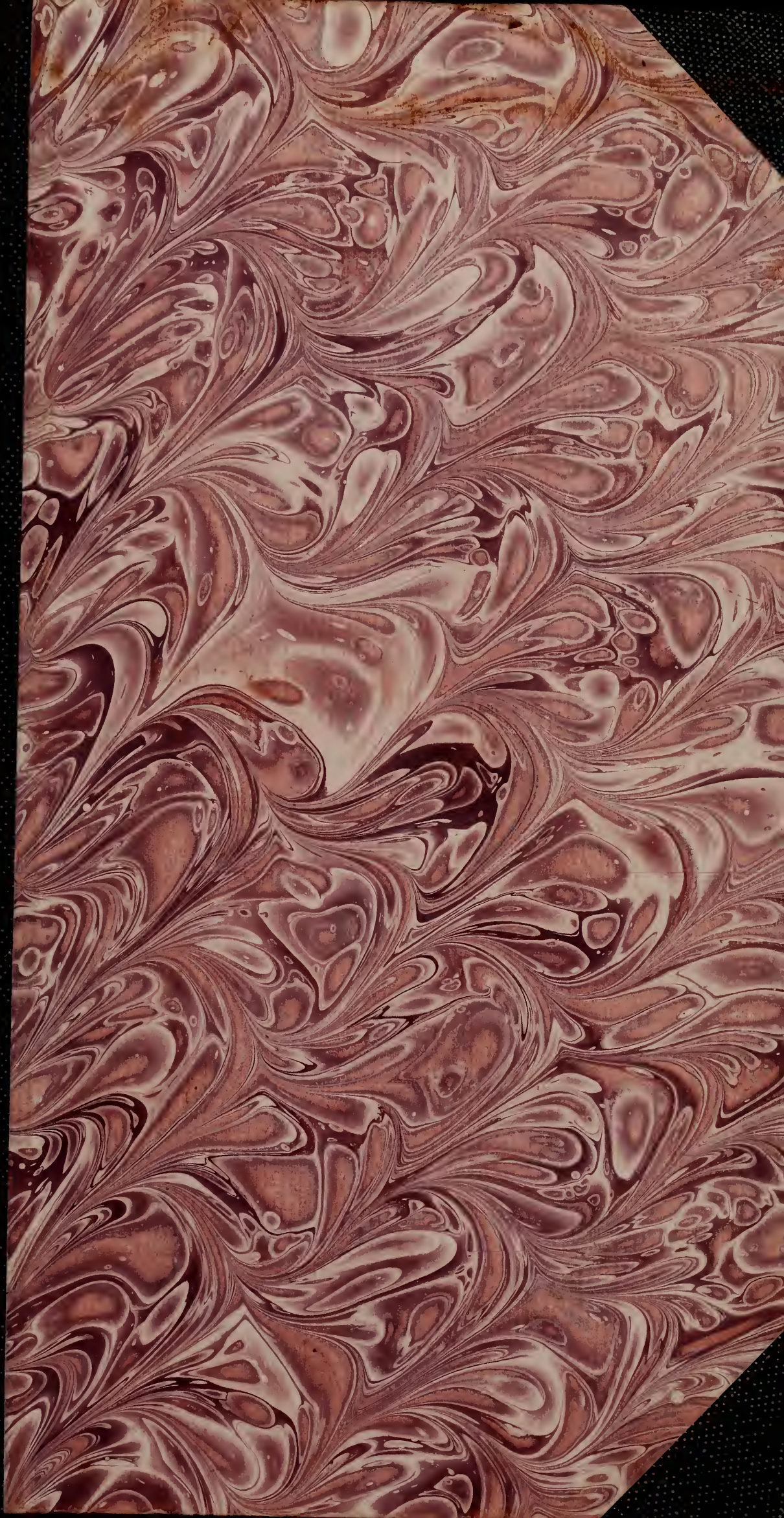

# ILLUSTRATED PRICE LIST

OF

# MICROSCOPES,

# MICROSCOPIC APPARATUS

AND OTHER

## OPTICAL INSTRUMENTS,

MANUFACTURED BY

# R. & J. BECK,

LONDON.

*"Vino Bono Non Opus Est Hedera."*

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AMERICAN BRANCH:

No. 1016 CHESTNUT STREET,

PHILADELPHIA.

W. H. WALMSLEY, Manager.

# THE FOLLOWING MEDALS

HAVE BEEN AWARDED TO

# R. & J. BECK,

FOR THE

*"Excellence of their Microscopes; and the Cheapness of their Manufacture:"*

THE COUNCIL MEDAL OF THE GREAT EXHIBITION OF 1851.

THE FIRST-CLASS MEDAL OF THE FRENCH EXHIBITION OF 1855.

THE PRIZE MEDAL OF THE INTERNATIONAL EXHIBITION OF 1862.

THE GOLD MEDAL OF THE SECOND FRENCH EXHIBITION OF 1867.

THE MEDAL AND DIPLOMA OF THE AMERICAN CENTENNIAL EXHIBITION OF 1876.

THE GOLD MEDAL OF THE NINTH CINCINNATI EXPOSITION OF 1881.

***WE DID NOT EXHIBIT AT PARIS IN 1878,***

# PREFACE.

The reputation enjoyed by the Microscopes and other Optical Instruments manufactured by us is world-wide, and has been maintained for more than a quarter of a century against all competition. This reputation was first gained, and was maintained during many years, through the production of First-Class instruments; perfection without regard to cost having been our aim. Of late years the Microscope having been greatly popularized, there has arisen a demand for cheap instruments, and a demand that has been mainly filled by literally worthless articles of French manufacture, made to look well and to sell, but as instruments of precision or research utterly useless. Believing that a discriminating public would sustain us in an effort to produce a thoroughly well-made and reliable Microscope for a low price, we some years since introduced our *Economic* and *National* Stands and *Accessories*, and the result has fully established the correctness of our anticipations. Their sale has been simply enormous among professional men and students, in medical and other colleges, to various departments of the Government, and to families and amateurs all over the country. This has been due to their perfect construction, mechanically and optically, and to their *cheapness;* no other instruments in the market at all approaching them in these particulars. The same exacting care that is bestowed upon the construction of our most costly stands and accessories is given also to these cheaper ones, and the result is seen in the production of instruments that really have no rivals.

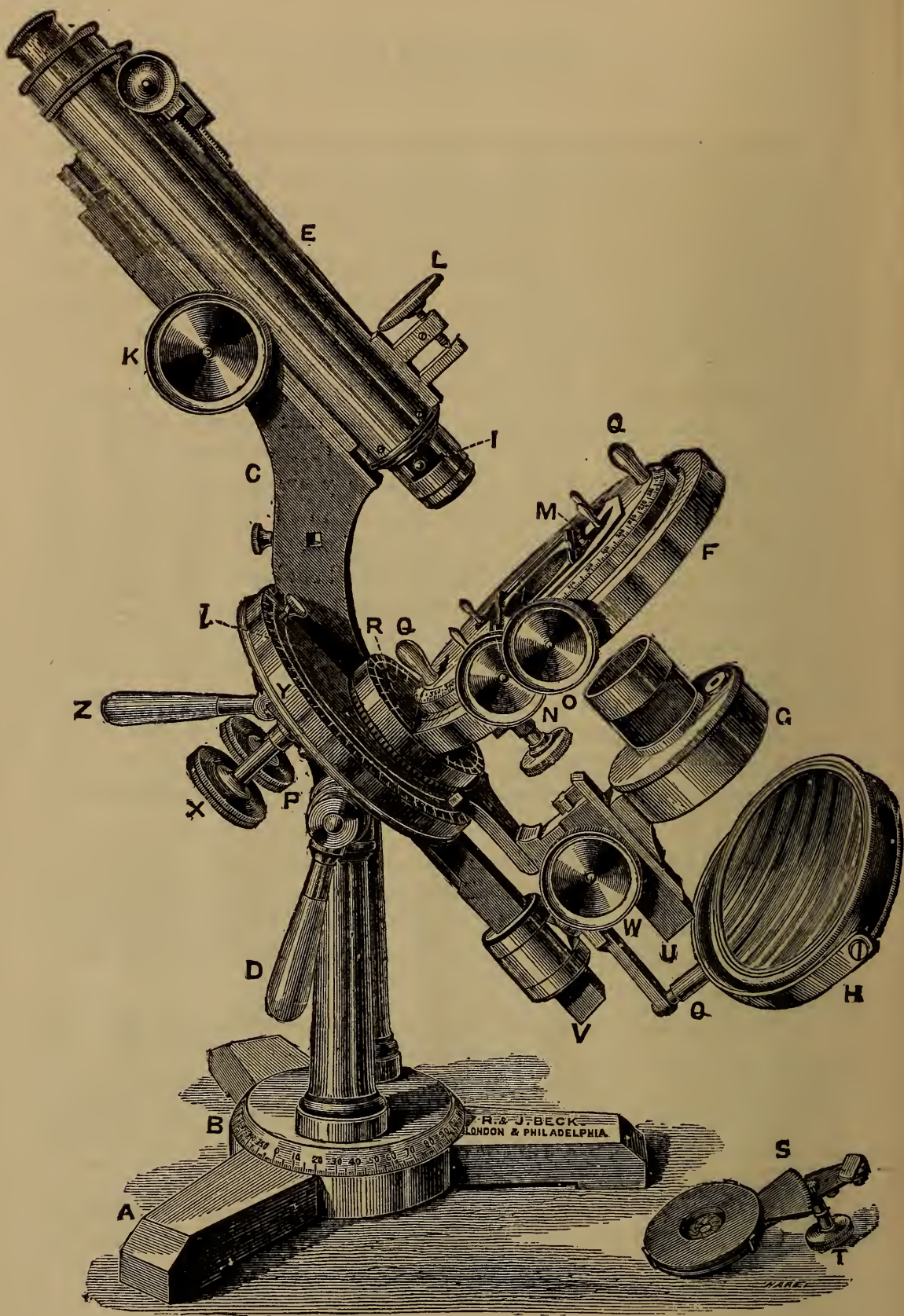
A demand having arisen of late for Stands, with Swinging Sub-Stages, and Broad-Gauge Screws, in addition to the usual *Society* Standard, we have fully met the same by the introduction of our "Ideal," and Improved National Microscopes, which will be found illustrated and described in these pages.

The details of the Optical Instruments manufactured by us having extended the size of this Catalogue to the largest convenient limits, we feel obliged to issue a *Second Part* (now in course of preparation), which will be devoted to the illustration and description of our *Standard Meteorological Instruments, Thermometers, Barometers, Anemometers, Rain Gauges, Compasses, Hygrometers*, etc., etc.

Thanking our friends for the liberal manner in which our efforts to furnish first-class instruments at moderate prices have been encouraged by them, we are

Yours truly,

*January* 1, 1882. R. & J. BECK.




No. 33. One-third Actual Size.

**"The International" Improved Large Best Microscope Stand.**

# DESCRIPTION of the IMPROVED LARGE BEST OR "INTERNATIONAL" MICROSCOPE STAND.

The Improved Large Best or "International" Microscope Stand has a tripod (A) for its base, upon which is placed a revolving fitting (B), graduated to degrees, by which means the Microscope can be turned around without its being lifted from the table, and the amount of such rotation registered; upon this fitting two pillars are firmly fixed, and between them the limb (C) can be elevated or depressed to any angle, and tightened in its position by the lever (D). The limb carries at one end the body (E) (Binocular or Monocular), with Eye-pieces and Object-glasses; in its centre the Compound Stage (F), beneath which is the circular plate, sliding on a dove-tailed fitting, and moved up and down by the lever (Z), and carrying the supplementary body or Sub-stage (G); and at the lower end a triangular bar carrying the Mirror (H). Each of these parts requires a separate description.

## THE BINOCULAR BODY.

The Binocular body consists of two tubes, the one fitted in the optical axis of the Microscope, and the other oblique. At their lower end and immediately above the object-glass there is an opening, into which a small brass box or fitting (I) slides; this box holds a prism so constructed that when slid in it intercepts half the rays from the object-glass, diverts them from their direct course, and reflects them into the additional or oblique tube. To the prism-box is attached a spring-catch, which, when pressed in, permits of the removal of the prism-box; but this is only needed for cleaning, as, when the box is drawn back to the distance allowed by this spring, the prism in no way interferes with the field of view, and all the rays pass up the direct body, and the Microscope is converted into a Monocular one.

The upper or eye-piece ends of the tubes are fitted with racks and pinion for varying the distances between the two eye-pieces, to suit the differences between the eyes of various persons; and arrangements are made for racking out one tube more than the other, to suit irregularities or inequalities between the eyes of the observer.

This body is moved up and down with a quick movement by means of the milled heads (K), and with a very delicate and fine adjustment by the milled head (L). This milled head works against a lever, which moves a slide independent of the rack-movement, and gives an adjustment at once certain and decided.

## THE STAGE.

The Compound Stage is of an entirely new construction: the object is most frequently merely placed upon it, but, if necessary, it can be clamped by carefully bringing down the spring-piece (M); the ledge will slide up or down, and the object may be pushed sideways; this arrangement forms the coarse adjustment. Finer movements in vertical and horizontal directions are effected by means of two milled heads (N and O), the screws attached to which are kept up to their work by opposing springs, so as to avoid all strain or loss of time. The whole stage revolves in a circular ring by the milled head (P), or this can be drawn out, and then it turns rapidly by merely applying the fingers to the two ivory studs (Q, Q) fastened on the top plate, which is divided into degrees to register the amount of revolution. The Stage is attached to the limb on a pivot, and can be rotated to any angle, which angle is recorded on the divided plate (R), or can be turned completely over, so that the object can be viewed by light of any obliquity without any interference from the thickness of the stage.

Beneath and attached to the stage is an iris diaphragm (S), which can be altogether removed, as shown in the illustration, from its dove-tailed fitting, so as

not to interfere during the rotation of the stage. The variations in the aperture of this diaphragm are made by a pinion working into a racked arc and adjusted by the milled head (T).

## THE APPARATUS BARS.

Beneath the stage are two triangular bars (U, V), the one revolving around and the other rigid in the optical axis of the instrument. On the former the sub-stage (G), carrying all the apparatus hereafter described for illumination and polarization, fits, and is racked up and down by the milled head (W); the mirror also, if desired, slides on the same bar; the revolving motion to this bar is given by the milled head (X), and the amount of angular movement is recorded on the circle (Y), whilst the whole of this part of the stand is raised and lowered concentric with the optical axis of the instrument by the lever (Z), and the amount of such elevation or depression registered on a scale attached to the limb. This bar can be carried around and above the stage, and be thus used for opaque illumination.

The lower triangular bar (V) carries the mirror H, or a right-angle prism, when the illumination is required to be concentric with the optical axis of the instrument, and independent of the movements of other illuminating apparatus.

## THE MIRROR.

The mirror-box contains two mirrors, one flat and the other concave; it swings in a rotating semicircle attached to a lengthening bar, which enables it to be turned from one side to the other, and revolves on a circular fitting for giving greater facilities in regulating the direction of the beam of light reflected, the whole sliding on either of the triangular bars, previously referred to, and made to reverse in the socket (*a*) so as to bring the centre of the mirror concentric with the axis of the Microscope in either case.

## THE SWINGING SUB-STAGE.

As the mirror alone is insufficient for many kinds of illumination, some provision has to be made for holding various pieces of apparatus between the object and the mirror. For this purpose a supplementary body, or sub-stage, is mounted perfectly true with the body, and is moved up and down in its fitting by rack and pinion connected with the milled heads (W). This sub-stage, to which reference has already been made, is now regarded as one of the most important parts of the Achromatic Microscope; in it all the varied appliances for modifying the character and direction of the light are fitted. But a few years since it was considered sufficient for this part of the stand to be constructed so as to move up and down perfectly coincident with the optical axis of the instrument, and for that purpose it was racked in a groove planed out on the same limb as that on the upper end of which the optical portions were carried. But lately microscopists have shown the desirability of affording every facility for lateral angular adjustments; and this has led to the sub-stage being attached to an arc (*b*) working in the circular plate (Y), and moved by a rack and pinion (X), whilst the amount of such angular movement is recorded on the upper surface of the plate (Y). Having once fixed the angular direction of the light, the focusing of it depends upon the lever (Z), which moves the circle up and down, and with it the arm carrying the illuminating apparatus, *in the optical axis of the instrument.* So long ago as 1854 Mr. Grubb, of Dublin, called attention to the advantage of mounting the illuminating apparatus on a revolving arm or arc, which he thus describes in his provisional specification for improvements in Microscopes, No. 1477, 5th July, 1854:—"My third improvement consists in the addition of a graduated sectorial arc to microscope, concentric to the plane of the object '*in situ*,' on which either the aforesaid prism or other suitable illuminator is made to slide, thereby producing every kind of illumination required for microscopic examination, and also the means of registering or applying any definite angle of illumination at pleasure." With but slight modification, this is the plan adopted in this Stand.

## FIRST-CLASS MICROSCOPES.

In these Microscopes the Stands, the Object-glasses, the Illuminating, and all Accessory apparatus, are carried to the highest possible perfection.

### PRICE $1650.

No. 1. ***Improved Large best Binocular Microscope, "The International," with Swinging Sub-stage, and New Arrangements for Rotating and Revolving the Concentric Rotating Stage with Iris Diaphragm, and also for adjusting and Rotating the Illuminating Apparatus, with all the latest additions complete.***

12 Object-glasses, magnifying from 8 to 10,000 linear: 4 in. (8°), 3 in. (12°), 1½ in. (23°), ⅔ in. (32°), $\frac{4}{10}$ in. (55°), $\frac{4}{10}$ in. (90°), ¼ in. (75°), ⅕ in. (100°), ⅛ in. (120°), $\frac{1}{10}$ in. immer. (160°), $\frac{1}{20}$ in. (140°), $\frac{1}{40}$ in. (140°).

Lieberkuhns to the following Object-glasses: 1½, No. 89, ⅔, No. 90, $\frac{4}{10}$, No. 91, ¼, No. 92.

10 Eye-pieces, viz., 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, 1 No. 4, 1 No. 5, No. 97, 1 pair Kelner's Eye-pieces, No. 96. Indicators to 6 Eye-pieces, No. 152. Graduated Draw-tube, No. 100. Erecting-glass, No. 99, for use with the ⅔ Object-glass for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, with revolving Diaphragm, No. 101. Patent Achromatic Condenser, No. 101*. Right-angle Prism, No. 104. Adapter for centering illuminating apparatus, No. 94. Brown's Iris Diaphragm, No. 113. Amici's Prism, No. 105. Nachet's Prism, No. 107. Wenham's Parabolic Reflector, No. 108. Spot-lens, No. 110. Rainey's Moderator, No. 135. White-cloud Illuminator, No. 127. Polarizing Apparatus, No. 116. Darker's Series of Selenites, No. 117. Sorby's Micro-Spectroscope, No. 66. Sorby's Standard Spectrum-scale, No. 67*. Sorby's Dichroiscope, No. 67. Leeson's Goniometer, No. 154. Tourmaline, No. 125. Two Double-image Prisms, and Selenite Film, and Brass Plate with holes, No. 123. Set of 6 Crystals, showing rings round the optic axis, No. 124. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Side Silver Reflector, No. 133. Parabolic Illuminator with Sorby's Reflector, No. 129. Beck's Patent Illuminator, No. 126. Three Dark Wells and Holder, No. 136. Opaque Disk Revolver, No. 138. Quadruple Nosepiece in Aluminium, No. 161. Wollaston's Camera Lucida, No. 155. Neutral-Tint-Glass Camera, No. 156. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Set of Live-Traps, No. 173. Lever Compressor, No. 162. Wenham's Compressor, No. 165. Parallel-plate Compressor, No. 163. Reversible Compressor, No. 164. Screw Live-Box, No. 166. Large Live-Box, No. 167. Small Live-Box No. 168. Growing-Cell, No. 172. Two Large Troughs, No. 169. Two Glass Plates with Ledge and Covers, No. 171. Set of Three Glass Fishing-Tubes, No. 180. Maltwood's Finder, No. 150. Frog-plate, N. 175. Mineral-holder, No. 145. Three-pronged Forceps, No. 143. Tightening-Key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Spanish Mahogany Case, with two boxes containing the Apparatus.

## PRICE $1100.

No. 2. ***Improved Large Best Binocular Microscope, "The International," with Swinging Sub-stage, and New Arrangements for Rotating and Revolving the Concentric Rotating Stage with Iris Diaphragm, and also for Adjusting and Rotating the Illuminating Apparatus, with the following accessories:***

9 Object-glasses, magnifying from 12 to 5000 linear:—3 in. (12°), 1½ in. (23°), ⅔ in. (32°), $\frac{4}{10}$ in. (90°), ¼ in. (75°), ⅕ in. (100°), ⅛ in. (120°), $\frac{1}{10}$ in. immer. (160°), $\frac{1}{20}$ in. (140°).

Lieberkuhns to the following Object-glasses:—1½, No. 89, ⅔, No. 90, $\frac{4}{10}$, No. 91, ¼, No. 92.

7 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, 1 No. 4, No. 97. Indicators to 4 Eyepieces, No. 152. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the ⅔ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, with revolving Diaphragm, No. 101. Right-angle Prism, No. 104. Plain Diaphragm. Amici's Prism, No. 105. Nachet's Prism, No. 107. Wenham's Parabolic Reflector, No. 108. Spot-Lens, No. 110. Polarizing Apparatus, No. 116. Darker's Series of Selenites, No. 117. Two Double-image Prisms and Selenite Film, and Brass Plate with holes, No. 123. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Parabolic Illuminator, No. 128. Three Dark Wells and Holder, No. 136. Opaque Disk Revolver, No. 138. Quadruple Nosepiece in Aluminium, No. 161. Wollaston's Camera Lucida, No. 155. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Lever Compressor, No. 162. Wenham's Compressor, No. 165. Parallel-plate Compressor, No. 163. Screw Live-Box, No. 166. Large Live-Box, No. 167. Small Live-Box, No. 168. Large Glass Trough, No. 169. Two Glass Plates with Ledge and Covers, No. 171. Set of Three Glass Fishing-Tubes, No. 180. Maltwood's Finder, No. 150. Frog-plate, No. 175. Mineral-holder, No. 145. Tightening-key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Spanish Mahogany Case, with two boxes containing the Apparatus.

## PRICE $725.

No. 4. ***Improved Large Best Binocular Microscope, "The International," with Swinging Sub-stage, and New Arrangements for Rotating and Revolving the Concentric Rotating Stage with Iris Diaphragm, and also for Adjusting and Rotating the Illuminating Apparatus, with the following accessories:***

5 Object-glasses, magnifying from 30 to 1300 linear:—1½ in. (23°), ⅔ in. (32°), $\frac{4}{10}$ in. (55°), ⅕ in. (100°), ⅛ in. (120°).

Lieberkuhns to the following Object-glasses:—⅔, No. 90, $\frac{4}{10}$, No. 91.

6 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, No. 97. Indicators to 2 Eyepieces, No. 152. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the ⅔ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, with revolving Diaphragm, No. 101. Plain Diaphragm. Wenham's Parabolic Reflector, No. 108. Polarizing Apparatus, No. 116. One Selenite. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser. No. 131. Parabolic Illuminator, No. 128. Three Dark

Wells and Holder, No. 136. Opaque Disk Revolver, No. 138. Double Nosepiece, No. 159. Wollaston's Camera Lucida, No. 155. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Wenham's Compressor, No. 165. Parallel-plate Compressor, No. 163. Large Live-Box, No. 167. Small Live-Box, No. 168. Large Glass Trough, No. 169. Two Glass Plates with Ledge and Covers, No. 171. Set of Three Glass Fishing Tubes, No. 180. Maltwood's Finder, No. 150. Mineral-holder, No. 145. Tightening-Key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Spanish Mahogany Case, with one box containing the Apparatus.

**PRICE $600.**

No. 6. ***New Large Best Binocular Microscope, with Concentric Rotating Stage, Centering and Rotating Sub-Stage and Iris Diaphragm, with the following Apparatus.***

4 Object-glasses, magnifying from 30 to 700 linear:—$1\frac{1}{2}$ in. (23°), $\frac{2}{3}$ in. (32°), $\frac{4}{10}$ in. (55°), $\frac{1}{5}$ in. (100°).

Lieberkuhns to the following Object-glasses:—$\frac{2}{3}$, No. 90, $\frac{4}{10}$, No. 91.

6 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, No. 97. Indicator to 1 Eyepiece, No. 152. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the $\frac{2}{3}$ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, with revolving Diaphragm, No. 101. Plain Diaphragm. Wenham's Parabolic Reflector, No. 108. Polarizing Apparatus, No. 116. One Selenite. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Parabolic Illuminator, No. 128. Three Dark Wells and Holder, No. 136. Double Nosepiece, No. 159. Wollaston's Camera Lucida, No. 155. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Wenham's Compressor, No. 165. Large Live-Box, No. 167. Small Live-Box, No. 168. Large Glass Trough, No. 169. Two Glass Plates with Ledge and Covers, No. 171. Set of Three Glass Fishing-Tubes, No. 180. Maltwood's Finder, No. 150. Mineral-holder, No. 145. Tightening-Key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Spanish Mahogany Case, with one box containing the Apparatus.

**PRICE $550.**

No. 7. ***New Large Best Monocular Microscope, with Concentric Rotating Stage, Centering and Rotating Sub-Stage and Iris Diaphragm.***

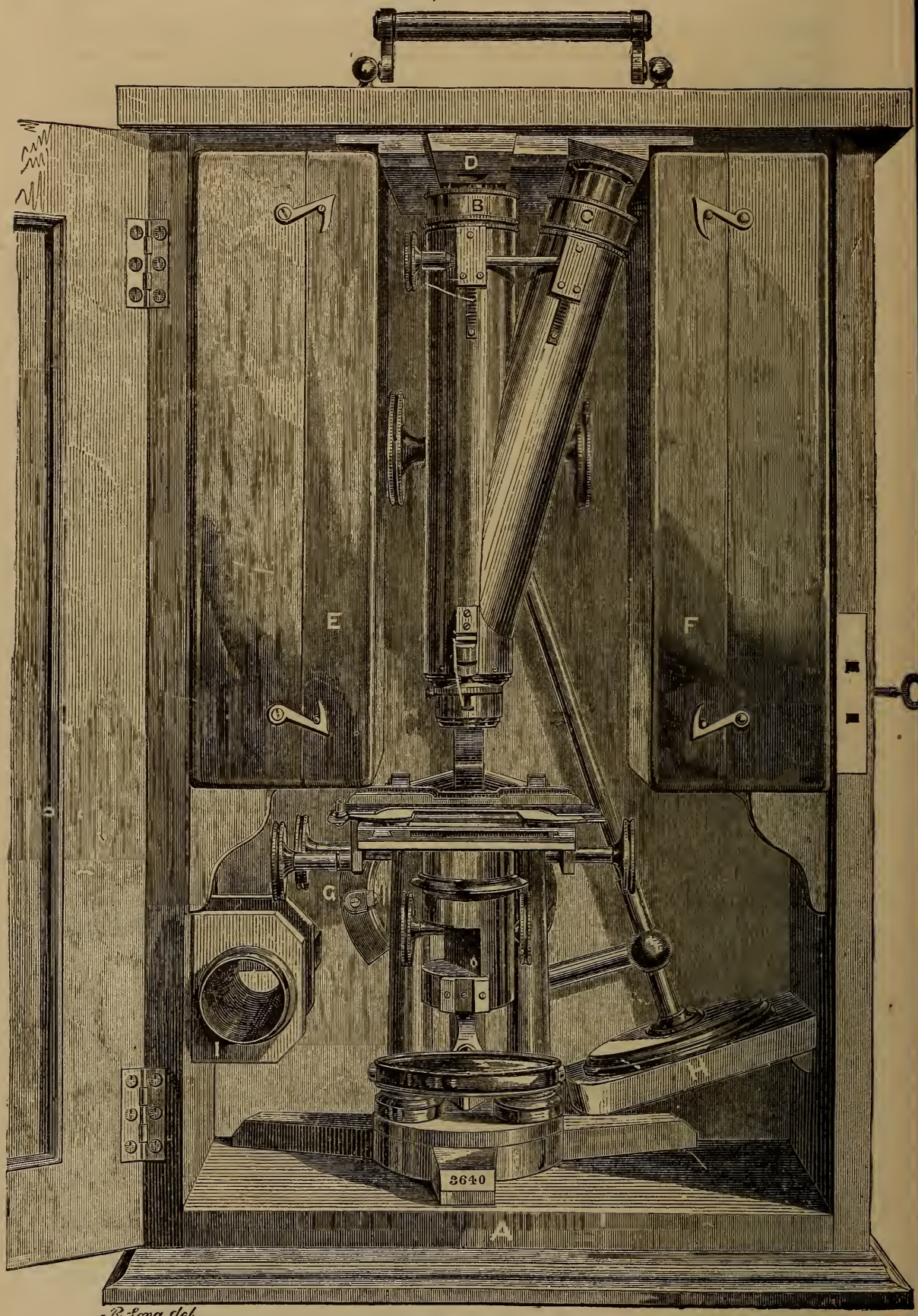
With the same Object-glasses and Apparatus as No. 6.

**PRICE $450.**

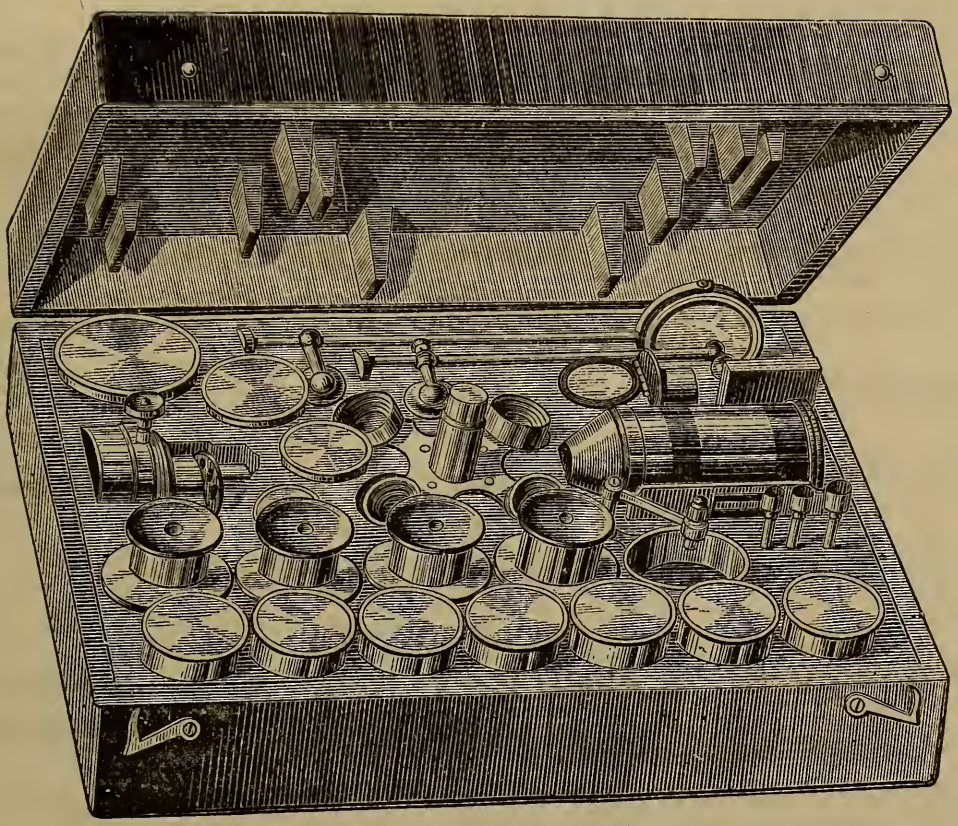
No. 8. ***New Large Best Binocular Microscope, with Concentric Rotating Stage, Centering and Rotating Sub-Stage and Iris Diaphragm, with the following Apparatus.***

3 Object-glasses, magnifying from 30 to 700 linear:—$1\frac{1}{2}$ in. (23°), $\frac{2}{3}$ in. (32°), $\frac{1}{5}$ in. (85°).

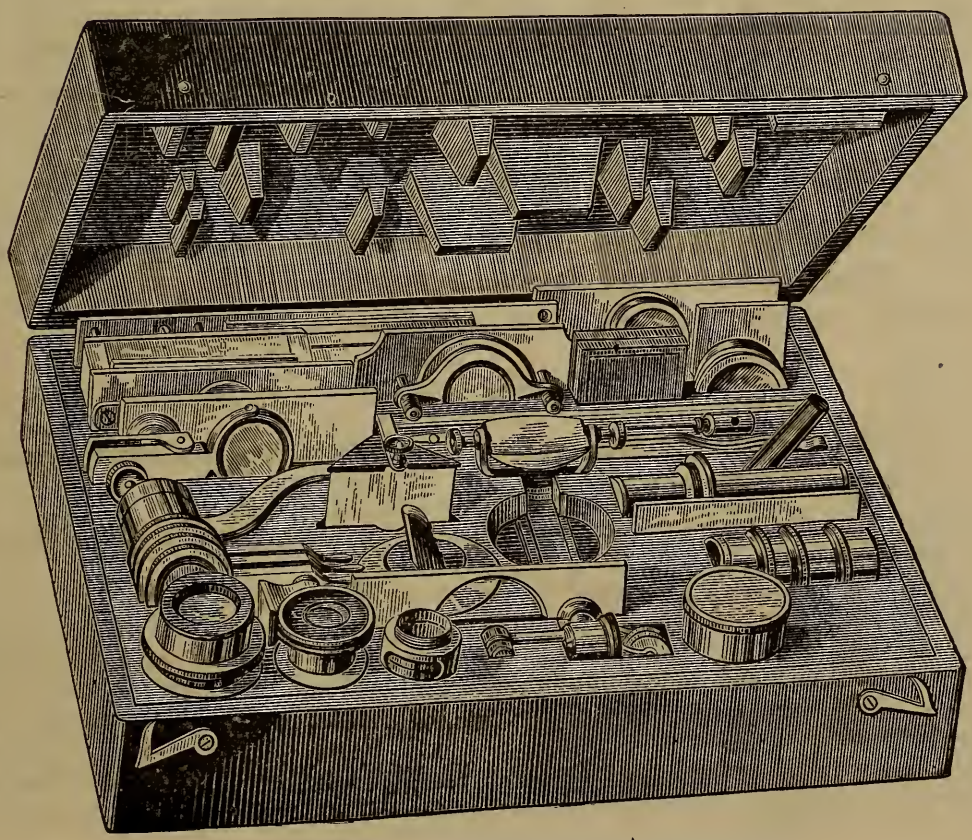
*The Cases for any of the first-class stands may be brass-bound and all blocks screwed in. This will add from $7.50 to $25.00 to the expense, according to the amount of apparatus.*




MODE OF PACKING FIRST-CLASS MICROSCOPES AND APPARATUS.



MODE OF PACKING FIRST-CLASS ACCESSORIES.



MODE OF PACKING FIRST-CLASS ACCESSORIES.

Lieberkuhn to the $\frac{2}{3}$ Object-glass, No. 90.

6 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, No. 97. Indicator to 1 Eyepiece, No. 152. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the $\frac{2}{3}$ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, No. 102. Polarizing Apparatus, No. 115. One Selenite. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Parabolic Illuminator, No. 128. Three Dark Wells and Holder, No. 136. Large Live-Box, No. 167. Two Glass Plates with Ledge and Covers, No. 171. Tightening-Key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Honduras Mahogany Case, with one box containing the Apparatus.

**PRICE $400.**

No. 9. ***New Large Best Monocular Microscope, with Centering and Rotating Stage, Centering and Rotating Sub-Stage.***

With the same Object-glasses and Apparatus as No. 8.

**PRICE $337.50.**

No. 10. ***New Large Best Binocular Microscope, with Concentric Rotating Stage, Centering and Rotating Sub-Stage and Iris Diaphragm, with the following Apparatus.***

2 Object-glasses, magnifying from 60 to 400 linear:—$\frac{2}{3}$ in. (32°), $\frac{1}{5}$ in. (85°).

4 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, No. 97. Indicator to 1 Eyepiece, No. 152. Graduated Draw-tube, No. 100. Smaller Side Condenser, No. 131. Large Live-Box, No. 167. Two Glass Plates with Ledge and Covers, No. 171. Tightening-Key, No. 181. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in an Upright Honduras Mahogany Case, with one box containing the Apparatus.

**PRICE $300.**

No. 11. ***New Large Best Monocular Microscope, with Centering and Rotating Stage, Centering and Rotating Sub-Stage.***

With the same Object-glasses and Apparatus as No. 10.

**PRICE $650.**

No. 12. ***New Small Best Binocular Microscope, with Concentric Rotating Stage and Centering Sub-Stage.***

5 Object-glasses, magnifying from 20 to 1300 linear:—$1\frac{1}{2}$ in. (23°), $\frac{2}{3}$ in. (32°), $\frac{4}{10}$ in. (55°), $\frac{1}{5}$ in. (100°), $\frac{1}{8}$ in. (120°).

Lieberkuhns to the following Object-glasses:—$\frac{2}{3}$ No. 90, $\frac{4}{10}$ No. 91.

6 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, No. 98. Indicators to 2 Eyepieces, No. 152. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the $\frac{2}{3}$ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, with revolving Diaphragm, No. 101. Wenham's Parabolic Reflector, No. 108. Polarizing Apparatus, No. 116. One Selenite. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Parabolic Illuminator, No. 128. Three Dark Wells and Holder,

No. 136. Opaque Disk Revolver, 1 tray of disks, No. 137. Double Nosepiece, No. 159. Wollaston's Camera Lucida, No. 155. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Wenham's Compressor, No. 165. Parallel-plate Compressor, No. 163. Large Live-Box, No. 167. Small Live-Box, No. 168. Large Glass Trough, No. 169. Two Glass Plates with Ledge and Covers, No. 171. Set of Three Glass Fishing-Tubes, No. 180. Maltwood's Finder, No. 150. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in a Strong Flat Spanish-Mahogany Case.

**PRICE $600.**

No. 13. ***New Small Best Monocular Microscope, with Concentric Rotating Stage and Centering Sub-Stage.***

With the same Object-glasses and Apparatus as No. 12.

**PRICE $530.**

No. 14. ***New Small Best Binocular Microscope, with Concentric Rotating Stage and Centering Sub-Stage.***

4 Object-glasses, magnifying from 20 to 720 linear:—1½ in. (23°), ⅔ in. (32°), $\frac{4}{10}$ in. (55°), ⅕ in. (100°).

Lieberkuhns to the following Object-glasses:—⅔, No. 90, $\frac{4}{10}$, No. 91.

6 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 pair No. 3, No. 98. Graduated Draw-tube, No. 100. Erecting-Glass, No. 99, for use with the ⅔ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Achromatic Condenser, No. 102. Wenham's Parabolic Reflector, No. 108. Polarizing Apparatus, No. 115. One Selenite. Large Bull's-eye Condensing-Lens, No. 130. Smaller Side Condenser, No. 131. Parabolic Illuminator, No. 128. Three Dark Wells and Holder, No. 136. Double Nosepiece, No. 159. Wollaston's Camera Lucida, No. 155. Eyepiece Micrometer, No. 146. Stage Micrometer, No. 147. Wenham's Compressor, No. 165. Small Live-Box, No. 168. Large Glass Trough, No. 169. Two Glass Plates, with Ledge and Covers No. 171. Set of Three Glass Fishing-Tubes, No. 180. Maltwood's Finder, No. 150. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in a Strong Flat Spanish Mahogany Case.

**PRICE $337.50.**

No. 16. ***New Small Best Binocular Microscope, with Concentric Rotating Stage and Centering Sub-Stage.***

2 Object-Glasses, magnifying from 60 to 720 linear:—⅔ in. (32°), ⅕ in. (85°).

Lieberkuhn to the ⅔ Object-glass, No. 90.

5 Eyepieces, viz. 1 pair No. 1, 1 pair No. 2, 1 No. 3, No. 98. Graduated Draw tube, No. 100. Erecting-Glass, No. 99, for use with the ⅔ Object-glass, for erecting the Image and varying the power from 5 to 150 linear. Smaller Side Condenser, No. 131. Three Dark Wells and Holder, No. 136. Parabolic Illuminator, No. 128. Small Live-box, No. 168. Two Glass Plates, with Ledge and Covers, No. 171. Stage Forceps, No. 144. Brass Pliers, No. 145*.

The whole packed in a Strong Flat Spanish-Mahogany Case.

*Any of the small best stands and apparatus may be had packed in upright Mahogany Case, with side case for the accessories, at an additional cost of five dollars.*

# PRICES OF FIRST-CLASS
# MICROSCOPE STANDS AND CASES,

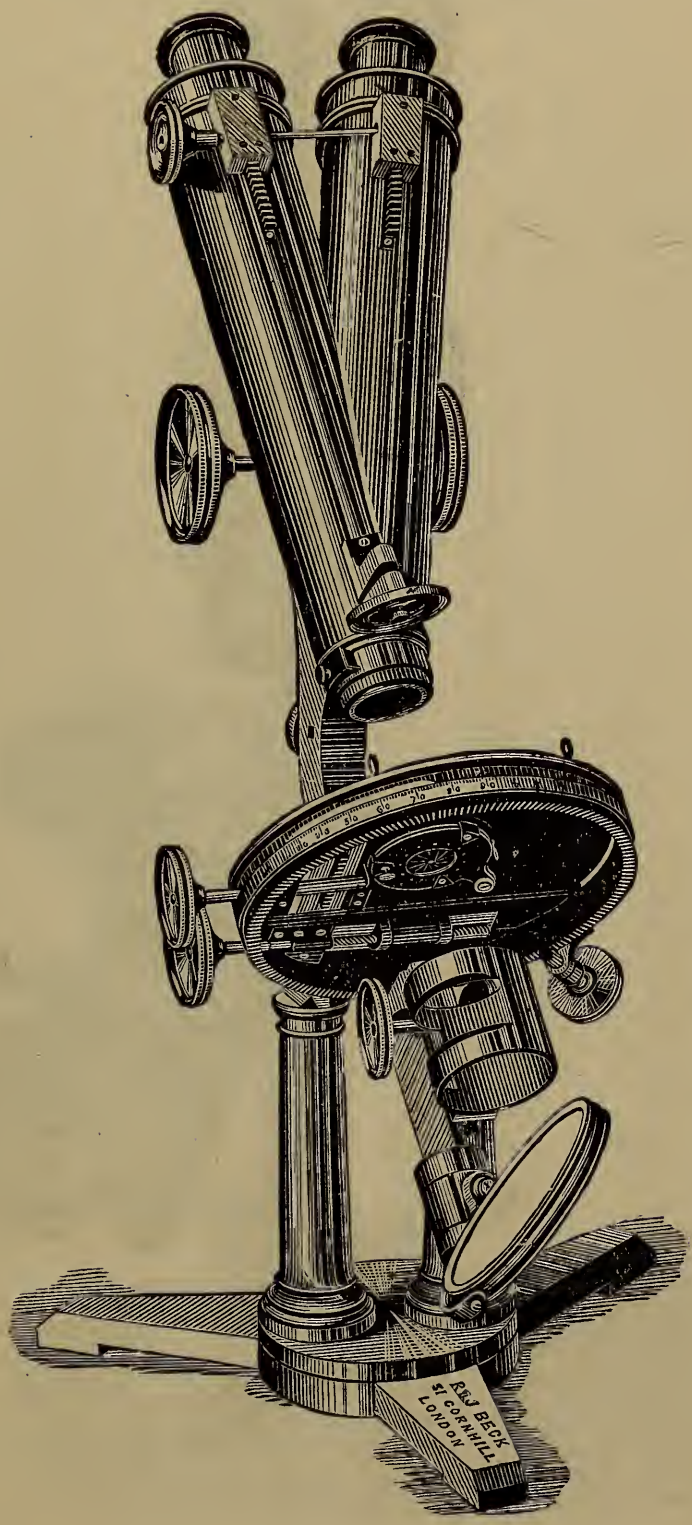
IF ORDERED SEPARATELY.

