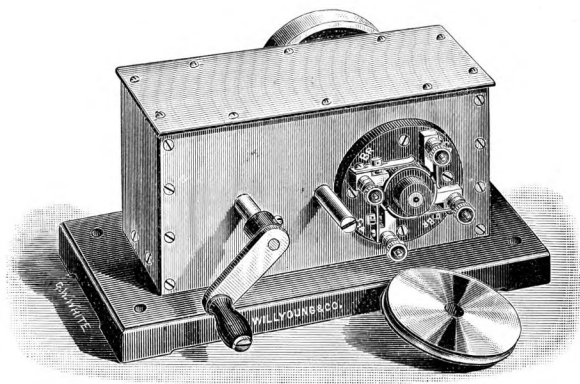
“ B 110 00

Eighteen coils of platinoid wire—0.5, 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400, 1000, 2000, 3000, 4000 and 10000 ohms, total resistance 21110.5 ohms. Bridge arms 1, 10, 100 and 10, 100, 1000 ohms, with reversing device to secure same result as from eight coils. Galvanometer and battery keys, also two plug binding posts for isolating particular coils. In mahogany box with brass segments upon dull finished hard rubber top. Rheostat coils accurate to within  $\frac{1}{25}$  of 1%; bridge coils accurate to within  $\frac{1}{50}$  of 1%.

For other types of Resistance Boxes, see Circular 160.



## Self-Induction Apparatus.



B1185.

**B1185. Secohmmeter** . . . . . Grade B. \$60 00

An improved form of the well-known instrument of Profs. Ayrton and Perry, recently designed by Messrs. Willyoung & Co., with the advice of Professor H. A. Rowland. The Secohmmeter will: 1. Compare two coefficients of self-induction; 2. Compare two capacities; 3. Compare two co-efficients of mutual induction; 4. Measure, absolutely, a co-efficient of self-induction; 5. Measure the actual resistance of a polarizable electrolyte, as well as serve for a large number of other determinations. The instrument consists, essentially, of two commutators mounted upon the one shaft, with *fly wheel* to steady speed and allowing both battery and galvanometer of a Wheatstone's bridge arrangement to be commuted at any desired speed from 300 to 6000 per minute and at an adjustable interval as regards themselves. *The apparatus may be driven by hand or motor as desired.*

**B1186. Profs. Ayrton and Perry's Variable Standard of Self-Induction**  
Grade B \$100 00

Reading direct in Milli-Henrys; range of variations from 3.5 to 35 M. H's. Of mahogany, built up to prevent warping.

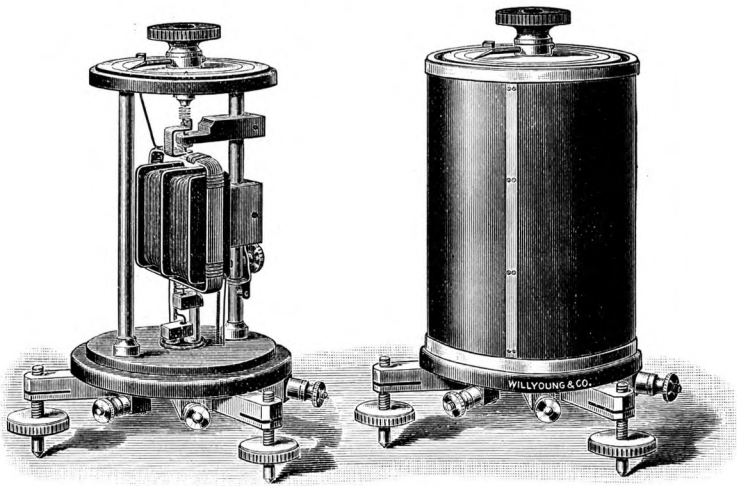
**B1187. Standard of Self-Induction** . . . . . Grade B \$30 00

Of one fixed value. Mounted in case like ordinary resistance; any value desired from 1 to 100 M. H's.

**B1188. Standard of Self-induction** . . . . . Grade B \$60 00

With four fixed values of 10, 20, 30 and 40 M. H's, and arranged with plugs like a resistance box. If desired, any or each of these values may be anything from 1 to 100 M. H's without increased cost.

## Electro-Dynamometers.



B1200 or B1200½.

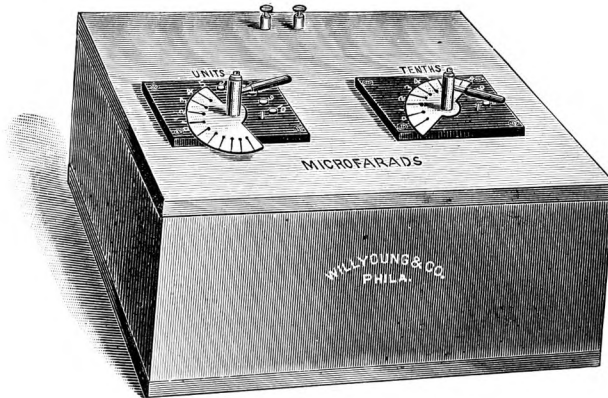
The Electro-Dynamometer is generally recognized as the only actual *standard* for *alternating* current measurements. Being also applicable to direct current tests, the range of usefulness is very great. Nos. B1200 and 1200½ are of new design, built especially to measure *very small* currents, with high degree of accuracy. The higher ranges are constructed on the usual "open form" style, with silk suspension for movable coil.

B1200.	<b>Electro-Dynamometer</b>	0.02 to 2 amperes,	. . . . .	\$55 00
B1200½.	" "	0.025 to 5	" . . . . .	60 00
B1201.	" "	0.2 to 20	" . . . . .	40 00
B1202.	" "	1. to 60	" . . . . .	40 00
B1203.	" "	5. to 200	" . . . . .	50 00
B1204.	" "	10. to 500	" . . . . .	90 00

Upon request, prices quoted for Electro-dynamometers made by Messrs. Siemens Bros. & Co., of London.

## Willyoung Adjustable Condensers.

For Alternating Current and other experimental purposes,  
X-Ray Photography, etc.



B1513.

These Condensers are capable of "standing up" continuously and without injurious heat effect, on *500 volts alternating* circuits. Direct currents of much greater potential can be safely used.

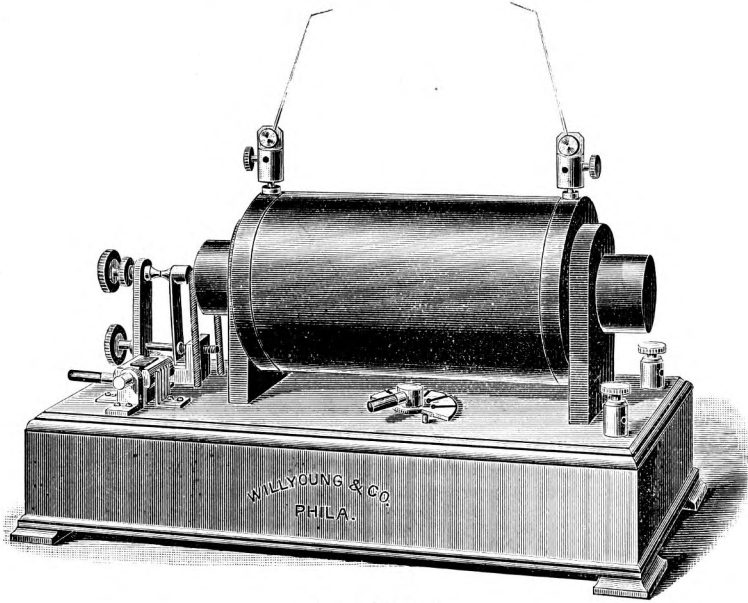
### CONDENSERS OF SINGLE VALUE.