## FIRST-CLASS MICROSCOPE STANDS.

| No. | | Price. |
|---|---|---|
| 33. | Improved Large Best Binocular Microscope Stand, "The International," with Swinging Sub-stage, and new arrangements for rotating and revolving the Concentric Rotating Stage with Iris Diaphragm, and also for adjusting and rotating the Illuminating Apparatus. Two pairs of Eye-pieces, Graduated Draw Tube, Pliers, Forceps, etc., | $325 00 |
| 34. | Improved Large Best Monocular Microscope Stand, "The International," with Swinging Sub-stage, and new arrangements for rotating and revolving the Concentric Rotating Stage, with Iris Diaphragm, and also for adjusting and rotating the Illuminating Apparatus. Two Eye-pieces, Graduated Draw Tube, Pliers, Forceps, etc., | 275 00 |
| 36. | New Large Best Binocular Microscope Stand, with Concentric Rotating Stage and Iris Diaphragm, Rotating and Centering Sub-stage, most complete movements to the Body, Stage, and Double Mirror. Two pairs of Eye-pieces, Pliers, Forceps, etc., mounted on two pillars, | 250 00 |
| 37. | New Large Best Monocular Microscope Stand, with Concentric Rotating Stage and Iris Diaphragm, Rotating and Centering Sub-stage, most complete movements to the Body, Stage, and Double Mirror. Two Eye-pieces, Pliers, Forceps, etc., mounted on two pillars, | 200 00 |
| 44. | New smaller Binocular Microscope Stand, on the same principle, and with the same actions as No. 36, Two pairs of Eye-pieces, Pliers, Forceps, etc., but with single pillar, | 200 00 |
| 45. | New smaller Monocular Microscope Stand, on the same principle, and with the same actions as No. 37, Two Eye-pieces, Pliers, Forceps, etc., but with single pillar, | 150 00 |

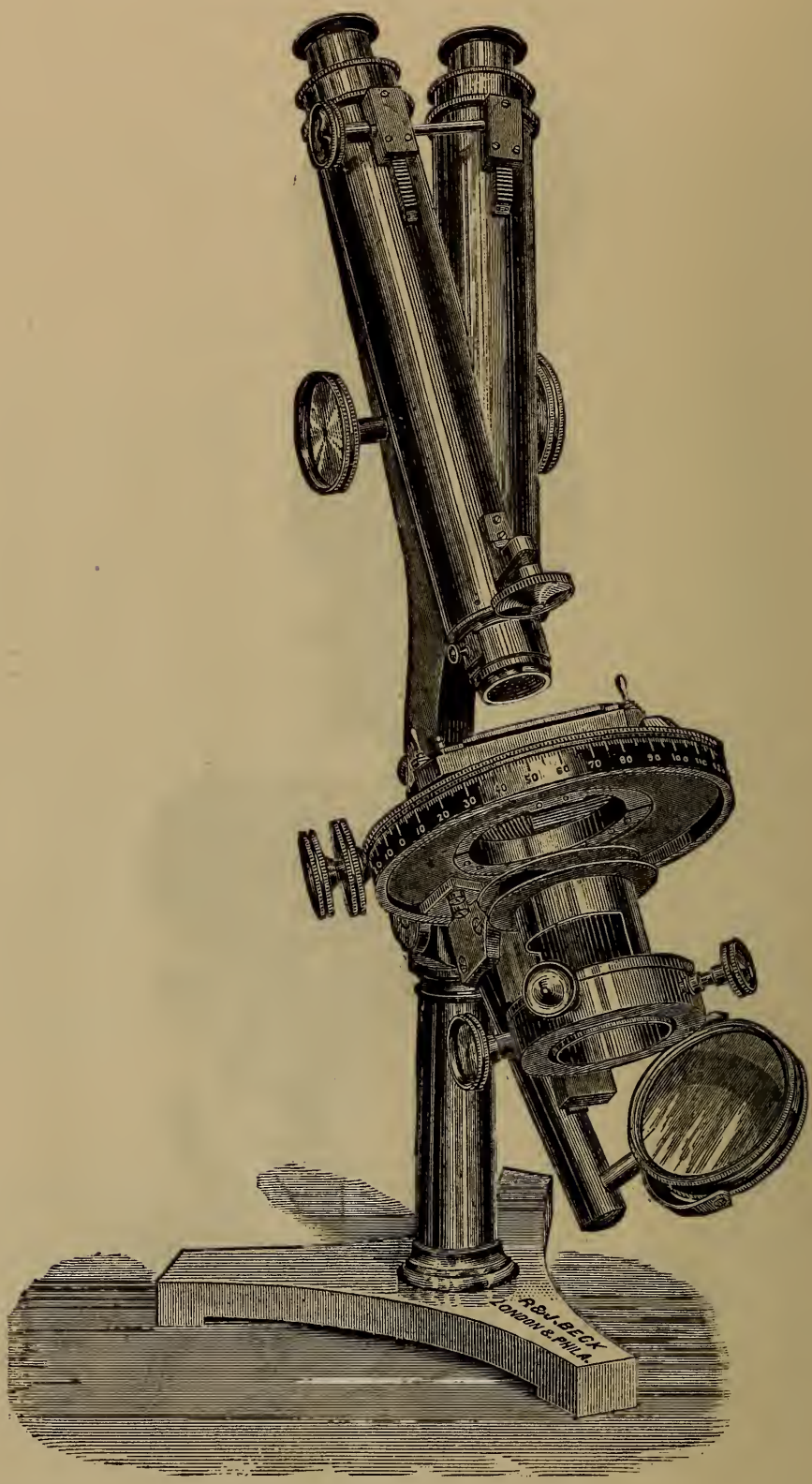
## CASES FOR FIRST-CLASS MICROSCOPES.

| | | |
|---|---|---|
| 46. | Best Upright Case, in Spanish Mahogany, for Nos. 33 to 37, with best brass handle, two boxes for Apparatus, | 37 50 |
| 47. | Best Upright Case, in Spanish Mahogany, for Nos. 33 to 37, with best brass handle, only one box for Apparatus, | 30 00 |
| 48. | Upright Case, in Honduras Mahogany, for Nos. 33 to 37, with best brass handle, two boxes for Apparatus, | 25 00 |
| 49. | Upright Case, in Honduras Mahogany, for Nos. 33 to 37, with best brass handle, one box for Apparatus, | 20 00 |
| 54. | Best Upright Case, in Spanish Mahogany, for Nos. 44 and 45, with best brass handle and box for Apparatus, | 27 50 |
| 55. | Upright Case, in Honduras Mahogany, for Nos. 44 and 45, with best brass handle and box for Apparatus, | 20 00 |
| 56. | Strong Flat Case, in Spanish Mahogany, with covered Dovetails, for Nos. 44 and 45, with best brass handle, | 16 00 |




No. 36. One-third Actual Size.

**Large Best Binocular Microscope Stand.**




No. 44. One-third Actual Size.

**New Small Best Binocular Microscope Stand.**

# *PRICES OF ACHROMATIC OBJECT-GLASSES AND APPARATUS FOR FIRST-CLASS MICROSCOPE STANDS.*

## ACHROMATIC OBJECT-GLASSES.

| No. | Focal length. | Linear magnify'g pow'r nearly, with eyepieces. | No. 1. | No. 2. | No. 3. | No. 4. | No. 5. | Angle of aperture, about. | Price. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ° | $ c. |
| 70 | 4 inches | Draw-tube closed..... | 10 | 16 | 26 | 32 | 52 | 9 | 15 00 |
| | | Ditto if drawn out, add for each inch..... | 1½ | 3 | 5 | 6 | 8 | | |
| 71 | 3 inches | Draw-tube closed ..... | 12 | 20 | 40 | 48 | 74 | 12 | 29 00 |
| | | Ditto if drawn out, add for each inch..... | 2 | 4 | 6 | 7 | 10 | | |
| 72 | 2 inches | Draw-tube closed..... | 20 | 38 | 70 | 85 | 130 | 18 | 29 00 |
| | | Ditto if drawn out, add for each inch..... | 4 | 6 | 8 | 12 | 15 | | |
| 73 | 1½ inches | Draw-tube closed..... | 30 | 56 | 100 | 120 | 190 | 23 | 29 00 |
| | | Ditto if drawn out, add for each inch..... | 5 | 7 | 12 | 15 | 22 | | |
| 74 | ⅔ inch | Draw-tube closed..... | 70 | 120 | 220 | 270 | 410 | 32 | 26 00 |
| | | Ditto if drawn out, add for each inch..... | 8 | 14 | 25 | 27 | 48 | | |
| 75 | $\frac{4}{10}$ inch | Draw-tube closed..... | 120 | 210 | 370 | 460 | 710 | 55 | 42·50 |
| | | Ditto if drawn out, add for each inch..... | 14 | 24 | 34 | 46 | 70 | | |
| 76 | $\frac{4}{10}$ inch | Draw-tube closed..... | 146 | 255 | 460 | 560 | 890 | 90 | 60 00 |
| | | Ditto if drawn out, add for each inch..... | 18 | 32 | 48 | 60 | 80 | | |
| 77 | ¼ inch | Draw-tube closed..... | 200 | 340 | 590 | 720 | 1120 | 75 | 42 50 |
| | | Ditto if drawn out, add for each inch..... | 24 | 42 | 63 | 85 | 120 | | |
| 78 | $\frac{1}{6}$ inch | Draw-tube closed..... | 225 | 400 | 700 | 860 | 1450 | 85 | 42 50 |
| | | Ditto if drawn out, add for each inch..... | 18 | 35 | 60 | 80 | 130 | | |
| 79 | $\frac{1}{6}$ inch | Draw-tube closed..... | 225 | 400 | 700 | 860 | 1450 | 100 | 52 50 |
| | | Ditto if drawn out, add for each inch..... | 18 | 35 | 60 | 80 | 130 | | |
| 80 | ⅛ inch | Draw-tube closed..... | 400 | 680 | 1180 | 1440 | 2240 | 120 | 69 00 |
| | | Ditto if drawn out, add for each inch..... | 50 | 85 | 140 | 180 | 280 | | |
| 81 | $\frac{1}{10}$ inch immer. | Draw-tube closed..... | 500 | 870 | 1500 | 1850 | 2800 | 160 | 50 00 |
| | | Ditto if drawn out, add for each inch..... | 60 | 100 | 180 | 190 | 370 | | |
| 82 | $\frac{1}{20}$ inch | Draw-tube closed..... | 900 | 1570 | 2750 | 3450 | 4950 | 140 | 125 00 |
| | | Ditto if drawn out, add for each inch..... | 80 | 150 | 300 | 350 | 900 | | |
| 83 | $\frac{1}{20}$ inch immer. | Draw-tube closed..... | 900 | 1570 | 2750 | 3450 | 4950 | 170 | 117 50 |
| | | Ditto if drawn out, add for each inch..... | 80 | 150 | 300 | 350 | 900 | | |
| 84 | $\frac{1}{40}$ inch | Draw-tube closed..... | 1800 | 3140 | 5500 | 6900 | 9900 | 140 | 170 00 |
| | | Ditto if drawn out, add for each inch..... | 160 | 360 | 600 | 700 | 1800 | | |

85. ⅛ inch, Homogeneous Oil Immersion. Four Systems. Numerical aperture about 1.32,..... $75 00

## LIEBERKUHNS FOR OBJECT-GLASSES.

| No. | Object-glass. | Price. | No. | Object-glass. | Price. | No. | Object-glass. | Price. |
|---|---|---|---|---|---|---|---|---|
| | | $ c. | | | $ c. | | | $ c. |
| 87. | 3-inch, | 5 75 | 89. | 1½-inch, | 5 75 | 91. | $\frac{4}{10}$-inch, | 4 00 |
| 88. | 2-inch, | 5 75 | 90. | ⅔-inch, | 4 20 | 92. | ¼-inch, | 4 00 |

## APPARATUS.

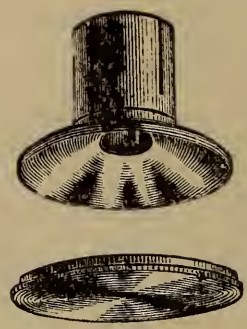
| No. | | Price. |
|---|---|---|
| 65. | Sorby's New Micro-Spectroscope, adapted to the Binocular Microscope, | $45 00 |
| 66. | Sorby's Spectroscope Eye-piece, for the Microscope, in Mahogany Case. (See "Popular Science Review," No. 18), | 50 00 |
| 67. | Sorby's Dichroiscope, | 9 00 |
| 67*. | Sorby's Standard Spectrum-scale, | 9 00 |
| 68. | Cells, for use with Sorby's Spectroscope, 6 sizes, assorted, per dozen, | 4 00 |
| 94. | Adapter for centering or throwing out of centre, and for revolving the Illuminating Apparatus; applicable only to "The International Stands," | 25 00 |
| 96. | Orthoscopic Eye-pieces, giving a very large field, each, | 9 00 |
| 97. | Eye-pieces for the Improved Large Microscope, each, | 7 50 |
| 98. | Eye-pieces for the Improved Smaller Microscope, each, | 6 75 |
| 99. | Erecting-glass, | 8 00 |
| 100. | Draw-tube for First-class Microscopes, | 4 75 |
| 101. | Achromatic Condenser, with Revolving Diaphragm, with stops, aperture from 25° to 80°, complete adjustments, | 42 50 |
| 101*. | Patent Achromatic Condenser, with Rotating front, with five Lenses for varying the magnifying power and angle of aperture, central rays stopped out by grinding off the back of two of the Front Lenses, | 45 00 |
| 102. | Achromatic Condenser, without Diaphragm, aperture from 20° to 60°, complete adjustments, | 22 50 |
| 103. | Brass Work of Achromatic Condenser, | 8 50 |
| 103*. | Set of Two Patches and one Central Stop, for Achromatic Condenser, | 3 50 |
| 104. | Right-angle Prism, for reflecting the light more perfectly than the Flat Mirror, | 22 50 |
| 104A. | Right-angle Prism, as applied to "The International," | 25 00 |
| 104*. | Achromatic Right-angle Prism, as Condenser instead of Mirror, | 27 50 |
| 105. | Amici's Prism, for oblique light, for the First-class Stands only, | 17 50 |
| 106. | Amici's Prism, on Separate Stand, | 17 50 |
| 107. | Nachet's Prism, for oblique light, | 9 00 |
| 108. | Wenham's Parabolic Reflector, for the First-class Stands, | 15 00 |
| 109* | Achromatic Amplifier; fitted to any stand | 15 00 |
| 110. | Spot Lens, mounted in brass fitting, | 4 50 |
| 111. | Equilateral Prism on Stand, for oblique illumination, | 9 00 |
| 112. | Adapter on Stand, for use of Object-glass as Condenser, | 5 00 |
| 113. | Brown's Iris Diaphragm, | 17 50 |
| 115. | Polarizing Apparatus, with 1 Film of Selenite, | 22 00 |
| 116. | Polarizing Apparatus, with extra-large Polarizing Prism, | 35 00 |
| 117. | Darker's Series of Selenites, adapted for the First-class Stands only, | 33 00 |
| 118. | Selenite Film, of two colors, | 2 25 |
| 119. | Selenite Stage, Red and Green or Blue and Orange, each, | 3 25 |
| 120. | Darker's Selenite Stage, giving 13 tints, | 18 50 |
| 121. | Black Glass, for Polarizing Light, | 4 50 |
| 122. | Bundle of Glass, for Polarizing Light, | 9 00 |
| 123. | Two Double-image Prisms and Selenite Film, with fittings to Eye-piece, and brass plate with holes, | 18 50 |
| 123*. | Single Double-Image Prism, in fitting, | 8 00 |
| 124. | Crystals to show rings round the Optic Axis, each, from, | 4 50 |
| 125. | Tourmalines, each, from, | 8 00 |
| 126. | Beck's Patent Illuminator, in a brass box, for viewing Objects as Opaque under high powers, | 4 50 |
| 126*. | Beck's Patent Illuminator, with Smith's Diaphragm, | 6 00 |
| 127. | White-cloud Illuminator, | 4 50 |
| 128. | Parabolic Illuminator, fitted to the 1½-inch and ⅔-inch Object-glasses, | 9 00 |
| 128*. | Parabolic Illuminator with fittings adjusting it to any Object-glass, | 10 00 |
| 129. | Parabolic Illuminator, same as No. 128, with the addition of Sorby's Reflector, | 18 00 |
| 130. | Large Bull's-eye Condensing Lens, on Stand, | 9 00 |
| 130*. | Large Bull's-eye Condensing Lens, on Stand, with Lamp attached, | 13 50 |

| No. | | Price. |
|---|---|---|
| 131. | Smaller Condensing Lens, with Fitting to Limb of the First-class Stands, | $8 00 |
| 132. | Smaller Condensing Lens, on Stand, | 6 00 |
| 133. | Side Silver Reflector, with Fittings to Limb of the First-class Stands, | 9 00 |
| 134. | Side Silver Reflector, on Stand, | 9 00 |
| 135. | Rainey's Light Moderator, on Stand, | 9 00 |
| 136. | Three Dark Wells and Holder, | 5 00 |
| 137. | Opaque Disk Revolver, one Tray of Disks in case, | 15 00 |
| 138. | Opaque Disk Revolver, with 3 Trays of Disks, Forceps, Capsule of Gold Size, in Mahogany Case, complete, | 25 00 |
| 139. | Opaque-Disk Revolver, and Forceps, | 9 00 |
| 140. | Boxes containing 24 Disks, | 4 50 |
| 141. | Trays containing 24 Disks, | 4 50 |
| 142. | Three-pronged Forceps, in German Silver, with Screw Adjustment, | 7 50 |
| 143. | Three-pronged Forceps, | 6 00 |
| 144. | Stage Forceps, | 3 50 |
| 144*. | Paper-pointed Forceps, | 50 |
| 145. | Stage Mineral-holder, | 9 00 |
| 145*. | Best Brass Forceps, | 3 25 |
| 146. | Eye-piece Micrometer, with Jackson's Adjusting Screw, | 8 50 |
| 147. | Stage Micrometer, mounted in brass, | 4 50 |
| 148. | Stage Micrometer, mounted in card, | 2 25 |
| 149. | Stage Micrometer, mounted in brass, parts of English Inch and Millimetre, | 6 00 |
| 149*. | Stage Micrometer, mounted in card, parts of English Inch and Millimetre, | 4 00 |
| 150. | Maltwood's Finder, in Case, | 3 50 |
| 152. | Indicator to each Eye-piece, | 2 25 |
| 153. | Shade to each Eye-piece, | 3 50 |
| 154. | Leeson's Goniometer, | 22 00 |
| 155. | Wollaston's Camera Lucida, with Lens to magnify Pencil Point, | 8 75 |
| 156. | Neutral-tint Glass Camera Lucida, | 3 25 |
| 157. | Steel Disk Camera Lucida, | 6 50 |
| 158. | Brook's Double Nose-piece, in Aluminium, curved, | 25 00 |
| 159. | Brook's Double Nose-piece, curved, | 12 50 |
| 159*. | Triple Nose-piece, curved, | 17 50 |
| 160. | Quadruple Nose-piece, curved, | 30 00 |
| 161. | Quadruple Nose-piece, curved, in Aluminium, | 42 50 |
| 162. | Lever Compressorium, | 8 50 |
| 163. | Parallel Compressor, | 9 00 |
| 164. | Reversible Compressor, | 9 00 |
| 165. | Wenham's Compressorium, for use with Wenham's Parabola, | 3 50 |
| 166. | Screw Live-box, | 6 50 |
| 167. | Large Live-box, | 3 75 |
| 168. | Smaller Live-box, | 3 00 |
| 169. | Large Glass Trough, with Wedge and Spring complete, | 3 75 |
| 170. | Smaller Glass Trough, with Wedge and Spring complete, | 3 00 |
| 171. | Glass Slip, with Ledge, | 40 |
| 172. | Growing-cell, for preserving objects alive in water for many days, | 4 50 |
| 173. | Set of Six Live-traps and Trough, in Case, complete, | 12 50 |
| 174. | Live-trap, | 3 25 |
| 175. | Frog-plate, with Bag, etc, complete, | 4 50 |
| 176. | Glass Slip, with Hollow and Ledge, | 50 |
| 177. | Glass Slip, with Hollow, and Ledge, and Lip, | 1 50 |
| 178. | Glass Slip, with Hollow, | 15 |
| 180. | Glass Tubes, Set of Three, | 50 |
| 181. | Key for Tightening Joint of First-class Instruments, | 2 25 |
| 182. | Opal Glass, for Moderating the Light, 3 x 1 inch, | 40 |
| 183. | Blue Glass, for Moderating the Light, 3 x 1 inch, | 40 |
| 186. | Astral Oil Lamp, Flat Wick and Shade, with arrangement for varying height of flame above the table, | 6 50 |
| 186*. | Case for Lamp, No. 186, and 1 chimney, | 4 00 |
| 188. | Gas Lamp, Argand Burner, Shade and six feet of flexible tubing, with arrangements for varying height of flame above the table, | 13 50 |
| 189. | Fiddian's Microscope Illuminator, in Case, | 15 00 |
| 190. | Lamp Chimneys, for Nos. 186 or 188, | 20 |
| 191. | Weber's Slip, with Convex Cell, | 75 |

## MICROSCOPIC ACCESSORIES.

No. 73.

No. 81.



Nos. 87-90.

Nos. 91-92.

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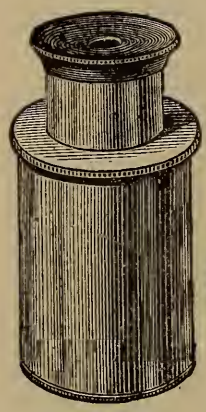

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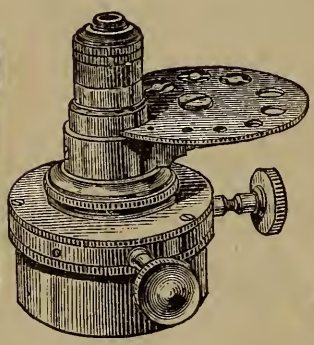

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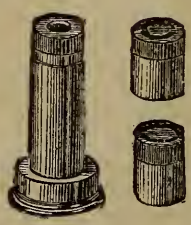

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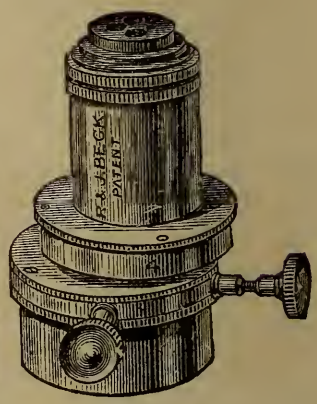


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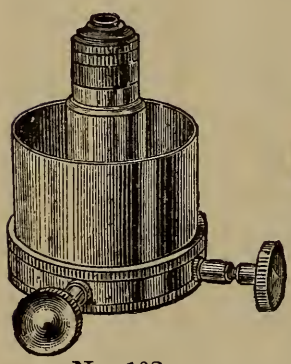

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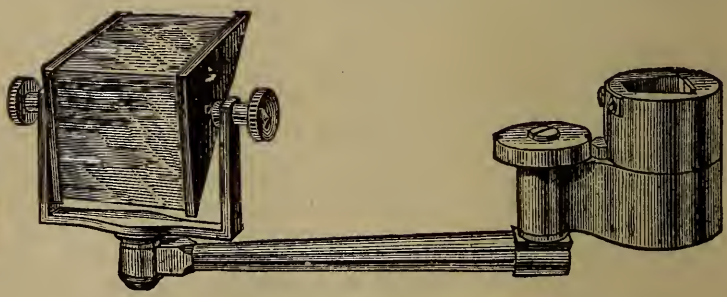

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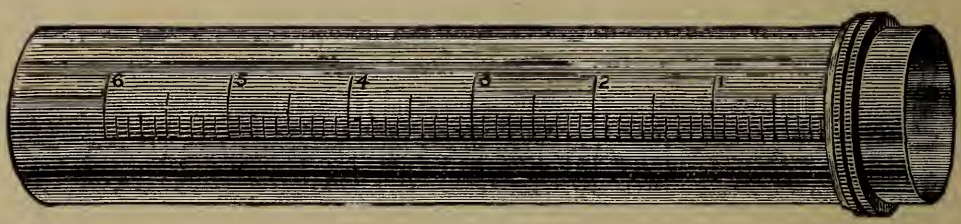


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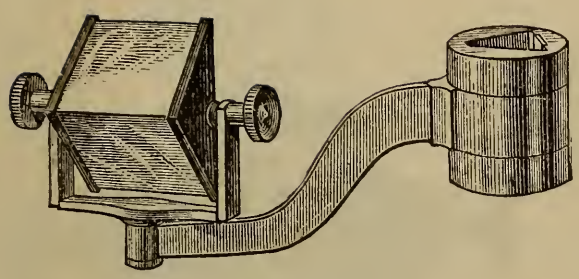

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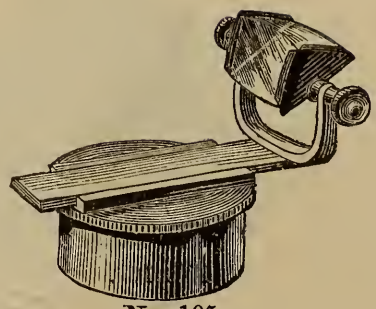

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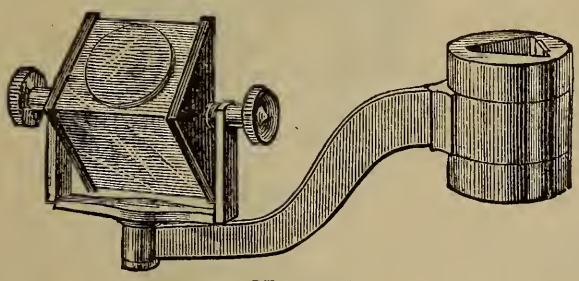

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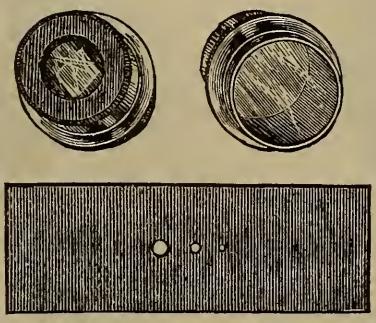

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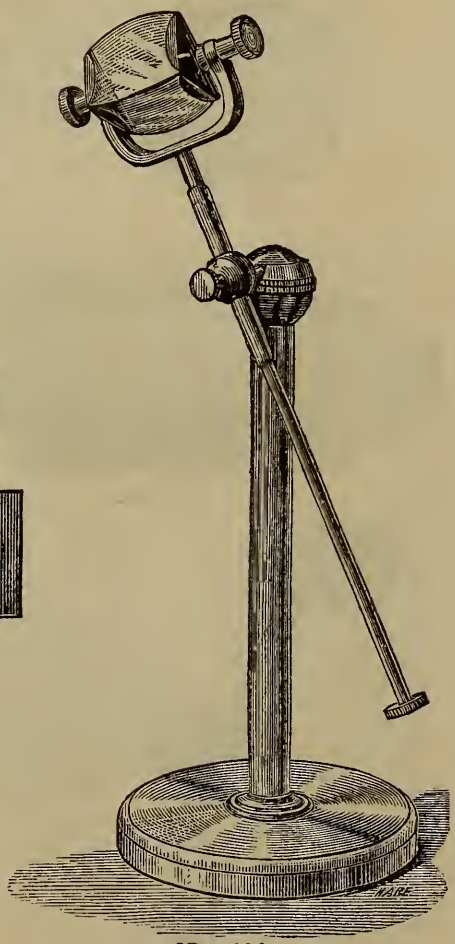

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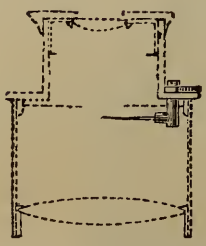

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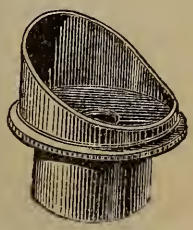

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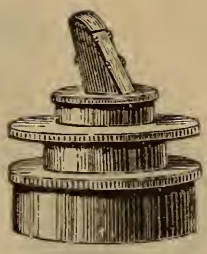

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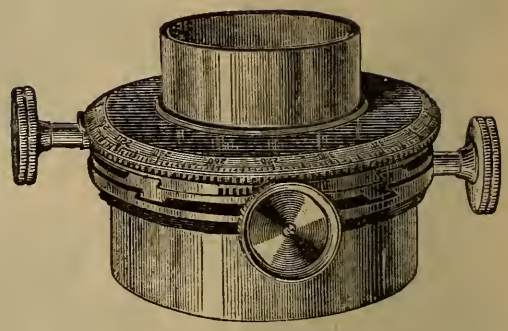

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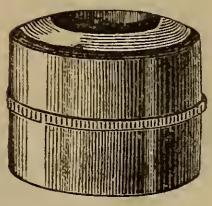

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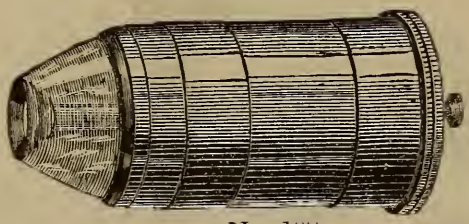

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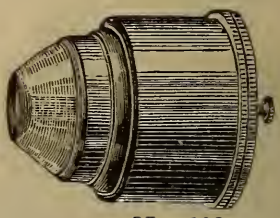

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No. 111

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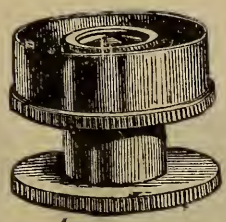

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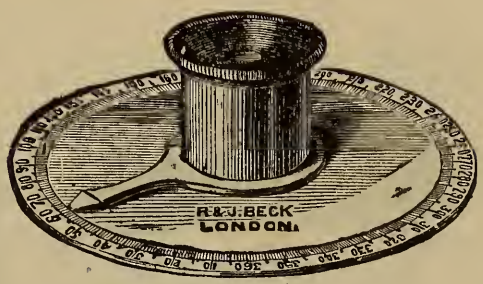


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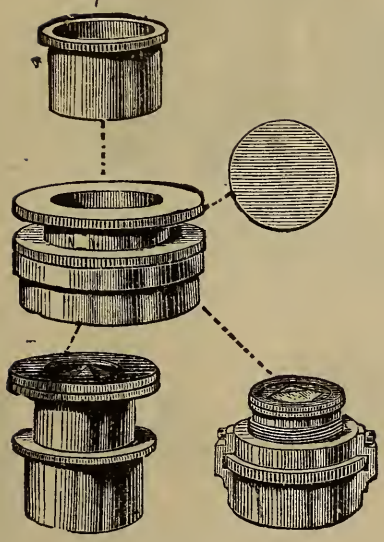

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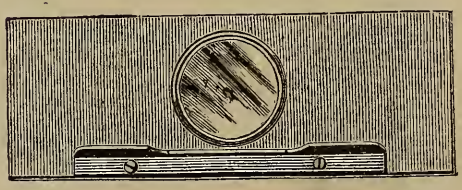

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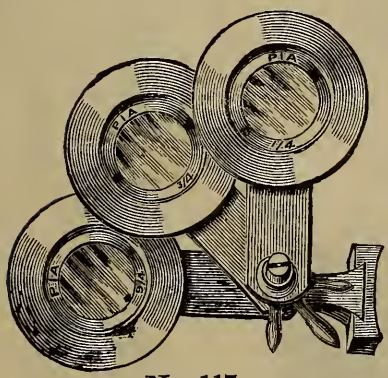


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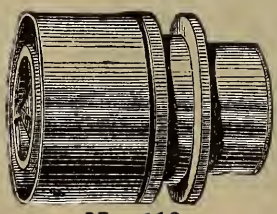

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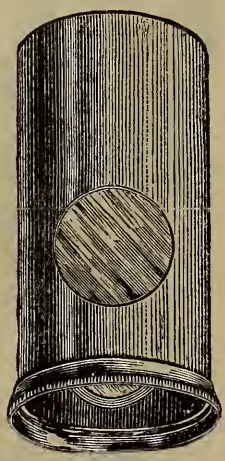

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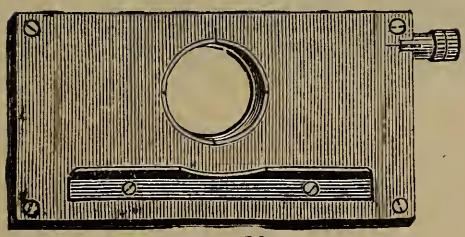

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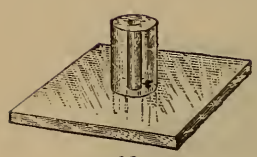

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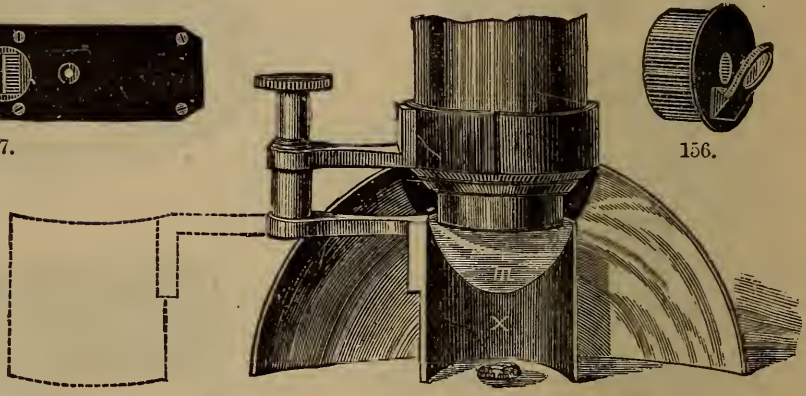

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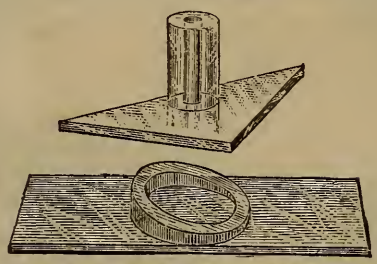

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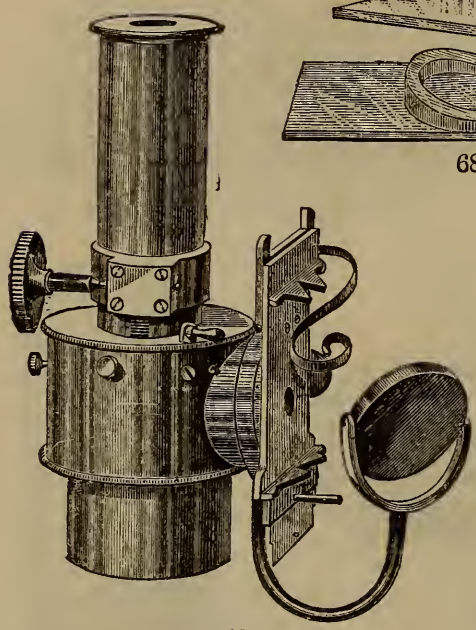

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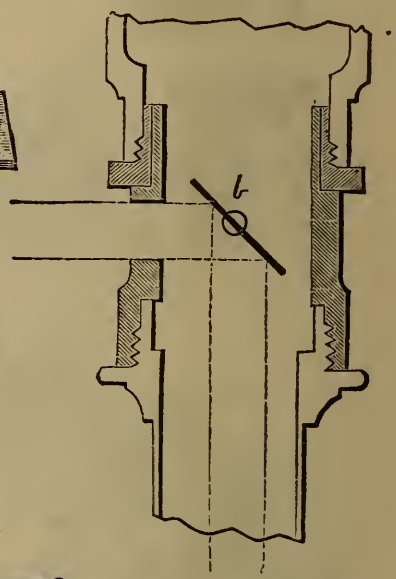

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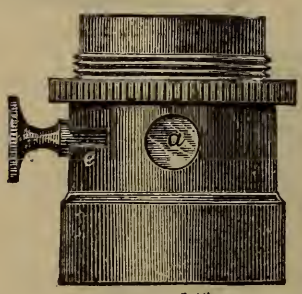

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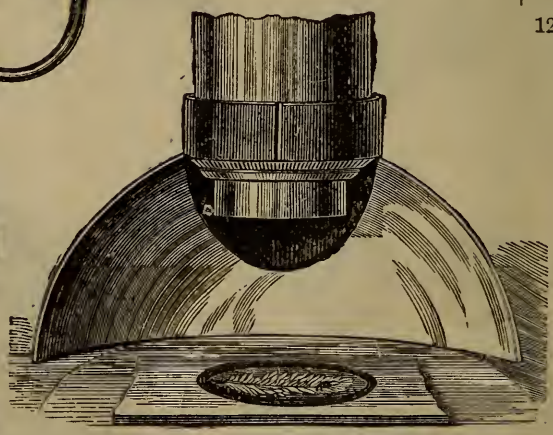

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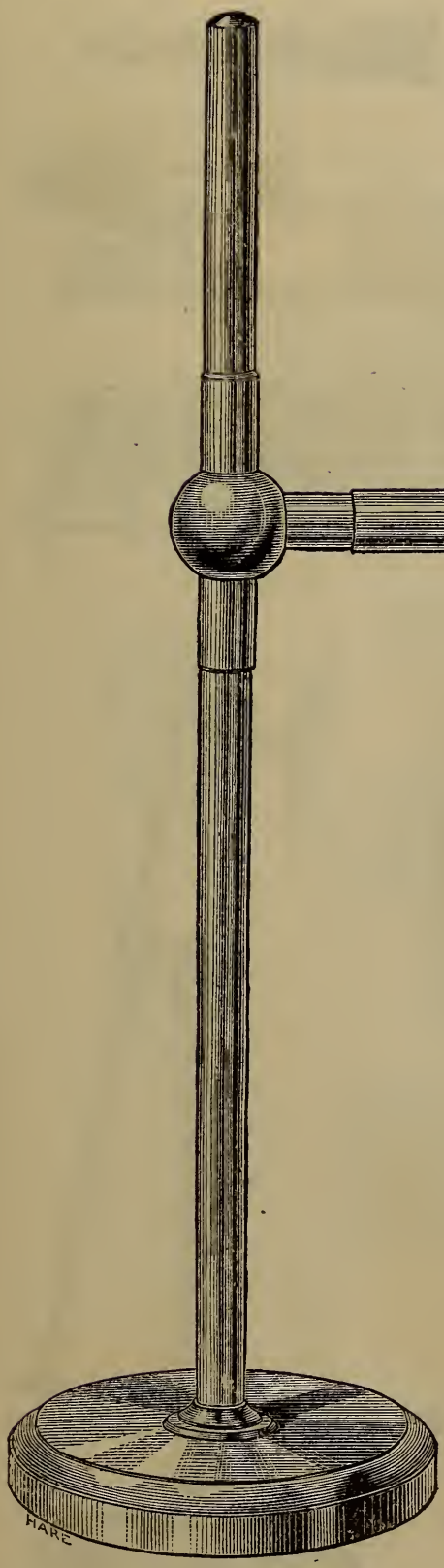


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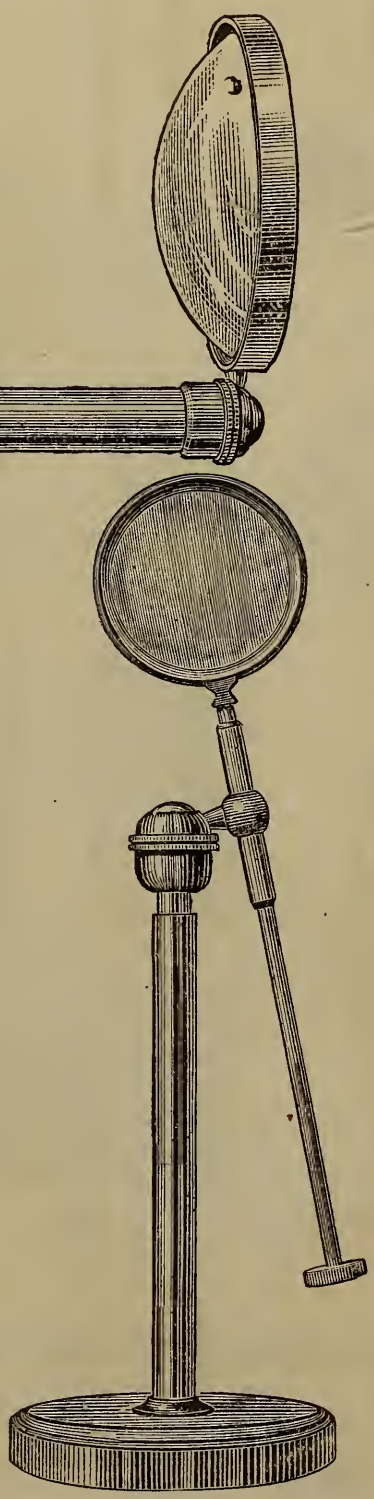

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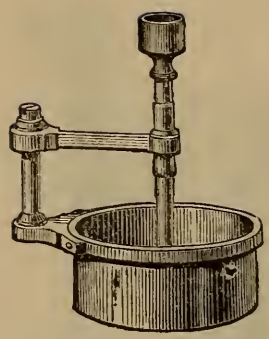

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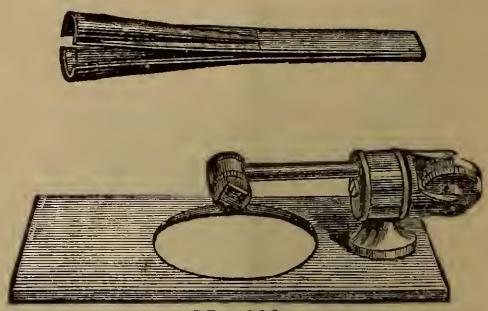

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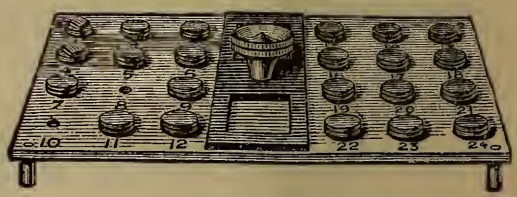


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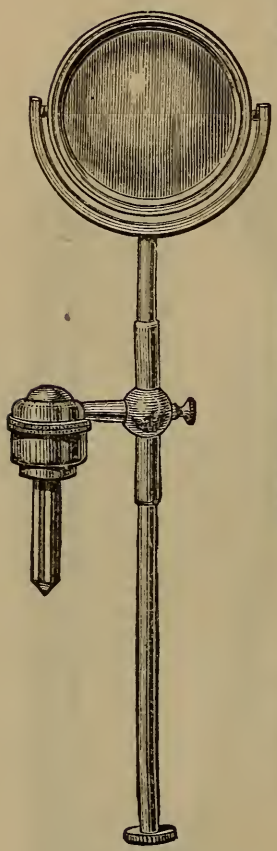

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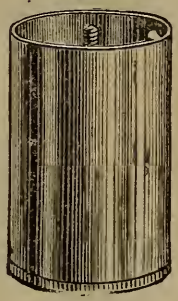

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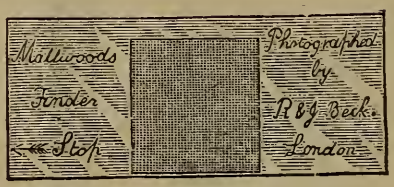


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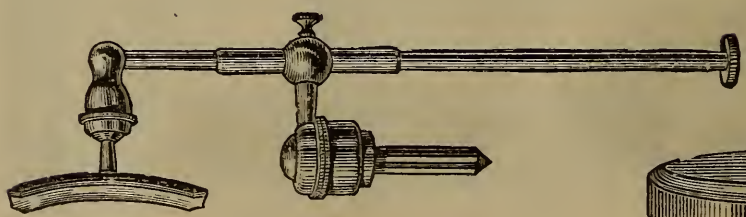

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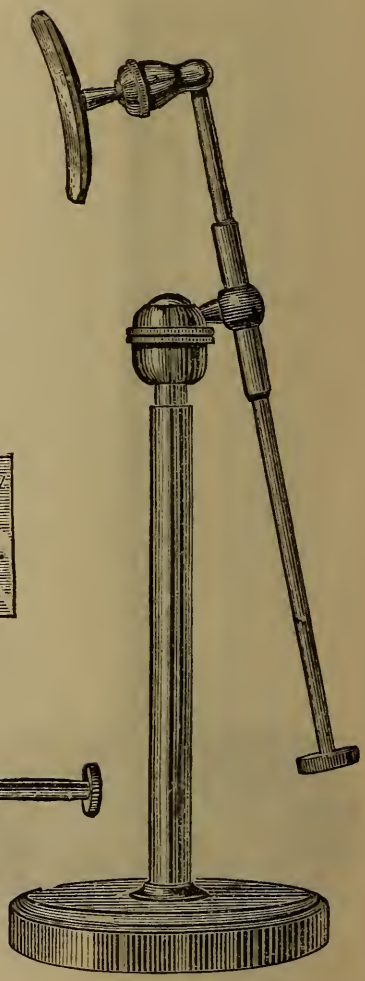

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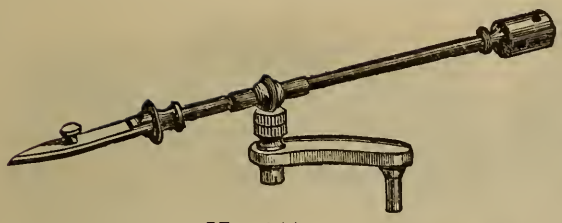

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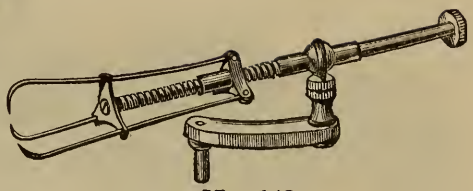

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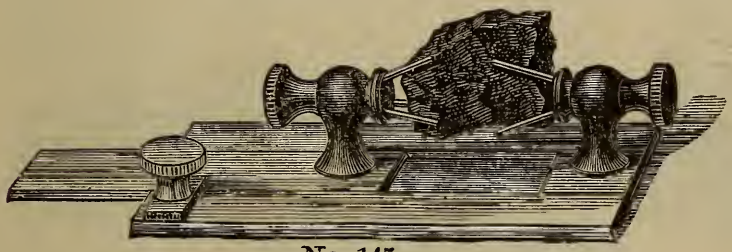

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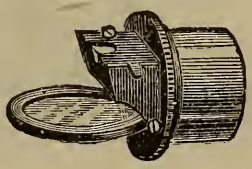

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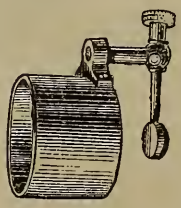

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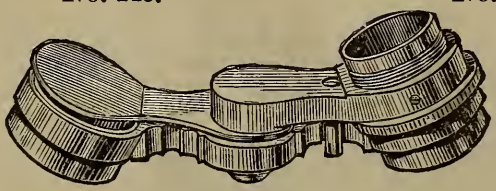

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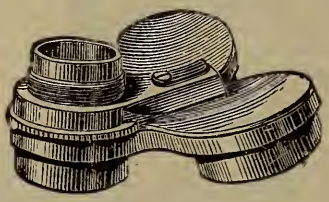

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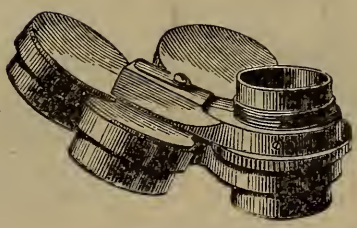

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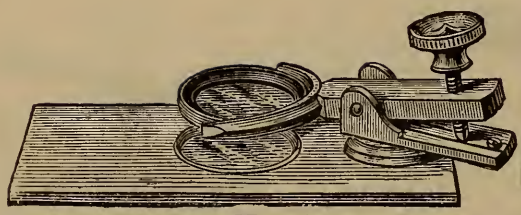

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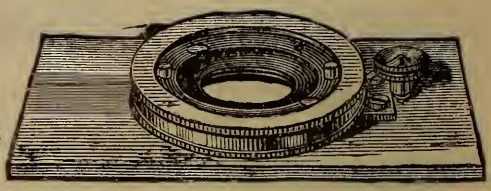

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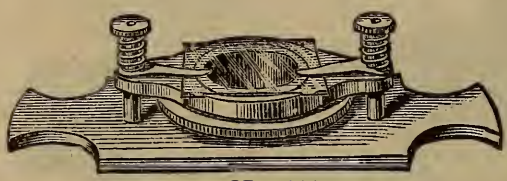

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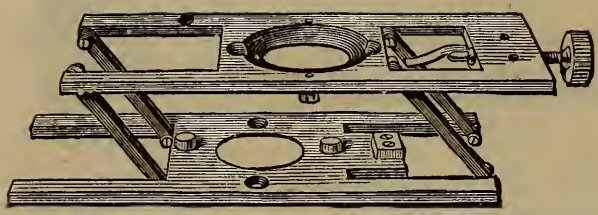

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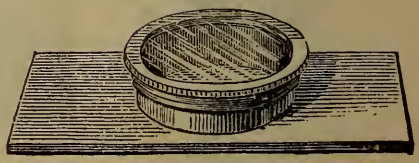

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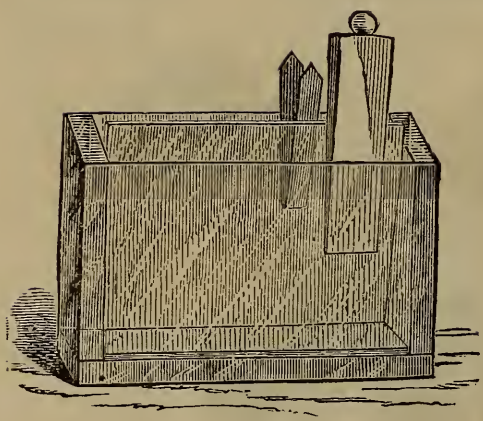

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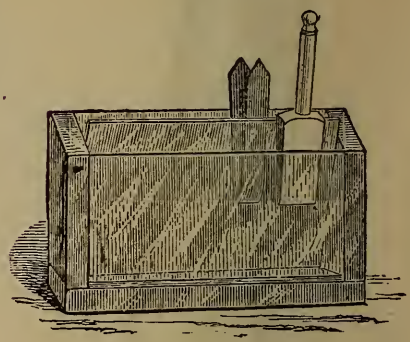

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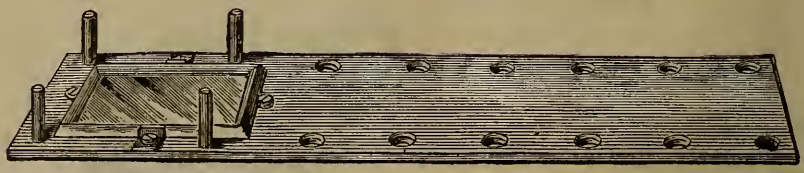

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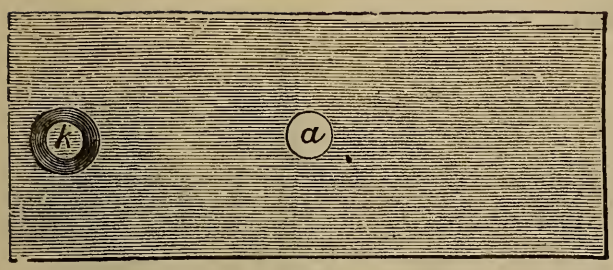


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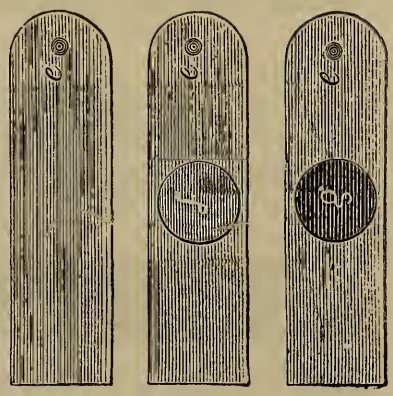

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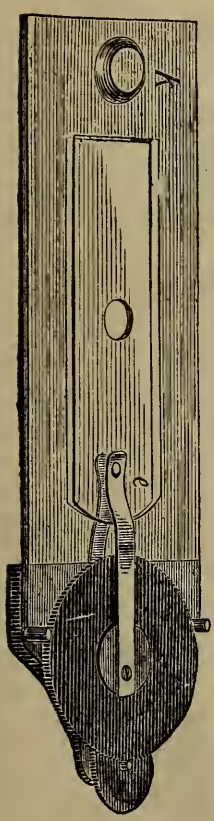

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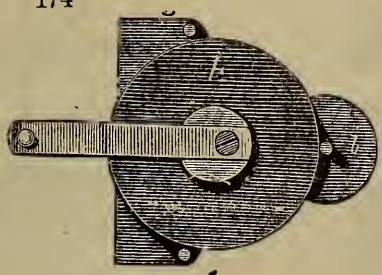

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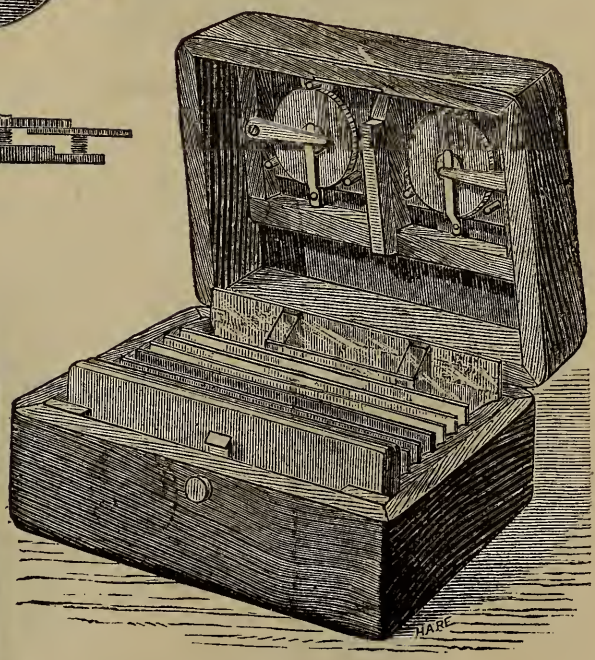

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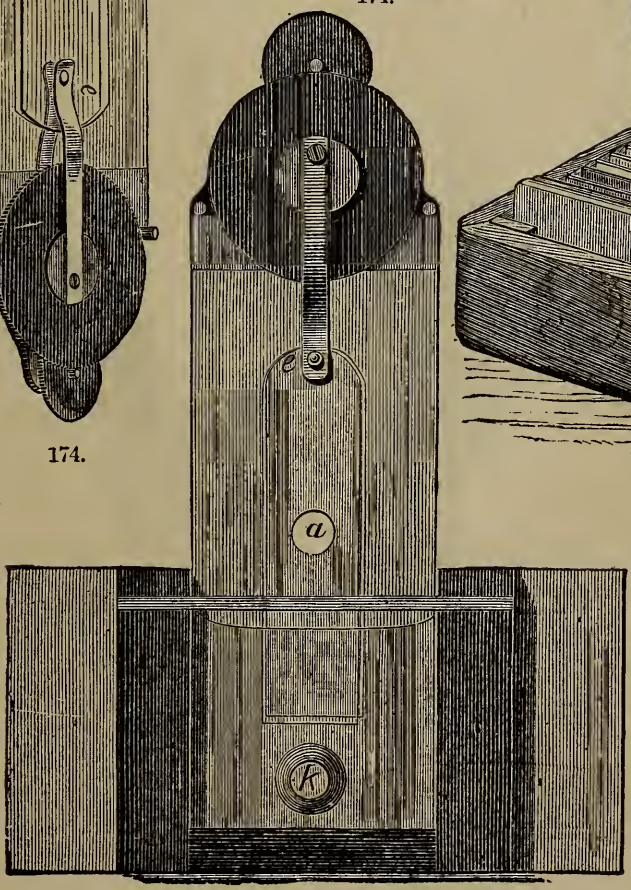


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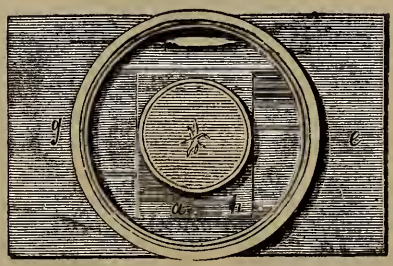

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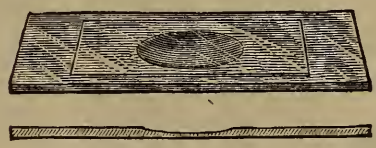

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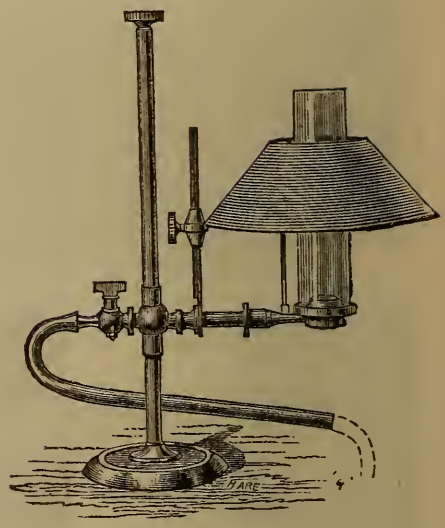


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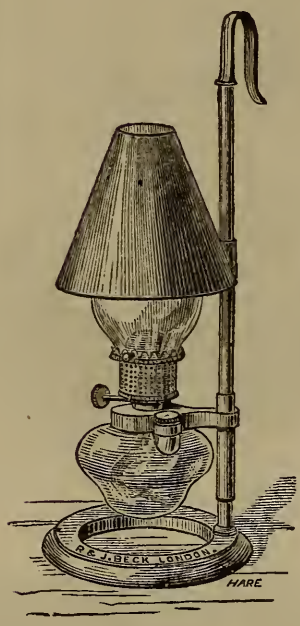


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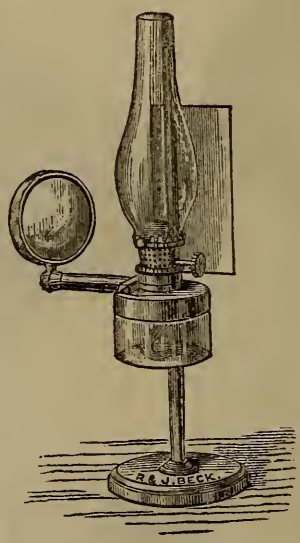


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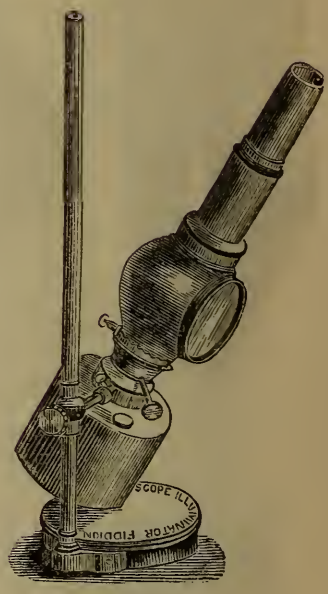

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No. 145*.

# ILLUSTRATED DESCRIPTION

OF THE

# MICRO-SPECTROSCOPE,

AS MANUFACTURED BY

## R. & J. BECK.

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In giving a description of the forms of Spectroscope as applied to the Microscope, we cannot do better than quote the following introductory explanation, written by H. C. Sorby, F. R. S.:

"Spectrum Analysis as applied to the Microscope must not be confounded with that branch of the subject which has yielded such admirable results in the hands of Bunsen, Kirchhoff, and other physicists. In that method of analysis it is the number and position of the narrow bright lines or bands into which the light of the incandescent body is divided by the Spectroscope that enable the experimenter to identify each different substance. It is, in fact, the analysis of the emitted light; whereas in Spectrum Analysis applied to the Microscope it is the analysis of light which has been modified by transmission through the substance under examination, and it is the absence and not the presence of particular rays which makes the spectra characteristic of different subjects. In this respect it is more analogous to Spectrum Analysis as employed in studying the chemical nature of the atmosphere of the Sun or stars, as illustrated by the researches of Kirchhoff, Müller and Huggins, but the principles involved are materially different. The absorption-bands in such cases are narrow, sharply defined lines, characteristic of absorption by gases; whereas those which play such an important part in researches with the Spectrum Microscope are usually broad, gradually shaded off on each side, and only in a few cases so narrow and sharply defined as to vie with some of the broader dark lines in the Solar spectrum."

The Micro-Spectroscope, No. 66, (figs. 1 and 2) consists of a series of prisms, A, arranged for direct vision, fitted into an Eye-piece, and supplied with various appliances—namely, a slit, B, a supplementary spectrum arrangement, C, consisting of a small right-angle prism, D, a stage, E, for placing an object upon, and a mirror, F, for reflecting the light and all the necessary adjustments.

In the focus of the top lens, G, of an Eye-piece especially constructed is placed what is technically termed a slit, B; this consists of two shutters meeting in the centre of the field, the one sliding up to the centre of the field of view, and the other adjusting by means of a delicate milled head, H. Upon the delicacy of the edge of this slit the value of the Spectroscope largely depends, any irregularity or piece of dust appearing as a dark band at right angles to the spectrum under examination, and greatly interfering with the definition.

In the same part of the Instrument is inserted a small right-angle prism, D, which can be pushed forward or drawn back out of the field of view by the milled head, I. In the former position it reflects the rays passing through any object placed upon the supplementary stage, E, to the eye placed at the eye-end of the Instrument, K, and enables the observer to compare two spectra with one another, or to measure and record the position of the absorption-bands, as will be described hereafter.

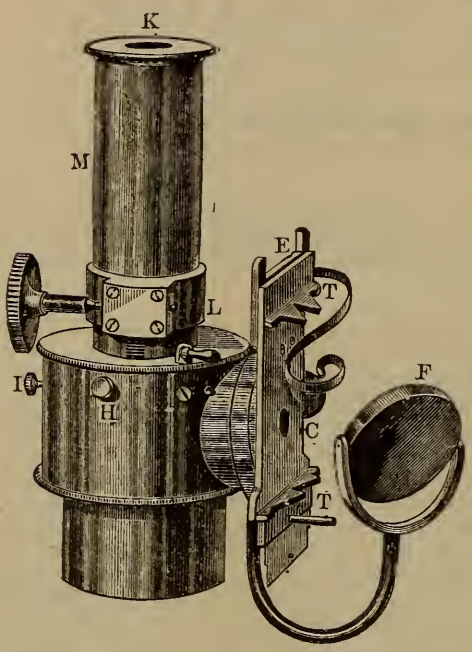
Placed on the flat surface of the Eye-piece are a couple of levers, L, moving two shutters, placed immediately over the slit, for regulating the length of the spectrum under examination.

Above the top lens, G, of the Eye-piece the most important portion of the Instrument slides; this consists of a series of prisms, A, so arranged as to give a direct-vision spectrum, and upon the amount of the dispersion of which prisms, much of the value of the Instrument depends.

At the side of the main tube is a supplementary stage, E, upon which a standard scale, to be described hereafter, or a second object is placed, supplied with a

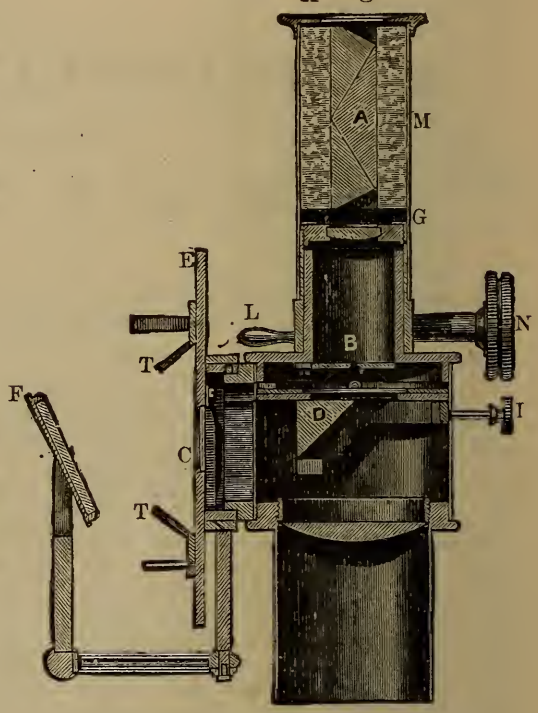
mirror, F, for reflecting the light through the object, the rays then being totally reflected by the right-angle prism, D, before alluded to, and thrown up the tube to the observer.

Fig. 1.




No. 66.

K Fig. 2.




No. 66.

## Directions for Using the Micro-Spectroscope.

Remove the ordinary Eye-piece of the Microscope, and slide the Spectroscope Eye-piece (Figs. 1 and 2) into the body in its place. Remove the upper tube, M, containing the series of prisms, and draw back the sliding slit by the milled head, H, so that one-half of the field of view is clear. Focus the microscope to the object to be examined, which is placed upon the stage, pass it up to the edge of the slit, move the side shutters by the levers, L, so as to shut off all side light, save that passing through the object, and push back the sliding side of the slit by the milled head, H. Focus the top lens of the Eye-piece to the slit by means

Fig. 3.

No. 67*.

of the rack-and-pinion, N, place the tube, M, containing the compound prism, A, over the Eye-piece, remove the object from the stage, adjust the slit by means of the adjusting milled head, H, so as to obtain clear vision, if by daylight, so that the Fraunhofer lines are faintly seen, replace the object to be examined upon the stage, and the absorption-bands will be readily seen.

The character of these bands and their position varies in every object; and if any practical use is to be made of the investigation, it is necessary not only to

observe, but to record their position. This is done by means of a Standard scale (fig. 3); the precise mode of attaining this result is described in full in the description of the Binocular Spectroscope.

The Standard scale, No. 67*, (fig. 3) used with the Micro-Spectroscope described above consists of two small Nicol's prisms having a plate of quartz .043 inch in thickness between them; it is placed when in use upon the supplementary stage, E, and held in its place by the two clips; the light is thrown in by the mirror, F, and the right-angle prism, D, reflects the image of the quartz-bands up to the eye-end, K.

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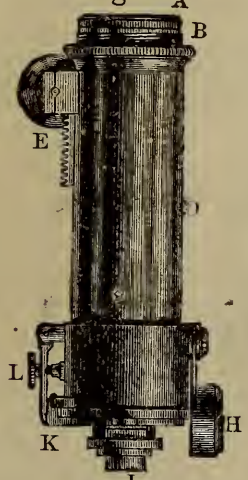
## Description of the Binocular Spectroscope.

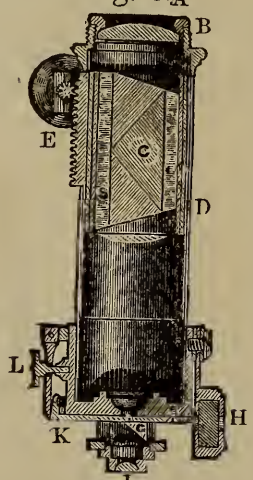
Whilst the Instrument already described is that which is most ordinarily in use, Mr. Sorby has planned another form (Sorby's Binocular Spectroscope, No. 65, figs. 4, 5), which can be used with the Binocular Microscope and which for

Fig. 4.




No. 65.

Fig. 5.




No. 65.

many purposes is superior to that already described and gives a larger dispersion. It consists of the following parts:

1st. An object-glass, A, specially arranged, screwing into the tube of the Microscope by the outside screw, B.

2d. A series of compound dense glass prisms, C, fitting immediately over the Object-glass, A.

3d. A tube, D, moving up and down upon that holding the prisms by means of rack and pinion, E, and carrying the following:

(*a*) A cylindrical lens, F, for lengthening out the spectrum.

(*b*) A small right-angle prism, G, sliding in and out of the field of view, which, when slid in, projects over half the field and throws an image of the dark bands in a piece of quartz polarized by means of two Herapathites or flakes of Iodide of Disulphate of Quinine, and termed (*c*) The Standard Scale, H. This portion of the apparatus is used when the observer desires to record the position of the absorption-bands. The plate of quartz which it contains is cut parallel to the optic axis,* of such a thickness that the line D in the Solar Spectrum comes between the third and fourth band. It is thus described by Mr. Sorby:—"In order to measure the exact position of absorption-bands, etc., seen in spectra, I have contrived a small apparatus which gives an interference-spectrum divided by black bands into 12 parts all of equal optical value. It is composed of two Nicol's prisms, or Herapathites, with an intervening plate of quartz about .043 inch thick, cut parallel to the principal axis of the crystal, the thickness being so adjusted that the sodium or D line is exactly 3½, counting the bands from the red end towards the blue."

*It is a well-known fact that a plate of quartz cut parallel to the optic axis will, under polarized light, give a series of black bands, the distance between such bands being due to the thickness of the plate of quartz.

4th. A small lens, I, to condense the light from the object. And 5th. A very accurate slit, K, one side of which is adjusted by means of the delicate milled head, L.

### Mode of Use.

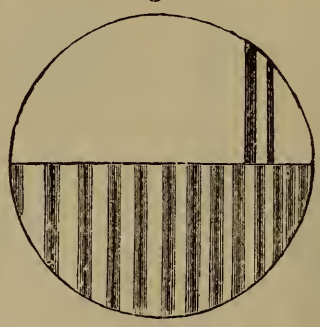
Screw the Object-glass, A, into the body of the microscope; slide the rest of the apparatus on to the object-glass, and turn the latter portion round so that the sides of the spectrum are seen square or upright, thus  , not thus  .

Adjust the outer tube by means of the rack-and-pinion movement, E, so that a clear image of the slit, K, is visible, regulate the width of the slit by the small milled head, L, so that if by daylight the more prominent lines in the Solar Spectrum are seen.

Focus the whole body of the Microscope so that the small lens, I, just touches the object to be examined. *Note.*—The small lens merely receives the light from the object and does not form an image of it.

If it is desired to register the position of the absorption-bands under view, push in the little prism, G, at the side, turn down the small box, H, containing the Standard Scale, and throw the light through it. In the field of the microscope will be seen on the upper half the spectrum of the object under observation, and on the under half an image of the standard scale as under (fig. 6).

Fig. 6.



The above illustration shows the appearance in the field of view when one half of the field is occupied by the Standard scale and the other by the object under investigation.

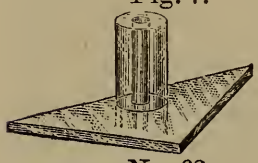
If the small Right-angle Prism, G, should require to be cleaned, it must be withdrawn carefully or steadily, to avoid chipping it. The carrier is made with a projecting prong *on one side*, which to a great extent protects the prism; but such protection cannot be put on the other side without stopping the light.

A piece of black paper has to be cemented on the back of the small prism, G, to stop the passage of any direct light. This can be turned up when the prism requires cleaning, which should be done with a delicate piece of wash-leather or cambric handkerchief.

If the cylindrical lens, F, is removed for cleaning, care must be taken in replacing it that the cell is screwed up so that the two marks on the lens are parallel with the slit, otherwise the definition will be impaired.

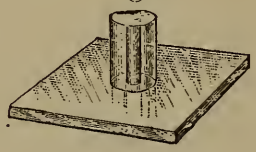
Fluids to be examined under the spectroscope may be placed in tubes and sealed up; but it is frequently desirable to have the means of selecting a certain depth of fluid for this purpose. Tubes are therefore used of different depths, No. 68, (figs. 7 and 8). Wedge-shaped cells (fig. 9) cemented on glass are also

Fig. 7.



No. 68.

Fig. 8.



No. 68.

Fig. 9.

No. 68.

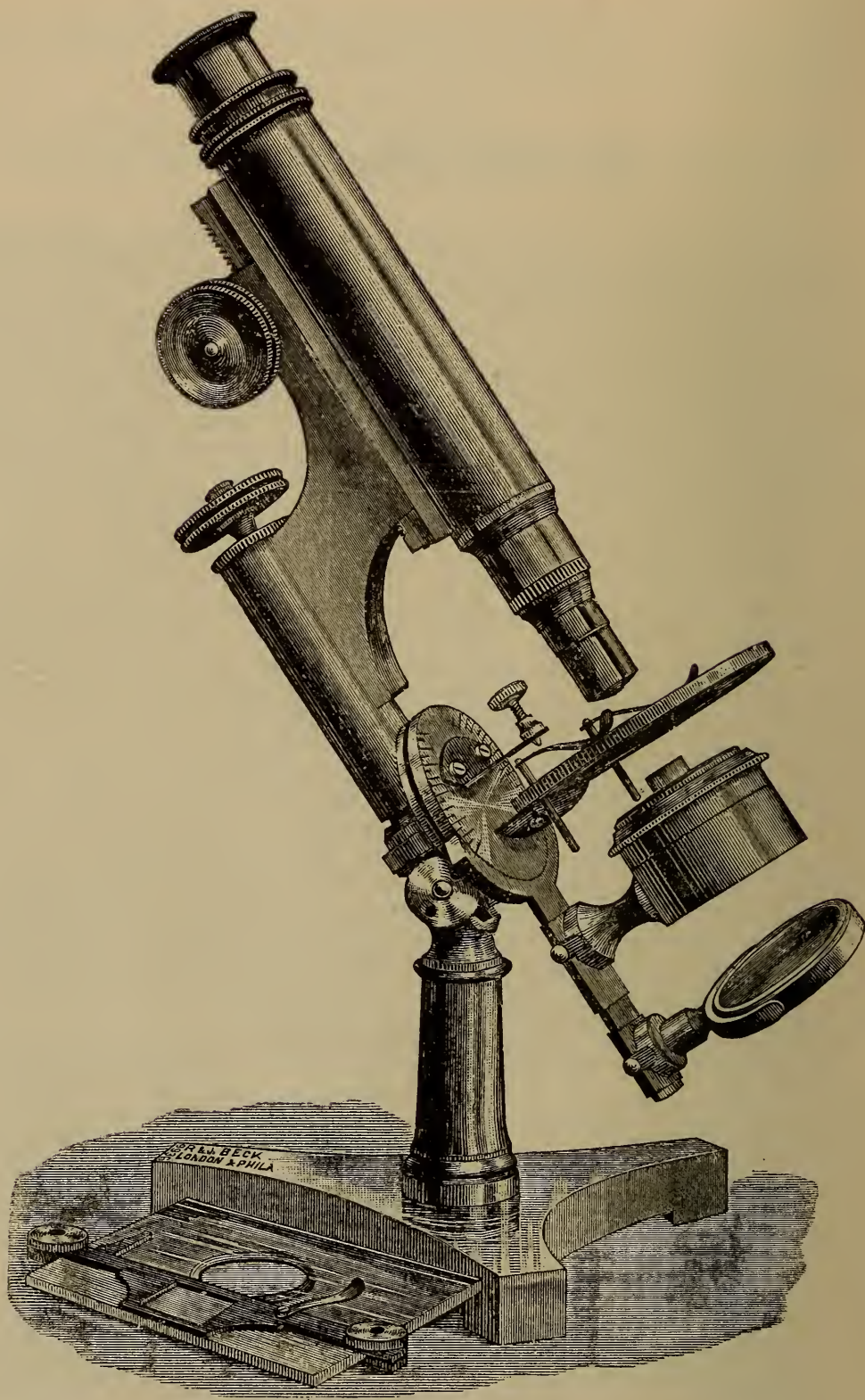
supplied, into which the fluid may be placed and a thin covering-glass placed on the top, so as to vary the thickness or depth of the fluid under view.

## THE "IDEAL" MICROSCOPE.

The general design of the new "*Ideal*" stand is that of our well-known "*Economic*," with such alterations and additions as the requirements of the most advanced workers demand. The instrument is wholly of brass, of the best workmanship and finish, fifteen inches in height, with the standard length of tube; the latter being telescopic, the stand may be shortened to eleven inches, a most convenient height when the instrument is used in the upright position. The base is a broad, heavy and perfectly steady tripod, from which rises a stout column to which the body is hinged so as to allow of its being inclined to any angle, with a stop at the horizontal position. The body is of the full standard size, using the same eye-pieces as those furnished with the "National" stands, and furnished with an adapter whereby objectives with either the society-screw may be used, or those with the new broad gauge or "Butterfield" screw, at will. The coarse adjustment of focus is made by a rack and pinion of exquisite smoothness, with sufficient length to permit the focusing of a four-inch objective. The fine adjustment is by a very delicate spring movement, controlled by a large milled-head at the rear of the body, most conveniently placed for the hand. The stage-ring or platform is made of very thin but stiff brass, with a large, central opening, and is provided with removable and reversible spring clips, exceedingly delicate, and adapted to any thickness of slide. By these a slide may be clamped on either the upper or the lower side of the stage and manipulated with the greatest ease, permitting the employment of the utmost obliquity of illumination. In addition to this stage-ring or platform, two movable stages are made, either of which is furnished, as desired by purchasers. In the first and cheaper form, a circular stage-plate of thin sheet-brass is provided, which revolves concentrically upon the stage-plate; in the second, a glass-stage with stop for a Maltwood finder, and movements of over one inch in all directions; and this is the one delineated in the illustration, which shows this glass-stage removed. The double mirror and sub-stage are attached to a stout triangular bar, which swings above the upper stage on either side, upon a graduated circle with a centering stop in the optic axis.

Both mirror and sub-stage slide upon this bar to any position required, or they can be entirely removed and employed separately or combined, as may be desired. The sub-stage ring is of the standard size, carrying any of the usual accessories, such as paraboloid, polariscope, achromatic condenser, dark-well and Woodward's prism, and is so arranged that the polariscope and achromatic condenser may be used in combination, thus greatly increasing the brilliancy of the former. The mirror swinging above the stage may be used as an illuminator for opaque objects, but a condensing lens for this purpose is also provided. Both the circular and the glass-stages are fitted for carrying a pair of stage-forceps; the diaphragms have openings of various sizes, which may be placed in immediate contact with the under surface of a slide if desired, and no pains have been spared to provide for all the wants of the working microscopist in every department of science in this one stand, which is believed to be at least unexcelled by any other of its class. The objectives furnished with it are those of our National series.

The *Binocular* "*Ideal*" Microscope Body is of the same size as that of the Economic, No. 264.*




No. 209.

ONE-HALF ACTUAL SIZE.

The above illustration represents *The "Ideal" Monocular Microscope Stand* (No. 209), and as furnished with No. 201. The glass stage is shown removed, and the spring clips of the thin *Diatom Stage* in position.

Illustration in Next Edition.

No. 211.

TWO-FIFTHS ACTUAL SIZE.

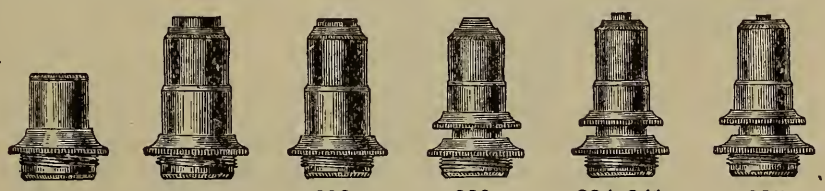
The above illustration represents *The "Ideal" Binocular Microscope Stand* (No. 211), and as supplied with No. 205. It shows the Glass Stage in position, and the thin revolving stage and sub-stage ring removed; and the Mirror bar at a very considerable inclination.

## PRICES OF THE "IDEAL" MICROSCOPES AND APPARATUS.

| No. | | Price. |
|---|---|---|
| 200. | ***The "Ideal" Microscope, Monocular,*** . . . . . With Swinging Sub-stage revolving around the upper Stage by a graduated Circle with Centering Stop, very thin Circular Stage with Clips, allowing the utmost obliquity of illumination, and removable Stage-plate rotating concentrically in the Optic Axis. Coarse adjustment by Rack and Pinion, and fine ditto by a delicate Micrometer Screw, conveniently placed at rear of arm, moving the entire body without tremor; Graduated Drawtube, two Eye-pieces and two Objectives (one inch No. 295 and one-sixth inch No. 298 of the National Series), Condensing Lens on Stand No. 226, Stage Forceps and Pliers with Glass Plate. The whole packed in handsome Mahogany Case with Drawer for usual accessories. | $70 00 |
| 201. | ***The "Ideal" Microscope, Monocular,*** . . . . . With Stand the same in all particulars as that furnished with No. 200, with the addition of a Movable Glass Stage with Stop for Maltwood Finder, as shown in the illustration; Objectives, Eye-pieces and all other accessories the same as those furnished with No. 200—in handsome Mahogany Case. | 75 00 |
| 205. | ***The "Ideal" Microscope, Binocular,*** . . . . . With two pairs of Eye-pieces, adjustment for different widths between eyes, Glass Stage, Objectives and all accessories the same as those furnished with Monocular Stand No. 200—in Mahogany Case. | 100 00 |
| 208. | ***The "Ideal" Microscope Stand, Monocular,*** . . . . Same as that furnished with No. 200; One Eye-piece. No accessories or case. . . . . | 45 00 |
| 209. | ***The "Ideal" Microscope Stand, Monocular,*** . . . . With Movable Glass Stage same as that furnished with No. 201; Two Eye-pieces. No accessories or case. | 55 00 |
| 211. | ***The "Ideal" Microscope Stand, Binocular,*** . . . . With Movable Glass Stage, the same as that with Stand No. 205; *Two* pairs of Eye-pieces. No accessories or case. | 75 00 |
| 215. | ***Mahogany Case for the Monocular "Ideal" Microscopes,*** . | 6 50 |
| 216. | ***Mahogany Case for the Binocular "Ideal" Microscopes,*** . | 7 50 |
| 217. | ***Mahogany Side Case,*** . . . . . Arranged to slide into either of the above Cases (No. 215 or 216), with Fittings for all the additional Apparatus (Nos. 238 to 248). | 3 50 |
| 220. | ***Mechanical Stage,*** . . . . . With Horizontal and Vertical Movements and Sliding Object-Holder, Revolving Concentrically in the Optic Axis. | 22 50 |
| 221. | ***The "Ideal" Iris Diaphragm,*** . . . . . | 7 50 |
| 222. | ***Conical Diaphragm,*** . . . . . | 2 50 |
| 223. | ***Adapter,*** . . . . . For using an Object-glass as Condenser, Nos. 221, 222 and 223, are specially fitted to the Sub-stages of the "Ideal" and Improved National Microscopes. | 2 00 |
| 224. | ***Blue Glass Light-Moderator,*** . . . . . | 2 50 |
| 226. | ***"Ideal" Side Condensing Lens,*** . . . . . On Stand, with Universal Movements. | 3 50 |
| 227. | ***Improved Stage Forceps,*** . . . . . | 2 50 |

## THE "IDEAL" SERIES OF ACHROMATIC OBJECT-GLASSES.

The "Ideal" Object-glasses in the following list have been carefully formulated and made to meet the wants of that large and growing class of *working* Microscopists, who, whilst requiring most exactingly the very highest performance in a lens, as to flatness of field, freedom from color, penetration, and perfect definition and resolution, do not care to pay the prices neccessarily charged for *fancy lenses*, made regardless of cost. The "Ideal" Series fully meets all these requirements, and we confidently recommend them as being superior in all respects to any others of similar cost now made. From the ¼ up they are furnished with Cover Corrections.



230. 231. 232. 233. 234–34* 235.

## PRICE LIST OF OBJECT-GLASSES AND LIEBERKUHNS.

| No. | Focal length. | Linear magnifying power nearly, with Eye-pieces. | | | | Degrees of angle of aperture. | Price. | No. | Lieberkuhns for Object-glasses. | Price. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Draw-tubes. | No. 1. | No. 2. | No. 3. | | $ c. | | | $ c. |
| 229. | 3 in. | closed | 12 | 20 | 40 | 8 | 16 00 | | | |
| 230. | 2 in. | closed | 24 | 40 | 70 | 10 | 13 00 | | | |
| 231. | 1½ in. | closed | 29 | 48 | 90 | 15 | 20 00 | 237 | 1½-inch | 4 00 |
| 232. | 1 in. | closed | 55 | 90 | 160 | 22 | 20 00 | 238 | 1-inch | 3 50 |
| 233. | ½ in. | closed | 120 | 200 | 360 | 40 | 20 00 | 239 | ½-inch | 3 50 |
| 234. | ¼ in. | closed | 210 | 350 | 600 | 75 | 20 00 | | | |
| 234*. | ⅙ in. | closed | | | | | 30 00 | | | |
| 235. | ⅛ in. | closed | 420 | 700 | 1000 | 85 | 40 00 | | | |
| 236. | $\frac{1}{20}$ in. | closed | 800 | 1200 | 2000 | 100 | 60 00 | | | |

## ADDITIONAL APPARATUS.

238. Lieberkuhn to 1-inch Object-glass, . . . . . $ 3 50
240. Dark Well, . . . . . 2 00
241. Achromatic Condenser and Fitting, . . . . . 8 50
242*. Wenham's Parabolic Reflector, for Dark-field Illumination, specially adapted to the Sub-stages of the "Ideal" and Improved National Microscopes, . . . . . 8 50
244. Polarizing Apparatus, complete, with Prisms, Film of Selenite and Adapter, . . . . . 15 00
245. Wollaston's Camera Lucida, for drawing an object, . . . . 6 50
245*. Vertical Camera Lucida, to be used with the Microscope in an upright position, . . . . . 8 00
246. Glass Micrometer, ruled into $\frac{1}{100}$ths and $\frac{1}{1000}$ths of an inch, . . 2 25
247. Small Live Box, . . . . . 2 50
248. Glass Trough, complete with Wedge and Spring, . . . . . 3 00
250. All the Above Additional Apparatus, from Nos. 238–248, (not including 245*), if ordered at once, . . . . . 45 00
253. Double Nosepiece, angular, . . . . . 7 00
253*. Triple Nosepiece, " . . . . . 15 00
254. Series of Two dozon Popular objects in Case, . . . . . 7 00
255. Series of Six Dozen Educational objects in Mahogany Case, . . . 30 00
256. Dr. Woodward's Diatom Prism, mounted, . . . . . 1 50
257. Hemispherical Lens, mounted, . . . . . 3 00
262. Eye-pieces for the "Ideal" Microscopes, Nos. 1, 2, 3, 4, or 5, each, . 5 50

## THE LITHOLOGICAL MICROSCOPE.

The general form of The Lithological Microscope Stand is the same as that of the "Ideal," and is sufficiently shown in the accompanying woodcut. Whilst specially constructed with a view to its employment by students of Mineralogy and Petrology, it is equally efficient for the work of the general Microscopist, as all of the apparatus of the "Ideal" and National Stands can be used upon it.

The body is provided with a Draw-tube (by which the Standard length of ten inches may be obtained), the head of which carries a bevelled circle graduated as shown in the illustration. A corresponding disc, with an index, is attached to the bottom of the analyzer-fitting, and rests directly upon the fixed divided circle, so that the analyzer can be set in any required position; and any amount of revolution imparted to it can also be registered. The eye-pieces—when inserted—are kept in a fixed position by a stud, which falls into a slot. Delicate crossed lines are fixed within the eye-pieces for the purpose of centering the instrument. A plate of Calc spar, cut at right angles to the optical axis, is mounted in a metal ring, which can be placed between the eye-glass and the analyzer for stauroscopic examinations.

The nose-piece, carrying the Society screw, is attached to the Body by the Butterfield or broad-gauge screw, and is provided with two small milled-heads (shown in the illustration), by means of which any objective may be accurately centered. It is also fitted with a Kleins quartz plate, set in a small brass mount. When not in use the aperture is closed by a revolving collar.

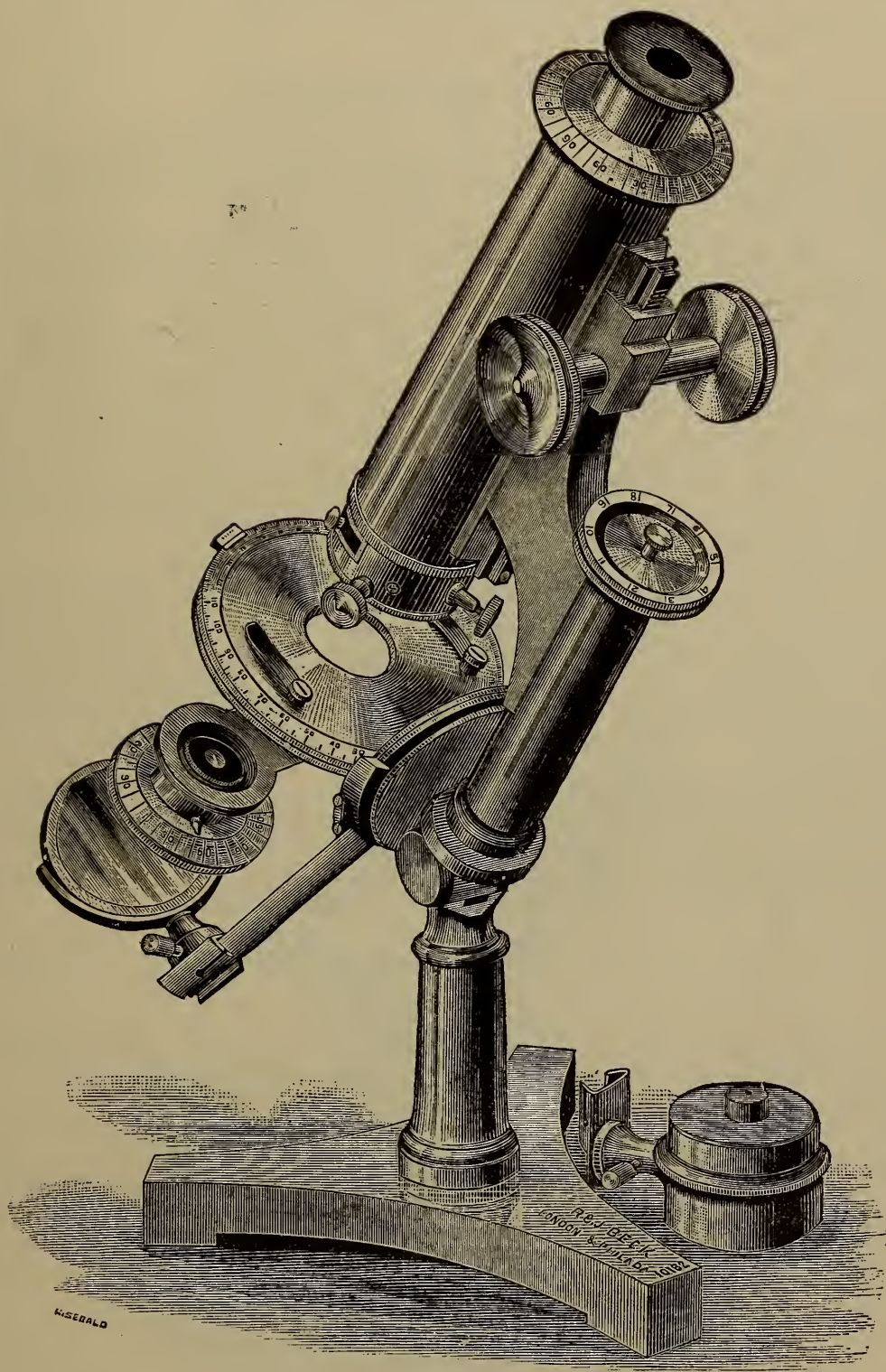
The stage is circular, and capable of concentric rotation; and it is divided on the margin to 360°. A Vernier is attached to the front, and an index-point to the back of the stage.

The polarizer slides into a fitting attached to an arm, which is pivoted on the lower immovable surface of the stage, so that it can readily be displaced when ordinary transmitted illumination is required; and replaced with equal facility.

Two small lenses (as condenser), affording a strongly convergent pencil of light, are set in metal rings which drop into the top of the fitting which surrounds the polarizing prism. When these are employed, and the analyzer is used *without the eye-piece* (a separate fitting being supplied for this purpose), examination of the rings and brushes presented by sections of certain crystals, can be advantageously carried on. The lower end of the fitting which carries the polarizer is surrounded by a graduated circle, turning beneath a fixed index, so that any position of the prism can be recorded, and the rotation imparted to it can be measured.

From the foregoing description it will be seen that this instrument is capable of performing the functions of an ordinary Microscope, a Polariscope and a Stauroscope. A Spectroscope (No. 65 or 66), or a Goniometer (No. 156), can also be employed if needful.

260. THE LITHOLOGICAL MICROSCOPE STAND, . . . . . $110 00
Stand as described above, with two eye-pieces; Polariscope, with condenser complete; swinging Sub-stage and rotating upper Stage—in handsome Mahogany case.




No. 260.

One-half Actual Size.

The above illustration represents very accurately the new Lithological Microscope Stand, with Polarizing prism thrown out of position, sub-stage removed, and Mirror inclined; and all the graduations, to stage, Polariscope and Eye-piece; with centering screws to nose-piece, and quartz-plate in position.

# THE ECONOMIC MICROSCOPE.

The Microscope is now such an absolute necessity for the student, to enable him satisfactorily to carry on his investigations, that it is more than ever incumbent on the optician to construct a sound economic instrument, adapted to the special requirements of this large and increasing class.

For ordinary pathological, physiological, and botanical investigations, many of the delicate adjuncts applied to the higher-priced instruments are unnecessary, and tend rather to confuse than to assist the beginner.

A firm Stand and well-corrected Object-glasses are, however, indispensable; and, with a view to meet this want, we have constructed and now introduce to the special attention of professors and students, the "ECONOMIC MICROSCOPE."

The description following will fully explain both the construction and the mode of using this instrument; whilst the scale of prices at the conclusion will, we trust, convince all who peruse them that we are able, by means of the machinery at our command, to offer those who do not desire to spend a large sum on a microscope, an instrument thoroughly adapted to their necessities, at a very moderate outlay.

A *Compound Achromatic Microscope*, consists essentially of two parts,—an *Object-glass* and an *Eyepiece*,—so called because they are respectively near the object and the eye when the instrument is in use. The object-glass screws, and the eyepiece slides, into opposite ends of a tube termed the *Body*, and upon the union of the two the magnifying power depends. The *Microscope Stand* is an arrangement for carrying the body, and is combined with a *Stage* for holding or giving traverse to an object, and a *Mirror* or some other provision for illumination.

The *Stand* of the ECONOMIC MICROSCOPE is made in two forms—the one with a *sliding coarse adjustment* for focussing the object, and the other where the *quick movement* is produced by a rack and pinion. On both stands the fine adjustment is given by means of a milled head at the top of the stem. The Object-glasses are attached to the stand with the Universal or Society Screw.

## DESCRIPTION OF THE STAND (Fig. 1, No. 263) AND APPARATUS AS SUPPLIED FOR $45 00.

The foundation of the stand (Fig. 1, No. 263) is a heavy Tripod base, A, from which rises a firm pillar, B, having at its top a hinge joint, C, which allows the body, D, to be inclined at any angle, and is sufficiently firm to permit of its being placed horizontal for use with the Camera Lucida.

At this price the instrument includes one *Eye-piece*. No. 2, and two *Object-glasses*, called the 1-inch and ¼-inch, from their magnifying power being nearly the same as single lenses of such focal lengths, a condensing lens for the illumination of opaque objects, a glass plate with ledge, for examination of fluids, and a pair of brass pliers. The whole packed in a neat Mahogany case, with lock and key.

Its *Linear Magnifying-powers* are nearly as under:—

| | Draw-tube closed. | Draw-tube pulled out. |
|---|---|---|
| 1-inch..... | 63 | 110 |
| ¼-inch..... ..... | 240 | 330 |

The Body is supplied with a draw- or lengthening-tube, V, which must be pulled out to give the full power to the object-glass, F.