B1500.	<b>1 Micro-farad Capacity</b> . . . . .	\$10 00
B1501.	<b>5 Micro-farads Capacity</b> . . . . .	20 00
B1502.	<b>10 Micro-farads Capacity</b> . . . . .	30 00

### WILLYOUNG ADJUSTABLE CONDENSERS.

B1510.	<b>1 Micro-farad Capacity</b> ; 10 sections of 1-10 M. F. each . . .	\$35 00
B1511.	<b>10 Micro-farads Capacity</b> ; 10 sections of 1 M. F. each . . .	42 50
B1512.	<b>100 Micro-farads Capacity</b> ; 10 sections of 10 M. F. each . . .	250 00
B1513.	<b>10 Micro-farads Capacity</b> ; 10 sections of 1-10 M. F., and 9 sections of 1 M. F. each . . . . .	60 00
B1514.	<b>100 Micro-farads Capacity</b> ; 10 sections of 1-10 M. F., 10 10 sections of 1 M. F., and 9 sections of 10 M. F. each . . .	350 00
B1515.	<b>100 Micro-farads Capacity</b> ; 10 sections of 1-10 M. F., and and 9 sections of 10 M. F. each . . . . .	300 00

## Willyoung Induction Coils.



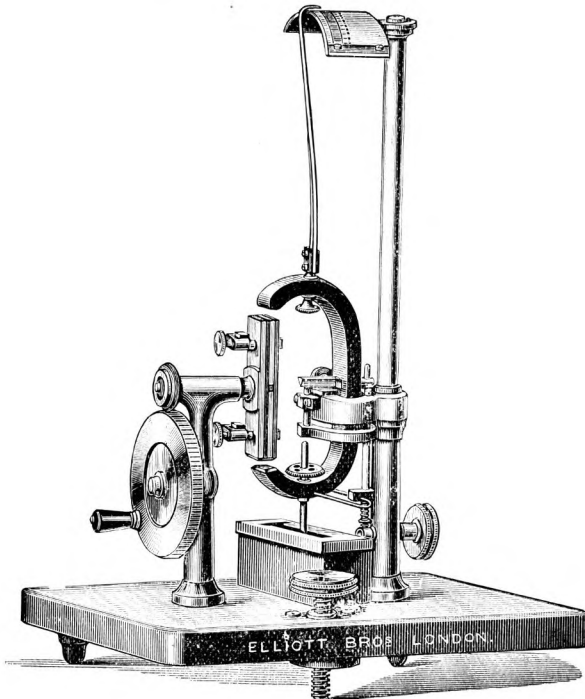
B1525 with B1540.

These Induction Coils have been designed in response to a demand for such apparatus of *highest* quality. They are guaranteed to give the full specified spark continuously, without danger of breakdown or other injury. The "secondary" in each coil is wound in many sections, insulated separately by a process original and very effective. An improved form of Apps "hammer-head" permits extremely minute adjustments of the vibrator to be made. A reversing and circuit closing switch is attached to the base of each coil.

The **Adjustable Condenser** (furnished only with Willyoung coils), enables the discharge to be varied gradually and with perfect control, exactly as a dynamo is regulated by a rheostat.

B1525.	<b>Willyoung Induction Coil ;</b>	2 inch spark	.....	\$40 00
B1526.	"	" 3 "	.....	60 00
B1527.	"	" 4 "	.....	85 00
B1529.	"	" 6 "	.....	100 00
B1531.	"	" 8 "	.....	125 00
B1533.	"	" 10 "	.....	160 00
B1535.	"	" 12 "	.....	200 00
B1540.	<b>Adjustable Condenser.</b>	<i>Extra</i>	.....	25 00

## Prof. Ewing's Magnetic Tester.



B1600.