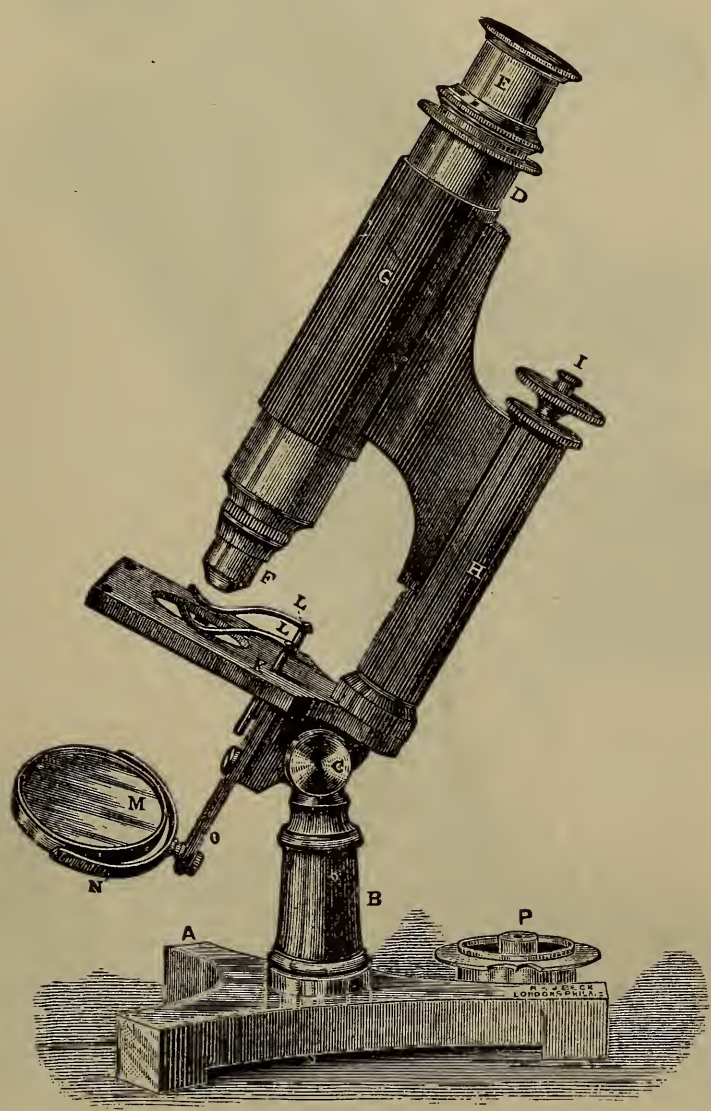
The *Quick-focussing movement* is produced by sliding the body, D, up and down in the tube, G, and the *slow motion* is given by the tube, H, sliding over the inner stem with a spring inside, and adjusted by the milled head, I.

The *Stage*, K, upon which the object is placed, has two springs, L, L, the pins attached to which may be inserted in any of the four holes on the stage, and by their pressure, (which can be varied by pushing them more or less down) they will hold the object under them or allow it to be moved about with the greatest accuracy.

The *Mirror*, M, besides swinging in the rotating semicircle, N, is attached to a bar, O, with a joint at each end allowing a lateral movement, so as to throw oblique light on the object; and for this purpose the tube beneath the stage, carrying the Diaphragm is attached by bayonet catches, and can be instantly removed, leaving a clear and very thin stage, allowing the utmost obliquity of illumination. This tube also carries the Polariscope, etc., etc.

The *Diaphragm*, P, slides in the substage-fitting, and consists of a tube containing two caps furnishing two sizes of openings, immediately in contact with the under surface of the slide to be examined, and also completely cutting off all light from the mirror when opaque objects are to be viewed.

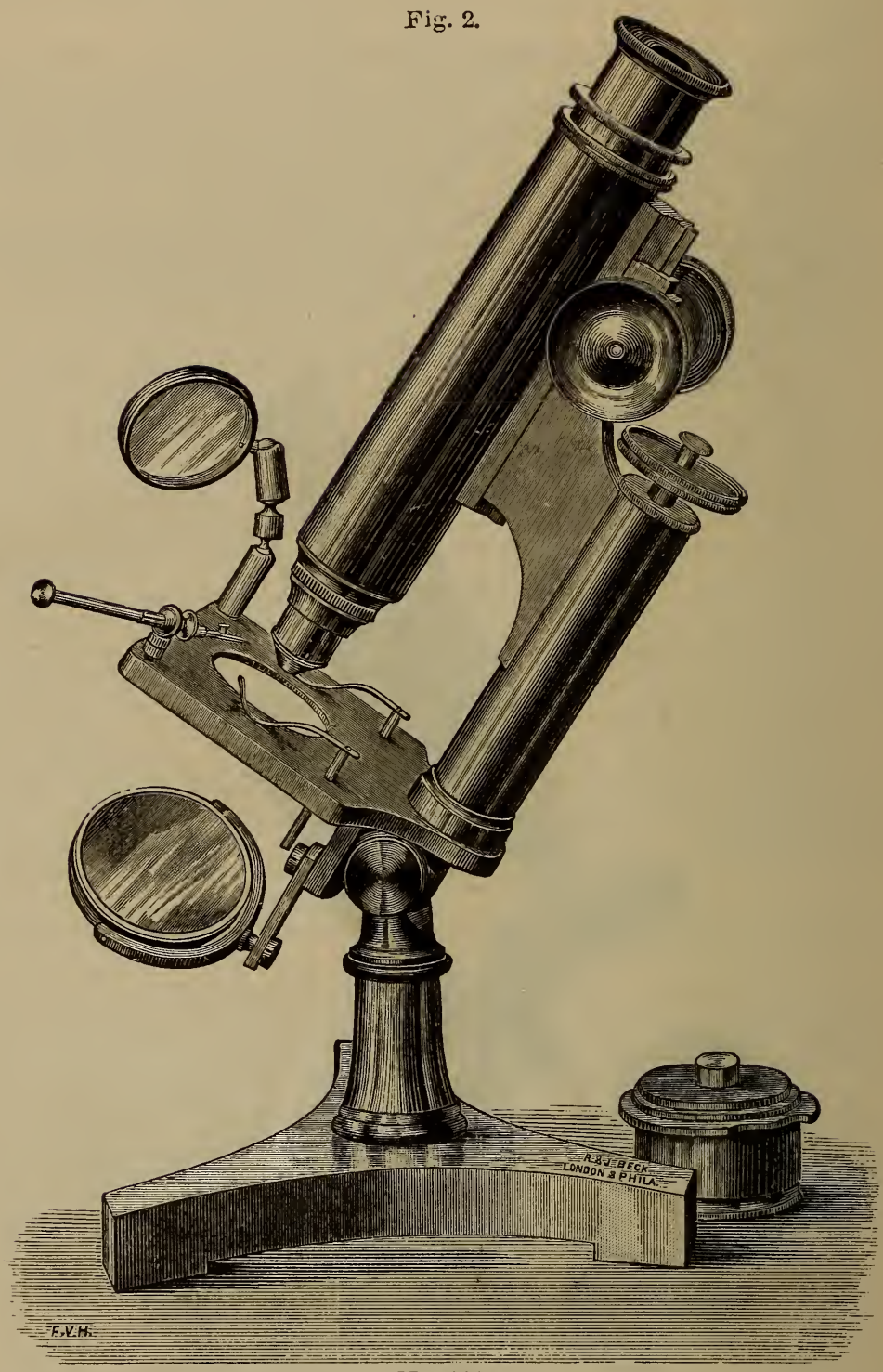
Fig. 1.




No. 263.
ONE-THIRD ACTUAL SIZE.

| No. | | Price. |
|---|---|---|
| 263 | *The Monocular Economic Microscope*, with Tripod base. Body sliding in a cloth-lined tube for quick adjustment of focus and delicate Micrometer Screw for fine ditto, with Draw Tube. Two Object-Glasses, 1 inch and ¼ inch, and one Eye-piece, No. 2, giving powers from about 60 to 350 diameters. Condensing Lens, Concave Mirror and Stage Forceps, etc. In Mahogany Case with lock. . . . . | $45 00 |

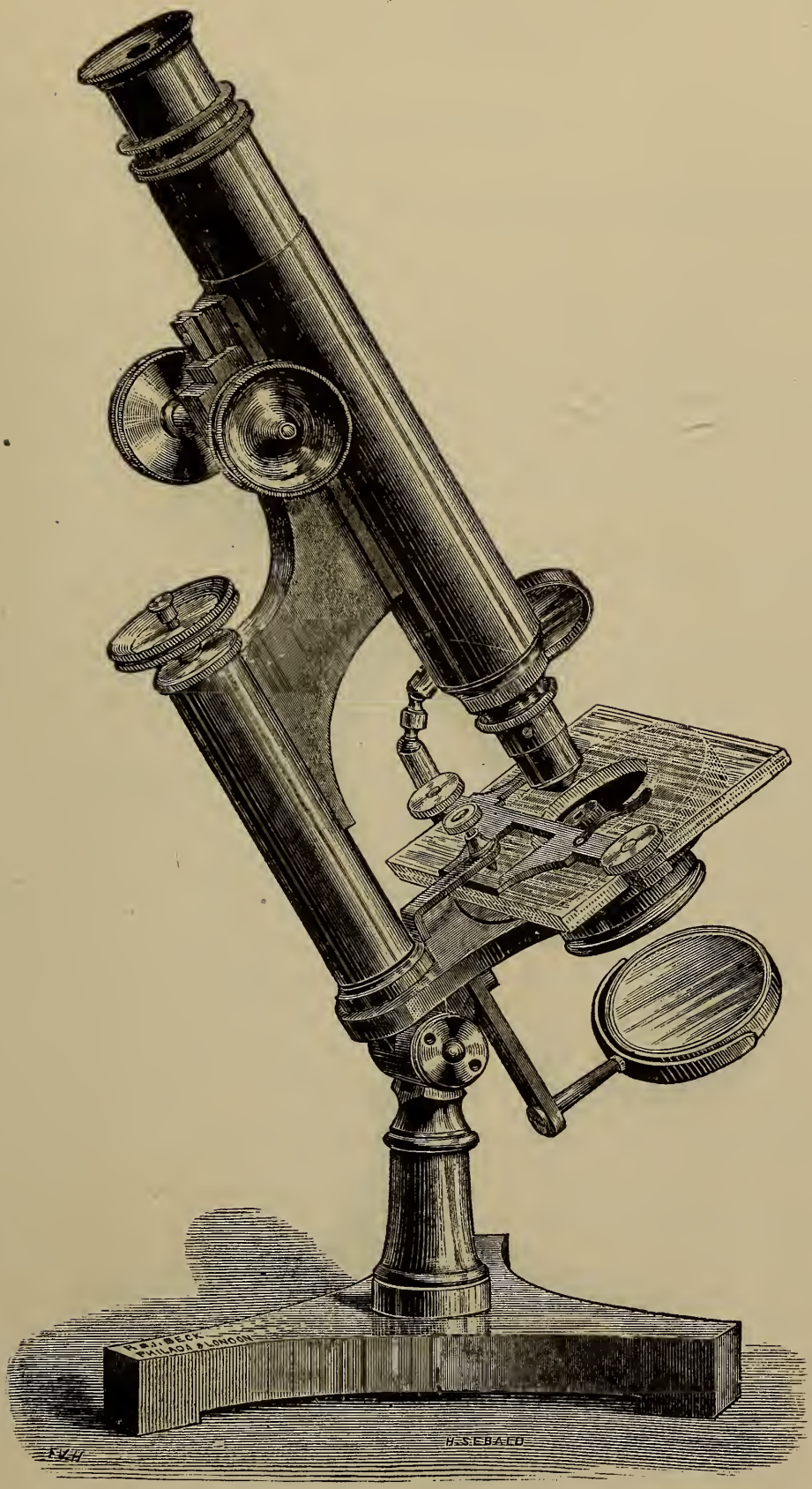
Fig. 2.




No. 264.

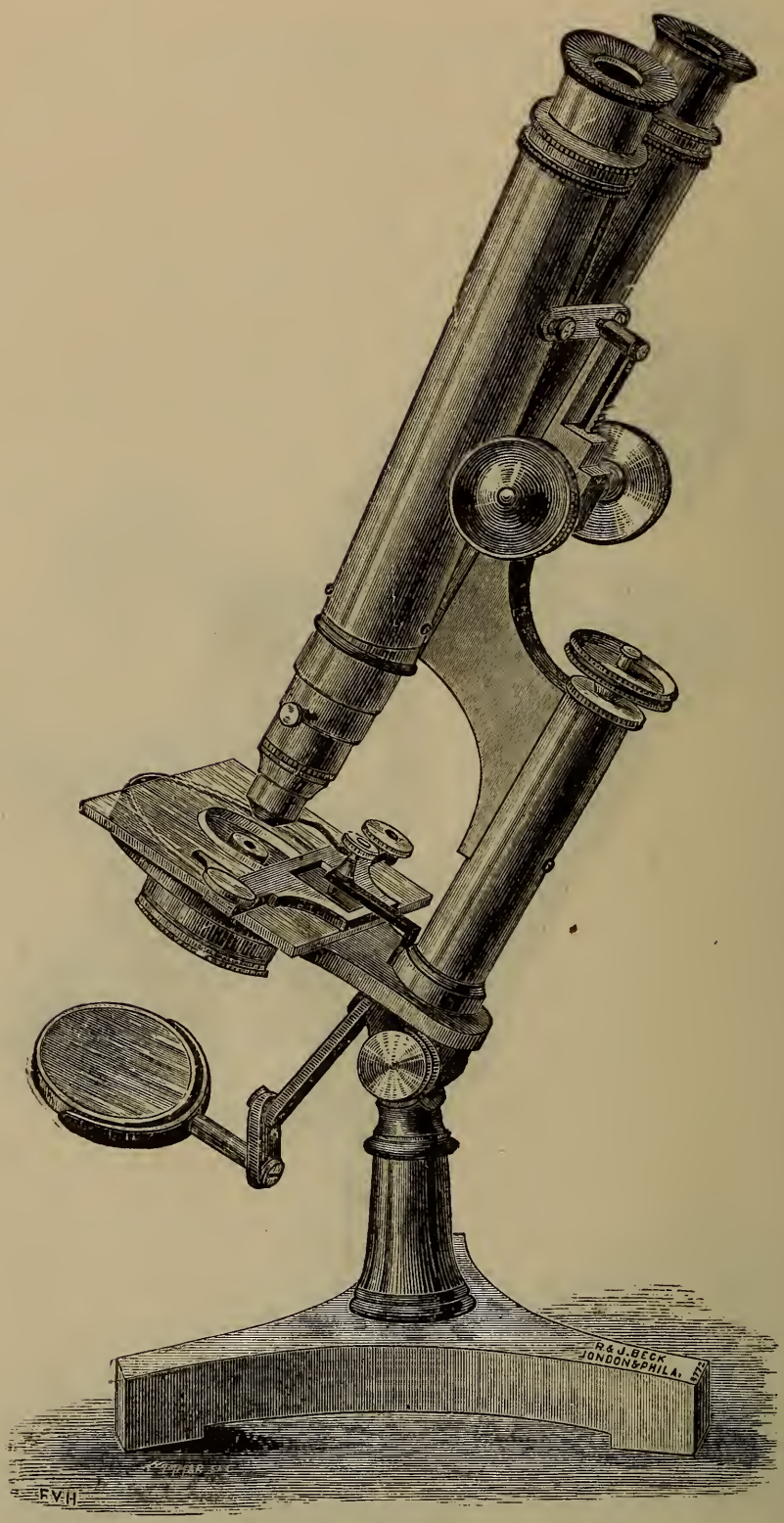
ONE-HALF ACTUAL SIZE.

| No. | | Price. |
|---|---|---|
| 264 | *The Monocular Economic Microscope*, with Rack-and-Pinion adjustment of focus, for the quick movement, and Micrometer Screw for fine; Draw-tube with Indicator at Standard length: Two Object Glasses, 1 inch and ¼ inch, and two Eye-pieces, Nos. 2 and 3, affording a range of powers from about 60 to 500 diameters. Plain Stage, with delicate removable and adjustable Clips, Concave and Plane Mirrors, Condensing Lens, Stage Forceps, Pliers and Glass Plate with ledge. In Mahogany Case with lock. . . . . | $55 00 |




No. 264.*

| No. | One-half Actual Size. | Price. |
|---|---|---|
| 264*. | *The Monocular Economic Microscope*, with movable Glass Stage, and Draw Tube; two Eye-pieces and two Object-glasses, ½ inch and ⅙ inch focus, having a range of powers from about 100 to 750 diameters; Stage Forceps, Pliers and Glass Plate with Ledge. In Mahogany Case, . . . . . | $65 00 |




No. 264.**

TWO-FIFTHS ACTUAL SIZE.

264**. The *Binocular Economic Microscope*, with 1-inch and $\frac{1}{6}$-inch Object-glasses, two pairs of Eye-pieces, concave and plane Mirrors, Side Condensing Lens for the illumination of opaque objects, movable glass stage, stage forceps, pliers and glass plate with ledge, in Mahogany Case, . . . . . $85 00

## DIRECTIONS FOR USE.

To adjust the focus of the Object-glass—

In Fig. 1, for the quick adjustment, slide the tube, D, up or down in the fitting, G. If a slight *spiral movement* is given to the tube by the finger and thumb, the motion may be made very gradual.

In Figs. 2 and 3, the same adjustment is made by turning the milled head backward or forward.

In both, turning the milled head, I, gives the slow or fine adjustment.

The *light* (which for transparent objects is reflected from the mirror, M, and for opaque objects is condensed by means of the lens, S) should, in general, be upon the left of the observer if the microscope-body is inclined, but in front if the Instrument is used in a vertical position. The best is that from a white cloud on a bright day; but a very satisfactory effect can be produced by means of a petroleum-oil, or gas-lamp, provided it is placed not more than 10 or 12 inches from the Instrument.

For the examination of minute striæ, *side-light* is necessary; for this purpose the mirror, M, must be used obliquely, the diaphragm, P, with its fitting removed, which will then allow the light to impinge on the object at a sufficiently *oblique* angle.

With the 1-inch Object-glass the light is generally in excess, and has to be lessened by means of the diaghragm, P, fitting under the stage; this can be slid up and down, thereby increasing or decreasing the cone of admitted rays of light.

To illuminate *opaque objects* the light is thrown upon them from above. A small condensing-lens, fitting into the stage, is used for this purpose; its focus for a lamp or candle, 4 inches from it, is about 3 inches; for daylight 2 inches. A large object can be placed upon the stage, but small ones are generally either laid on a slip of glass or held in the forceps. When viewing opaque objects, the diaphragm, P, should be placed in position and the solid cap attached, so as to exclude all light from below the stage.

A glass plate, with a ledge and some pieces of thin glass, are applicable for many purposes, but are specially intended for *objects in fluid.* Thus a drop is placed upon the plate and covered by a piece of thin glass, or, the object being put upon the plate and the thin glass over it, the fluid is applied near one side and runs under by capillary attraction.

Glass of any kind requires occasional *cleaning;* a piece of soft wash-leather is the best for the purpose.

The fronts of the *Object-glasses* may be carefully wiped; but if they require anything more, it must be done by the makers.

When cleaning the *Eye-pieces*, which should be done *frequently*, the cells containing the glasses must be unscrewed, and replaced one at a time, so that they may not be mixed.

Any dirt upon the *Eye-pieces* may be detected by turning them round whilst looking through the Instrument; but if the *Object-glasses* are not clean, or are injured, it will for the most part only be seen by the object appearing misty.

The whole or any part of the extra apparatus described in the following pages may be added to the instrument at any time, without its being sent back to the makers.

## ADDITIONAL APPARATUS.

Although the Instrument, as already described, may be considered complete and probably sufficient for many observers, yet the following additions can be made, all of which, packed in a small tray, will fit into the case which contains the Microscope:

When the light from the concave mirror proves insufficient for any object requiring an intense transmitted light, the *Acromatic Condenser* (No. 241, Fig. 3) may be employed with advantage: this slides, by its tube, into the fitting under the stage of the Instrument, in which it has to be moved up or down until the focus of its lenses falls upon the object, the light having been previously reflected in the proper direction by the mirror.

Fig. 3.
241.

Fig. 4.
238*.

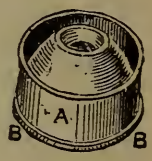
Fig. 5.
240.

The *Illumination of Opaque Objects*, already described, must be more or less one-sided; and in most cases it is desirable that it should be so. An illumination on any or every side, however, is easily obtained, provided the object is not too large, by means of the *Lieberkuhn* (No. 238*, Fig. 4). This is a silvered cup, which slides or screws upon the front of the object-glass; and light thrown upwards by the mirror will be reflected by it down upon the object; it will then be found that, by slightly varying the inclination of the mirror, every necessary alteration in the direction of the illumination can be obtained. The *Lieberkuhn* here shown is intended for the 1-inch object-glass.

It is in most cases necessary, when using the Lieberkuhn, to slide a *Dark Well* (No. 240, Fig. 5) under the stage to prevent any light entering the Object-glass direct from the Mirror.

*Dark-Field Illumination* is, to appearance, a means of seeing a transparent object as an opaque one. The principle, however, is that all the light shall be thrown under the object, but so obliquely that it cannot enter the Object-glass unless interrupted by the object; this is best accomplished by *Wenham's Parabolic Reflector* (No. 242, Fig. 7).

Fig. 7.




No. 242.

In this Microscope, the *Parabolic Reflector* fits under the stage in the same fitting as the achromatic condenser, and the adjustment of its focus upon the object (which is when its apex almost touches it) is made by giving it a spiral motion in the fitting—that is, carefully pushing it up or down at the same time that it is turned round by the milled edge, B. B. As the rays of light must be parallel when they enter it, the *Flat Mirror* is generally used; daylight will then require only direct reflection, but the rays from an artificial source will have to be made parallel by putting the Condenser (No. 266) between the light and the mirror, about $1\frac{3}{4}$ inches from the former, and $4\frac{1}{2}$ inches from the latter. Nearly the whole surface of the mirror should be equally illuminated, which may be tested by temporarily placing upon it a card or piece of white paper.

Fig. 8.

B

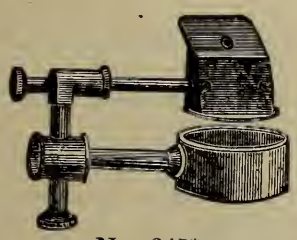
A

No. 244*.

*Polarized Light*, a beautiful appliance by which many objects otherwise almost invisible are shown in every imaginable color, can here only be treated of by describing the way in which it is applied to this Microscope by the following apparatus (No. 244*, Fig. 8): A Nicol's prism as a polarizer, A, fits, and can be turned round, in the fitting under the stage; another prism, B, is fitted to an adapter which screws *above* the object-glass, and also revolves. When only alternate black and white images are given by the prisms alone, a film of selenite, fitted in a cap which slips *over* the Polarizing prism, will produce colored ones.

To draw an object, the *Camera Lucida* (No. 245,) is used. It slides on in the place of the cap of either Eye-piece, with its flat side uppermost, as shown. The body of the Microscope must be in a horizontal position, and the whole instrument has to be raised until the edge of the prism is exactly 10 inches from a piece of paper placed upon the table. The light must be so regulated that no more than is really necessary is upon the object, whilst a full light should be thrown upon the paper. Only one eye is to be used; and if one-half of the pupil be directed over the edge of the prism, the object will appear upon the paper, and can be traced on it by a pencil, the point of which will also be seen.

With the *Vertical Camera Lucida*, (No. 245*), the Microscope remains in an upright position, and the paper upon which the drawing is to be made, can be placed either at the side or in front of the instrument. This form of Camera is specially adapted for use with *The Histological Microscope*, (No. 340).



No. 245*.

No. 245.

Substituting in the place of the object a piece of glass ruled into 100ths and 1000ths of an inch, termed a *Micrometer* (No. 246, Fig. 10), its divisions can be marked on the same or another piece of paper, and, by comparing them with the sketch, the object can be most accurately measured. These divisions, also, if compared with a rule divided into inches and tenths, will give the magnifying power: thus, supposing $\frac{1}{100}$ths of an inch when marked on the paper measured 1 inch and $\frac{3}{10}$, the magnifying power would be 130.

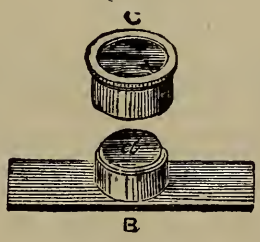
The *Live-box* (No. 247, Fig. 11) hardly needs description; the object is confined between the glass, *a*, of the lower part, B, and that of the cap C; the distance between them can be varied by sliding the latter more or less on. As the thin glass is only dropped into a slight recess in the top of the cap, and is held there by the heads of the two screws, it can be easily taken out for wiping, or be replaced by another when broken.

The *Glass Trough* (No. 248, Fig. 12), for larger objects in water, must be used with its thinner plate of glass, *b*, in front. The modes of confining such objects,

Fig. 10.

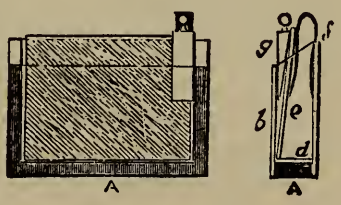

No. 246.

Fig. 11.




No. 247.

Fig. 12.




No. 248.

and keeping them near the front surface, must vary according to the occasion. For many it is a good plan to place a piece of glass, *e*, diagonally in the trough, its lower edge being kept in its place by a strip (*d*) at the bottom; then if the object introduced is heavier than water, it will sink till stopped by the sloping plate. Sometimes a very slight spring (*f*) may be applied behind this plate to advantage, with a wedge (*g*) in front to regulate the depth.

## PRICES OF THE ECONOMIC MICROSCOPE AND APPARATUS.

| No. | | Price. |
|---|---|---|
| 263. | The Monocular Economic Microscope, with sliding coarse adjustment, 1-inch and ¼-inch Object-glasses, one Eye-piece, Concave Mirror, condensing lens, glass plate with ledge, brass pliers and Diaphragm, in Mahogany Case, | $45 00 |
| 264. | The Monocular Economic Microscope, with Rack-and-pinion coarse adjustment, with 1-inch and ¼-inch Object-glasses, two Eye-pieces, Concave and Plane Mirrors, side Condensing-Lens, Diaphragm, Stage-Forceps, Pliers, Glass slip, with ledge, in Mahogany Case, | 55 00 |
| 264*. | The Monocular Economic Microscope, with Movable Glass Stage 1 inch and ⅙ inch objectives, and the same fittings and case as with No. 264, | 65 00 |
| 264**. | The Binocular Economic Microscope, with Movable Glass Stage, Concave and Plane Mirrors, a side Condensing-Lens for the illumination of opaque objects, lever adjustment for different widths of eyes, two pairs of Eye-pieces, the same objectives and accessories as with No. 264*, in Mahogany Case, | 85 00 |
| 263*. | The Monocular Economic Microscope-Stand, the same as with No. 263, with two Eye-pieces and Mahogany Case, | 32 50 |
| 264B. | The Monocular Economic Microscope-Stand, the same as with No. 264, with two Eye-pieces and Mahogany Case, | 37 50 |
| 264C. | The Monocular Economic Microscope-Stand, the same as with No. 264*, with two Eye-pieces, Movable Glass Stage, side Condensing-Lens and Mahogany Case, | 50 00 |
| 264E. | The Binocular Economic Microscope-Stand, the same as with No. 264**, with two pairs of Eye-pieces, Movable Glass Stage, side Condensing-Lens and Mahogany Case, | 65 00 |
| 265. | Eye-Pieces for 340-42. Nos. 1, 2 or 3, each, | 4 50 |
| 265*. | Eye-Pieces for the Economic Microscopes. Nos. 1, 2 or 3, each, | 5 00 |
| 266. | Side Condensing-Lens, | 2 50 |
| 267. | Stage-Forceps, | 2 50 |
| 268. | Pliers, | 50 |

## ADDITIONAL APPARATUS.

| | | |
|---|---|---|
| 238*. | Lieberkuhn to 1-inch Object-Glass, | 3 50 |
| 240. | Dark Well, | 2 00 |
| 241. | Achromatic Condenser and Fitting, | 8 50 |
| 242. | Wenham's Parabolic Reflector, for Dark-field Illumination, | 8 50 |
| 243*. | Flat Mirror for 263 (in which case a double one is substituted for the concave single one, which has to be returned), | 3 00 |
| 244*. | Polarizing Apparatus, complete with Prisms, film of Selenite, and adapter, | 13 50 |
| 245. | Wollaston's Camera Lucida, for drawing an object, | 6 50 |
| 245* | Vertical Camera Lucida, | 8 00 |
| 246. | Glass Micrometer, ruled into $\frac{1}{100}$ths and $\frac{1}{1000}$ths of an inch, | 2 25 |
| 247. | Small Live-Box, | 2 50 |
| 248. | Glass Trough, complete with Wedge and Spring, | 3 00 |
| 249*. | All the above "Additional Apparatus," from Nos. 239* to 248, (not including 245*), if ordered at once, | 45 00 |

## THE NEW NATIONAL MICROSCOPE.

In the three years that have elapsed since we brought out the *New National Microscope* we have sold many hundreds of the same, and the sale is steadily on the increase. It is used in most of the Colleges and Hospitals throughout the country, and is universally and deservedly pronounced to be the best instrument ever made at the price. The utmost care has been taken throughout to introduce only the best workmanship into its construction, and, mechanically and optically, it is as nearly perfect as possible. The design of the stand is graceful and pleasing, it is well balanced in all positions, and is adapted to every variety of work, whilst its general finish and appearance are most elegant. Every variety of accessory apparatus can be used with it, and the pieces specially constructed for it are of the best description, and of very moderate cost.

The *Glass Stage*—moving with exquisite smoothness in any desired direction, and revolving with such accuracy that an object in the field of the $\frac{1}{6}$-inch is not thrown out of view—is usually all that any observer needs. If, however, the movement of the object requires greater nicety than a direct action from the hand can give, this stage can be taken off, and replaced by the Mechanical Stage (No. 290), which has very smooth vertical and horizontal movements by means of Milled-Heads; and can also be revolved concentrically, the same as the plain Glass Stage.

*The National Series of Objectives* has most deservedly acquired a *National* reputation; several thousand of them are in use, and we confidently assert that no other lenses of their cost are in any manner comparable with them. Their corrections are of the most perfect character, and in all the qualities of good working glasses they have never been excelled, whilst their low cost leaves no excuse for the employment of cheap (and "nasty") French Triplets, as heretofore, by those who do not care to pay the prices demanded for the highest grades of Objectives.

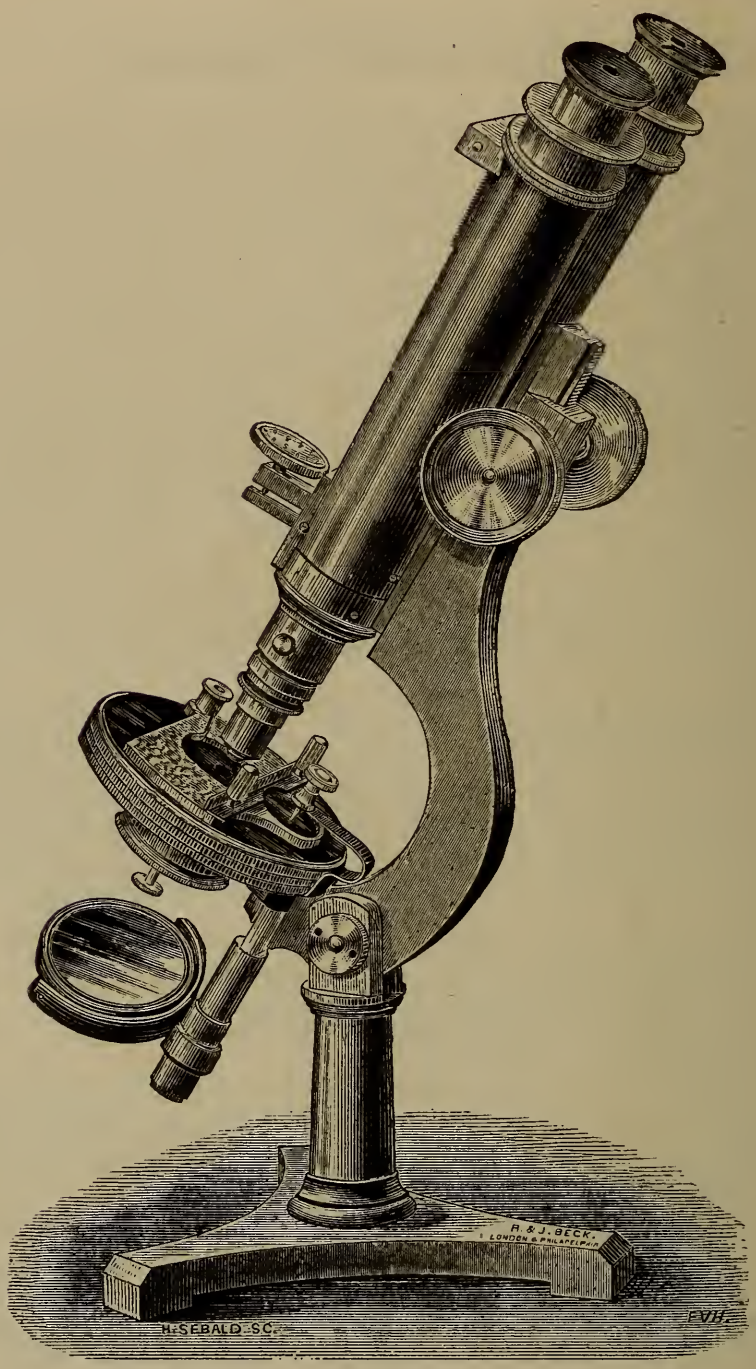
In order to meet the wants of those who require greater power we have recently replaced the $\frac{1}{4}$-inch objective heretofore furnished with Nos. 275 and 276, with a $\frac{1}{6}$-inch. The $\frac{1}{4}$ will still be furnished to those who prefer it to the $\frac{1}{6}$th. If desired the $\frac{2}{3}$-inch (No. 296) will also be furnished with these two Microscopes in place of the usual 1-inch without extra charge.

We shall strive to maintain the position of *The New National Microscope* by taking the greatest care in the selection of the Object-glasses and all *Accessories*, and by using every effort to perfect the brass work, and doubt not that such efforts will obtain a still more extensive sale for it.

## DESCRIPTION OF THE NEW NATIONAL MICROSCOPE.

The Stand, which is 15 inches in height, is constructed entirely of brass, of the highest finish and best workmanship, having a broad, heavy *tripod* base. From the centre of this base rises a stout column, to the top of which is attached, by a firm joint, the *Jackson-model* arm, carrying the compound body, by which

# THE NEW NATIONAL BINOCULAR MICROSCOPE.

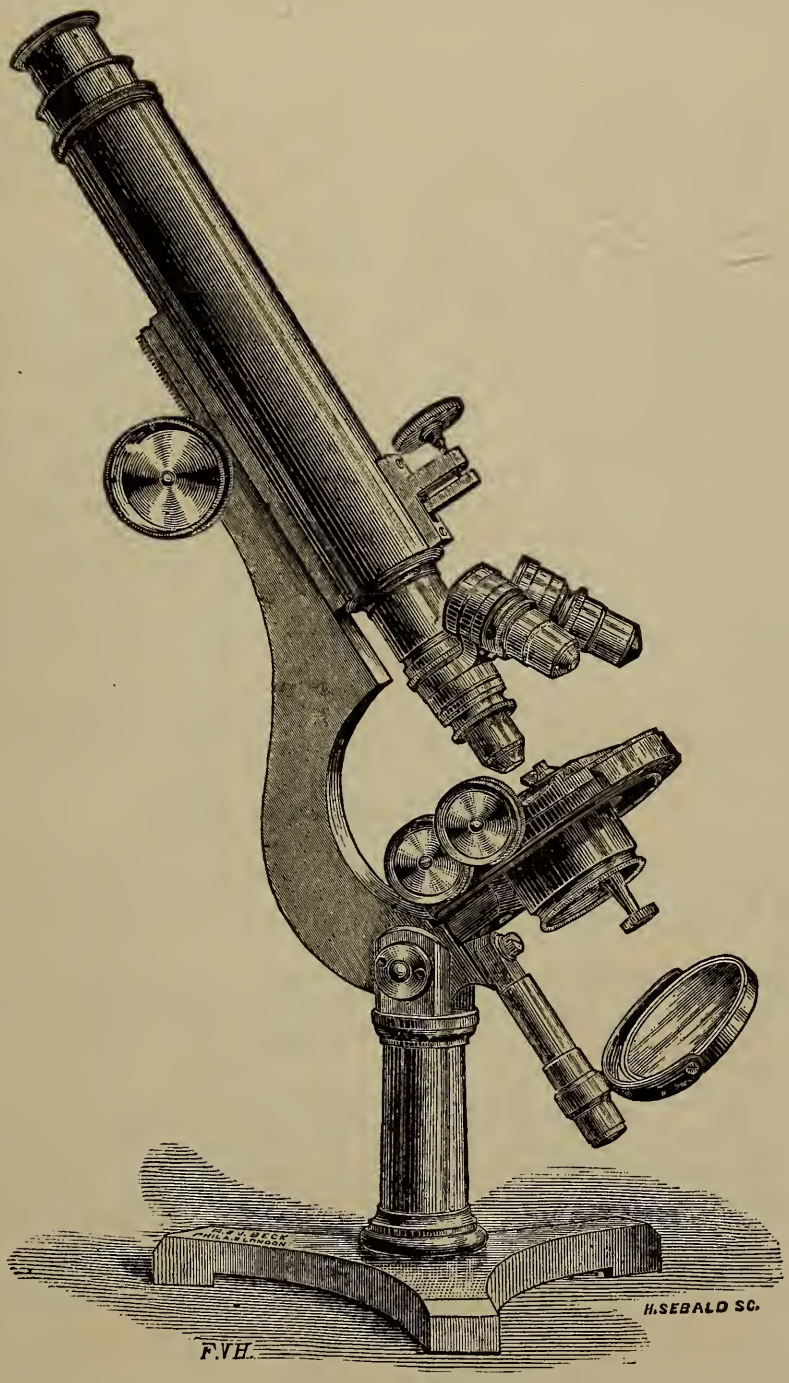



No. 279.

One-third Actual Size.

The above Illustration represents *The New National Binocular Stand*, (No. 279), and as furnished with No. 275. The Revolving Glass Stage is the same as that furnished with the *Monocular* stand, (No. 280).

## THE NEW NATIONAL MONOCULAR MICROSCOPE.




No. 280, WITH 290 AND 253.*
ONE-THIRD ACTUAL SIZE.

The above Illustration represents *The New National Monocular Stand*, (No. 280), and as furnished with No. 276; to which are added Triple Nose-piece, (No. 253*), and Mechanical Stage, (No. 290), to show the same in position.

the inclination can be varied to any degree, from vertical to horizontal, the whole instrument being perfectly steady and free from tremor in any position. The very highest powers may be used with it, as the body, being supported by the arm throughout its entire length, cannot have any unsteadiness or motion of its own.

The quick Adjustment of Focus is effected by means of Rack and Pinion, with large Milled Heads, which works so smoothly that there is no need to use the Fine Adjustment for any power lower than ¼ of an inch. The latter adjustment is by means of a delicate Micrometer screw and lever attachment, working with absolute freedom from all motion, and by which the very highest powers may be focused with the greatest exactness.

The Stage is of glass, with a complete rotation in the Optic Axis, upon the top of which is a sliding object-holder, very thin, and with a spring clip for holding the object in place during rotation. This clip is removable, in an instant, and the Stage forceps can be inserted in its place, thus allowing the latter to be moved about with the object-carrier. Beneath the Stage is a tube carrying all the sub-stage apparatus, as the Achromatic Condenser, Wenham's Parabola, Polarizing Apparatus, etc., etc. This is securely attached to the Stage by a bayonet catch, and can be instantly detached, leaving a very thin and unobstructed Stage for Oblique Illumination. The *Shutter Diaphragm* is of novel construction, with the various sized openings almost in contact with the underside of the object under examination, a great improvement upon the old revolving disk Diaphragm. A Double Mirror *Concave* and *Plane* is hung upon a swinging bar, and arranged with every possible motion for Direct and Oblique Illumination.

The Accessories and their Use are fully described on pages 47, 48 and 49 of this Catalogue; those supplied with the Popular, Economic and National Stands, being essentially the same, and equally applicable to either Instrument.

## WENHAM'S BINOCULAR BODY.

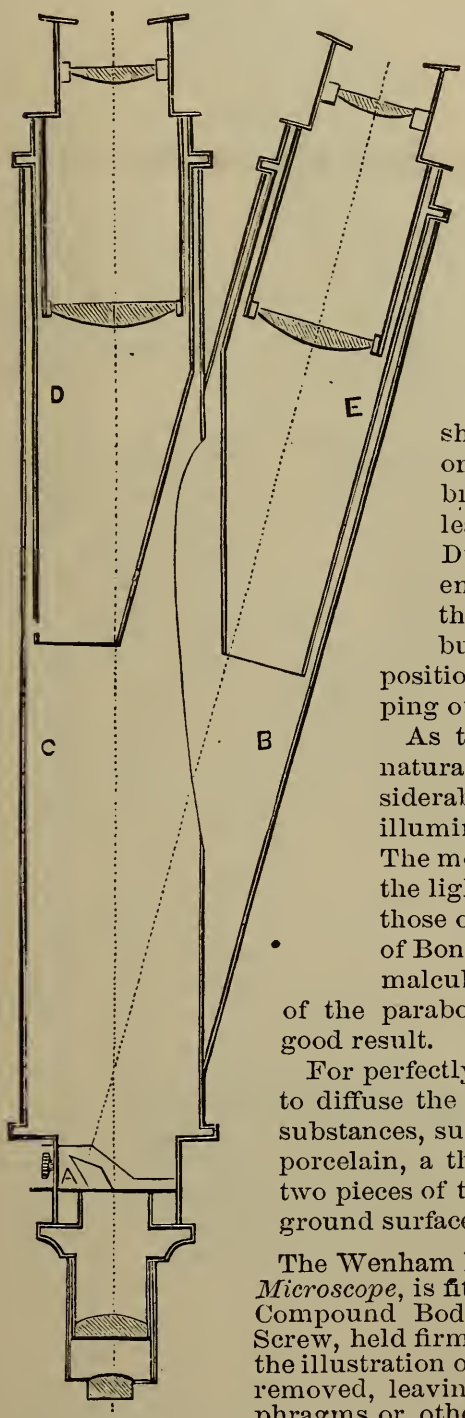
Thus far in this description the Microscope has only been considered as having a single body; the addition, therefore, of the Binocular Body, shown in section by the accompanying figure, requires a few explanations and directions for use.

The purpose of the Binocular Microscope is to give stereoscopic vision of objects, whereby the form, distance and position of the various parts are instantly seen; and the result is almost as striking as if the minutest object were placed in the hand as a model.

To accomplish this, the only plan yet known is the equal division of the rays after they have passed through the object-glass, so that each eye may be furnished with an appropriate one-sided view of the object; but the methods hitherto contrived to effect this not only materially injure the definition of the object-glasses, but also require expensive alterations in their adaptation, or, more frequently still, a separate stand; whereas, the following arrangement, contrived by Mr. Wenham, is no obstacle to the use of the Monocular Instrument, and the definition even of the highest powers is scarcely impaired. It consists of a small prism mounted in a brass box, A, which slides into an opening immediately above the object-glass, and reflects one-half of the rays, which form an image of the object, into an additional tube, B, attached at an inclination to the ordinary body, C. One-half of the rays take the usual course, with their performance unaltered: and the remainder, although reflected twice, show no loss of light or definition worthy of notice, if the prism be well made.

As the eyes of different persons are not the same distance apart, the first and most important point to observe in using the Binocular is that each eye has a full and clear view of the object; this is easily tried by closing each eye alter-

nately without moving the head, when it may be found that some adjustment is necessary by racking out the draw-tubes, D, E, of the bodies by means of the small milled head, near the eye-pieces; this will increase the distance of the centres; and, on the contrary, the tubes, when racked down, will suit those eyes that are nearer together.




If the prism be drawn back till stopped by the small milled head, the field of view in the inclined body is darkened, and the rays from the whole aperture of the object-glass pass into the main body as usual, neither the prism nor the additional body interfering in any way with its use as a Monocular Microscope.

By unscrewing the small milled head, the prism can be withdrawn altogether for the purpose of being wiped; this should be done frequently, and very carefully, on all four surfaces, with a perfectly clean cambric or silk handkerchief or a piece of wash-leather; but no hard substance must be used. During this process the small piece of blackened cork fitted between the prism and the thick end of the brass box may be removed; but it must be carefully replaced in the same position, as it serves an important purpose in stopping out extraneous light.

As the Binocular Microscope gives a real and natural appearance to objects, this effect is considerably increased by employing those kinds of illumination to which the naked eye is accustomed. The most suitable are all the opaque methods where the light is thrown down upon the surface; but for those objects that are semi-transparent, as sections of Bone or Teeth, Diatomaceæ, living aquatic Animalcules, etc., the dark-field illumination by means of the parabolic reflector (No. 242) will give an equally good result.

For perfectly transparent illumination, it is much better to diffuse the light by placing under the object various substances, such as tissue-paper, ground glass, very thin porcelain, a thin film of yellow bees'-wax, run between two pieces of thin glass, or a slip of Cobalt blue glass with ground surface.

The Wenham Prism of *The Improved Binocular National Microscope*, is fitted in a Nose-piece which is attached to the Compound Body by the "Broad Gauge" or Butterfield Screw, held firmly in proper position by a pin as shown in the illustration on Page 57. This Nose-piece can be entirely removed, leaving the body or tube entirely free from diaphragms or other obstructions, permitting the use of objectives bearing the above-named Screw; or by means of an Adapter, with Society Screw (which is also furnished with the Stand), ordinary objectives of the widest apertures.

With each "Ideal," Economic or National Microscope *sold by us at retail*, one dozen assorted objects of the Popular Series in a neat box are furnished.