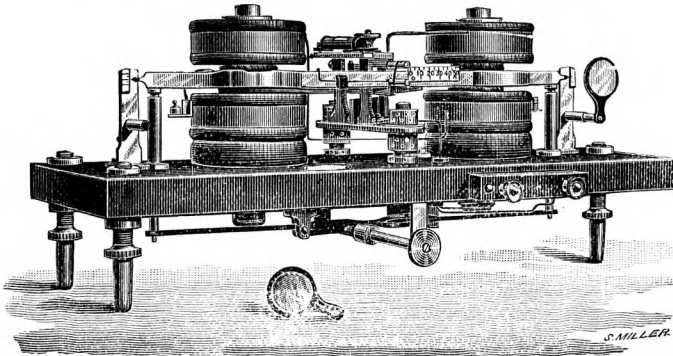
B1600. **Prof. Ewing's Magnetic Tester** . . . . . £25

This instrument (manufactured by Elliot Bros. London), meets the want which has been felt of a means for testing magnetic quality in a simple and expeditious way. Suitable for workshop as well as laboratory use. Its special application is in testing transformer plates, or plates of dynamo armatures.

For a full description see Prof. Ewing's Paper in the *Journal of the Institution of Electrical Engineers* (London), April 25th, 1895.

*One hundred and fifty page Illustrated Catalogue* (E-4), of Electrical and Scientific Apparatus made by Elliott Bros., mailed free upon receipt of 15 cents to pay postage.

## LORD KELVIN'S Standard Electric Balances.



B1703.

B1700.	<b>Centi-ampere Balance</b> ; range 1 to 100 centi-amperes . . .	\$240 00
B1701.	<b>Deci-ampere Balance</b> ; range 1 to 100 deci-amperes . . .	240 00
B2702.	<b>Deka-ampere Balance</b> ; range 1 to 100 amperes . . .	240 00
B1703.	<b>Hekto-ampere Balance</b> ; range 6 to 600 amperes . . .	240 00
B1704.	<b>Kilo-ampere Balance</b> ; range 25 to 2500 amperes . . .	400 00
B1705.	<b>Watt Balance</b> for 100 amperes . . . . .	240 00
B1706.	<b>Watt Balance</b> for 600 amperes . . . . .	240 00
B1707.	<b>Watt Balance</b> for 2000 amperes . . . . .	280 00
B1708.	<b>Composite Kilo-ampere Balance</b> , for directing currents ; can be used in conjunction with Centi-ampere Balance, to measure currents from 0.1 to 5000 amperes, or as a Wattmeter . . . . .	280 00
B1710.	<b>Composite Balance</b> ; can be used as Wattmeter, Voltmeter, Centi-ampere Balance and Hekto-ampere Balance, to measure from 0.2 to 500 amperes . . . . .	280 00
B1711.	<b>Resistances for use with Centi-ampere Balance</b> , and Composite Balance when used as Voltmeters . . . . .	48 00

RESISTANCES FOR USE WITH WATT BALANCES

B1712.	For use on circuits up to 200 volts . . . . .	48 00
B1713.	“ “ “ 2000 “ . . . . .	112 00

For Special Price List of Lord Kelvin's Instruments see Circular 145.

*Special "Duty Free" Prices quoted to Colleges upon request.*

## The Waterman Calorimeter.



B1800.

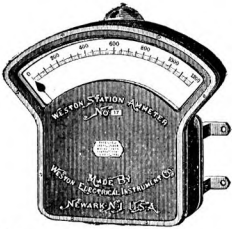
B1800. **Waterman Calorimeter** . . . . . \$70 00

This improved apparatus, designed by and made under authority of Mr. F. A. Waterman, Princeton University, permits application of the "method of mixtures," with great accuracy, in determining specific heat of solids. A little practice in manipulation of the calorimeter enables the operator to keep the cup practically at its initial temperature throughout each determination, thus obviating the use of radiation correction and "water equivalent" of the cup. Also, the electric heater permits the heating of the body under investigation to any temperature ordinarily desired.

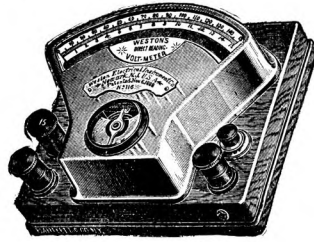
The Calorimeter is well calculated for student use as well as for research work, for which its wide range of application makes it especially suitable.

For detailed description of the apparatus and method of use, see paper by Mr. Waterman: "An Improved Calorimeter for the Application of the Method of Mixtures" in *The Philosophical Magazine*, London, November, 1895, and "The Specific Heats of the Metals" in *The Physical Review*, New York, November, 1896.

## Weston Standard Voltmeters, Ammeters, Wattmeters and Ohmmeters.



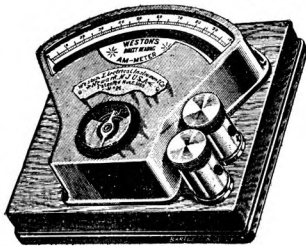
Illuminated Dial Ammeter.



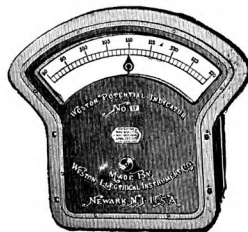
Portable D-C Voltmeter.



Portable A and D-C Voltmeter.



Portable D-C Ammeter.



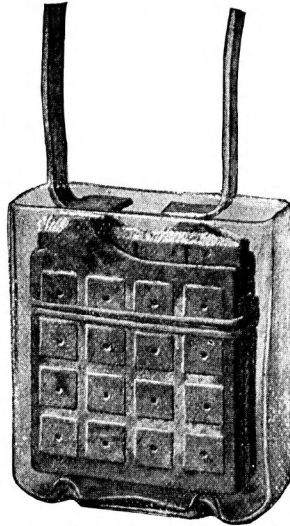
Illuminated Dial Voltmeter.

Interested parties are requested to send for *Illustrated Catalogue "X,"* which contains the most complete and correct list of apparatus made by the Weston Electrical Instrument Co., that has yet been published. As *Selling Agent* for these standard instruments we are in position to furnish them to colleges and the trade in general at regular factory prices, and shall be glad to give any further particulars that may be desired.

*Orders for Weston Instruments are especially solicited.*



## The "Chloride Accumulator."



Element in Glass Jar.

### ABRIDGED PRICE=LIST.

Number of plates <b>Type "B"</b> . . . . .	<b>3.</b>	<b>5.</b>	<b>7.</b>	
Discharge in Amp. for eight hours . . . . .	5/8.	1 1/4.	1 7/8.	
Price for Element and Glass Jar . . . . .	\$1.65	\$2.90	\$4.15	
Number of plates <b>Type "C"</b> . . . . .	<b>3.</b>	<b>5.</b>	<b>7.</b>	
Discharge in Amp. for eight hours . . . . .	1 1/4.	2 1/2.	3 3/4.	
Price for Element and Glass Jar . . . . .	\$2.40	\$3.75	\$5.30	
Number of plates <b>Type "D"</b> . . . . .	<b>3.</b>	<b>5.</b>	<b>7.</b>	<b>9.</b>
Discharge in Amp. for eight hours . . . . .	2 1/2.	5.	7 1/2.	10.
Price for Element and Glass Jar . . . . .	\$3.75	\$5.75	\$7.50	\$9.40
Number of plates <b>Type "E"</b> . . . . .	<b>5.</b>	<b>7.</b>	<b>9.</b>	<b>11.</b>
Discharge in Amp. for eight hours . . . . .	10.	15.	20.	25.
Price for Element and Glass Jar . . . . .	\$9.00	\$12.85	\$16.20	\$20.00

Bolt connectors lead covered, each . . . . . 25 cents.

For *complete price-list* of all sizes of the "Chloride Accumulators," see Circular 155; free upon request.