## DESCRIPTION OF THE IMPROVED NATIONAL MICROSCOPE.

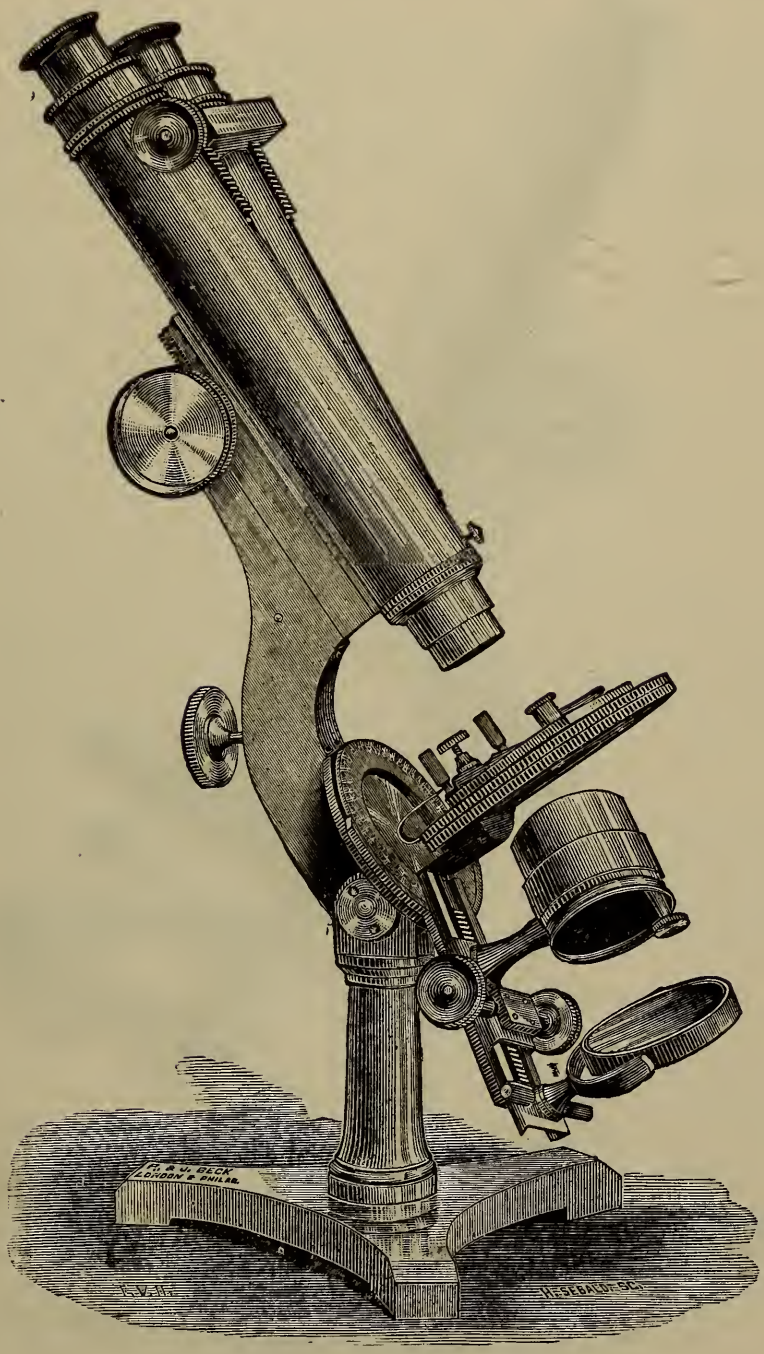
Although the popularity of the New National Microscope continues to grow steadily, there has arisen a demand among certain Microscopists for additions to that instrument which we can no longer resist, and following the initiative taken in the production of our "Ideal" Stand, have now introduced the same general features, with others peculiarly its own, into the *Improved National Microscope*, which we present and recommend as being far superior to any of its class and cost heretofore produced.

The general form and design of the Improved instrument are the same as those of the old one, and with the alterations and additions can be readily comprehended by a glance at the accompanying illustrations. The admirable rotating glass stage, with its movable slide holder, have been retained without alterations, excepting the addition of a stop for Maltwood's Finder, and a considerable reduction in thickness. The triangular bar carrying the Mirror and Sub-stage revolves around the Main Stage, as in the "Ideal" Microscope, upon a graduated circle, by which the degree of obliquity of illumination can be accurately read. There is a Centering Stop to this swinging bar in the Optic Axis, and as it is arranged to swing *above* the stage, the Mirror can be used for Opaque illumination, although a Condensing Lens on Stand is also provided for this purpose. The Mirror, which is double (concave and plane), *slides* up and down upon this bar, and is provided with every needful adjustment. The Sub-stage carrying all forms of illuminating apparatus is adjusted by Rack and Pinion.

The Wenham prism in the Binocular Stand is mounted in a nosepiece which can be entirely removed from the Compound body, leaving the full-sized tube, *without diaphragm*, to receive an objective bearing the Broad-gauge or Butterfield Screw, or an adapter with Society Screw (which is provided with each stand), whereby objectives of the widest angles may be employed as with an ordinary Monocular tube. The Monocular Stand is likewise provided with the same adapter to permit the use of the Broad-gauge Screw. This necessitates the removal of the fine adjustment from the nosepiece as in the old form of Nationals, and in the Improved form it will be found placed conveniently at the rear of the limb bearing the Compound body; a large milled head moving the latter with the greatest smoothness and delicacy. The workmanship and finish throughout are of the best, and the Stand may be fairly called First-class. The construction of the Sub-stage is such that nearly all the apparatus from No. 65 to 183 of this Catalogue may be used upon it, in addition to that which is especially designed for it.

As will be seen from the accompanying Price List, we have fitted the Improved Nationals with two Series of Objectives, the first and cheaper being those of our old and well known National grade, the others the "Ideal" class, which are of a still higher quality with cover correction for the $\frac{1}{6}$-inch. At their respective costs either of these series of objectives are superior to all others now made, and are fully equal to all the demands of *true* workers, possessing the *real* requirements of flatness of field, freedom from color, penetration, and great defining powers.

# THE IMPROVED NATIONAL BINOCULAR MICROSCOPE.

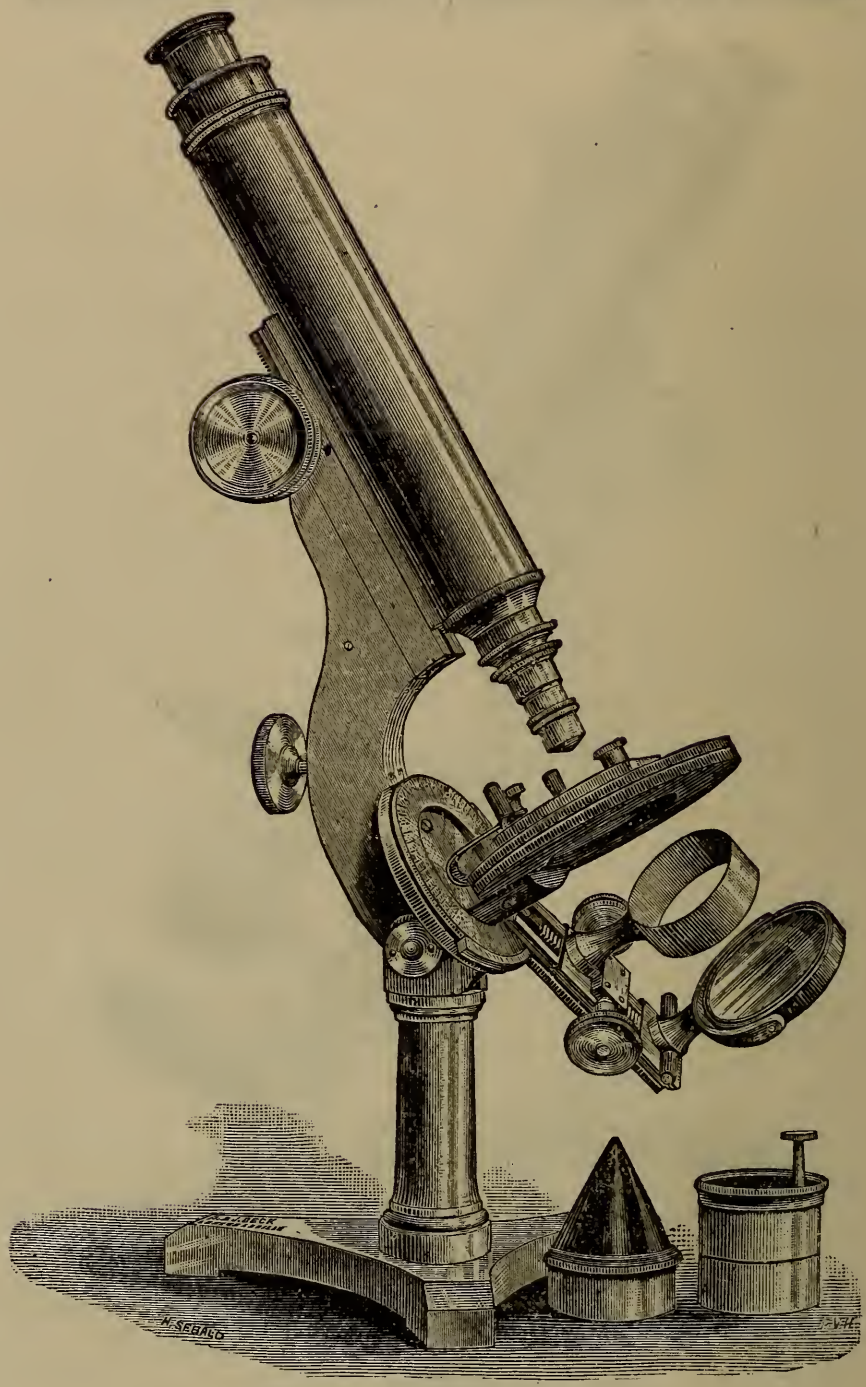


No. 279*.

ONE-THIRD ACTUAL SIZE.

The above illustration represents *The Improved National Binocular Stand* (No. 279*) and as furnished with Nos. 275*–275**. It shows the Swinging Sub-stage inclined at a slight angle, with graduated circle around which it swings, and Shutter Diaphragm in position, together with Rack and Pinion to Sub-stage; also Fine Adjustment Screw and Removable Nosepiece carrying Binocular Prism.

# THE IMPROVED NATIONAL MONOCULAR MICROSCOPE.



No. 280*.

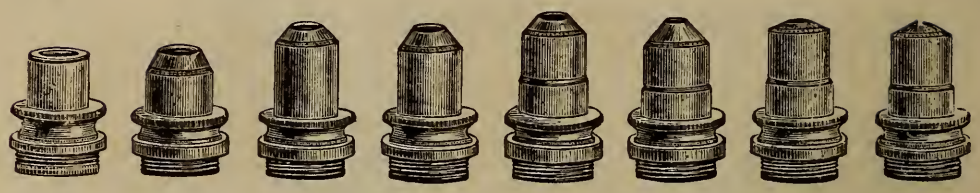
ONE-THIRD ACTUAL SIZE.

The above illustration represents *The Improved National Monocular Stand* (No. 280*), and as furnished with Nos. 276* and 276**. It shows the Swinging Sub-stage, inclined *from the observer* at a considerable angle, with the Mirror and Ring for carrying the Accessories in position. The Shutter Diaphragm is removed, but shown on the table together with the Conical one, No. 222.

## PRICES OF THE IMPROVED NATIONAL MICROSCOPES.

| No. | | Price. |
|---|---|---|
| 275. | ***The New Binocular National Microscope,*** . . . . . With *Concentrically Rotating Glass Stage*, and 1-inch (No. 295) and $\frac{1}{6}$-inch (No. 298*) Object-glasses, having the respective apertures of 19 and 85 degrees, and magnifying from about 47 to 600 diameters, two pairs of Eye-pieces (No. 262), Stage Forceps (No. 227), Condensing Lens on Stand (No. 291), a Glass Plate, with Ledge for the examination of objects in fluid, and a pair of Pliers; the whole packed in French polished Mahogany case, with brass handle and lock, and fittings for the accessories. | $110 00 |
| 276. | ***The New Monocular National Microscope,*** . . . . With Two Eye-pieces and the same Object-glasses and fittings as with No. 275—in Mahogany case. | 85 00 |
| 279. | ***The New Binocular National Microscope Stand,*** . . . With one pair of Eye-pieces, Concave and Plane Mirrors, Shutter Diaphragm, Stage Forceps, Glass Plate, and Pliers. | 75 00 |
| 280. | ***The New Monocular National Microscope Stand,*** . . . With one Eye-piece, Concave and Plane Mirrors, Shutter Diaphragm, Stage Forceps, Glass Plate, and Pliers. | 50 00 |
| 275*. | ***The Improved Binocular National Microscope,*** . . . . With Concentrically Rotating Glass Stage, and Swinging Sub-stage, fitted with Rack and Pinion, new Fine adjustment, and removable Nosepiece, 1-inch (No. 295) and $\frac{1}{6}$-inch (No. 298*) Object-glasses, Two pairs of Eye-pieces (No. 262), Stage Forceps (No. 227), Condensing Lens on Stand (No. 291), a Glass Plate with Ledge and a pair of Pliers—the whole packed in an elegant French polished Mahogany case, with good brass handle and lock, and a drawer for the accessories. | 125 00 |
| 276*. | ***The Improved Monocular National Microscope,*** . . . . With Concentrically Rotating Glass Stage, and Swinging Sub-stage, fitted with Rack and Pinion, new Fine adjustment, and all the recent improvements, 1-inch (No. 295) and $\frac{1}{6}$-inch (No. 298*) Object-glasses, Two Eye-pieces (No. 262), Stage Forceps (No. 227), Condensing Lens on Stand (No. 291), Glass Plate with Ledge and Pliers—packed in Mahogany case, with drawer. | 100 00 |
| 275**. | ***The Improved Binocular National Microscope,*** . . . . With Concentrically Rotating Glass Stage, with Stop for Maltwood Finder, and Swinging Sub-stage, fitted with Rack and Pinion, new Fine Adjustment, and and all the recent improvements: 1-inch (No. 232) and $\frac{1}{6}$-inch (No. 234*) Object-glasses, of the "Ideal" Series, Two pairs of Eye-pieces (No. 262), Double Nose-piece (No. 253), Stage Forceps (No. 227), Condensing Lens on Stand (No. 291), and Glass Plate with Ledge and Pliers.—In Mahogany Case with Drawer. | 150 00 |
| 276**. | ***The Improved Monocular National Microscope,*** . . With Two Eye-pieces, Stand, Object Glasses, and all apparatus precisely the same as those with No. 275**—in Mahogany case. | 125 00 |
| 279*. | ***The Improved Binocular National Microscope Stand,*** . With Swinging Sub-stage and all improvements, Two pairs of Eye-pieces, Diaphragm, Stage Forceps, Glsss Plate and Pliers. | 100 00 |
| 280*. | ***The Improved Monocular National Microscope Stand,*** . With Swinging Sub-stage and all improvements, Two Eye-pieces, Diaphragm, Stage Forceps, Glass Plate and Pliers. | 75 00 |
| 281. | ***Mahogany Cabinet for the New National Microscopes,*** . | 12 00 |
| 282. | " " " " " " " . With Sidecase and Fittings for all Accessories, 239* to 248. | 17 50 |

## NEW NATIONAL SERIES OF OBJECTIVES.



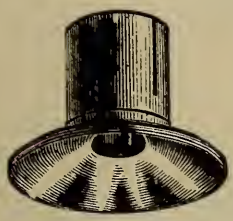
293 294 295 296 297 298 299 300

In order to meet the universal demand for good and well corrected Object-glasses, adapted to the wants of true observers, who need reliable glasses at a moderate cost, impossible in lenses of the very highest grade, we have now introduced our ***New National Series,*** which we confidently recommend as the best low-priced Objectives ever made. They are corrected with great care, are exceedingly well mounted, furnished with the Society Screw, and packed in handsome engraved Brass Boxes. The Series is as follows:

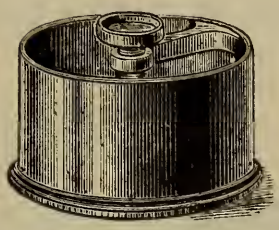
| No. | Focal length. | Linear magnifying power nearly, with Eye-pieces. | | | | Degrees of angle of aperture. | Price |
|---|---|---|---|---|---|---|---|
| | | Draw-tubes. | No. 1. | No. 2. | No. 3. | | $ c. |
| 293. | 3 in. | closed | 12 | 20 | 32 | 7° | 7 00 |
| 294. | 2 in. | closed | 23 | 43 | 70 | 10° | 7 00 |
| 295. | 1 in. | closed | 47 | 78 | 116 | 19° | 9 00 |
| 296. | $\frac{2}{3}$ in. | closed | 65 | 110 | 170 | 25° | 10 00 |
| 297. | $\frac{1}{2}$ in. | closed | 100 | 170 | 260 | 38° | 12 00 |
| 298. | $\frac{1}{4}$ in. | closed | 200 | 340 | 520 | 75° | 12 00 |
| 298*. | $\frac{1}{6}$ in. | closed | 275 | 480 | 750 | 85° | 15 00 |
| 299. | $\frac{1}{8}$ in. | closed | 365 | 620 | 965 | 95° | 20 00 |
| 300. | $\frac{1}{16}$ in. | closed | 730 | 1240 | 1930 | 110° | 30 00 |
| 301. | $\frac{1}{20}$ in. | closed | 900 | 1550 | 2500 | 120° | 45 00 |

## ADDITIONAL APPARATUS.

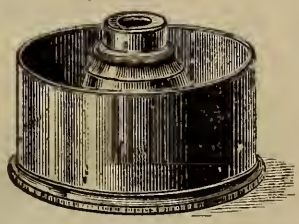
239*. Lieberkuhn to 1-inch Object-glass, . . . . . $3 50
240. Dark Well, . . . . . 2 00
241. Achromatic Condenser and Fitting, . . . . . 8 50
242. Wenham's Parabolic Reflector, for Dark-field Illumination, . . 8 50
244. Polarizing Apparatus, complete with Prisms, Film of Selenite and Adapter, . . . . . 15 00
245. Wollaston's Camera Lucida, for drawing an object, . . . . . 6 50
245*. Vertical Camera Lucida, . . . . . 8 00
246. Glass Micrometer, ruled into $\frac{1}{100}$ths and $\frac{1}{1000}$ths of an inch, . . 2 25
247. Small Live-Box, . . . . . 2 50
248. Glass Trough, complete with Wedge and Spring, . . . . . 3 00
250*. All the above Additional Apparatus, from Nos. 239* to 248 (not including 245*), if ordered at once, . . . . . 45 00
222. New Conical Diaphragm, . . . . . 2 50
253. Double Nose-Piece, Angular, . . . . . 7 00
253*. Triple Nose-Piece, " . . . . . 15 00
262. Eye-pieces, Nos. 1, 2, 3, 4 or 5, each, . . . . . 5 50
290. Stage, with Horizontal and Vertical Mechanical Movements, Sliding Object-holder, and Revolving Fitting complete, . . . . 22 50
291. Condensing Lens, on Stand, . . . . . 6 00
292. Draw-tube for "The National Microscope," . . . . . 3 50



No. 239*.



No. 240.



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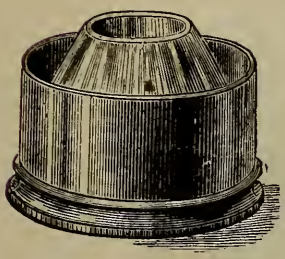
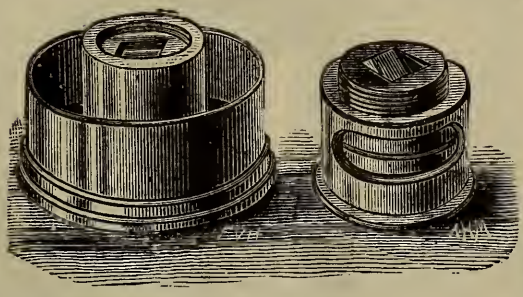
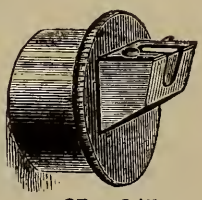


No. 242.

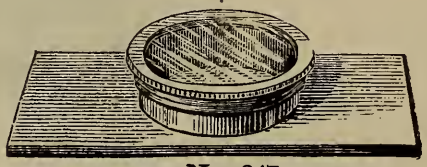


No. 244.



No. 245.


No. 246.



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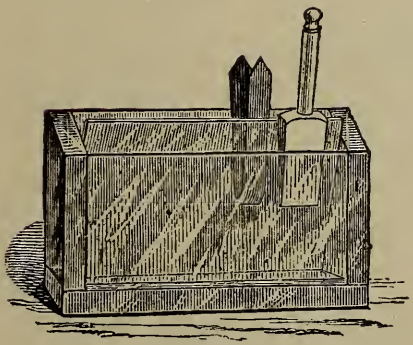
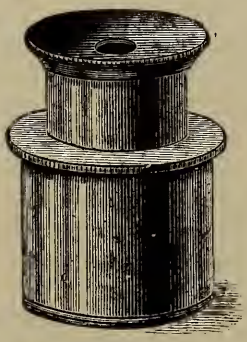
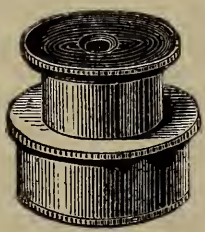


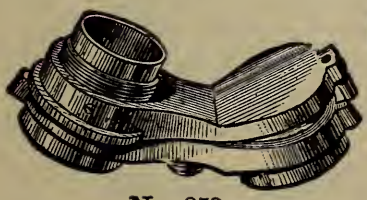
No. 248.



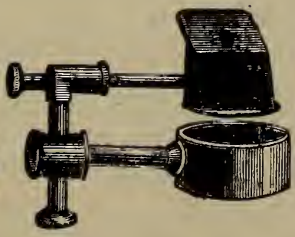
No. 262, No. 2.



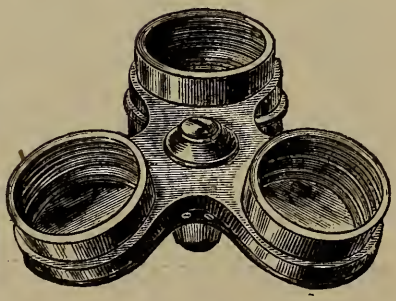
No. 262, No. 3.



No. 253.

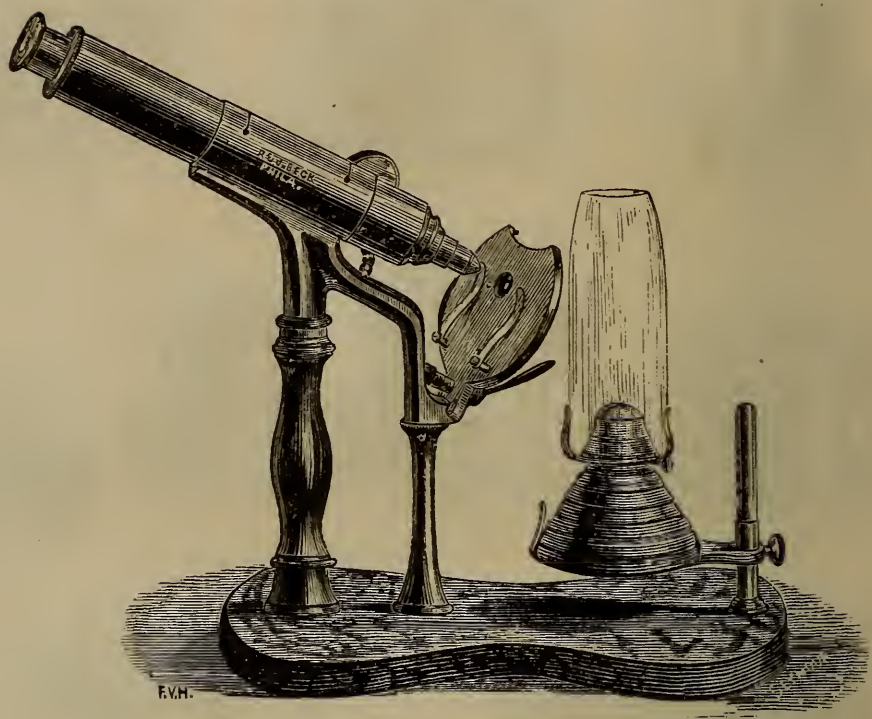


No. 245*



No. 253*.

## HOLMES'S LECTURE ROOM MICROSCOPE.



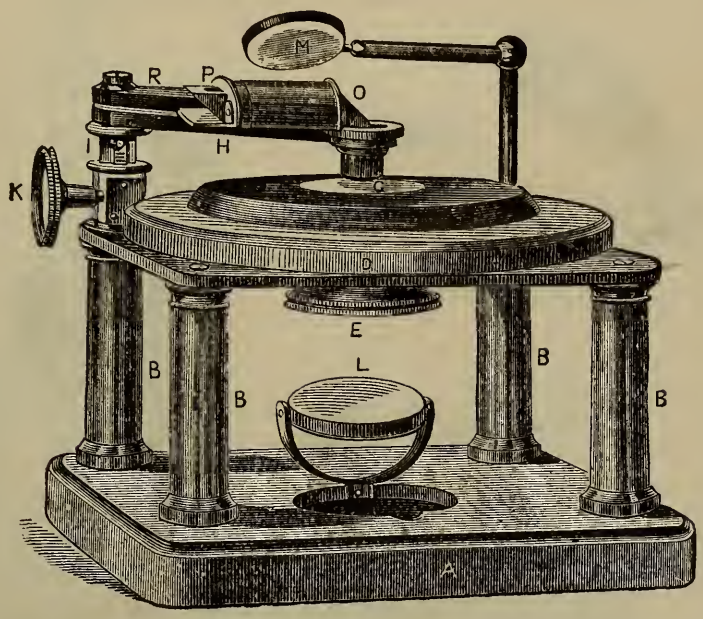

No. 305.

305. ***Holmes's Lecture Room Microscope,*** stand only as figured, . $15 00

The "Holmes's Lecture Room Microscope" was originally designed by Dr. O. W. Holmes, of Boston, for use in his own class. By slight modifications of his original plan, we have succeeded in producing the instrument in a somewhat improved form, and feel assured it exactly fills a long-felt want, combining as it does a *perfect Class* microscope, with a very excellent and practical stand for all ordinary table use. Supported on a base of polished walnut by a column of the same wood (which forms the handle for class use), is a light frame of brass, bearing upon its upper surface, at an angle most convenient for observation, a short, split tube, through which the compound body slides with perfect smoothness, forming the coarse adjustment for focus. The fine adjustment is effected by a micrometer screw and lever beneath the stage. The latter is furnished with light spring clips, for holding the object, and a revolving diaphragm with different-sized openings. The compound body is furnished with a first-class eye-piece (A or B, as desired); and the "*Society Screw*," whereby any objective of standard English or American make can be used on it. A coal-oil lamp on adjustable stand, firmly secured to the base of the instrument, furnishes the illumination. For transparent objects, the light from the edge or width of the flame is allowed to fall directly upon the object, through the central aperture of the stage. For opaque objects, the lamp is raised to the top of its stand, and its rays allowed to fall upon a small concave mirror attached to the brass frame by an universal joint, whence they are reflected upon the object. The entire height of the instrument is about twelve inches, size of base ten by four inches, weight two and three-quarter pounds.

307 Holmes's Lecture-Room Microsope Stand, the same as 305, with addition of adjustable mirror for use by daylight, . . . . $20 00

# IMPROVED DISSECTING MICROSCOPE.



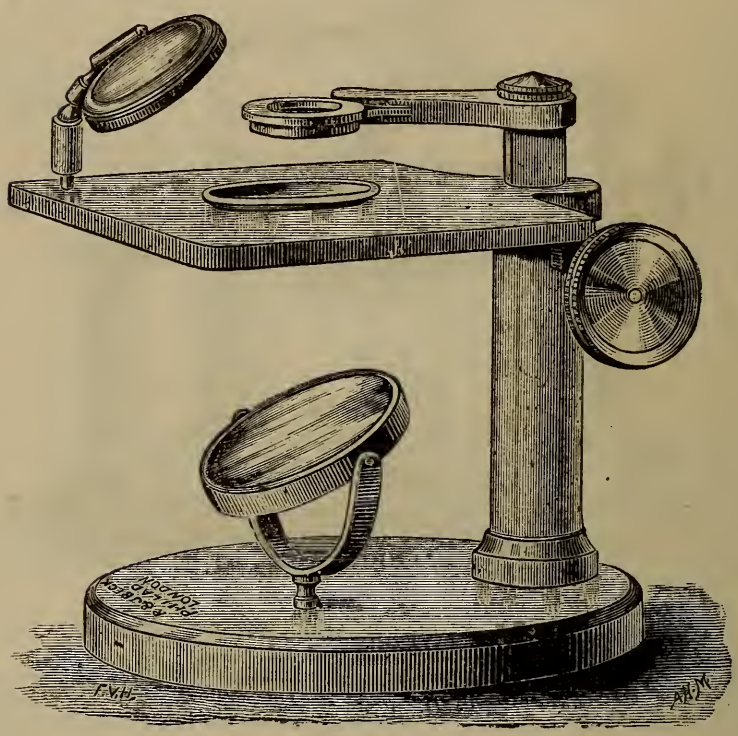

No. 308.

308. ***Improved Dissecting Single Microscope,*** . . . . . $42 50
Stand with complete sliding and revolving Stage-plates; One Arm to carry the lenses, with rack-and-pinion adjustment; Side Condenser on lengthening arm; Mirror with complete adjustments; Two single lenses and Two Coddingtons, ¾ and ½-inch focus; the whole packed in a strong Mahogany Case.

## ADDITIONAL APPARATUS.

| | | |
|---|---|---|
| 309. | Coddington Lens, 1-inch focus, | $6 00 |
| 310. | " " ¼-inch focus, | 6 00 |
| 311. | " " ⅛-inch focus, | 6 00 |
| 312. | Holder for Glass Slips, | 2 00 |
| 313. | Two Brass Saucers with Glass Bottoms, | 2 50 |
| 314. | Two Flat Glasses, | 85 |
| 315. | Two Concave Glasses, | 2 00 |
| 316. | One Piece of Box-wood covered with Cork, | 65 |
| 317. | One Gutta-Percha Tray loaded with Lead, | 85 |
| 318. | One Piece of Lead and Cork, | 65 |
| 319. | One Pair of Steel Forceps, | 1 25 |
| 320. | Two Pairs of Scissors, | 3 50 |
| 321. | One Needle-holder, | 2 00 |
| 322. | Two Knives, | 2 00 |
| 323. | Two Hooks, | 1 75 |
| 324. | Two Points, | 1 75 |
| 325. | Wooden Tray for holding Dissecting Instruments, | 2 75 |
| 326. | Box for containing additional Apparatus, | 2 75 |
| 327. | All the above Additional Apparatus, from Nos. 309–326, if ordered at once, | 40 00 |
| 328. | Binocular Prisms and Arm for carrying ditto, | 20 00 |

## NEW MODEL DISSECTING MICROSCOPE.



No. 330.

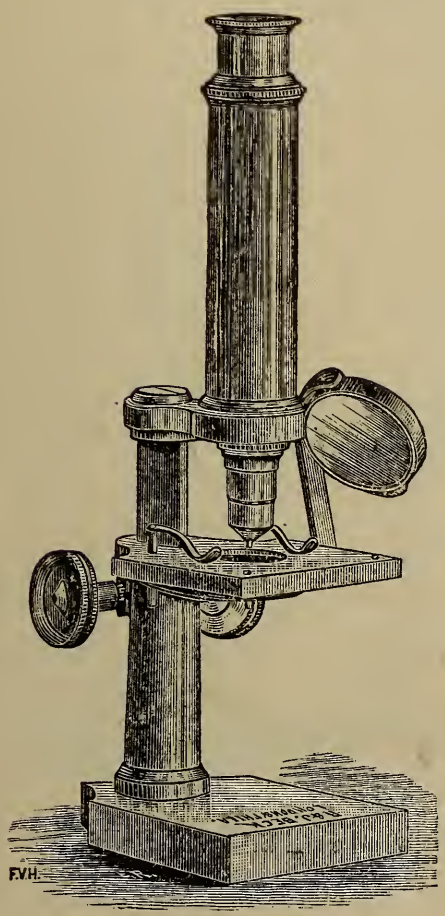
One-half Actual Size.

330. ***New Model Dissecting Single Microscope,*** . . . . . $15 00
Stand all brass, with broad circular Base and large firm Stage with Spring Clips for holding a slide, and small concave glass Saucer; Jointed Arm to carry the lenses, with rack-and-pinion adjustment of focus; Concave Mirror and Side Condensing Lens with complete adjustments; two dissecting needles in holders and one pair of brass forceps, two *single* lenses of 1½ and 1-inch focus; the whole packed in a strong Mahogany Case with handle and lock.

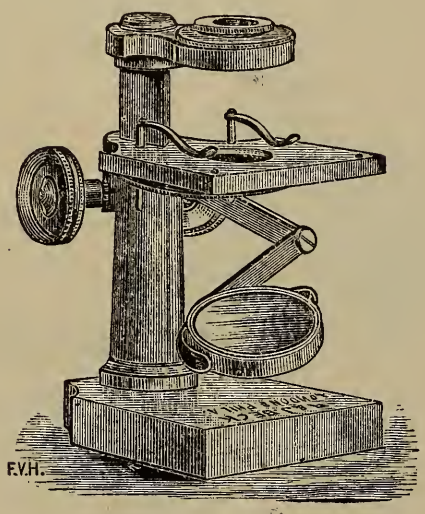
331. ***New Model Dissecting Single Microscope,*** *Stand only*, with one Lens; no Case or Condenser, . . . . . 10 00
332. Single Lens of 1-inch focus, . . . . . 2 50
333. " " " ¾ " " . . . . . 2 50
334. Coddington Lens of ¾-inch focus . . . . . 6 00
336. " " " ½ " " . . . . . 6 00
338. *Hand Rests* which can be immediately attached to both sides of the stage, and removed at pleasure, . . . . . 2 50

This instrument has been specially designed to meet a long-felt want for a thoroughly good dissecting Microscope, at a very moderate cost. The Stand is very firm, with a roomy Stage of the exact height from table for convenient use; the lenses are exceedingly good, and of the most useful powers, and the whole will be found very satisfactory for most purposes. Any of the accessories from Nos. 309 to 326 can be used with it.

# NEW HISTOLOGICAL DISSECTING MICROSCOPE.




No. 340.




No. 340.

ONE-THIRD ACTUAL SIZE.

| No. | | Price |
|---|---|---|
| 340. | ***The New Histological Dissecting Microscope,*** with outfit as described below, . . . . . | $25 00 |

This instrument combines a Compound Microscope with a Single and Dissecting one in a very compact, practical and economical form. The stout immovable arm carrying the lens when used as a Single Microscope, is so arranged that a compound body with *Eye-piece* and *draw tube* may be attached to its upper surface, whilst beneath it is fitted with the *Society Screw*, whereby any objective may be used with it. The Rack-and-Pinion adjustment work so smoothly that a ¼-inch objective may be focused with the utmost exactness. The Mirror beneath the stage is so adjusted upon a swinging arm that it may be turned up *over* the stage for the illumination of an opaque object. A revolving diaphragm, with various sized openings, is attached to the under side of the stage. The outfit consists of a single lens of one-inch focus for dissecting and botanical work, and an achromatic objective of ¼-inch focus, the same as furnished with the Economic Microscopes, and one Eye-piece, giving a range of powers, with the draw tube, of between 200 and 300 diameters, a pair of brass pliers, two dissecting needles in Ebony handles and a glass plate with ledge. The whole packed in a neat Mahogany case with lock. Any of the accessories 309 to 326 are applicable to this instrument.

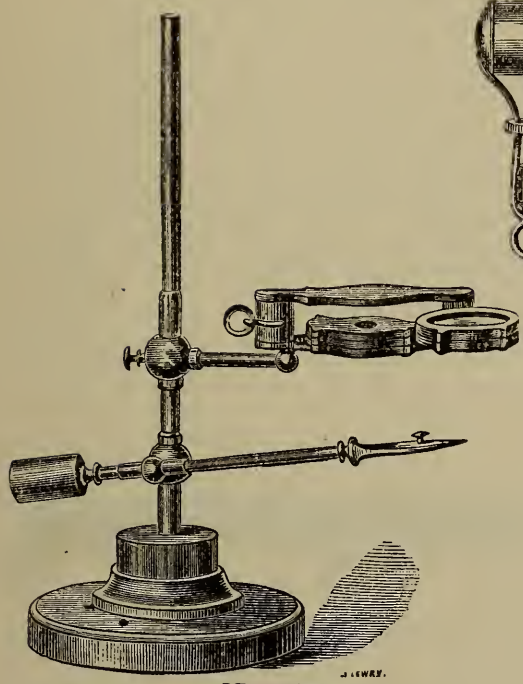
| | | |
|---|---|---|
| 341. | ***The New Histological Dissecting Microscope,*** with the same outfit as with 340, and the addition of the Economic 1-inch Objective, | 32 00 |

## THE 'SCHOLARS' MICROSCOPE.

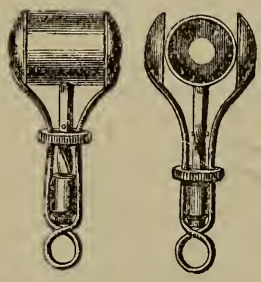
PRICE, $25 00.

Illustration and Description in Next Edition.

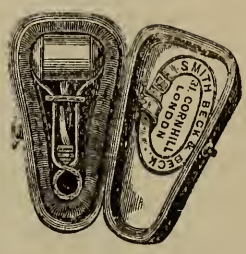
## CODDINGTON LENSES, etc.



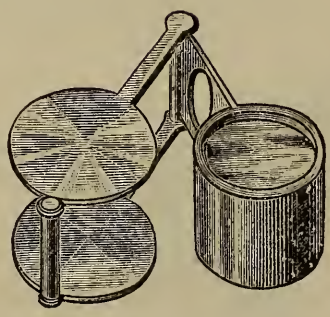
No. 343.



No. 351.




No. 350.



Nos. 355–358.

| No. | | Price. |
|---|---|---|
| 343. | Combination of Three Lenses, mounted in Tortoise-shell, on Brass Stand, with Adjusting Arms and Sliding Forceps for holding an object, | $13 50 |
| 344. | Combination of Three Lenses, in Tortoise-shell, on Brass Stand, with Adjusting Arm, | 7 50 |
| 346. | Combination of Three Lenses, mounted in Tortoise-shell, for pocket, | 5 00 |
| 347. | Coddington Lens, ¾-inch focus, mounted in Silver, | 12 50 |
| 348. | " " ¾-inch focus, mounted in Aluminium Bronze, | 12 50 |
| 349. | " " ¾-inch focus, mounted in German Silver, | 8 50 |
| 350. | " " ½-inch focus, mounted in Gold, | 22 50 |
| 351. | " " ½-inch focus, mounted in Silver, | 8 50 |
| 352. | " " ½-inch focus, mounted in Aluminium Bronze, | 8 50 |
| 353. | " " ½-inch focus, mounted in German Silver, | 7 00 |

## ACHROMATIC TRIPLETS.

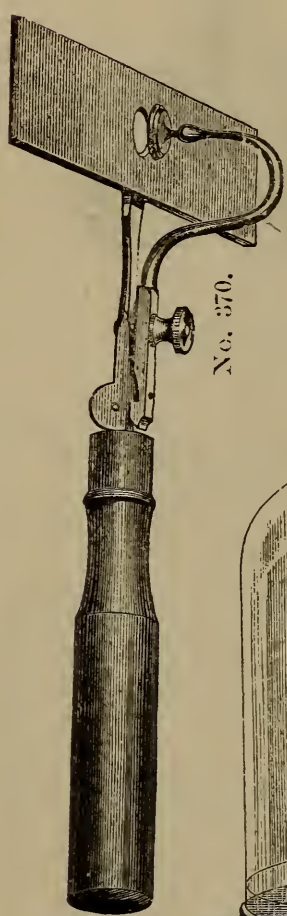
| | | |
|---|---|---|
| 355. | Beck's Achromatic Triplet, 1-inch focus, in Silver Case, | 13 50 |
| 356. | " " " ¾ " " " | 12 50 |
| 357. | " " " ½ " " " | 12 50 |
| 358. | " " " ¼ " " " | 13 50 |

## CASES OF MOUNTING MATERIALS.

No. PRICE

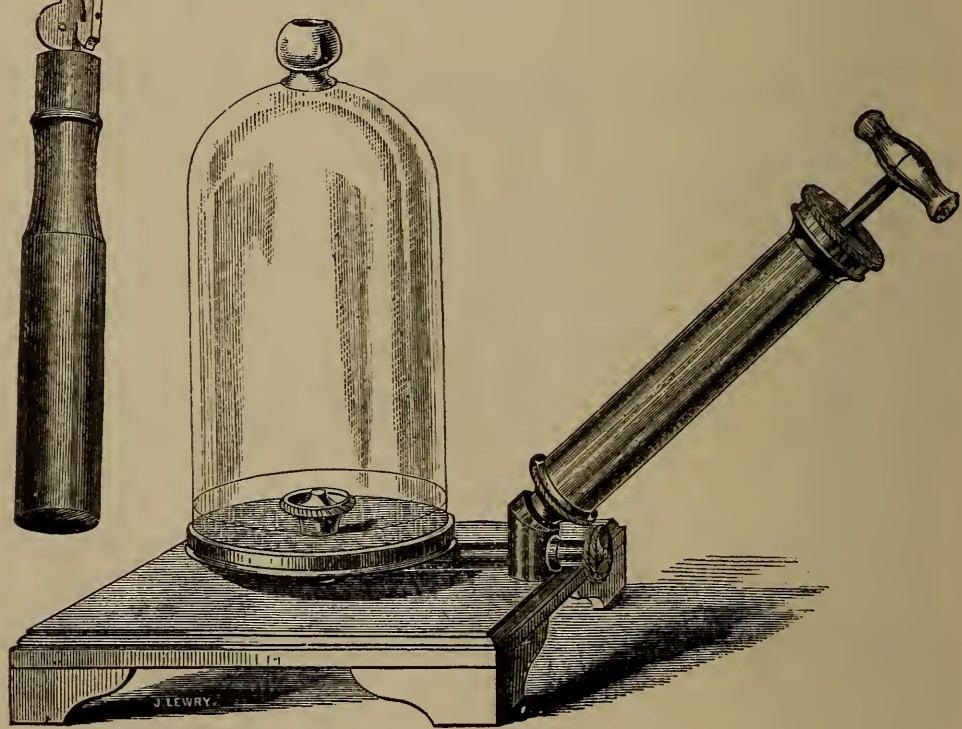
360. ***Collection of Mounting Materials and Dissecting Instruments,*** Consisting of Wood-cutting Instrument and Chisel, Instrument for cutting circles of thin Glass, Glazier's Diamond, Writing Diamond, Cell-making Instrument, Brass Table and Lamp, Page's Forceps, Case of Dissecting Instruments, containing 4 Knives, 2 Hooks, 2 Points, 3 pairs of Scissors, 3 pairs of Forceps and Needle-holder, Valentin's Knife, 1 oz. Thin Glass, 9 dozen Slips, 3 inch by 1 inch, 3 dozen Wooden Slips, 3 dozen Glass Cells, 200 Labels, 5 Capped Bottles, containing Canada Balsam, Asphalt, Gold-size, Glycerine and Marine Glue, Bottle of Dean's Medium. 3 Stoppered Bottles for containing Chloroform, Nitric Acid and Liq. Potassæ, . . $100 00

The whole packed in a strong Mahogany Case.



No. 370.

No. 369.




No. 372.

## CASES OF MOUNTING MATERIALS.

| No. | | Price. |
|---|---|---|
| 361. | ***Collection of Mounting Materials,*** . . . . . | $40 00 |
| | Consisting of Writing Diamond, Cell-making Instrument, Brass Table and Lamp, Page's Forceps, Case for Dissecting Instruments, 1 oz. Thin Glass, 6 dozen Slips, 3 inch by 1 inch, 3 dozen Wooden Slips, 2 dozen Glass Cells, 150 Labels, 5 Capped Bottles, containing Canada Balsam, Asphalt, Gold-size, Glycerine and Marine Glue, 1 Bottle of Deane's Medium. The whole packed in a strong Mahogany Case. | |
| 365. | Reagent and Mounting Rack, containing 12 bottles, filled with various reagents, cements, etc., each provided with a dropping tube fitted to the cork, and ten test tubes with fittings, . . . | 3 00 |
| 368. | Improved Wood Cutting Machine, with Chisel, packed in Mahogany Case, . . . . . | 9 50 |
| 369. | Page's Wooden Forceps, for holding Glass Slips, when heated, . | 50 |
| 370. | Smith's Mounting Instrument for pressing down the Cover on the Glass Slips, with a graduated pressure, . . . . . | 3 00 |
| 372. | Small Air-pump and Receiver, . . . . . | 12 50 |

## CABINETS FOR MICROSCOPIC OBJECTS.

| | | |
|---|---|---|
| 465. | Mahogany Cabinet to hold 600 objects, with double glass doors and improved slide-rests, showing each object clearly when the drawers are pulled out, and allowing their easy removal, . . | 45 00 |
| 466. | Best Spanish Mahogany Cabinet, with glass panel and deep drawer at bottom, to hold 1000 objects, . . . . . | 70 00 |
| 467. | Honduras Mahogany Cabinet, without glass panel or deep drawer, to hold 1000 objects, . . . . . | 55 00 |
| 468. | Best Spanish Mahogany Cabinet, with glass panel, to hold 750 objects, . . . . . | 50 00 |
| 469. | Honduras Mahogany Cabinet, without glass panel, to hold 750 objects, . . . . . | 44 00 |
| 470. | Best Spanish Mahogany Cabinet, with glass panel, to hold 500 objects, . . . . . | 40 00 |
| 471. | Honduras Mahoghany Cabinet, without glass panel, to hold 500 objects, . . . . . | 35 00 |

In the above Cabinets there are porcelain tablets let into the fronts of the drawers. The drawers are numbered and the specimens lie flat.