The Electric Storage Battery Co. has appointed us *Special Selling Agent for Educational Institutions.*

## Student Laboratory Spectrometers.

MADE BY SOCIÉTÉ GENEVOISE, GENEVA.



B1850.

**B1850. Student Laboratory Spectrometer . . . . . \$75 00**

Handsomely finished in lacquered brass, except base, which is japanned. Circle 13 cm. diameter; divided on brass to  $\frac{1}{2}^\circ$ , reading by vernier to  $1'$ . Table with movement independent of circle, and support for prism adjustable by three screws. Aperture of telescope and collimator, 20 mm; focal distance, 135 mm.; with flint glass prism 35 mm. across face.

**B1851. Laboratory Spectro-Goniometer . . . . . \$100 00**

Same style and quality of workmanship as B1850. Circle 15 cm. diameter, divided on silver to  $\frac{1}{6}^\circ$ , reading by verniers and magnifiers to  $20''$ . The circle, table and support for prism or crystal have motion independent of each other. Aperture of telescope and collimator 22 mm, the former with Zeiss mirror ocular. With flint glass prism 35 mm. across face.

**B1852. Support for Crystal . . . . . \$27 50**

When used in conjunction with B1850 or B1851, goniometric measurements by "reflection" can be made.

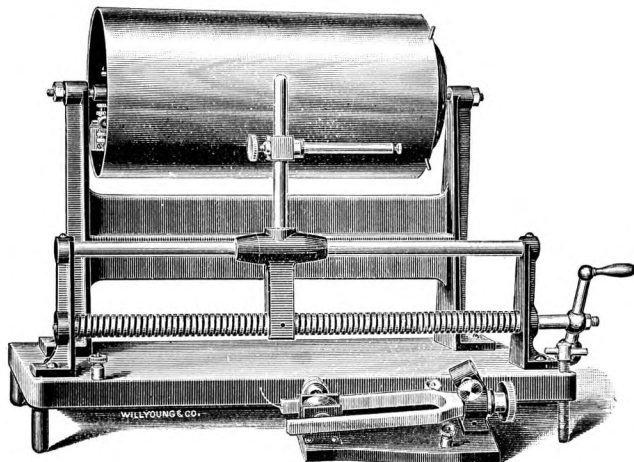
**B1853. Holder for Rowland Diffraction Grating . . . . . \$9 00**

Fitted to B1850 or B1851. Will hold a  $\frac{1}{4}$  inch grating.

As *Selling Agent* for apparatus made by the *Société Genevoise*, particular attention is given to the importation of their *Standard Physical Instruments; 1896 Descriptive Catalogue* (printed in French), 172 pages, mailed free to intending buyers.

*Special "Duty Free" Prices quoted to Colleges and Schools.*

## Scripture's Revolving Drum.



S1 and S1½.

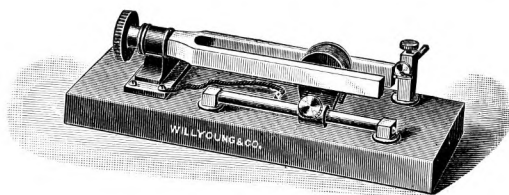
S1. **Scripture's Revolving Drum** . . . . . \$50 00

A brass cylinder 12 in. long and  $6\frac{1}{4}$  in. diameter, is supported above a solid metal base; at one end is grooved pulley with milled rim, so that the drum may be revolved by pulley or hand. Upon the base in front of the drum are two metal ways in which slides a vertical stand arranged to take the time marker (S6). This stand is moved along the ways at any designed speed by means of a screw of 4 threads to the inch, one end of which works in a fixed bearing, while the screw itself passes through the base of the stand as a nut. A small handle upon the end of the screw allows it to be rotated and the slide advanced at any desired rate. Records may be made either upon the drum itself by smoking its surface, or upon a sheet of glazed paper, also smoked, stretched around the drum and its ends glued together.

S1½. **Electrical Tuning Fork** . . . . . \$14 00

Arranged to mark directly upon the Drum of S1; 200 vibrations per second.

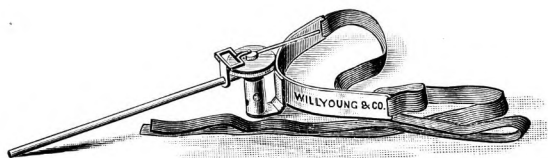
## Scripture's Electric Fork, Etc.



S5A.

S5A. **Scripture's Electric Fork** . . . . . \$16 00

Tuning Fork of 200 vibrations per second, mounted upon wooden stand. Dry contact only. The end of one prong is polished, to render the fork available for manometric flame experiments.



S18 and S19.

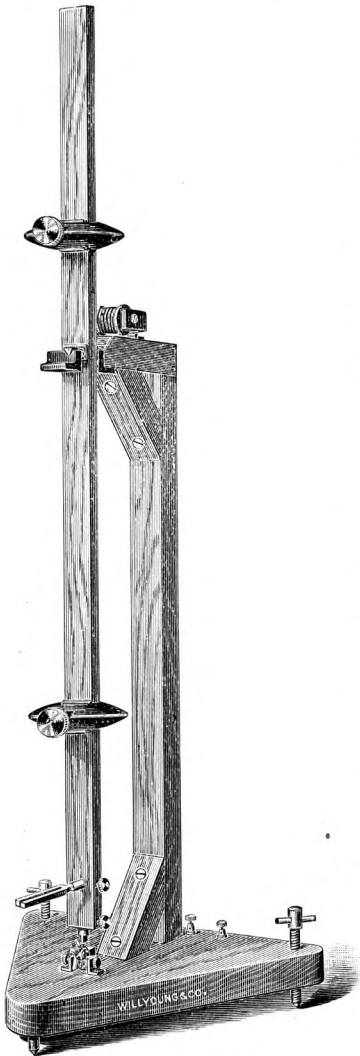
S18. **Marey Tambour** . . . . . \$5 00

New design, very light and durable. The rubber diaphragm can be quickly replaced. Handsomely finished in nickel plate.

S19. **Tongue Attachment for Tambour** . . . . . \$4 00

This consists of a device which may be held against the chin by a light band passing around the neck, and which is itself arranged to hold a tambour. The tip of the tongue rests against a light stud projecting from a tambour, so that a record of the tongue's steadiness may be obtained. Handsomely finished in nickel plate.

## Improved Psychological Pendulum.



S72 with S73 and S74.

S72. **Improved Psychological Pendulum** . . . . . \$15 00

Pendulum of ash, one meter long, swinging upon hardened steel knife edges in hardened steel bearings. Wide variations in rate of swing may be obtained by use of two adjustable lead bobs.

A contact point is so arranged that an electrical circuit is instantaneously opened or closed at each swing.

S73. **Tuning Fork** . . . . . 2 50

Addition to S72, converting it into a "Fork Pendulum," for the experiment of §64b "*Experimental Psychology*," Part I, by Dr. Sanford.

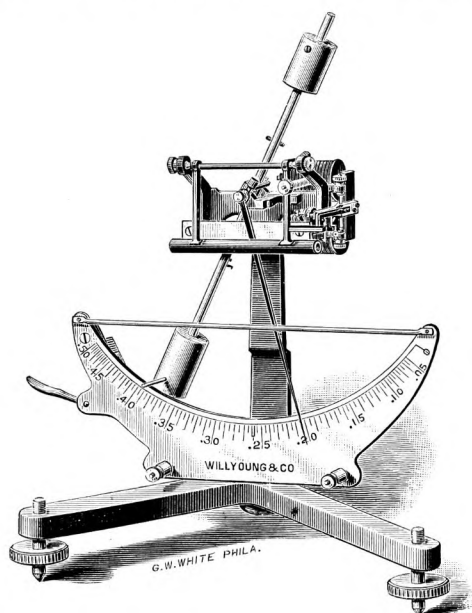
S74. **Electrical Maintaining Device** . . . . . 7 50

Attachment for S72, whereby the pendulum swing is automatically continued as long as desired.