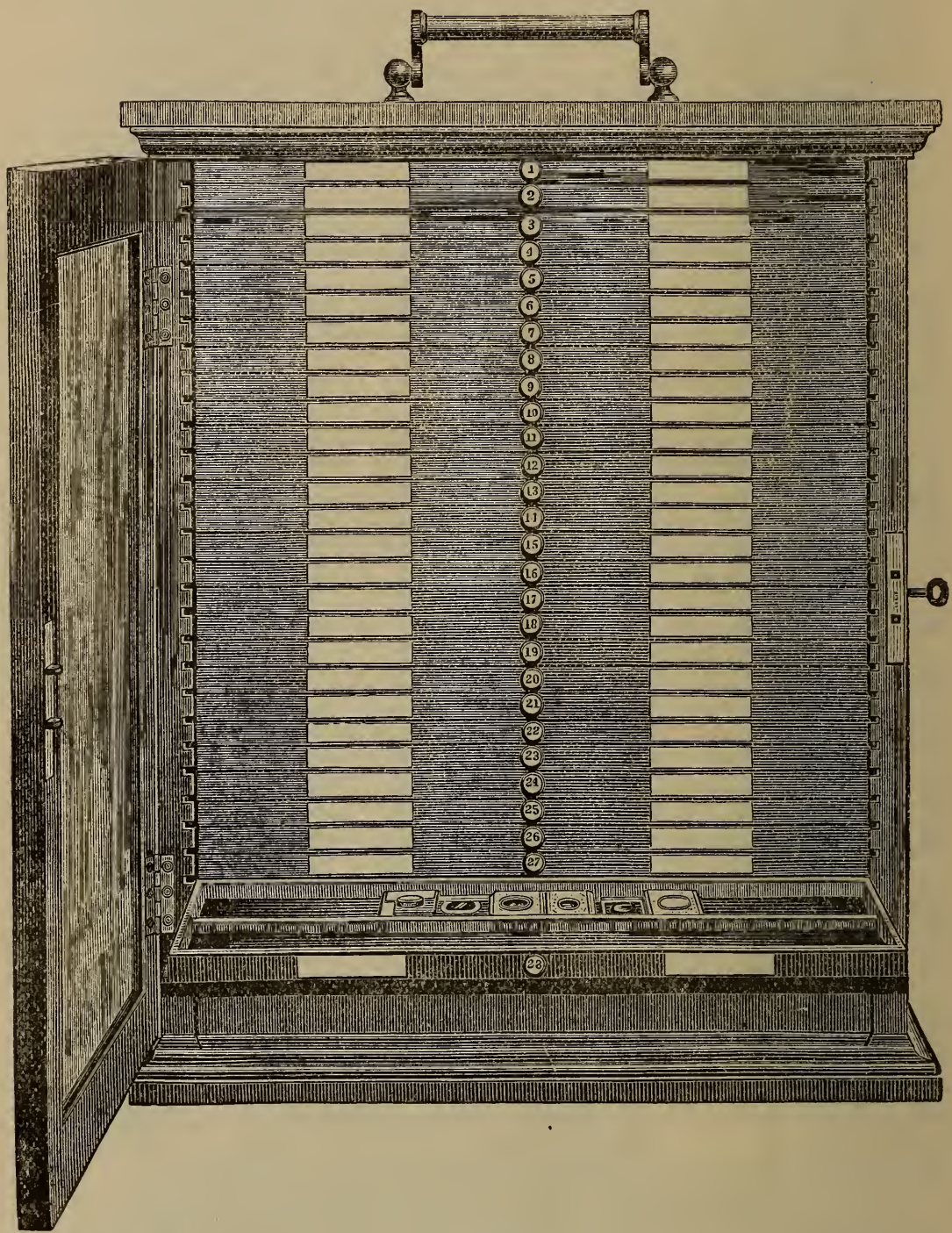
## POSTAL BOXES FOR MICROSCOPIC OBJECTS.

| | | |
|---|---|---|
| 482. | Card-board Boxes fitted with Racks to hold 12 Objects, . . . | 15 |
| 484. | Postal Boxes, to take 1 Object, . . . . . | 6 |
| 485. | " " " 3 " . . . . . | 8 |
| 486. | " " " 6 " . . . . . | 10 |
| 487. | " " " 12 " . . . . . | 12 |
| 488. | " " " 25 " . . . . . | 15 |

## CASES FOR MICROSCOPIC OBJECTS.

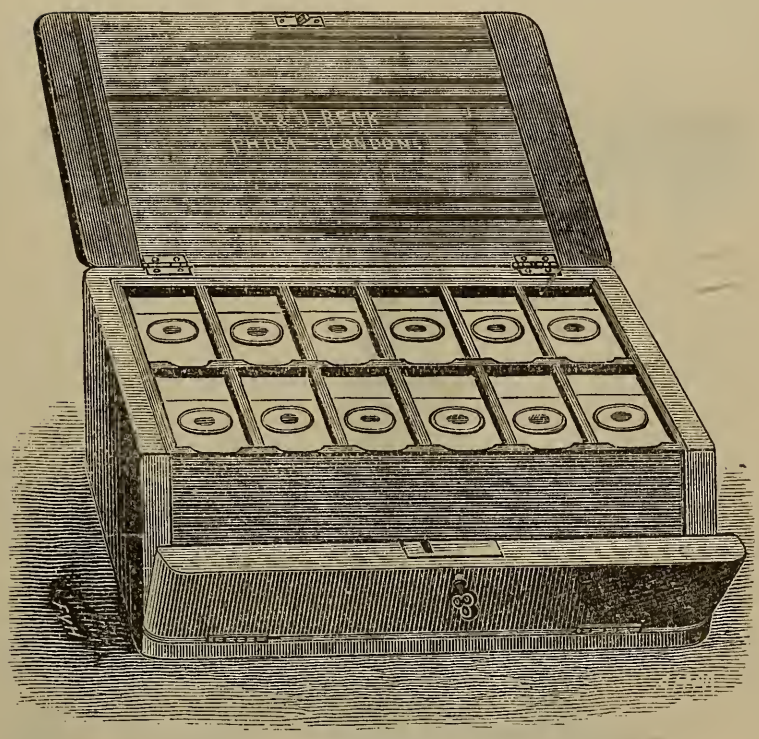
| | | |
|---|---|---|
| 489. | Portable Horizontal Slide Case, with 12 Trays, holding 12 dozen objects, lying flat, the same as in case No. 472, with a substantial cover of bookbinder's cloth, . . . . . | 4 00 |

## CABINET FOR MICROSCOPIC OBJECTS.



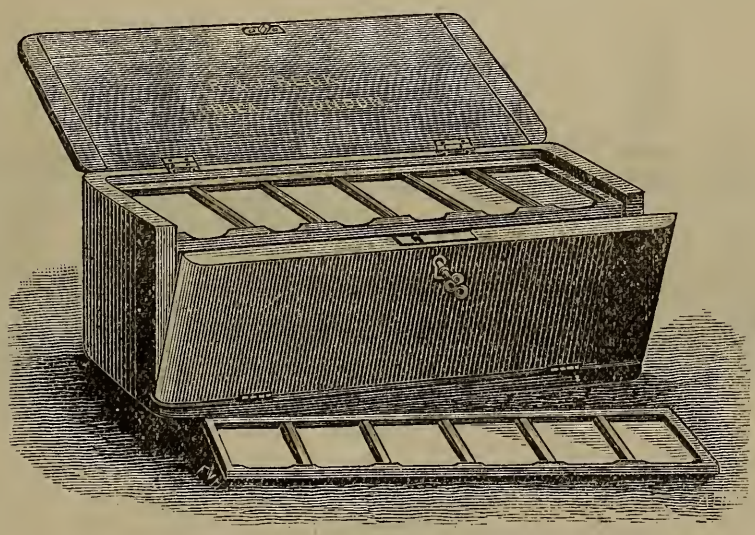

No. 466.
One-Fourth Actual Size.

# CASES FOR MICROSCOPIC OBJECTS.



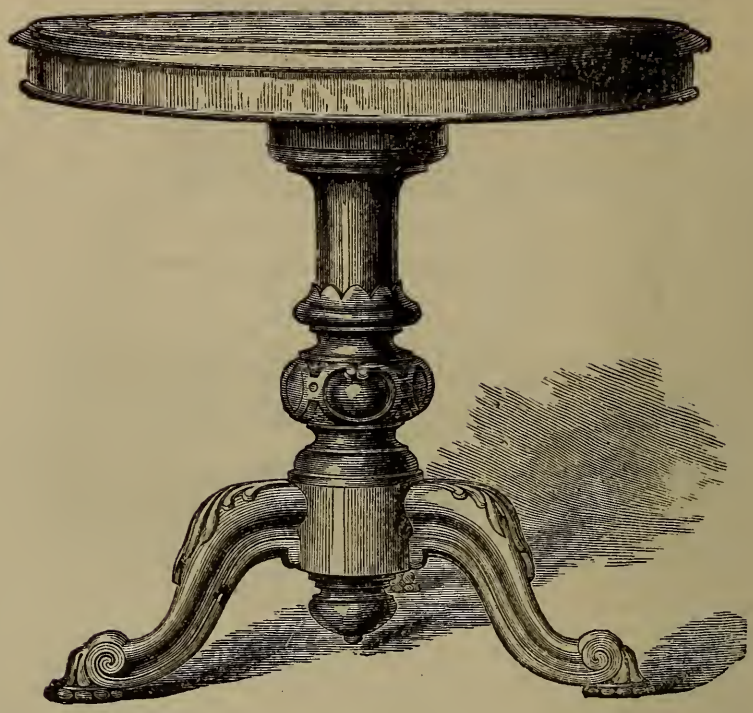

No. 472.

| No. | | Price. |
|---|---|---|
| 472. | Portable Horizontal Slide Cabinet, in Mahogany, with 12 Trays, to hold 12 doz. Objects, | $8 00 |
| 473. | Portable Horizontal Slide Cabinet, in Mahogany, with 12 Trays, to hold 6 doz. Objects, | 5 00 |
| 474. | Portable Horizontal Slide Cabinet, in Mahogany, with 6 Trays, to hold 3 doz. Objects, | 3 00 |
| 474*. | Portable Horizontal Slide Cabinet, in Pine, with 4 Trays, to hold 2 doz. Objects, | 1 00 |



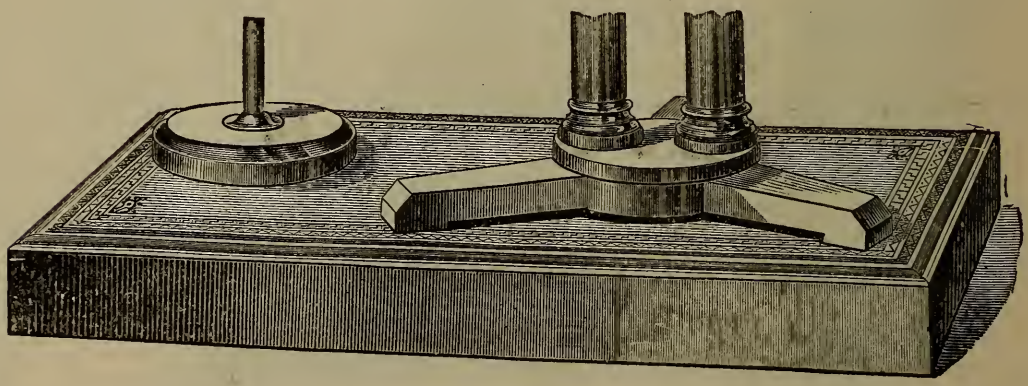
No. 473.

## TABLES, etc.



No 491.

| No. | | Price. |
|---|---|---|
| 491. | Revolving Table, especially arranged for Microscopic purposes, in Walnut or Mahogany, with handsome Leather Top, Gilt Border, | $50 00 |
| 492. | Revolving Table, the same in construction and size as 491, with plain Eastlake base, and Solid Walnut Top, finished in shellac, . . | 25 00 |
| 493. | Revolving Table with Solid Iron Frame, and Walnut Top, 30 inches in diameter. Very firm and steady, . . . . . | 12 00 |



No. 495.

| | | |
|---|---|---|
| 495. | Walnut-wood Stand, with Leather Top, on Rollers, to carry a Microscope and Lamp round a Table, . . . . . | 7 50 |

## HAND MAGNIFIERS, etc.

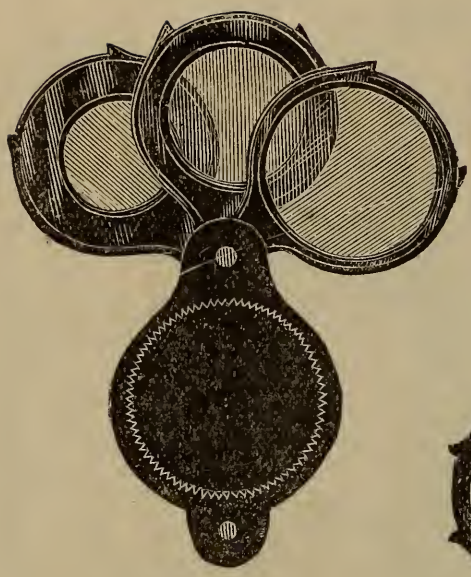
| No. | | Price. |
|---|---|---|
| 600. | Oval-shape, Hard-rubber Case, 1 Lens, about $\frac{3}{4}$-in diam. | 30 |
| 601. | " " " " " 1 " . . " 1 " | 50 |
| 602. | " " " " " 1 " . . " $1\frac{1}{4}$ " | 60 |
| 603. | " " " " " 1 " . . " $1\frac{1}{2}$ " | 75 |
| 604. | " " " " " 1 " . . " $1\frac{3}{4}$ " | 90 |
| 605. | Long-shape, " " " 1 " . . " $\frac{3}{4}$ " | 40 |
| 606. | " " " " " 1 " . . " $\frac{15}{16}$ " | 60 |
| 607. | " " " " " 1 " with dia'm, " $\frac{5}{8}$ " | 75 |
| 608. | " " " " " 2 " " " " $\frac{5}{8}$ " | 1 00 |
| 609. | " " " " " 3 " " " " $\frac{5}{8}$ " | 1 50 |
| 615. | " " " " " 2 " . . " $\frac{3}{4}$ " | 65 |
| 616. | " " " " " 2 " . . " $\frac{15}{16}$ " | 90 |
| 619. | " " " " " 3 " . . " $\frac{3}{4}$ " | 90 |
| 620. | " " " " " 3 " . . " $\frac{15}{16}$ " | 1 25 |
| 621. | " " " " " 2 " . . $\frac{7}{8}$ and $\frac{1}{2}$ " | 1 25 |
| 625. | Linen-prover, Brass frame with $\frac{1}{4}$ or $\frac{1}{2}$-in. Open Square, . . . | 50 |
| 626. | " " Nickel-plated, " " " . . . | 75 |
| 627. | " " " $\frac{1}{4}$ or $\frac{1}{2}$-in. opening; Achromatic lens, | 1 00 |

## WATCHMAKERS' AND ENGRAVERS' GLASSES, etc.

| | | |
|---|---|---|
| 630. | Watchmakers' Glass of $\frac{7}{8}$, 1-inch, $1\frac{1}{8}$-inches diameter, as desired, . | 50 |
| 630*. | " " with two lenses, of different powers . . . | 75 |
| 631. | " " " small lens, high power, . . . . | 75 |
| 632. | Engravers' " " 2 plano-convex lenses, $1\frac{3}{8}$-inches diam., . | 1 50 |
| 632*. | " " " 1 double " lens, $1\frac{3}{8}$ inches diameter . | 75 |
| 633. | " " " 2 plano " lenses, $1\frac{5}{8}$-inches diam., . | 2 00 |
| 633*. | " " " 1 double " lens, $1\frac{5}{8}$-inches diameter, . | 1 00 |
| 634. | " " " 2 plano " lenses, $1\frac{7}{8}$ inches diam., . | 2 50 |
| 634*. | " " " 1 double " lens, $1\frac{7}{8}$ inches diameter, . | 1 25 |
| 635. | " " " 2 plano " lenses, $2\frac{1}{8}$-inches diam., . | 3 00 |
| 635*. | " " " 1 double " lens, $2\frac{1}{8}$-inches diameter, . | 1 50 |
| 636. | Seed Microscope, with glass cage for living insects, small size, . | 75 |
| 636*. | " " " " " " " medium size, . | 1 00 |
| 637. | " " " " " " " large size, . . | 1 50 |
| 638. | Flower " " forceps for living insects, folds in pocket-case, | 2 00 |
| 639. | Three-legged Microscope, Brass frame, 2 plano-convex lenses, adjustment for focus, . . . . . | 75 |
| 640. | Three-legged Microscope, Rubber frame, 2 plano-convex lenses, . | 1 00 |
| 641. | " " Steel frame, 2 plano-convex lenses, . | 1 25 |

## CODDINGTON LENSES.

| | | |
|---|---|---|
| 642. | Coddington lens, Brass frame, small size, . . . . . | 1 00 |
| 643. | " " " medium size, . . . . . | 1 50 |
| 644. | " " " large size, . . . . . | 2 00 |
| 645. | " " German-silver frame, with cover, . . . . | 2 50 |
| 646. | " " Silver-plated " " very fine article, | 4 00 |
| 647. | " " " and engraved, " " " | 5 00 |
| 648. | " " Gilt " " " " " | 6 00 |



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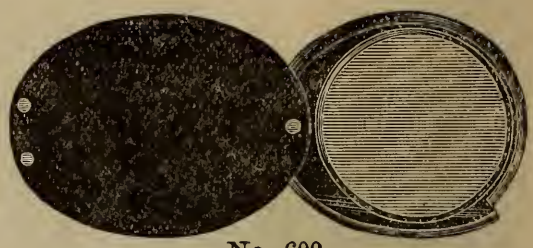

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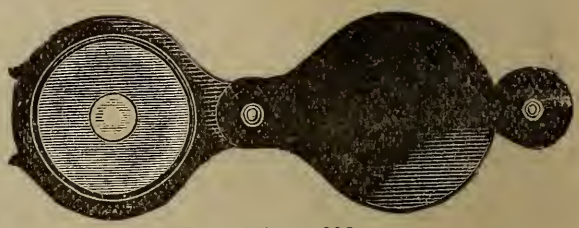
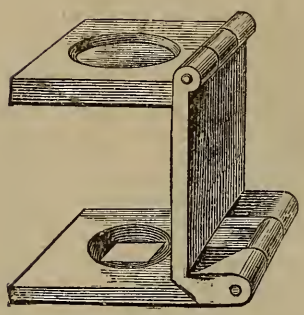
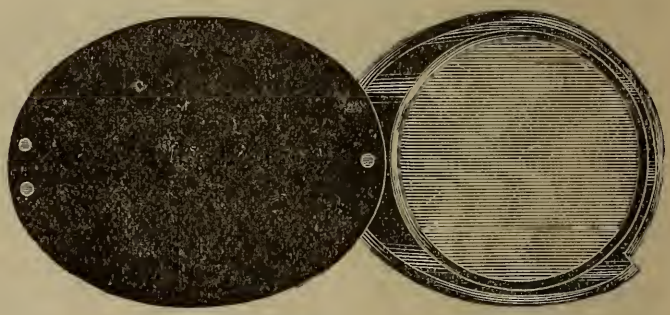


Nos. 607 to 609.



Nos. 625, 626.



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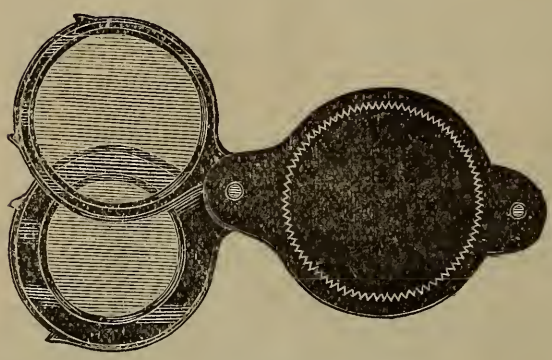

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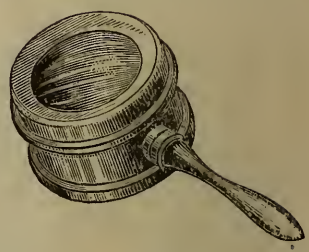
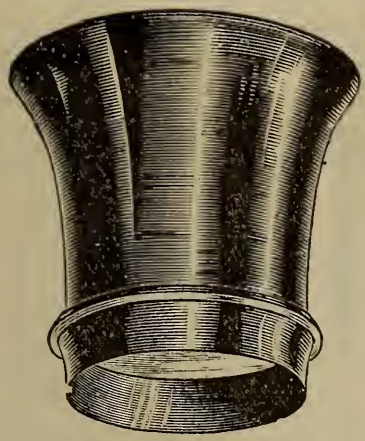


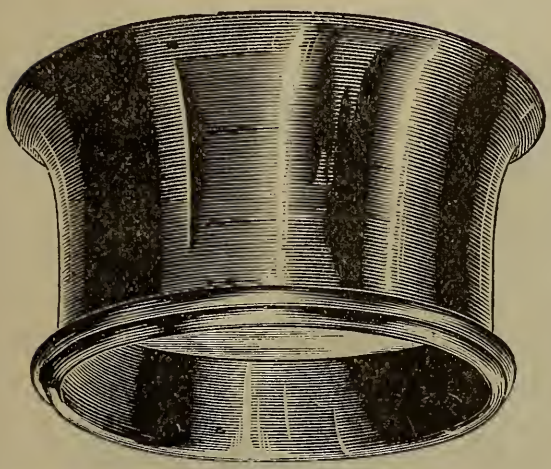
Nos. 642-644.

No. 621.



No. 630.

No. 631.



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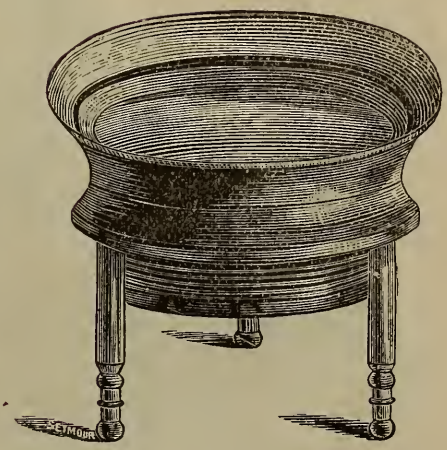

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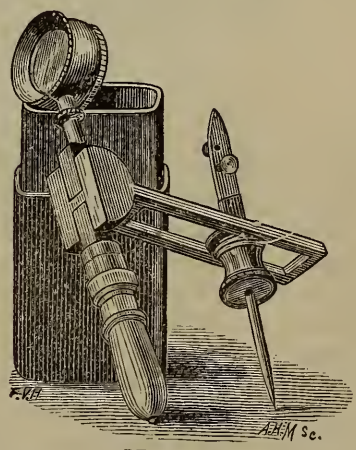

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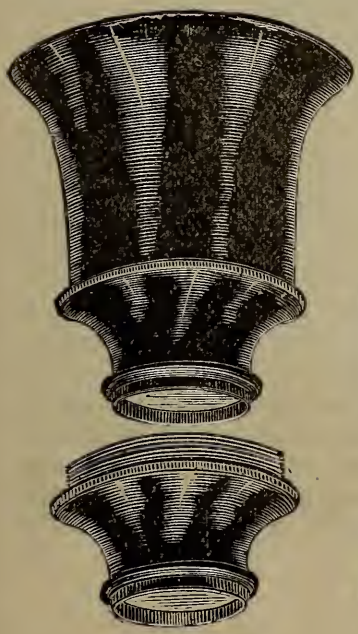

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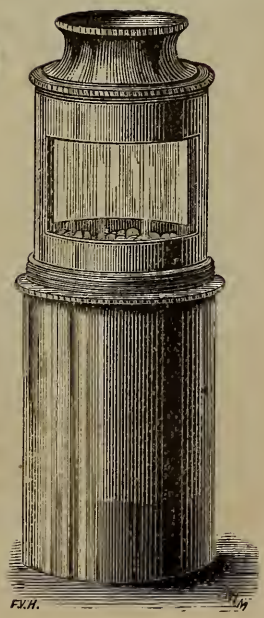

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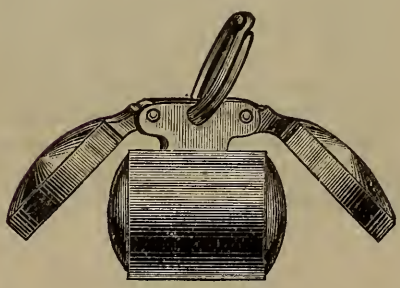
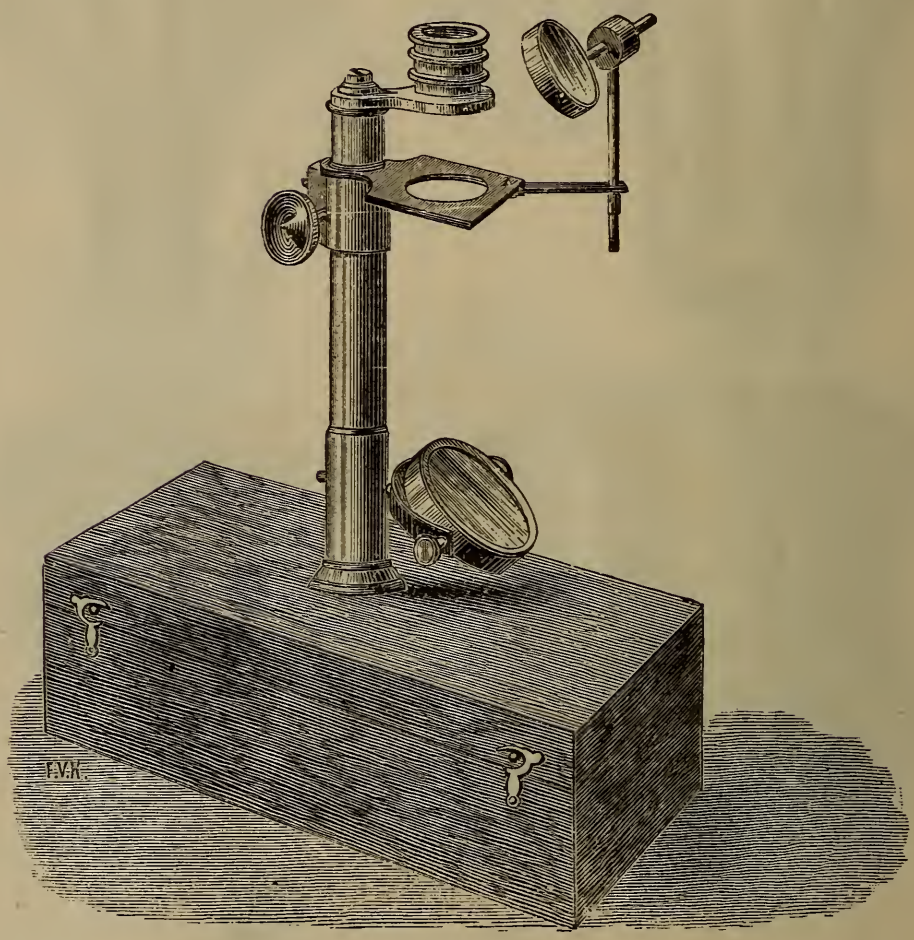


No. 646.

## THE SCHOOL MICROSCOPE.



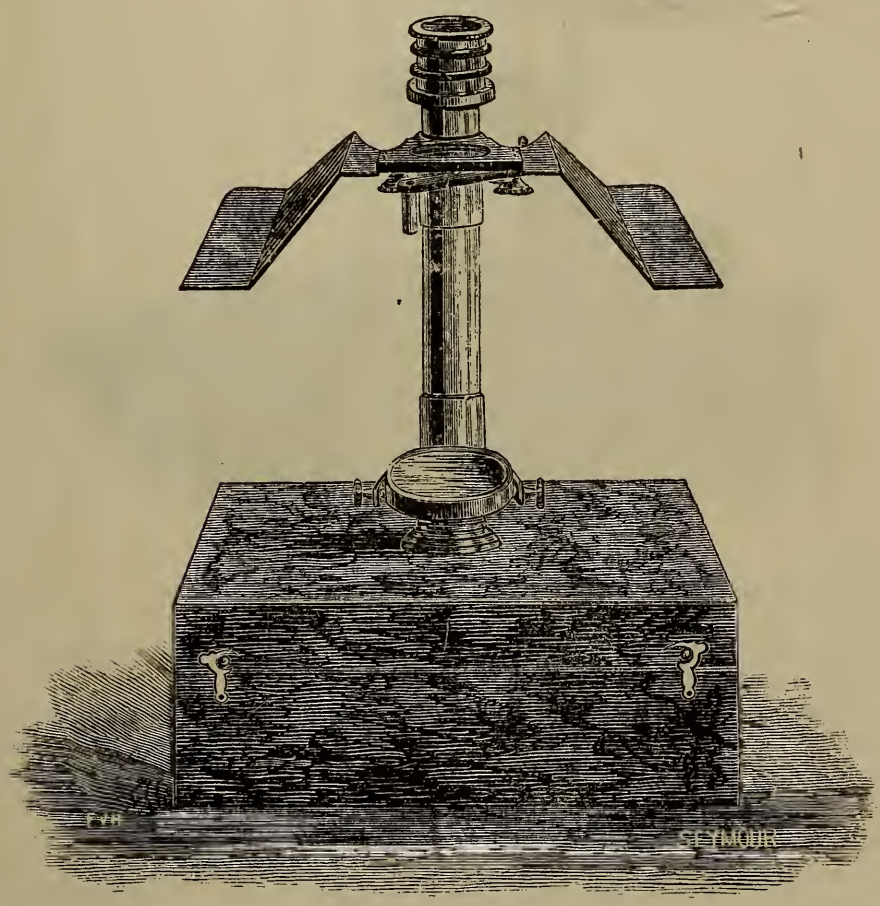
No. 650.

| No. | | Price. |
|---|---|---|
| 650. | ***The School Microscope,*** . . . . . | $6 00 |

This instrument consists of a tubular stem about five inches high, the lower end of which screws firmly into the lid of the box wherein the instrument is packed when not in use. To the upper end of this stem the stage is firmly fixed; while the lower end carries a concave mirror. Within the tubular stem is a round pillar having a rack cut into it, against which a pinion works that is turned by a milled head, and the upper part of this pillar carries a horizontal arm which bears the lenses, so that by turning the milled head, the arm may be raised or lowered, and the requisite focal adjustment obtained. Three magnifiers are supplied, and by using them either separately or in combination, a considerable range of powers, from about five to forty diameters, is obtained. A condensing lens for opaque objects, a pair of brass forceps and pliers, and an aquatic box for the examination of objects in water, are also supplied. This instrument is peculiarly adapted for educational purposes, being fitted in every particular for the examination of botanical specimens, small insects or parts of insects, water-fleas, the larger animalcules, and other such objects as young people may readily collect and examine for themselves; and those who have trained themselves in the application of it to the study of nature, are well prepared for the

advantageous use of the Compound Microscope. But it also affords to the scientific inquirer all that is essential to the pursuit of such investigations as are best followed out by the concurrent employment of a Simple and a Compound Microscope, the former being most fitted for the preparation, and the latter for the examination of many kinds of objects.

## THE SCHOOL DISSECTING MICROSCOPE.



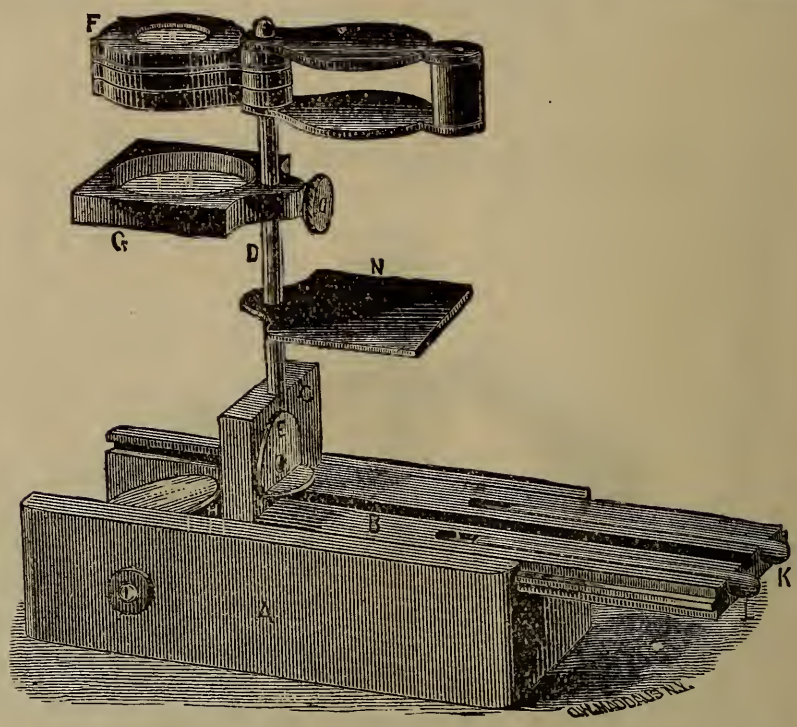
No. 651.

651. ***The School Dissecting Microscope,*** . . . . . $8 00

This instrument is the same as *The School Microscope*, No. 650, with the addition of two hand rests, as shown in the illustration, which at once convert it into a most excellent and convenient *Dissecting Microscope.* They are attached to the stage by milled heads, and are instantly removed if desired. The whole, microscope, lenses and hand rests, can be packed in the case, which measures six by three inches, and two and a quarter inches deep.

The Lenses are of a most excellent quality, the Stand firm and well finished, and it would seem impossible to improve on this really excellent instrument, either in compactness, efficiency or cheapness. The accompaniments are the same as those with No. 650.

## THE EXCELSIOR POCKET AND DISSECTING MICROSCOPE.

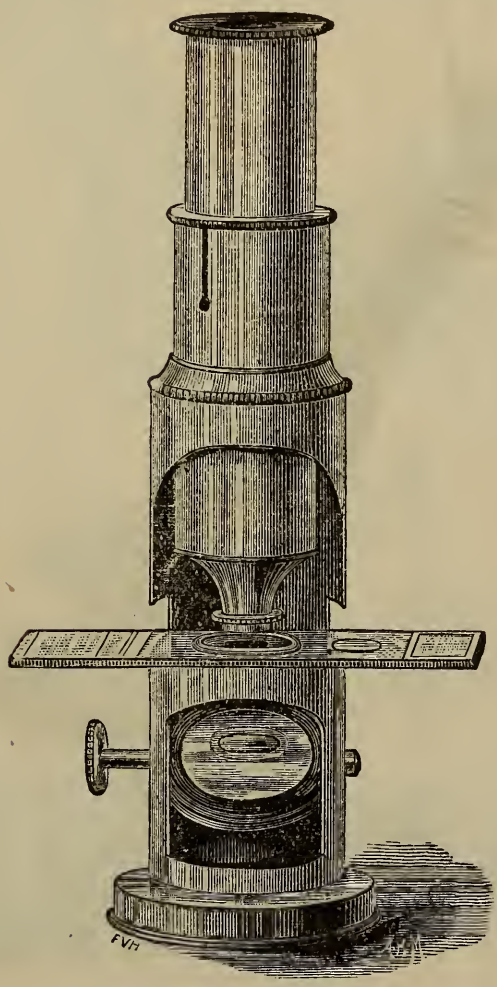



No. 652.

652. The Excelsior Microscope, with Three Lenses, . . . . . $2 75
653. " " with Two Lenses, . . . . . 2 50
654. Set of three hard rubber Slides, with openings of different kinds, to serve as linen provers, . . . . . 25

The construction and method of using this Microscope is very simple, and will be readily understood from an inspection of the engravings. It consists primarily of a small wooden case, the exact size of that shown in the engraving. To one end of the lid of this case is attached one of the ends of the box; and when the lid is reversed and turned upside down, it may be slid into the groove of the case, and then forms a stand for the lenses and glass stage, as shown in Fig. 652. The lenses and stage are supported by a steel rod, the lower end of which is hinged to the lid, so that it may be turned down and lie in a groove provided for it. When raised into the position shown in the figure, it is held very securely in place by means of a button; and this button also serves to retain it in the groove when it is turned down. The glass stage, which is fitted into a frame of hard rubber, slides easily on the stem, so as to be readily adjustable for focus, while at the same time it may be firmly fixed, by means of a set-screw, at any desired height, and will then serve as a stage for dissecting purposes. The frame which holds the lenses fits on the top of the stem. A mirror is fitted into the case, and is readily adjustable by means of the button shown on the outside, so that light may be reflected up through the stage when the objects to be examined are transparent; and when they are to be viewed by reflected light, there is a dark ground of hard rubber, which is also carried by the stem, and may be turned under the stage, so as to cut off all transmitted light. Dissecting needles, with neat handles, fit into appropriate grooves.

# THE BOYS' COMPOUND MICROSCOPE.



No. 655. Two-thirds Actual Size.

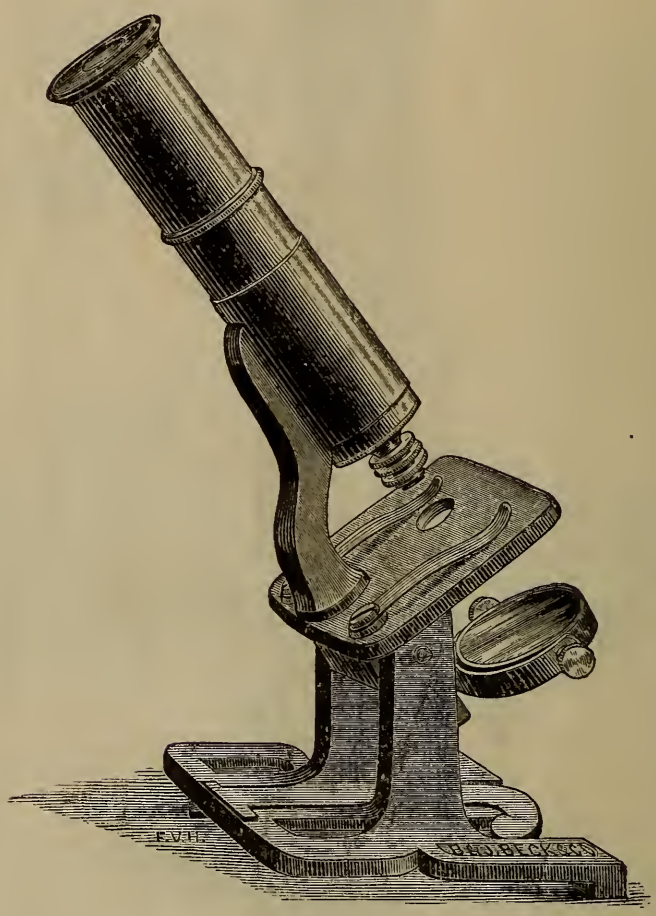
655. ***Boys' Compound Microscope,*** . . . $2 50

This instrument is a well-made and substantial one, and well adapted to the study of objects requiring rather more power than can be conveniently obtained with a *simple* microscope. It will show satisfactorily the larger animalculæ in pond-water, the scales from a butterfly's wing, and similar minute objects. The stand is of polished brass handsomely lacquered, with one eye-piece and one object-glass magnifying, when combined, about 40 diameters or 1600 times. One prepared object, two glass slips and a pair of brass forceps, are furnished with it, and the whole is packed in a neat, polished walnut-wood case.

The Rev. Mr. Wood's little book, "*The Common Objects of the Microscope*" (No. 1002 of our Catalogue), will be found a most useful and entertaining adjunct to the instrument. A copy will be mailed to any address for 50 cents. It contains 400 illustrations, printed in colors.

With each Household Microscope, *sold at retail,* six interesting objects are furnished without charge.

# THE UNIVERSAL HOUSEHOLD MICROSCOPE.



No. 660.

ONE-HALF ACTUAL SIZE.

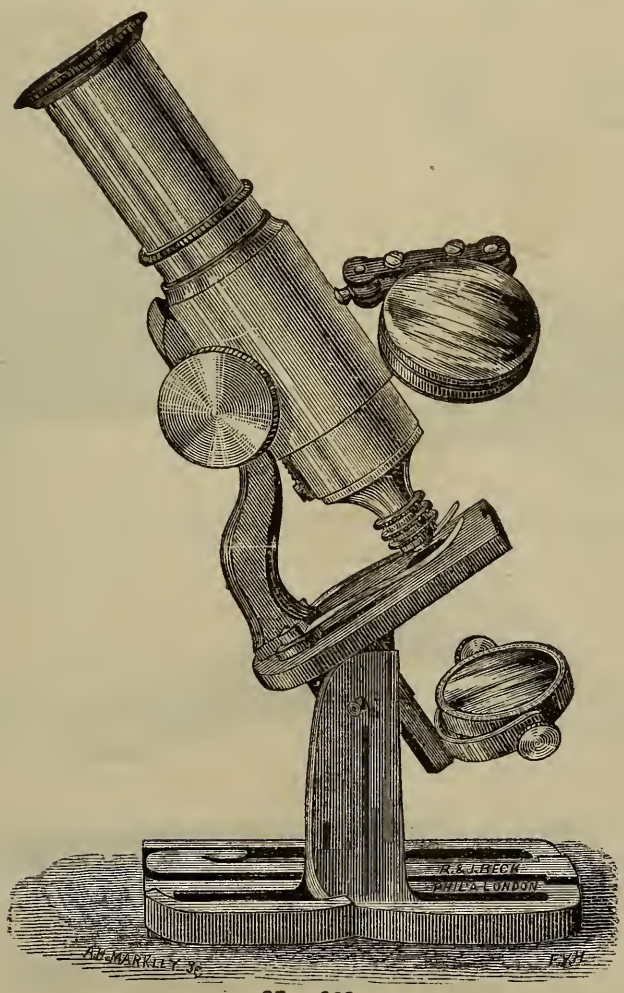
| No. | | Price. |
|---|---|---|
| 660. | ***The Universal Household Microscope,*** . . . . . | $5 00 |

There are a number of Microscopes under this name in the market, and in adding ours to the list, we have endeavored to add to their efficiency and convenience, whilst somewhat reducing the cost.

The Stand is ten inches in height, with hinged joint, allowing it to be inclined to any angle for convenience of observation. The base is of cast-iron, the design forming the monogram, R. & J. B., handsomely bronzed, the compound body of finely lacquered brass, with draw-tube for increasing the power. The object-glass is of three powers, usable separately or combined, magnifying from about 20 to 100 *diameters*, or, in popular terms, from 400 to 10,000 *times*. The markings upon the scales of butterfly's wings, and most animalcules in pond-water are very well shown by these glasses. A pair of brass forceps, two glass slips, and one prepared object accompany it, the whole contained in a neat and strong walnut-wood case.

661. THE UNIVERSAL HOUSEHOLD MICROSCOPE, the same as 660, with an *Achromatic Object-glass* of three powers, in place of the one furnished with 660, magnifying from 30 to 150 diameters, with excellent definition, entirely free from color, . . . . . 8 00

# THE UNIVERSAL HOUSEHOLD MICROSCOPE.




No. 663.
ONE-HALF ACTUAL SIZE.

| No. | | Price. |
|---|---|---|
| 663. | THE UNIVERSAL HOUSEHOLD MICROSCOPE, with rack and pinion adjustment of focus, a condensing lens, for the illumination of opaque objects, and an *Achromatic* object-glass (Triplet) giving powers from about 30 to 250 diameters. The same fittings accompany it as are furnished with No. 660, and the whole is packed in a handsome French polished Mahogany case, . . . . . | $12 00 |

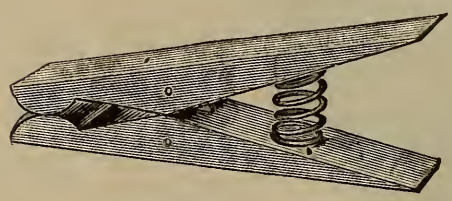
## ACHROMATIC OBJECTIVES. (French Manufacture).

These object-glasses are all *triple* combinations excepting the first, which is a *doublet;* and are really well corrected lenses, giving a clear, well-lighted field with excellent definition. They all have the *French Screw* the same as that of No. 663, but can be fitted with the *Society Screw* for an additional cost of 75 cents each.

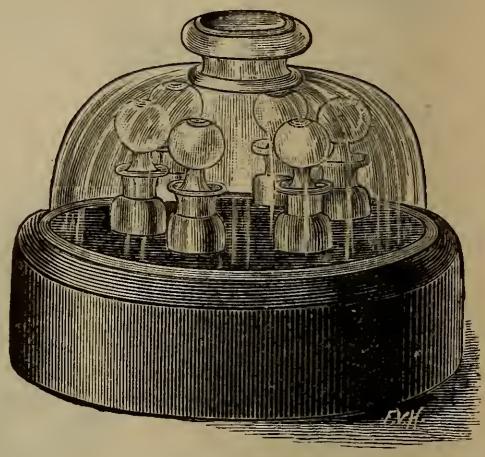
| | | |
|---|---|---|
| 764. | Achromatic Objective No. 0, 1-inch, doublet, . . . . . | 2 50 |
| 765. | " " " 1, $\frac{1}{2}$ " triplet, . . . . . | 3 00 |
| 766. | " " " 2, $\frac{1}{4}$ " " . . . . . | 3 50 |
| 767. | " " " 3, $\frac{1}{6}$ " " . . . . . | 4 00 |
| 768. | " " " 4, $\frac{1}{8}$ " " . . . . . | 5 00 |
| 769. | " " " 5, $\frac{1}{10}$ " " . . . . . | 7 00 |
| 770. | " " " 6, $\frac{1}{15}$ " " . . . . . | 10 00 |

## DISSECTING AND MOUNTING INSTRUMENTS AND MATERIALS.

No. 781.

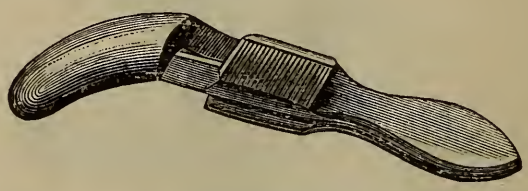


No. 782.



No. 802.

| No. | | Price. |
|---|---|---|
| 781. | Spring Compressor, Nickel-plated, per doz., | 75 |
| 782. | " " Wood, per doz., | 25 |

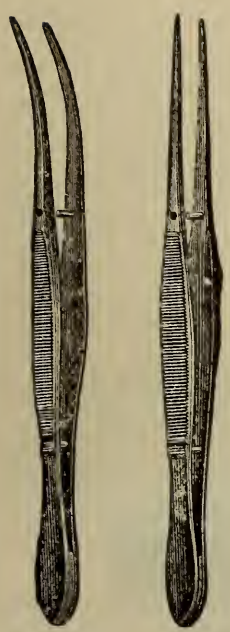


No. 785.

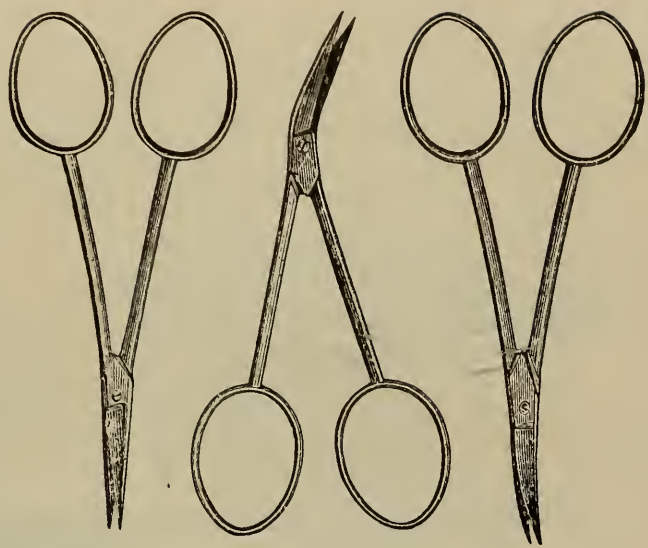
No. 786.

No. 786*.

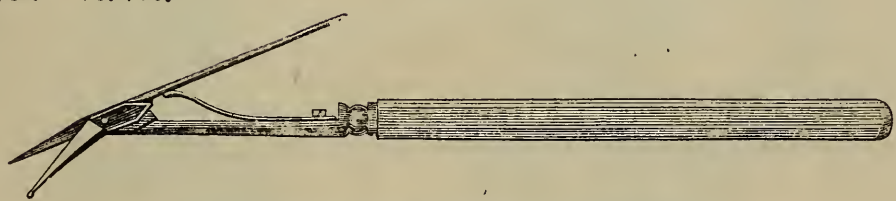
| | | |
|---|---|---|
| 783. | Forceps, brass, 3 inches long, | 25 |
| 784. | " Quekett's for taking objects out of deep bottles, | 2 50 |
| 785. | " Bull-nose, | 1 00 |
| 786. | " Cutting, | 2 50 |
| 786*. | " opening by pressure, | 2 00 |
| 787. | " Steel Nickel-plated, straight, 4 inches long, | 1 00 |
| 788. | " " " curved, 4 " | 1 00 |
| 789. | " " " " 4 " very delicate, | 1 50 |
| 790. | " " " straight, 4 " " " | 1 50 |
| 791. | Scissors for dissecting, straight blades, very delicate, | 1 50 |
| 792. | " " blades curved on the flat, | 1 50 |
| 793. | " " elbow blades, | 1 50 |
| 794. | " " " " very strong, | 1 25 |
| 795. | " " with spring, exceedingly delicate, | 6 00 |
| 796. | Needle-holder, for Dissecting Needles. Fig. 1, | 75 |
| 797. | " for dissecting, straight point, ebony handle, | 15 |
| 798. | " " " hook " " " | 15 |
| 798*. | " hook for dissecting double points. Fig. 2, | 75 |
| 798**. | " " " triple " " 3, | 1 00 |
| 799. | Knives, for dissecting, Figs. 5 to 18, each, | 75 |



No. 789. No. 790.

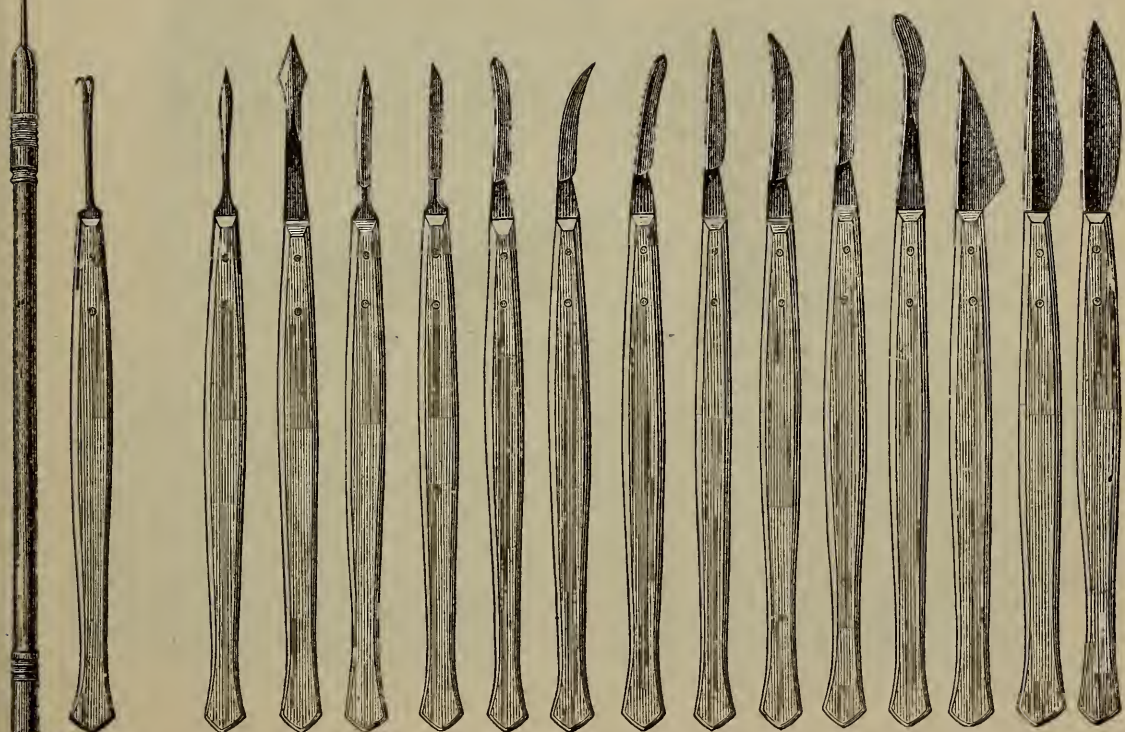


No. 791. No. 793. No. 792.



No. 795.

No. 803.



1. 2. 3. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18.

Nos. 796–99.

No. PRICE.

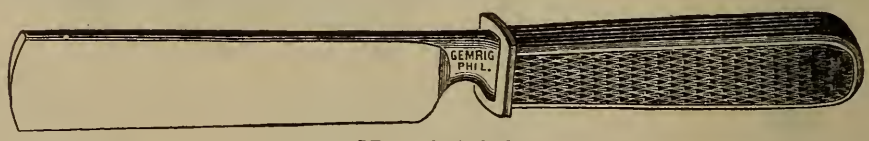
800. CASE OF DISSECTING INSTRUMENTS, containing 1 pair forceps (788), 1 pair scissors (793), 2 dissecting knives (799), 2 needle-holders (796), with needles, . . . . . $7 50

801. CASE OF DISSECTING INSTRUMENTS, containing 1 pair forceps (787), 1 pair ditto (789), 1 pair scissors (792), 1 pair ditto (793), 3 dissecting knives (799), 2 needle-holders (796), with needles, 1 Valentine's knife (803), . . . . . 15 00

802. DR. RANVIER'S "NECESSAIRE," . . . . . 3 50

This indispensable little piece of apparatus, which is in use in all the Hospitals of Paris, and by most Microscopists there, consists of a circular base of polished wood, in which are arranged six reagent bottles, with ground capillary-tube stoppers, the whole covered with a low bell-glass, to exclude dust.

803. KNIFE, VALENTINE'S, for cutting sections of soft tissues, . . 6 50

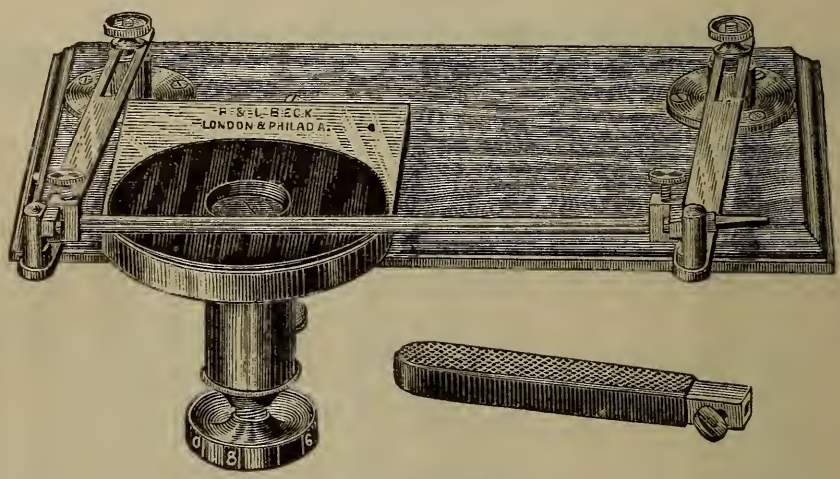



Nos. 804–806.

804. KNIFE, for use with section cutters, Nos. 808 to 811, in Morocco case, 4 00

805. KNIFE, for use with section cutters, heavy blade, in Morocco case, 5 50

These knives are made specially for us, and are guaranteed to be of the very first quality. Each is ground flat on one side and hollow on the other, and can be furnished to cut toward or from the operator as desired.




Nos. 807–809.

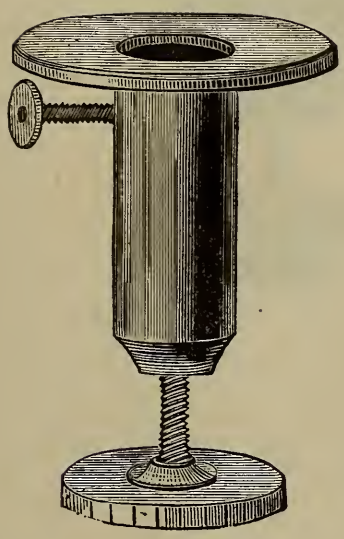
807. DR. SEILER'S SECTION-KNIFE AND CARRIER, adapted to any Microtome of the style of 808* or 809. By use of this the largest and thinnest sections, absolutely even in thickness, may be cut, . . 13 50

807* DR. SEILER'S SECTION-KNIFE AND CARRIER, for use with No. 810 in both its forms, . . . . . 15 00

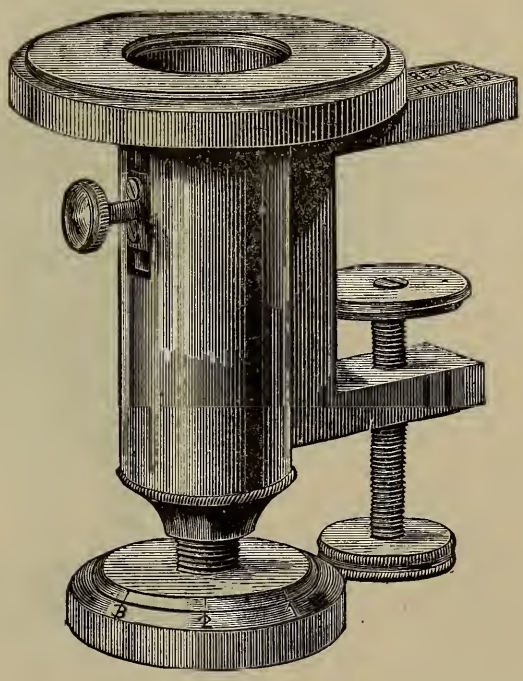
808. SECTION CUTTER, Dr. Ranvier's pattern, with glass top, and binding screw for holding wood and other hard substances, . . . . 7 00

808* SECTION CUTTER, the same as No. 808, with the addition of a clamp for fastening to table, . . . . . 8 00

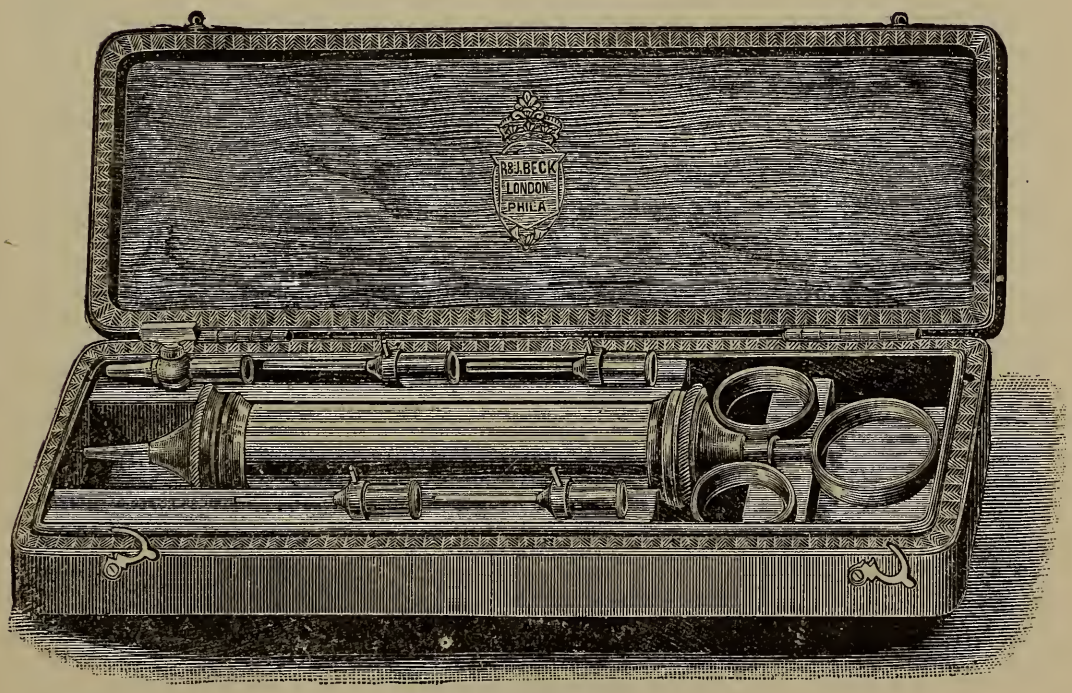
809. SECTION CUTTER, Army Medical Museum pattern, with glass top, and clamp for fastening to table, . . . . . 10 00



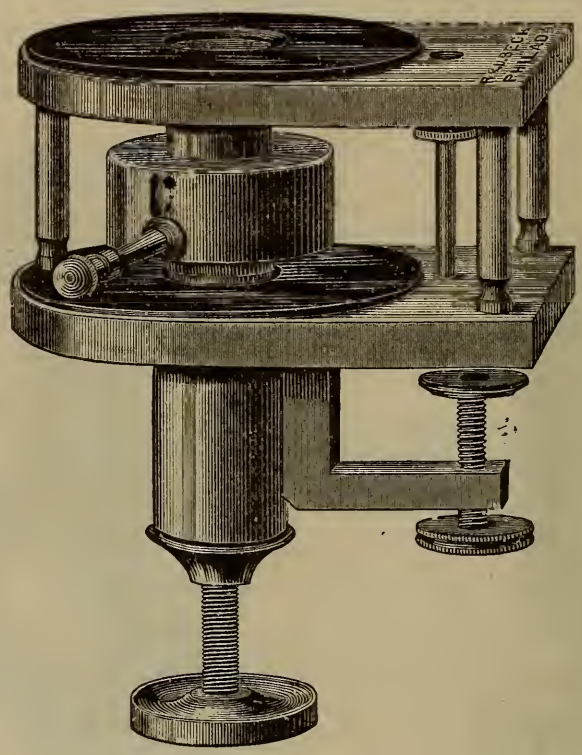
No. 808.



No. 808*.



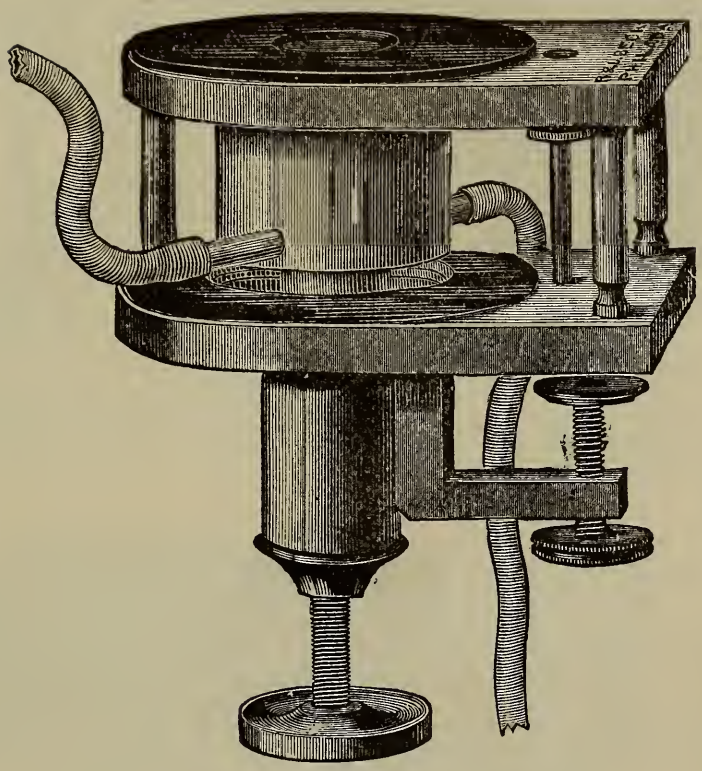

Nos. 813–14*.



No. 810.

| No. | | Price. |
|---|---|---|
| 810. | Section Cutter, (Mr. Walmsley's adaptation of Dr. Bevan Lewis's Ether Spray Microtome). Complete with Atomizer, . . . . | $20 00 |

This instrument, now largely in use by our leading Histologists, and by the Medical Department of the Army, is confidently recommended as the most complete and perfect Microtome yet produced. To the excellent Section Instrument, of the Army Medical Museum pattern, No. 809, a second table, with glass top, is added, through which a brass-topped tube, with Condensing Chamber beneath, is advanced by the same Micrometer screw. Some thickened gum-water being put upon the top of this tube, a piece of tissue, say a portion of spinal column from a freshly-killed animal, may be placed in it, and the nozzle of the freezing Atomizer having been introduced into the tube beneath, the tissue will be solidly frozen in from one to three minutes. Ether may be used, but Rhigolene is much better (we can supply it, if desired); a considerable portion of it will be condensed in the chamber, and can be drawn off by the tube, shown in the illustration, for further use. The Knife should be kept cold by being placed on a block of ice before using. Full directions for use accompany each instrument. If the purchaser already has a freezing Atomizer, the Microtome may be purchased without it for $16.00. This Microtome as well as 809 is made in two sizes, with tubes of 1 inch and 1½ inches diameter. In ordering please state which size is desired.



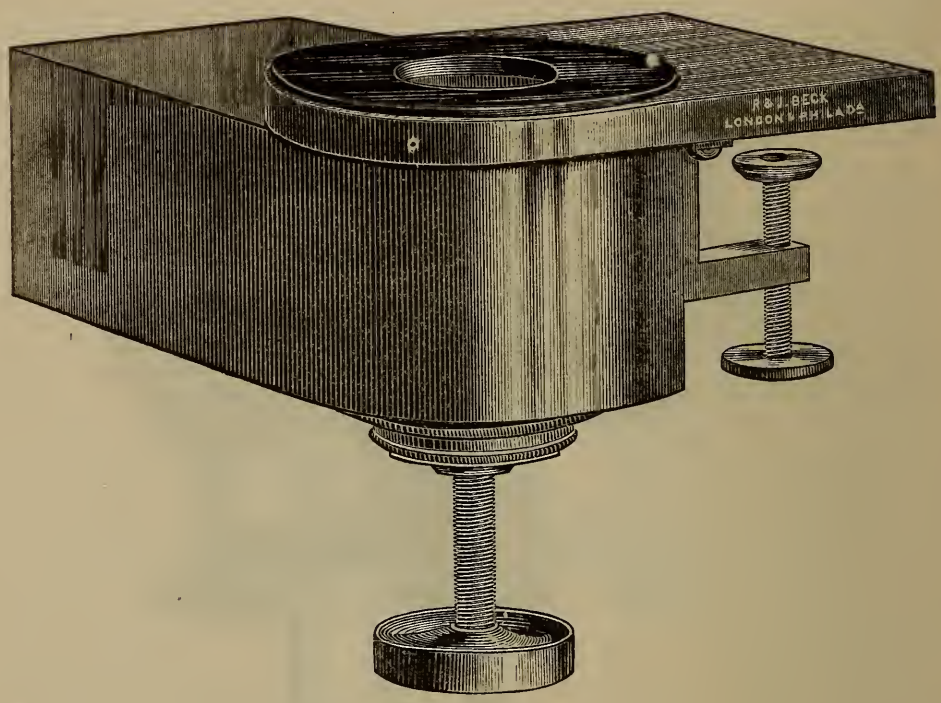
No. 810*.

| No. | | PRICE. |
|---|---|---|
| 810*. | TAYLOR'S FREEZING MICROTOME, Complete with Rubber Tubing, | $16.00 |

This instrument, the device of Mr. Thomas Taylor, Microscopist of the Department of Agriculture, at Washington (*and by him patented*), is designed to effect the rapid freezing of tissues for sectioning, without the fatigue or expense attendant upon the use of an atomizer for the same purpose. It is extremely simple in construction, cannot get out of order, and is always ready for use wherever a block of ice and some salt can be procured.

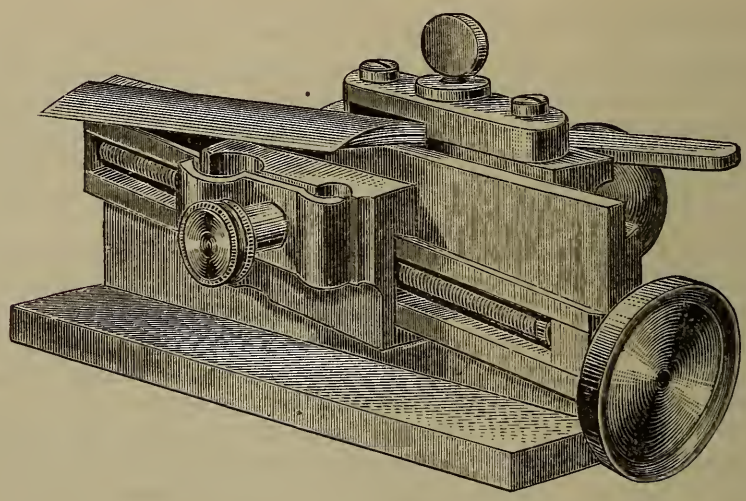
Its general design is the same as that of the preceding instrument No. 810. As in that form, the Microtome is a double one, equally adapted to imbedding or freezing. The lower, or imbedding instrument is the same as that of our No. 809, to which is added a second table precisely the same as in No. 810, through which a brass topped Chamber is advanced by the same Micrometer screw. To this Chamber are attached supply and discharge tubes; the latter being slightly smaller than the former, and prolonged inside the chamber to within ⅛th of an inch of its top, insures the same being kept constantly full of the freezing fluid. The latter is the product of the melting of chopped or shaved ice and coarse salt, and is supplied to the large tube of the freezing chamber, by means of a syphon rubber tube leading to the vessel containing the same. The discharge is by means of another rubber tube, and the flow can be regulated at pleasure by nipping the discharge tube with an ordinary spring clothes pin.

Having arranged with Mr. Taylor for the manufacture and sale of this Microtone, we are prepared to furnish it made at our own works and guaranteed to be of the best workmanship and finish. Mr. Taylor's device is simply the method of freezing by the flow of melting ice through the chamber. All other portions of the instrument are precisely the same as those in our Microtone No. 810, so well and favorably known to Microscopists everywhere.



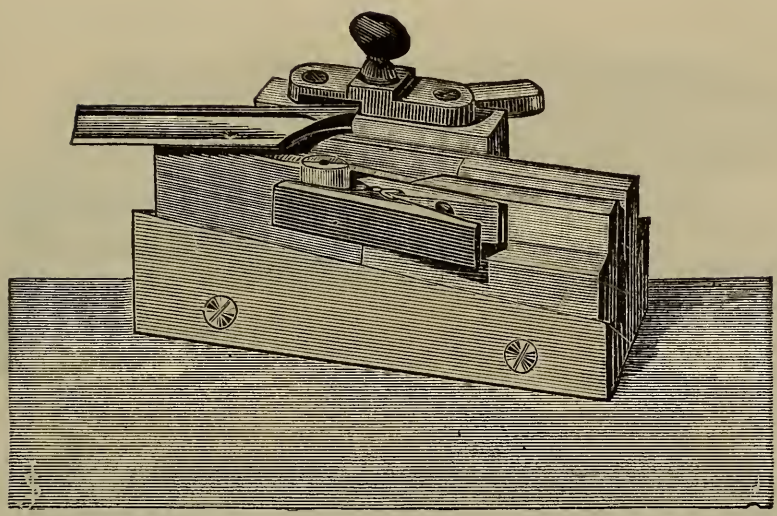

No. 811.

| No. | | Price. |
|---|---|---|
| 811. | Section Cutter (Rutherford's Microtome), Army Medical Museum pattern, large size, with ice-box for freezing, . . . | $15 00 |

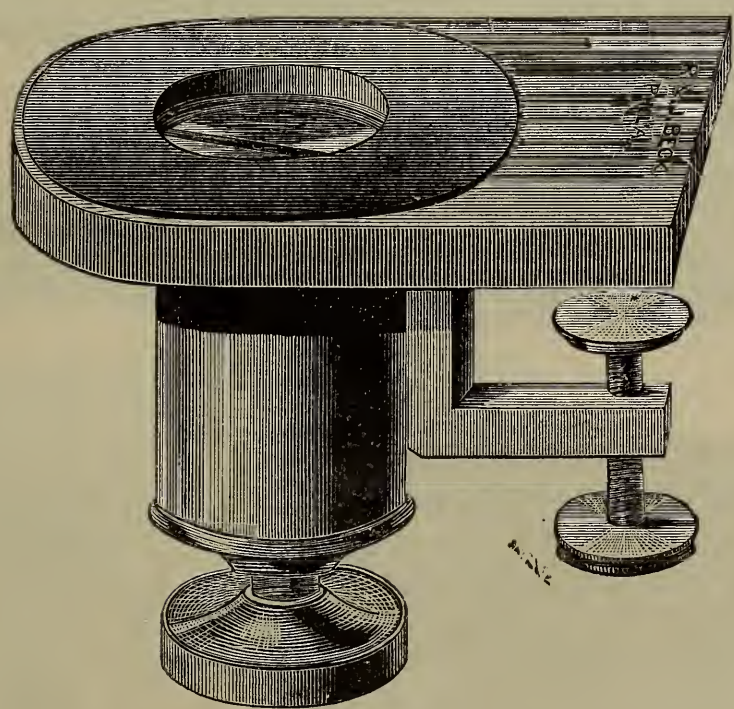


No. 812*.

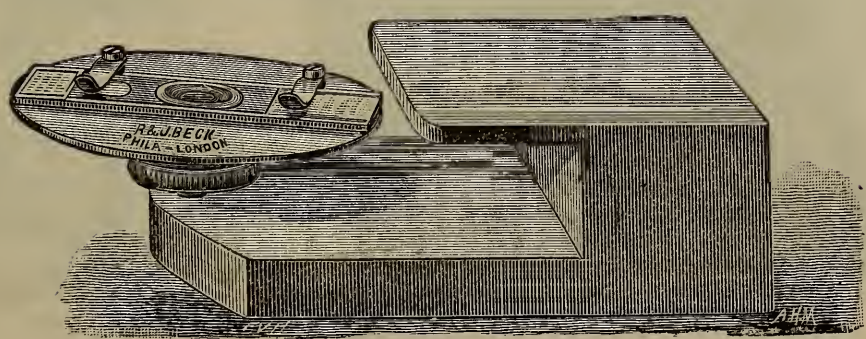
| | | |
|---|---|---|
| 812. | Section Cutter, pattern of M. Rivet, in wood, with knife, . . | 7 50 |
| 812*. | " " " " " in brass, with Micrometer Screw and Knife, . . . . . | 15 00 |
| 813. | Injecting Syringe, of brass, finest quality, ½-oz. capacity, with four pipes and stop-cock, in fine Morocco case, . . . . . | 9 00 |
| 814. | Injecting Syringe, the same as 813, of 1-oz. capacity, . . . | 10 00 |
| 814*. | " " " " 2-oz. " . . . | 12 00 |
| 815. | Turn-Table, with Walmsley's centering adjustment, . . . | 4 00 |



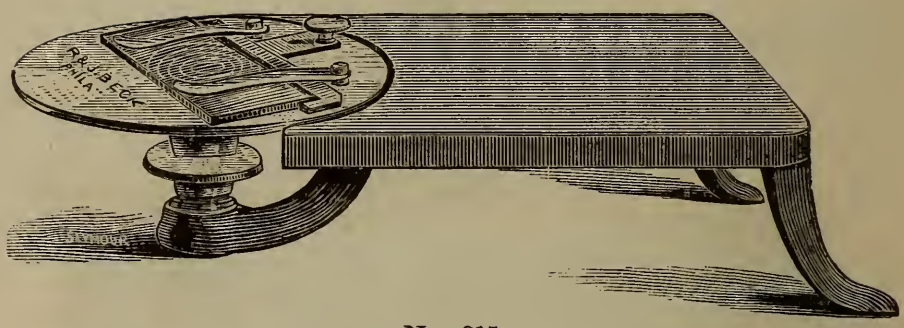
No. 812.



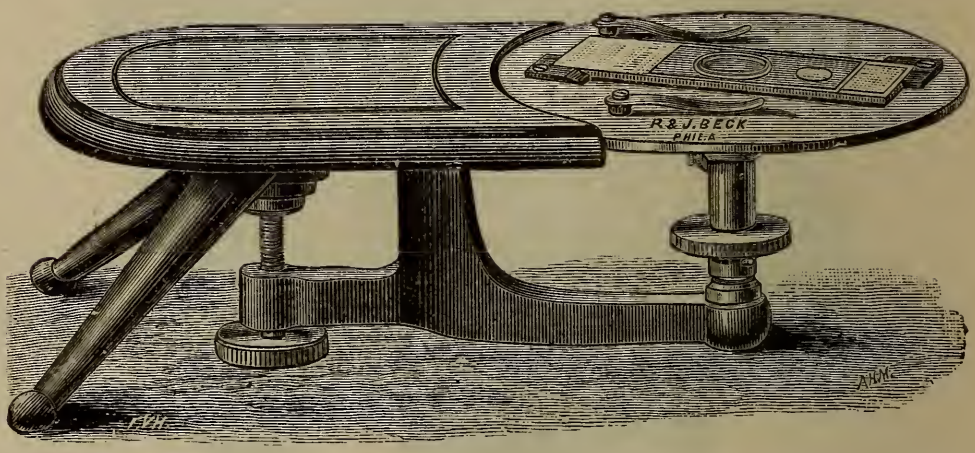
No. 809.




No. 816.

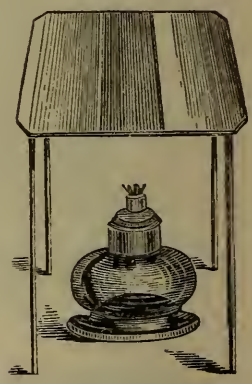



No. 815.

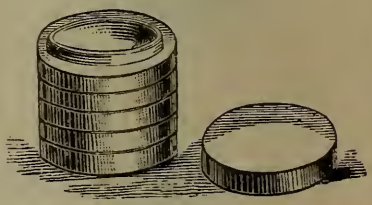



No. 818*.


No. 874.

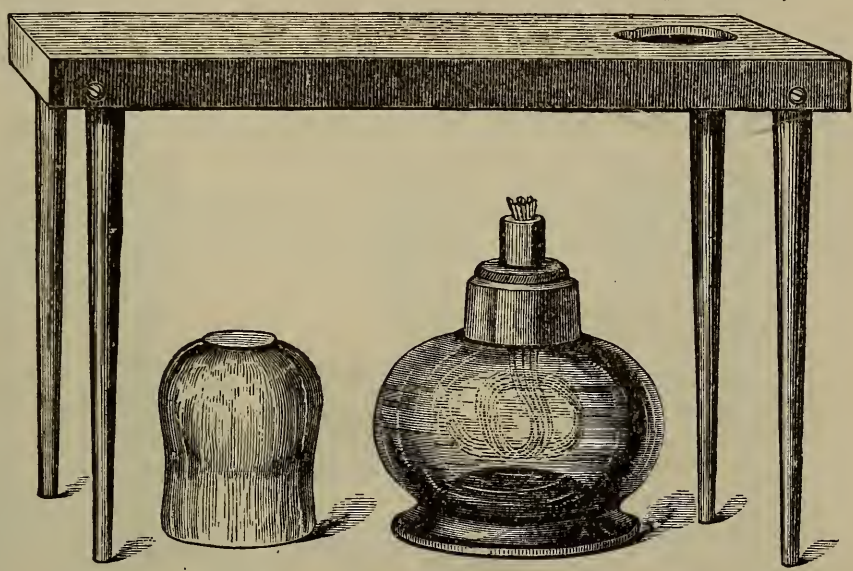


No. 819.*



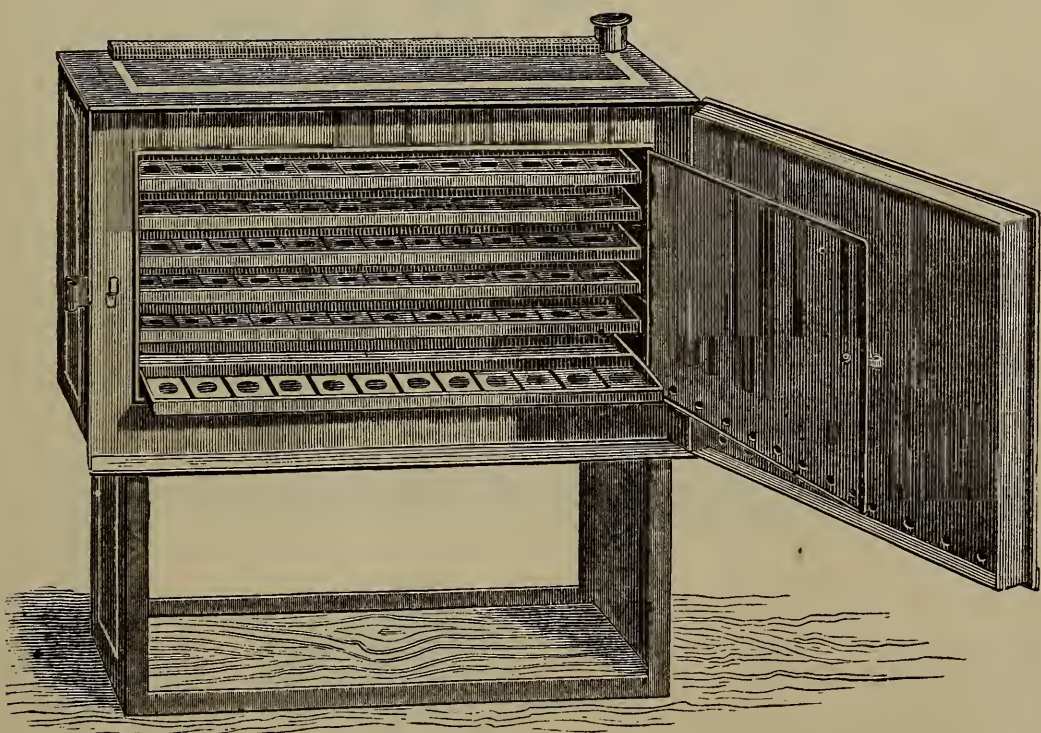
No. 875.

| No. | | Price. |
|---|---|---|
| 816. | Turn-Table, Shadbolt's, | 3 00 |
| 817. | " " Sidle's "Congress," self-centering, | 6 50 |
| 818. | " " Cox's improved self-centering, for all Slides, | 6 00 |
| 818*. | " " Beck's "New Spring," self-centering for all slides, and with clamp for attaching to edge of a table or shelf; recommended as being the most perfect Turn-table as yet produced, | 7 00 |



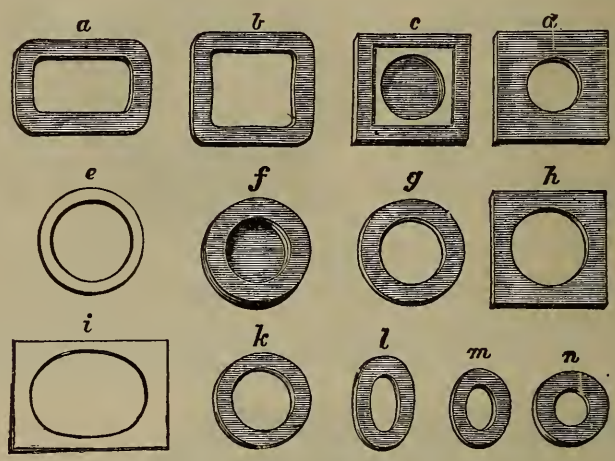
No. 819.

| | | |
|---|---|---|
| 819. | Brass Table, with folding legs and lamp, for mounting with balsam, | 2 50 |
| 819*. | Brass Table and Lamp, small size, | 1 50 |



No. 876.

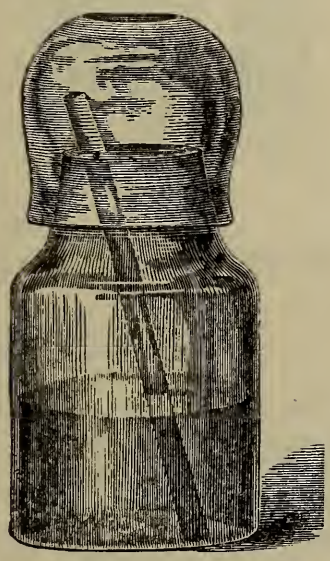
| No. | | Price. |
|---|---|---|
| 820. | Flatted Crown Glass Slips, Chance's Best, 3x1 inch, cut edges, per dozen, 15 cents, per gross, | $1 75 |
| 821. | Flatted Crown Glass Slips, Chance's Best, 3x1 inch, smoothed edges, per dozen, 30 cents, per gross, | 3 00 |
| 822. | Plate Glass Slips, Chance's Patent, 3x1 inch, cut edges, per dozen, 30 cents, per gross, | 3 00 |
| 823. | Plate Glass Slips, Chance's Patent, 3x1 inch, smoothed edges, per dozen, 40 cents, per gross, | 4 50 |
| 824. | Plate Glass Slips, Chance's Patent, 3x1 inch, extra thin, smoothed edges, per dozen, 55 cents, per gross, | 5 00 |
| 825. | Wooden Slips, 3x1 inch, with hole in centre, used in mounting objects between thin glass, or opaque, per dozen, | 25 |
| 826. | Glass Slips, with Hollow, 3x1 inch, smooth edges, per dozen, | 1 50 |
| 827. | Glass Slips, 3x1 inch, smooth edges, with cells of various sizes, shapes and depths, attached by marine glue, ready for use, per dozen, | 2 50 |




No. 828.

| | | |
|---|---|---|
| 828. | Glass Cells, of various sizes, shapes and depths, per dozen, | 1 00 |
| 829. | Block-Tin Cells, of various sizes and depths, for fluid and balsam mountings, per dozen, | 50 |
| 830. | Hard-Rubber Cells, of various sizes and depths, for dry and opaque mountings, per dozen, | 15 |
| 830*. | Atwood's Hard-Rubber Cells, per dozen, | 30 |
| 831. | Thin Glass, in sheets, No. 3, $\frac{1}{50}$ to $\frac{1}{100}$, per oz., | 75 |
| 832. | " " " " No. 2, $\frac{1}{100}$ to $\frac{1}{150}$, " | 1 00 |
| 833. | " " " " No. 1, $\frac{1}{150}$ to $\frac{1}{200}$, or thinner, per oz., | 1 50 |
| 835. | " " " squares, No. 3, per dozen, 18 cents, " | 1 25 |
| 836. | " " " " No. 2, " 20 " " | 2 25 |
| 837. | " " " " No. 1, " 25 " " | 2 75 |
| 838. | " " in circles, No. 3, per dozen, 20 cents, per oz., | 2 25 |
| 839. | " " " " No. 2, " 25 " " | 2 75 |
| 840. | " " " " No. 1, " 30 " " | 3 75 |
| 841. | Watch Glasses, all sizes, each 7 cents, per dozen, | 75 |
| 842. | Dipping and Dropping Tubes, each, | 10 |
| 843. | Pippets, with bulb, | 25 |
| 844. | Test Tubes, all sizes, each, 3 to 8 cents, per dozen, | 30 to 75 |
| 845. | Bell Glass, for preserving objects from dust during preparation, | 50 |
| 847. | Canada Balsam, pure, in collapsible tubes, | 25 |
| 848. | " " in chloroform, requires no heat, per bottle, | 50 |
| 849. | " " in Benzole, " " " " " | 50 |
| 849*. | " " in absolute alcohol, | 50 |
| 850. | Damar, " " " " " | 50 |
| 851. | Glycerine, pure, " " | 25 |

| No. | | Price |
|---|---|---|
| 852. | Glycerine, Camphorated, for mounting fresh-water algæ, per bottle, | 25 |
| 853. | " Jelly, | 50 |
| 854. | Deane's Medium, | 35 |
| 855. | Farrant's Medium, | 60 |
| 856. | Absolute Alcohol, (Dr. Squibb's,) | 25 |
| 857. | Benzole, Pure, | 25 |
| 858. | Brunswick Black, | 25 |
| 859. | Asphalte, | 25 |
| 860. | Gold-Size, | 25 |



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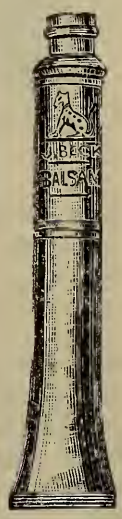
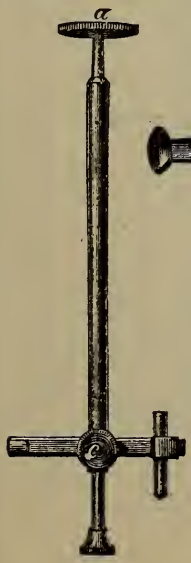


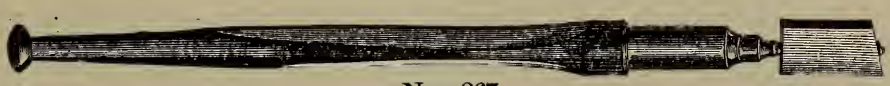

No. 847.


No. 861.

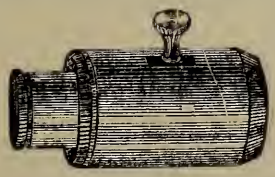
| | | | |
|---|---|---|---|
| 861. | Marine Glue, | per bottle, | 35 |
| 861*. | Liquid Marine Glue | " " | 50 |
| 862. | Oil of Cloves, | " " | 50 |
| 863. | Bell's Cement, | " " | 50 |
| 863* | Brown's Transparent Rubber Cement, | " " | 35 |
| 864. | White Zinc Cement, | " " | 50 |
| 865. | Punches, various sizes, ¼ inch to 1 inch, | each, 50 to 1 | 50 |
| 865* | Improved Punch for cutting cells from Sheet Wax, | | 1 50 |
| 866. | Instrument for cutting circles of thin glass, in case, | | 10 00 |
| 867. | Glaziers' Diamonds, from | | 4 00 to 10 00 |
| 868. | Writing Diamonds, best quality made, each, | | 3 50 |



No. 866.



No. 867.



No. 865*.

No. 868.

No. 872. No. 872.* No. 872.

| No. | | Price |
|---|---|---|
| 869. | Capped Bottles for containing fluid used in mounting objects, each, | 50 |
| 870. | Dropping " with glass bulb stopper, . . . . . " | 25 |
| 871. | " " " rubber top " . . . . . " | 30 |
| 872. | Small Collecting Bottles, . . . . . per dozen, 30 to | 1 00 |
| 872.* | Capillary Bottles, . . . . . each, | 50 |
| 873. | Wright's Diatom Collecting Bottle, complete in case, . . . . | 4 00 |
| 874. | MOUNTING CABINET, as arranged by Mr. Walmsley; containing 6 compressors, *wood* (782), 6 ditto Nickel-Plated (781), Steel Forceps (788), Scissors (793), Knife (799), Needles (797 and 798), Turn-table (816), Brass Table and Lamp (819*), ½ gross slips (821), ½ oz. assorted Squares and Circles (836 and 839), 1 doz. Hard-Rubber Cells (830), 1 doz. Block-tin Cells (829), 3 Watch-glasses (841), Dropping Tube (842), Tube of Balsam (847), Damar (850) or Balsam (849), Glycerine (851), Glycerine Jelly (853), Hæmatoxylon (877), Brunswick Black (858), Gold-size (860), Oil of Cloves (862), White Zinc Cement (864), Dropping-bottle (871), 1 Nest of Saucers (875), wide-mouth Glass Jar for Solutions, 2 Camel's-Hair Brushes in long handles. The whole packed in a polished mahogany cabinet with lock, . . . . | 25 00 |
| 875. | Porcelain Saucers, in nests of 5 with cover, all fitting, dust tight. The most useful of all articles in staining tissues and soaking in oil of cloves, (two sizes), . . . . . | 60 and 80 |
| 876. | Hot-water Drying Case, for drying tissues and hardening Balsam mountings, made entirely of heavy Planished Copper, will harden twelve dozen specimens at once, . . . . . | 15 00 |

## STAINING AND INJECTING FLUIDS, Etc.

| | | | |
|---|---|---|---|
| 877. | Hæmatoxylon, . . . . . | per bottle, | 25 |
| 878. | Ammonia Carmine, . . . . . | " " | 25 |
| 879. | Borax " . . . . . | " " | 25 |
| 880. | Carmine Red, . . . . . | " " | 35 |
| 881. | Dr. Woodward's Violet Carmine, . . . . . | " " | 25 |
| 882. | Methyl Aniline, Green, . . . . . | " " | 25 |
| 883. | Magenta " Red, . . . . . | " " | 25 |
| 884. | Blue " . . . . . | " " | 25 |
| 885. | Eosin, . . . . . | " " | 25 |
| 886. | Osmic Acid, $\frac{1}{32}$ oz. in glass capsule, . . . . . | | 3 00 |
| 887. | Picro Carmine, . . . . . | per bottle, | 25 |
| 888. | Sulphindigotate of Soda, (Dr. Seiler's,) . . . | " " | 25 |
| 889. | Carmine Injecting, Gelatine, (Dr. Seiler's,) . . . | " oz. | 1 00 |

One oz. of this Gelatine dissolved in ten oz. of distilled water forms an admirable Injecting Fluid.

## LABELS, etc., FOR MICROSCOPIC OBJECTS.

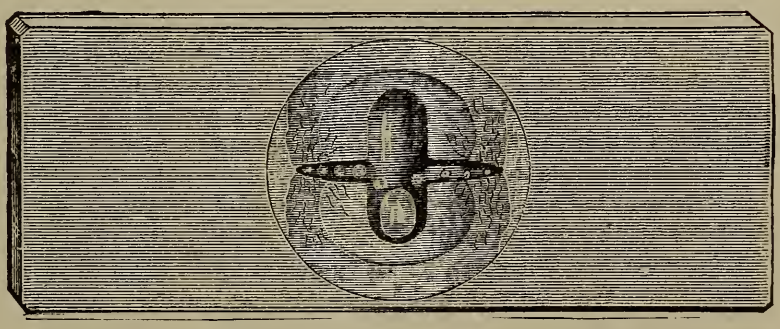
891

892

894

| No. | | | Price. |
|---|---|---|---|
| 890. | Adhesive Labels, Plain White, Round or Oval, . . | per box, | 10 |
| 891. | " " Assorted Colors, Square, neatly bordered, | " 100, | 25 |
| 892. | " Fronts for covering slides, handsome gold design | " 100, | 50 |
| 893. | " " for covering slides, handsome bronze design | " 100, | 30 |
| 894. | Backs for covering slides, . . . . . | " 100, | 10 |
| | Backs or fronts if with holes punched, *extra*, . . . | " 100, | 15 |

## HOLMAN'S LIFE AND CURRENT SLIDES.



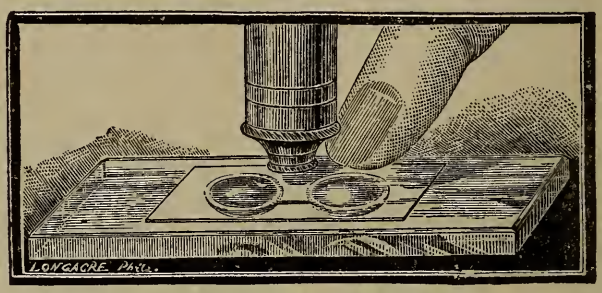
No. 895.

These very useful and ingenious accessories to the Microscope are attracting great attention among scientific men everywhere, and have received the strongest commendations from Medical and other Scientific Journals at home and abroad. By an arrangement with the inventor we are enabled to supply them to our customers of the most perfect quality, each one having passed through Mr. Holman's hands before being delivered to us.

895. ***Holman's Life Slide,*** with Cover in a neat Box,. . . . . $1 50

*The Life Slide* consists of a plate of thick glass 3 x 1-inch, with a deep oval cavity ground in its centre, to contain the mass of material under observation. Around the margin of this oval cavity is a polished bevel, and from the bevel extends a small cut, the object of which is to afford an abundance of fresh air to the living things within. It is found upon inclosing the animalculæ, etc., that they will invariably seek the edge of the pool in which they are confined, and the beveled edge permits the observer to take advantage of this disposition; for when beneath it, the objects are within the range of the highest powers.