**Special Catalogue of Psychological Apparatus free upon request. Careful attention given to "Duty Free" importation orders.**

## The Fitz Chronoscope.

For Reaction Times and other Time Measurements.



The Fitz Chronoscope is an accurate and direct reading instrument for the measurement of periods of time varying from 1-20 to 1 or 2 seconds. Several different styles are made, to all of which the following general description applies: Upon a light but rigid supporting casting swings a pendulum, **P**. Moving with the pendulum is a light flat index, **I**, which swings over a scale, **S**, graduated in fractions of a second so as to show the time taken by the pendulum to swing from the zero position upon the right to the particular point on the scale. In using the chronoscope the pendulum (and index) is carried to the extreme right, where it is caught back by a detent energized by an electro-magnet in circuit with the stimulus key. When the signal is given by the key (making a sound, exposing a light, or by any other usual method) the closed circuit frees the pendulum, which with its index, swings instantly over its scale. When the re-action key is operated, it is made to open once more the chronoscope circuit; this releases a light clamp between which and the main frame the index swings. This clamp, being normally free of the index against the tension of a powerful spring, instantly catches the index and binds it against the scale, thus GIVING THE TIME OF RE-ACTION DIRECTLY in known fractions of a second. The pendulum itself swings on and is caught fast at the left of its arc by a special device. By then operating a mechanical key at-

tached to the instrument the pendulum is automatically carried a trifle further to the left and then freed, when it swings back to the right, catching up the index as it passes, to be caught fast by the detent, the instrument is then ready for a second experiment. Successive experiments may thus be made to follow one another with practically NO lost intervening time.

The pendulum is so made as to be almost frictionless, and careful tests have shown the error in the use of this instrument to be almost inappreciable. THE SCALES ARE ALL EMPIRICALLY GRADUATED BY COMPARISON WITH THE TIMES OF FALLING BODIES, AND THEIR ACCURACY IS GUARANTEED.

For many of the usual re-action experiments the Fitz chronoscope will be found superior to any form of chronograph method, being much simpler, more convenient, and quicker.

These instruments have been supplied to the laboratories of the World's Museum, Chicago, and of the Women's College, Lynchburg, Va.; also to the gymnasium of the Y. M. C. A., Chicago, Ill., and to the University of Colorado, Boulder, Col., State Normal School, San Jose, Cal., etc.

### NET PRICE LIST.

#### Dr. Fitz's Pendulum Chronoscope—Style A.

This is the original open form as first made by Dr. Fitz. The base and supporting frame are of neatly japanned metal, while the working parts are of lacquered brass. It is made with several different ranges as below. Each instrument is supplied in wooden carrying-case.

#### Dr. Fitz's Pendulum Chronoscope—Style B.

Same as above, but enclosed. A mahogany dust-proof cover, with glass front, fits down over the working parts. It may be removed by means of two fastenings.

#### Single Scale Instruments.

	Time of full swing	First graduation.	*After first division the remainder occur every	Style A, open	Style B, enclosed
No. 1	½ second	1-20 second	5-1000 second.	\$60 00	\$75 00
“ 2	1 “	1-10 “	1-100 “	60 00	75 00
“ 3	2 “	1-5 “	2-100 “	60 00	75 00

#### Multiple Scale Instruments.

No. 4; with two interchangeable pendulums as in Nos. 1 and 2 . . . . .	70 00	85 00
“ 5; with two interchangeable pendulums as in Nos. 3 and 4 . . . . .	70 00	85 00
“ 6; with three interchangeable pendulums as in Nos. 1, 2 and 3 . . . . .	80 00	95 00

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