*The Life Slide* is constructed to retain the greatest quantity of material under the smallest cover glass, and is designed to be used with the highest powers of the Microscope for studying the Bacteria, Vibriones and other low forms of life. For studying the circulation of the blood in the tail of the Tadpole, it is the most perfect contrivance imaginable. The deep oval cavity will contain the body of a small Tadpole, whilst the tail lies extended in the beveled portion, and may be examined with the highest powers. Another very important feature in the device is the fact that a preparation may be kept with it for days or weeks together without losing vitality, owing to the simple arrangement for supplying fresh air.




No. 896.

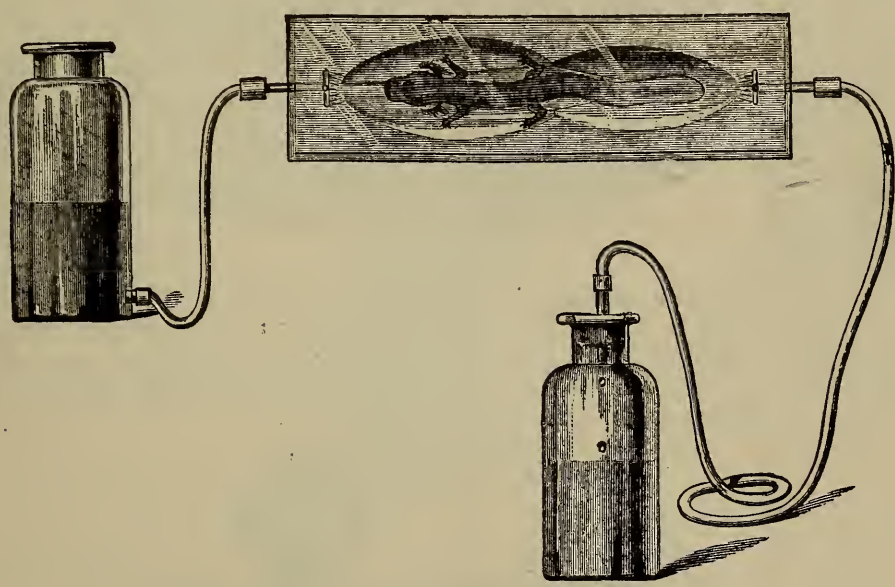
896. ***Holman's Current Slide,*** with Cover, in a neat Box, . . . . $1 50

*The Current Slide*, consists of a slip of plate-glass 3 x 1 inch, in which two oval concave cells are ground, there being a space of $\frac{1}{12}$ inch left between the cells. These cells, which are about $\frac{1}{2}$ inch in diameter and as deep as the glass will permit—say $\frac{1}{16}$ inch deep—are united by a very shallow channel somewhat below the centre of the two cells, so that with cells placed $\frac{1}{12}$ inch apart, the channel is about $\frac{3}{12}$ inch long. Both the cells and channel are polished. If a few drops of blood be placed in the cells, and a cover of thin glass be pressed down, some of the blood, finding its way between the surfaces in contact, will dry, and act as a cement to hold the fluid blood in the cells in place. The quantity of blood being insufficient to fill the cells, a considerable amount of air becomes imprisoned with the blood, and the expansion of the air in either cell will drive the blood through the channel into the adjacent cell, and in the shallow channel it is presented under the most favorable condition for examination. By holding the top of the finger near one or the other cells, the heat is enough to cause the expansion and a consequent more or less rapid flow of the fluid through the channel. This flow may be arrested, or continued and reversed at will, by change of the position of the finger, so that any particles floating in the liquid can pass in succession across the field, but can be arrested and examined with ease at will.

So sensitive is the apparatus, that even with the highest powers, a corpuscle, granule or cell in the field of view, may be leisurely turned over and over in any desired position, thus affording an unequaled means of observation and study to the microscopist; and while the eye is examining at leisure the

behavior of the objects beneath it, the mind is charmed with the simplicity of the means by which their motions are controlled.

Blood or other fluid inclosed in the cells remains in good condition for examination for several days, and changes undergoing in the fluid can be examined.



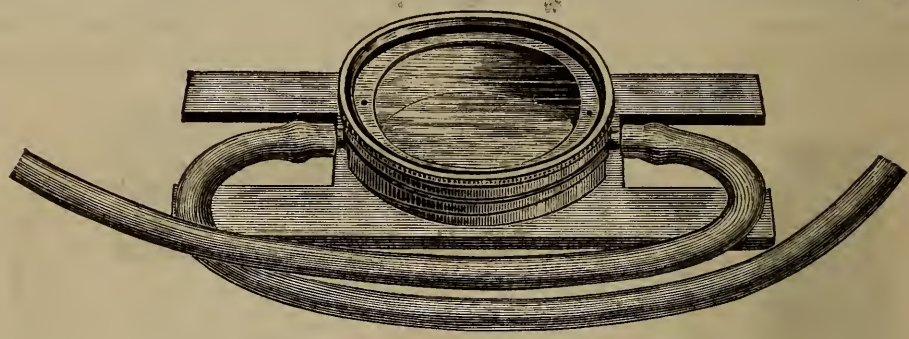
No. 897.

897. ***Holman's Syphon Slide,*** complete, with Flexible Tubes and Glass Cover, but without Bottles, . . . . . $4 00

This is a modification of the "LIFE" and "CURRENT" slides, whereby living objects of suitable size and habits can be retained under observation uninterruptedly for days or even weeks. A current of water, or other fluid, is made to flow continuously through the chamber containing the object, so that the processes of respiration, circulation, digestion and nutrition, the phenomena of inflammation, and the effects of some classes of poisons, may be studied at leisure and under perfectly natural or entirely controllable conditions. The habits of life of small aquatic animals are similarly brought within reach of our observations. For use with the Magic Lantern, in projecting the images of living objects upon the screen, this apparatus is absolutely perfect—the flow of fresh water through the chamber being so constant that its inmates are entirely free from inconvenience during the most protracted exhibition.

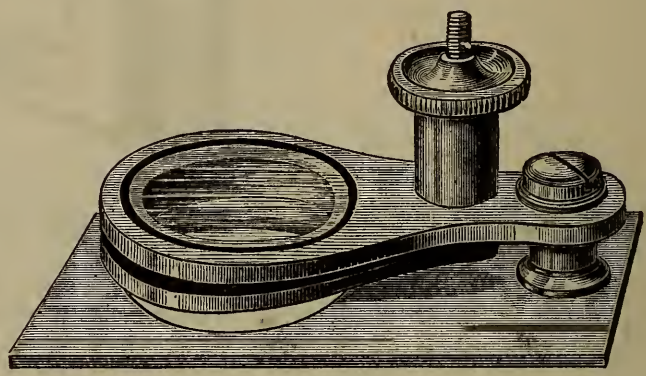
The following description of the SYPHON SLIDE will render its construction and use quite clear. In a slip of thick plate glass, a chamber is excavated similar to that in the LIFE SLIDE. In each end of this chamber are fine perforations, too small to permit the escape of the animal under view, but sufficient to maintain a flow of water. These openings merge into tubular mouths, to each of which is attached a tightly-fitting elastic tube: one of these communicates with the reservoir of water, whilst the other acts as an escape-conduit. The position of the slide, when in use, must be slightly *above* the level of the reservoir, while the escape-tube must rest *below* the same, thus insuring a veritable *syphon* action in the apparatus; a constant flow of water being secured in connection with the required atmospheric pressure for the retention of the cover on the slide. It is not necessary to have bottles specially fitted for use with this apparatus; any vessel capable of holding water will answer, it being only necesary to insert the end of one tube in the reservoir, and by gently sucking at the end of the other establish a flow of the water, which will continue so long as the reservoir contains any.

898. ***Holman's Syphon Animalcule Cage,*** complete, with flexible tubes, $4 50



No. 898.

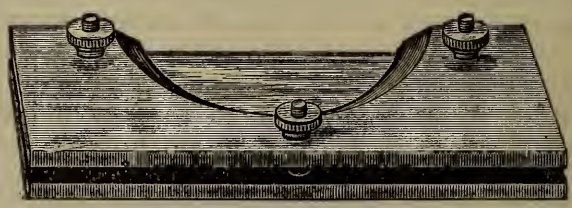
This new device of Mr. Holman's consists simply of an Animalcule Cage of the largest size, (No. 167 of this Catalogue,) to which is attached a pair of flexible rubber tubes, as shown in the illustration, which act as a syphon, and give the device a special value as a moist chamber for studying growing fungi and other minute and delicate plants without disturbing them.



No. 899.

899. ***Holman's New Parallel Compressor,*** . . . . . $6 00

This Compressor is arranged differently from all other devices of the kind in having the thin covering-glass *fixed* and *immovable*, whilst compression of the cell-contents is effected by moving the *lower* plate of glass, which is done by means of a milled-head and spiral spring. The lower plate is so arranged as to swing out laterally from beneath the cover, thus allowing both to be readily cleansed.

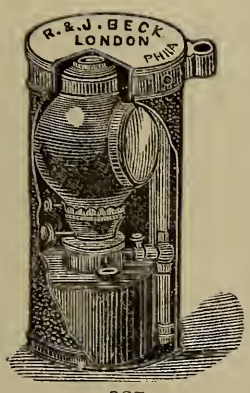


900.

900. ***Beck's New Hard Rubber Zoophyte Trough,*** . . . . . $3 00

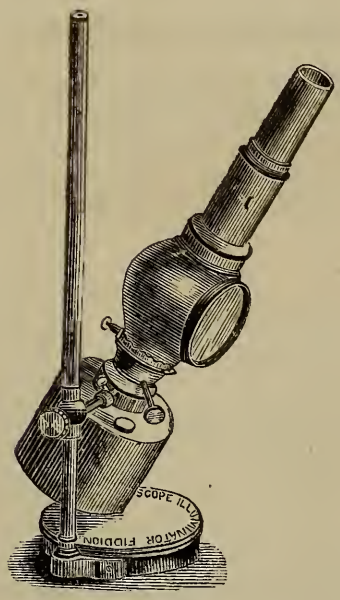
This new Trough is so neat, convenient and free from faults that it cannot fail to be used with pleasure. Two plates of glass are separated by a half ring of soft rubber (of any desired thickness), and clamped together by two plates of hard rubber held in position by three binding screws, and cut away to show the objects, as in the illustration. Any thickness of glass can be used with this device, and the same can be easily taken out for cleansing, or replaced if broken, and the thickness of the cell can be varied indefinitely by using different thicknesses of sheet rubber between the glasses.

# FIDDIAN'S MICROSCOPE ILLUMINATOR.

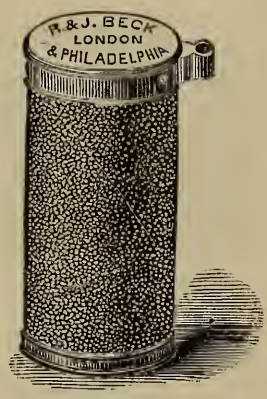



925.

LAMP WHEN PACKED IN CASE.



925. LAMP.




925.

EXTERIOR OF CASE.

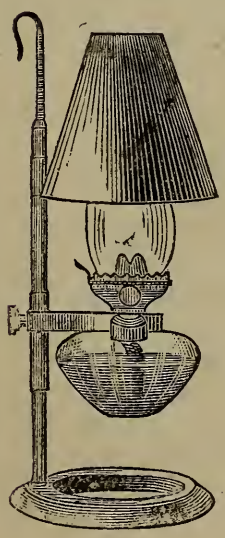
| No. | | Price. |
|---|---|---|
| 925. | Fiddian's Microscope Illuminator, nickel plated, . . . . | $15 00 |

This very convenient and useful Lamp has been designed to combine the qualities of other Microscope Lamps, together with greater portability, the whole fitting into a brass tubular box, the exterior of which is covered with morocco leather, the lid forming the stand of the Lamp. The metallic chimney being telescopic, occupies a very small compass; the condenser fits into the cell in front. The reservoir is of brass, and will contain sufficient petroleum for six hours' consumption. The entire Lamp fitting into the case from the top, escape of the oil is prevented.

In trimming the Lamp care should be taken that the wick is perfectly dry, and the petroleum of good quality; also that none of the oil gets upon the metallic chimney or reservoir, or a bad smell will be given off until the oil is burnt away.

In using the Lamp it will be found convenient to slightly incline it, so as to bring the broad surface of the flame more parallel with the surface of the mirror of the Microscope.

When it is necessary to re-line the chimney, screw off the sliding portion, wash out the old lining, and recoat it with superfine Plaster of Paris. When dry it will be found ready for use—a few minutes will be found sufficient to do this.



929.

*Size of Case:—Height, 6 inches; Diameter 3 inches.*

| No. | | Price. |
|---|---|---|
| 929. | Beck's Microscope Lamp. This very portable, simple, and cheap lamp, is arranged to carry the flame at any desired height above the table, thus adapting it to the use of all sizes of Microscopes. The shade is of paper, enamelled green on the exterior, affording full protection to the eyes, and emitting no heat. The base is heavy, and the lamp perfectly steady at any height, . | 6 50 |
| 930. | German Student Lamp. Brass, . . . . | 5 00 |
| 931. | " " " Nickel-plated, . | 6 00 |

## MÖLLER'S DIATOMACEEN AND OTHER TYPEN PLATTES.

951. Möller's Diatomaceen Typen Platte, No. 1, is a slide of the usual size—three inches by one inch—comprising about 500 Diatoms (correctly 392 distinct species and varieties), being acknowledged types of Seventeen Genera of the Order Diatomaceæ. The shells are arranged in four quadrangles, each formed of six lines, and each line containing about sixteen species, presenting a figure of the following form :

| I | II |
|---|---|
| 1..... | 1..... |
| 2..... | 2..... |
| 3..... | 3..... |
| 4..... | 4..... |
| 5..... | 5..... |
| 6..... | 6..... |

| III. | IV. |
|---|---|
| 1..... | 1..... |
| 2..... | 2..... |
| 3..... | 3..... |
| 4..... | 4..... |
| 5..... | 5..... |
| 6..... | 6..... |

Easy reference to each member is afforded by an accompanying Printed Catalogue, by which the name of any individual Diatom on the slide may be learned ; or any name in the Catalogue as easily identified with its corresponding shell on the slide.

The classification is that of Herrn A. Grunow, of Berndorf, near Wien.

To the name of each Diatom is appended : its nature, whether fossil or recent; its origin, whether marine or from brackish or fresh water; its geographical locality, with the name of the naturalist who assigned its nomenclature.

Price, in morrocco case, with bound Catalogue, . . . . . $30 00

952. Möller's Diatomaceen Typen Platte, No. 2, is a smaller collection of One Hundred Diatoms, by the same artist, arranged on the same plan in one quadrangle, accompanied by a printed Catalogue, and quite equal in quality to the larger collection. Price, . . . . 12 00

953. Möller's Diatomaceen Typen Platte, No. 3, is similar to 952, but has the name of each Diatom photographed beneath it, so that specimen and name can be seen at one view. Price, . . . . 13 50

954. Möller's Diatomaceen Probe Platte is a collection of 20 Diatoms, by the same artist, arranged in a single line, on a slide of the usual size—3x1 inch—in Balsam, and graduated according to their value as test objects. In a neat morocco leather case, with descriptive list. Price, . . . . . 6 00

955. Möller's Diatomaceen Probe Platte, the same as 954, but mouuted dry. Price, . . . . . 7 50

956. Möller's Typen Platte of the Holothuridæ, containing 34 species mounted on a slide of usual size—3x1 inch. In morocco case, with descriptive Catalogue, Price, . . . . . 15 00

957. Möller's Typen Platte of the Echinoidea, on slide 3x1 inch. In morocco case, with Catalogue. Price, . . . . . 7 50

## FASOLDTS' BANDS OF TEST LINES.

These superb rulings are believed to be superior to any ever made, and since the death of M. Nobert, are the only ones that can be depended upon for accuracy and uniformity of spacing. They are ruled on thin glass and mounted in brass frames 3x1 inches.

| No. | | | | | | | | | PRICE. |
|---|---|---|---|---|---|---|---|---|---|
| 975. | 18 | Bands, | 5,000 | to | 120,000 | to | the | inch, | $ 15 00 |
| 976. | 27 | " | 5,000 | " | 250,000 | " | " | " | 25 00 |
| 977. | 36 | " | 5,000 | " | 500,000 | " | " | " | 50 00 |
| 978. | 41 | " | 5,000 | " | 1,000,000 | " | " | " | 100 00 |
| 980. | 19 | " | 100 | " | 6,000 | " | " | Millimetre, | 18 00 |

## DOUBLE STAINED VEGETABLE TISSUES.

These very beautiful and instructive preparations, by our Mr. Walmsley, comprise a great variety of Tissues, Sections of Stems, Roots, Leaves, Seeds, etc., stained by his own processes, and mounted in the best manner. They will be found far superior to any similar preparations ever before offered for sale, and are worthy of a place in the Cabinet of every Microscopist. They range in price from 50 cents to $1.00, according to variety, difficulty of preparation, and perfection of staining.

## SERIES OF POPULAR OBJECTS.

30 cents each, $3.00 per dozen, $6.00 for two dozen in box.

Six dozen, in handsome mahogany case with twelve trays and lock, . $20 00

In order to meet the demand for objects of a popular character, at very low prices, we have prepared under Mr. Walmsley's supervision, a very large variety of beautiful, interesting and valuable subjects, at the above cheap rates. These comprise about one hundred varieties of Diatoms, many species of Algæ, Marine and Fresh-water; Foramnifera, Polycistina, Spicules of Synapta, Gorgonia and Sponges, insect parts in immense variety—opaque and transparent—some whole insects, vegetable preparations of every kind, including some Double Stainings, in short, a wonderful variety of objects deservedly *popular*. They are all clean, neatly mounted and correctly named, and though not *selected* as those named in the foregoing lists, many of them will be found fully equal in all particulars to the more expensive ones. An assortment will be sent on selection, the same as the others.

## SERIES OF HOUSEHOLD OBJECTS.

Slides $2\frac{3}{8}$x$\frac{3}{4}$ inch, 18 cents each. $2.00 per dozen.

This series of objects comprises most of the subjects named in the Popular Series, mounted on small slides of the French size, and are especially adapted to examination with the smaller and cheaper Microscopes. They are all good and clean, and being exceedingly cheap, a considerable assortment can be had for very little outlay. Every young person will appreciate their beauty and the instruction to be derived from their careful examination.

*Our Complete Classified list of Objects in every Department of Natural Science, is now issued in a separate pamphlet of 32 pages, which will be mailed on application, to any address in the world, free.*

## DEMONSTRATION LENSES.

| No. | | Price. |
|---|---|---|
| 1206. | Demonstration Lenses. A set of six, 1¾ inches diameter, showing the forms of the various kinds of lenses, viz.: Double Convex, Double Concave, Plano-Convex, Plano-Concave, Meniscus Convex, and Meniscus Concave. Per set, . . . . . | $2 50 |

## COSMORAMA LENSES.

| | | |
|---|---|---|
| 1209. | Double or Plano-Convex Lens, 8 inches diameter, and either 30, 36, 48 or 72 inches focus, each, . . . . . | 4 00 |
| 1210. | Double or Plano-Convex Lens, 7 inches diameter, same foci as 1209, each, . . . . . | 3 00 |
| 1211. | Double or Plano-Convex Lens, 6 inches diameter, of either 24, 30, 36, 48 or 72 inches focus, each, . . . . . | 2 50 |
| 1212. | Double or Plano-Convex Lens, 5 inches diameter, of either 18, 20, 24, 30, 36, 48 or 72 inches focus, each, . . . . . | 1 75 |
| 1213. | Double or Plano-Convex Lens, 4 inches diameter, of either 12, 14, 16, 18, 20, 24, 30, 36, 48 or 72 inches focus, each, . . . . . | 1 25 |
| 1214. | Double or Plano-Convex Lens, 3 inches diameter, any focus 6 to 36 inches, each, . . . . . | 75 |
| 1215. | Double or Plano-Convex Lens, 2 inches diameter, any focus 6 to 36 inches, each, . . . . . | 60 |
| 1216. | Double or Plano-Convex Lens, 1¼ inches diameter, any focus 5 to 48 inches, each, . . . . . | 50 |

## MICROSCOPE AND TELESCOPE LENSES.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1217. | Double or Plano-Convex Lens, | | 1 | inch | diameter, | 2 | inches focus, | 75 |
| 1218. | " | " | " | ¾ | " | 1½ | " | 75 |
| 1219. | " | " | " | ⅝ | " | 1¼ | " | 75 |
| 1220. | " | " | " | ½ | " | 1 | " | 75 |
| 1221. | " | " | " | ⅜ | " | ¾ | " | 75 |
| 1222. | " | " | " | ¼ | " | ½ | " | 75 |
| 1223. | " | " | " | 3/16 | " | ¼ | " | 75 |
| 1224. | " | " | " | ⅛ | " | ⅛ | " | 75 |

## ACHROMATIC OBJECT-GLASSES for SPY-GLASSES and TELESCOPES.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1225. | Achromatic Object-Glass, | | 1½ | inches | diameter, | 18 to 30 | inches focus, | | 2 00 |
| 1226. | " | " | 1¾ | " | " | 18 to 30 | " | " | 3 50 |
| 1227. | " | " | 2 | " | " | 18 to 30 | " | " | 4 00 |
| 1228. | " | " | extra fine finish, 2 in. diam., 36 in. focus, | | | | | | 7 00 |
| 1229. | " | " | " | " | 2½ | " | 44 | " | 10 00 |
| 1230. | " | " | " | " | 3 | " | 48 | " | 22 50 |
| 1231. | " | " | " | " | 3½ | " | 54 | " | 45 00 |
| 1232. | " | " | " | " | 4 | " | 60 | " | 80 00 |

## PRISMS.

| No. | | Price. |
|---|---|---|
| 1235. | Solid Flint Glass Prisms, 3 inches long. each, | $ 50 |
| 1236. | " " 4 " " | 60 |
| 1237. | " " 5 " " | 80 |
| 1238. | " " 6 " " | 1 00 |
| 1239. | " " 7 " " | 1 25 |
| 1240. | " " 8 " " | 1 50 |

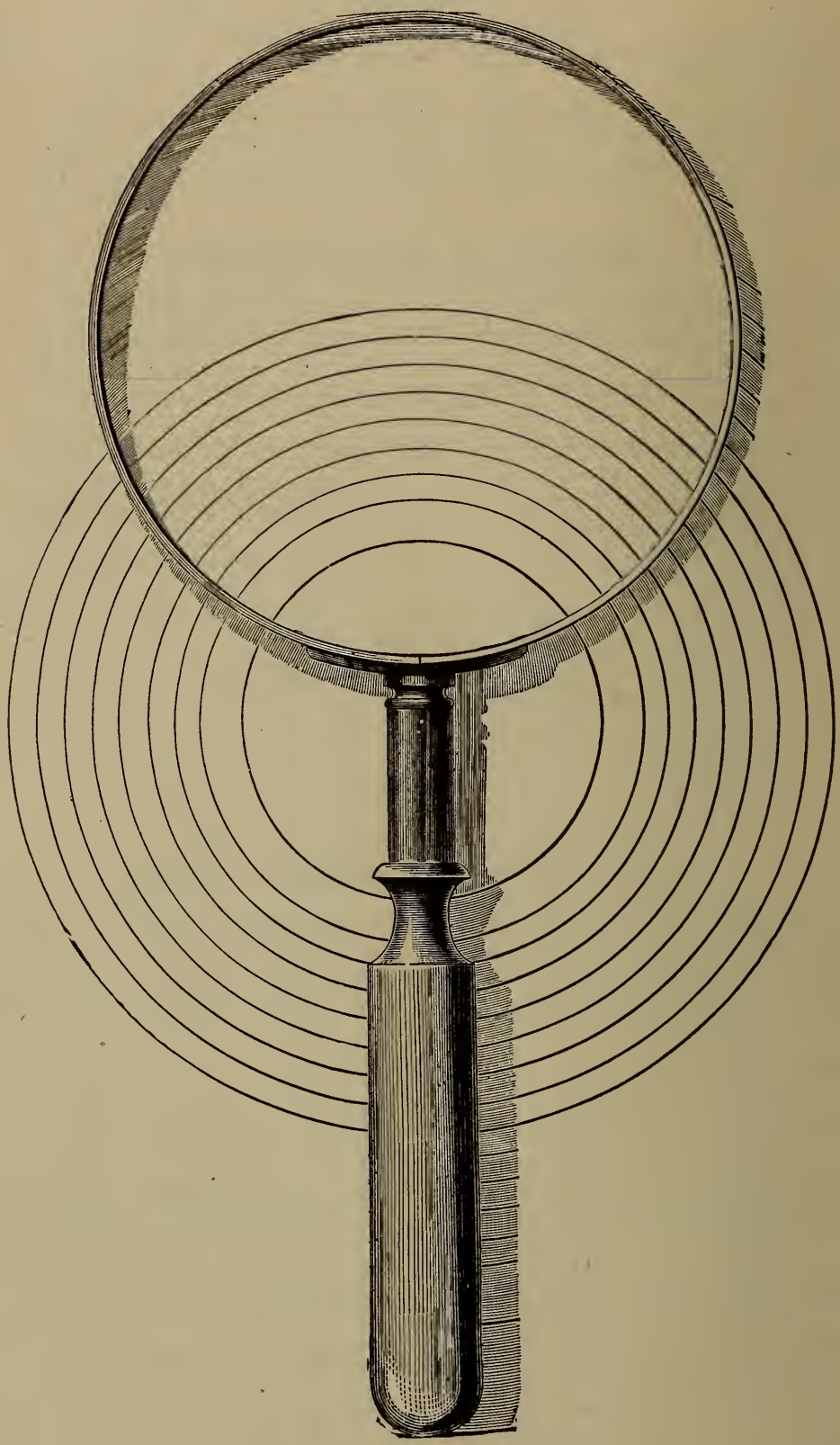
## READING AND PICTURE GLASSES.

| | | |
|---|---|---|
| 1324. | Reading Glass, oxidized metal frame, double convex lens, 2 in. diam., | 75 |
| 1325. | Reading Glass, oxidized metal frame, double convex lens, 2½ inches diameter, | 1 00 |
| 1327. | Reading Glass, oxidized metal frame, double convex lens, 3½ inches diameter, | 1 75 |
| 1329. | Reading Glass, oxidized metal frame, double convex lens, 4½ inches diameter, | 3 00 |
| 1330. | Reading Glass, gilt metal frame, ivory handle, one double convex lens, 2½ inches diameter, | 2 25 |
| 1331. | Reading Glass, gilt metal frame, ivory handle, double convex lens, 4 inches diameter, | 4 00 |
| 1332. | Reading Glass, black metal frame, wood handle, double convex lens, 3 inches long by 1½ inches wide, | 1 25 |
| 1333. | Reading Glass, black metal frame, wood handle, double convex lens, 4 inches long by 2 inches wide, | 2 00 |
| 1334. | Picture Glasses, wood frame and handle, double convex lens 5 inches diameter, | 4 00 |
| 1335. | Picture Glasses, wood frame and handle, double convex lens 6 inches diameter, | 5 00 |

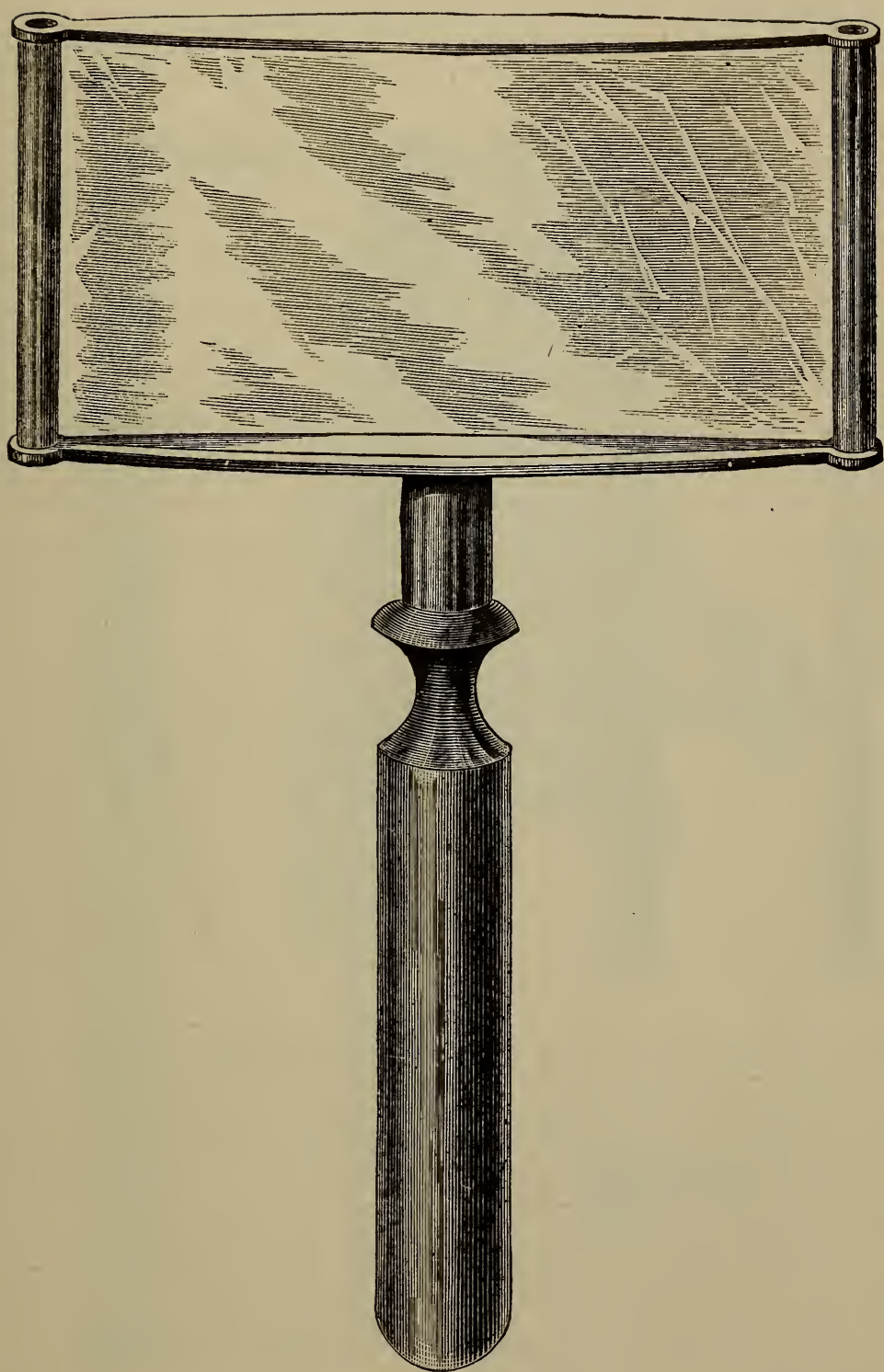
## DOUBLE CYLINDRICAL READING GLASSES.

These entirely new and very superior Reading Glasses are made of a double cylindrical lens, with its axes crossing at right angles, giving an entirely flat field free from chromatic or spherical aberration, reading to the extreme edge. Their great superiority to the old form of double convex lenses is apparent at a glance.

| | | |
|---|---|---|
| 1340. | Reading Glass, double cylindrical, German silver frame, black handle, 2x3 inches, | $2 50 |
| 1341. | Reading Glass, double cylindrical, German silver frame, black handle, $2\frac{3}{16}$x$3\frac{1}{4}$ inches, | 3 50 |
| 1342. | Reading Glass, double cylindrical, German silver frame, black handle, $2\frac{5}{16}$x$3\frac{3}{4}$ inches, | 4 50 |
| 1343. | Reading Glass, double cylindrical, German silver frame, black handle, $2\frac{3}{4}$x$4\frac{1}{4}$ inches, | 5 50 |
| 1344. | Reading Glass, double cylindrical, German silver frame, black handle, $2\frac{7}{8}$x$4\frac{1}{2}$ inches, | 6 50 |
| 1345. | Reading Glass, double cylindrical, German silver frame, ivory handle, 2x3 inches, | 4 00 |
| 1346. | Reading Glass, double cylindrical, German silver frame, ivory handle, $2\frac{3}{16}$x$3\frac{1}{4}$ inches, | 5 00 |
| 1347. | Reading Glass, double cylindrical, German silver frame, ivory handle, $2\frac{5}{16}$x$3\frac{3}{4}$ inches, | 6 00 |



Nos. 1324 to 1333.



Nos. 1340 to 1350.

| No. | | Price. |
|---|---|---|
| 1348. | Reading Glass, double cylindrical, gilt frame, ivory handle, $2\frac{3}{16}$x$3\frac{1}{4}$ inches, | $6 00 |
| 1349. | Reading Glass, double cylindrical, gilt frame, ivory handle, $2\frac{3}{4}$x$4\frac{1}{4}$ inches, | 9 50 |
| 1350. | Reading Glass, double cylindrical, gilt frame, ivory handle, $2\frac{7}{8}$x$4\frac{1}{2}$ inches, | 10 50 |

## ACHROMATIC SPY-GLASSES OR TELESCOPES.

No. 1375.

No. 1381.

No. 1385.

No. 1390.

1375. Achromatic Spy-glass, with wood body, and three draws, 15 inches long when drawn out, 6 inches long when shut up; object-glass 1 inch in diameter. Power 15 times, . . . . . $2 50

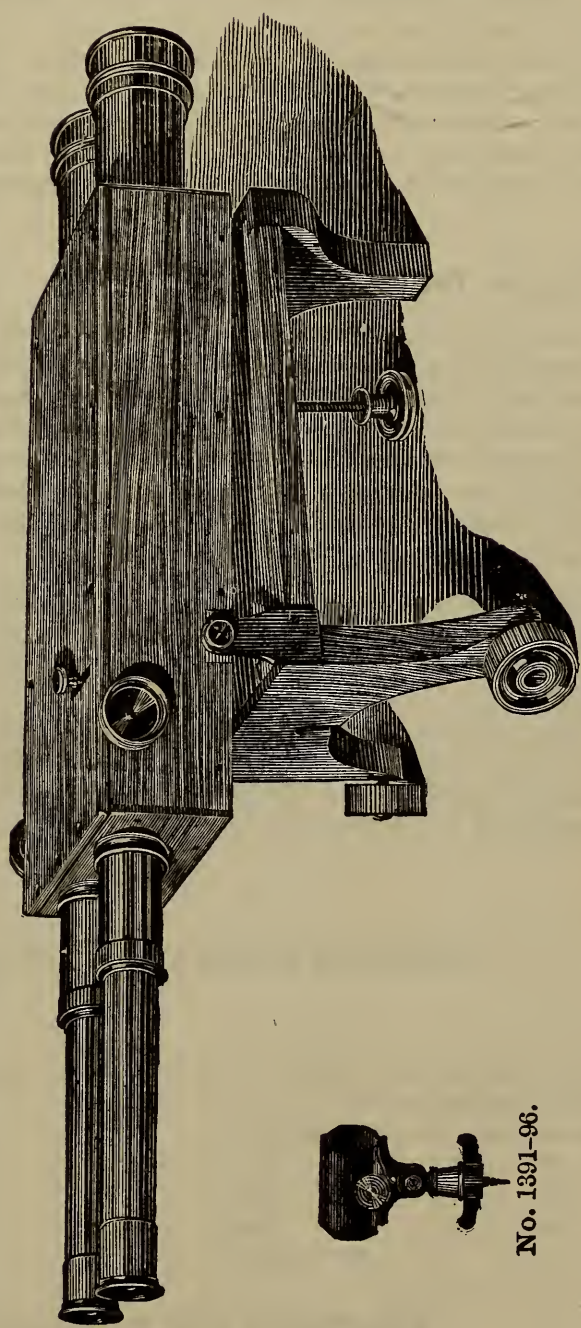
1376. Achromatic Spy-glass, with wood body, and three draws, 16 inches long when drawn out, 6 inches long when shut up; object-glass $1\frac{1}{8}$ inches in diameter. Power 20 times, . . . . . 3 50

1377. Achromatic Spy-glass, with wood body, and three draws, 23 inches long when drawn out, 8 inches long when shut up; object-glass $1\frac{3}{8}$ inches in diameter. Power 25 times, . . . . . 5 00

1378. Achromatic Spy-glass, with wood body, and three draws, 30 inches long when drawn out, 10 inches long when shut up; object-glass $1\frac{5}{8}$ inches in diameter. Power 30 times, . . . . . 7 50

1379. Achromatic Spy-glass, with wood body, and four draws, 37 inches long when drawn out, 11 inches long when shut up; object-glass $1\frac{7}{8}$ inches in diameter; a very superior glass. Power 35 times. . 13 50

No. 1388.



No. 1389.



No. 1391-96.

| No. | | Price. |
|---|---|---|
| 1380. | Achromatic Spy-glass, with wood body, and four draws, 42 inches long when drawn out, 11½ inches long when shut up; object-glass 2⅛ inches in diameter, with sun-glass. Power 40 times, . . | $20 00 |
| 1381. | Achromatic Spy-glass, with wood body, and four draws, 48 inches long when drawn out, 13½ inches long when shut up; object-glass 2⅜ inches in diameter, with sun-glass. Power 50 times, . . | 30 00 |
| 1385. | Achromatic Spy-glass, with metal body covered with Morocco, two draws, 30 inches long when drawn out, 20 inches long when closed; object-glass 1½ inches in diameter. Power 30 times, . | 10 00 |
| 1387. | Rifle Spy-glasses, 10¾ inches long; object-glass ½ inch diameter, . | 2 50 |
| 1388. | Naval Achromatic Spy-glass, tapering wood body and one draw, 55 inches long when drawn out, 45 inches long when shut up; rack and pinion for adjusting the focus. Power 50 times. . . | 40 00 |

1389. ***Binocular Telescope on Stand,*** . . . . . 115 00

This instrument may be placed either on a broad window-sill or on a table, and is intended for use at the sea-side or where there is an extensive prospect. The Achromatic Object-Glasses are $1\frac{6}{10}$ inches in diameter, magnifying 15 linear. The adjustment for focus is made with rack and pinion. The distance between the eyes is regulated by a small milled head on the top of the box. The two wheels attached to one end of the Stand allow of a steady and easy horizontal movement, and the large milled head underneath, (as shown in the illustration), gives a vertical one.

| | | |
|---|---|---|
| 1389.* | Binocular Telescope for hand use, mounted as an ordinary Field Glass. Object glasses $1\frac{6}{10}$ inch in diameter, magnifying power 16 linear; Sun and spray shade, in solid leather sling case, complete, . . . . . | 60 00 |
| 1390. | Wooden Tripod Stand, with vertical and horizontal motion, upon which to place a spy-glass; an exceedingly useful article, as a glass of much power cannot be held in the hand with sufficient steadiness to produce the best effect, . . . . . | 5 00 |

## PORTABLE CLAMPS FOR SPY-GLASSES.

| | | |
|---|---|---|
| 1391. | Brass Clamp with Gimlet Screw, to fasten spy-glasses 1375 and 1376 to a Post or Tree, . . . . . | 1 75 |
| 1392. | The same to fit spy-glass 1377, . . . . . | 2 00 |
| 1393. | " " " 1378, . . . . . | 2 75 |
| 1394. | " " " 1379, . . . . . | 3 25 |
| 1395. | " " " 1380, . . . . . | 3 75 |
| 1396. | " " " 1381, . . . . . | 4 25 |

## EYE-PIECES FOR TELESCOPES.

| | | |
|---|---|---|
| 1397. | Celestial Eye-piece, of any power, made to order, . . . . | 6 50 |
| 1398. | Terrestrial Eye-piece, of any power, made to order, . . . | 12 00 |
| 1399. | Sun-glass fitted to any Telescope, . . . . . | 2 00 |

## ASTRONOMICAL TELESCOPES.

There are few instruments which yield more pleasure and instruction than the Telescope. Even a small instrument of only an inch and a half or two inches aperture will serve excellently well to supply *profitable* amusement to those who know how to apply its powers. Indeed, a well constructed *Achromatic* of two to three inches aperture will not merely afford amusement and instruction—it may be made to do useful work. It is of this class of Telescopes that we now propose to briefly speak, as we sell only those with *Achromatic* object glasses.

The false coloring of the image produced by a *single* lens is due to *Chromatic Aberration.* The pencil of light proceeding from a point, converges not to one point, but to a short line of varying color, Thus a series of colored images is formed, at different distances from the object-glass. So that if a screen were placed to receive the mean image *in focus*, a colored fringe due to the other images (*out of focus, and therefore too large*) would surround the mean image. Happily it becomes possible to correct the chromatic aberration of one glass by superadding that of another, and thus we have the Achromatic Objective. This is effected by combining a convex lens of *Crown* glass with a concave lens of *flint* glass, the convex lens being placed nearest to the object. A little color still remains, but not enough to interfere seriously with the distinctness of the image.

But even if the image formed by the *object-glass* were perfect, if viewed through a *single* convex lens of short focus, it would appear curved, indistinct, colored and also *distorted*, because viewed by pencils of light which do not pass through the centre of the eye-glass. These effects are removed by using an *eye-piece*, consisting of *two* lenses instead of a single one. Two forms are employed. The first is Huyghen's, also called a *negative* eye-piece, because a real image is formed *behind* the *field-glass* (the lens which lies nearest to the object-glass). The second form is Ramsden's, also called the *positive* eye-piece, because the real image formed by the object-glass lies *in front* of the field-glass. The lenses are usually plano-convex, the convexities being turned *towards* the object-glass in the negative eye-piece, and towards each other in the positive. The negative form is used in all observations requiring distinct vision only, whilst the positive is used for micrometrical measurements.

For the instruments described in the following list the ordinary mountings on pillar and claw stand, or wooden tripod are sufficiently steady and convenient. The larger and more elaborate Telescopes requiring Equatorial mountings will be found described and illustrated further on among those of our own manufacture. Those from Nos. 1400 to 1421 are made by Bardou of Paris, especially for us, and bear our name and guarantee in addition to those of the famous maker.

An equatorially mounted telescope can be directed by means of the circles to any celestial object whose right ascension and declination are known. On the other hand, to bring an object into the field of view of an alt-azimuth, it is necessary, either that the object itself should be visible to the naked eye, or else that its position should be pretty accurately learned from the star maps, so that it may be picked up by the alt-azimuth after a little searching. A small telescope, called a *finder*, should be attached to all telescopes from the three-inch up, intended for general observation. The finder has a large field of view, and is adjusted so as to have its axis parallel to that of the large telescope. Thus a star brought to the centre of the large field of the finder (indicated by the intersection of cross lines placed at the focus of the eye-glass), is at, or very near, the centre of the smaller field of the large telescope.

The Object-glass should be kept as free as possible from dirt, damp, or dust,

but it is not advisable to remove every speck which, despite such precaution, may accidentally fall upon it. When it becomes necessary to clean the glass, the substance used should be soft, perfectly dry, and free from dust. An *old* silk or fine linen handkerchief, frequently washed and smoothly ironed, without any starch, makes the best of all articles for this purpose. As the dust which has fallen upon the object-glass is most probably *gritty* and therefore liable to scratch the same, the proper method is to clean a small space near the edge of the glass, and to *sweep* from that space as a centre. In this way the dust is *pushed before* the silk, and does not cut the glass. It is always well to suspect the presence of gritty dust, and adopt this cautious method of cleaning.

The two glasses should on no account be separated.

The Eye-pieces require to be as carefully preserved from damp and dust as the Object-glass, and to be more frequently cleaned.

The telescope should not be mounted within doors if it can be conveniently used on solid ground, as every movement in the house will cause the instrument to vibrate unpleasantly. Further, if it is placed in a warm room, currents of cold air from without will render objects under observation hazy and indistinct. If the telescope is used in a room, the temperature of the latter should be made as nearly equal as possible to that of the outer air.

The object, or the part of an object, to be observed, should be brought as nearly as possible to the centre of the field of view. This of course is readily done with an Equatorial mount moved by clock-work. But in the class of instruments we are now considering, the best plan is so to direct the telescope, by means of the finder, that the object shall be just out of the field of view, and be brought (by the earth's motion) across the centre of the field. Thus the vibrations which always follow the adjustment of the tube will have subsided before the object appears. The object should then be intently watched during the whole interval of its passage across the field of view.

It is important that the observer should recognize the fact that the highest powers do not necessarily give the best views of celestial objects. High powers in all cases increase the difficulty of observation, since they diminish the field of view and the illumination of the object, increase the unsteadiness with which (owing to the earth's motion) the image moves across the field, and magnify all defects due to instability of the stand, imperfection of the Object-glass, or undulations of the atmosphere. A good Object-glass of three inches aperture will in very favorable weather bear a power of about 300, when applied to the observation of close double or multiple stars, but for all other observations *much* lower power should be used. Nothing but failure and annoyance can follow the attempt to employ the highest powers on unsuitable objects or in unfavorable weather.

In favorable weather the following is a good general test of the performance of a telescope of two to three inches aperture, such as are named in this list: a star of the third or fourth magnitude at a considerable elevation above the horizon should exhibit a small well defined disc, surrounded by two or three fine rings of light.

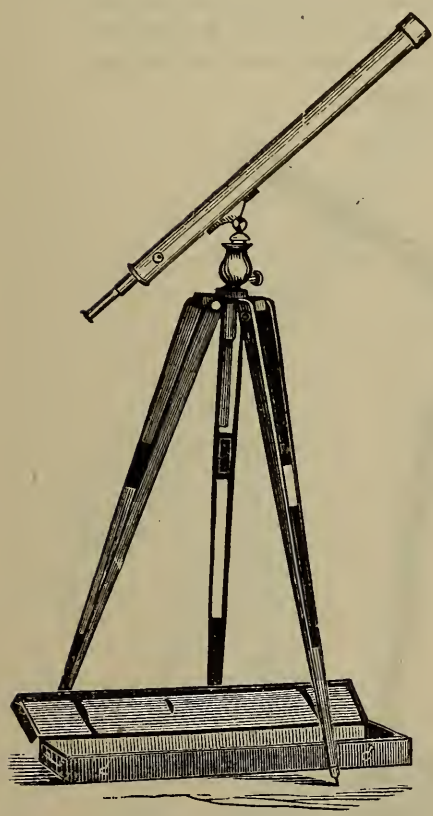
The presence of fog or haze should not deter the telescopist from attempting observations, since with a hazy sky, definition is often singularly good. Neither must the observer expect distinct vision of objects near the horizon. Objects near the eastern horizon during the time of morning twilight are especially confused by atmospheric undulations; in fact, early morning is a very unfavorable time for the observation of all the celestial bodies.

For a fuller account of the work which may be done with telescopes of two to three inches aperture we refer the reader to the valuable little book, No. 1025 of this catalogue: "Half Hours with the Telescope," by Prof. Richard A. Proctor, from which we have liberally quoted in compiling these remarks.

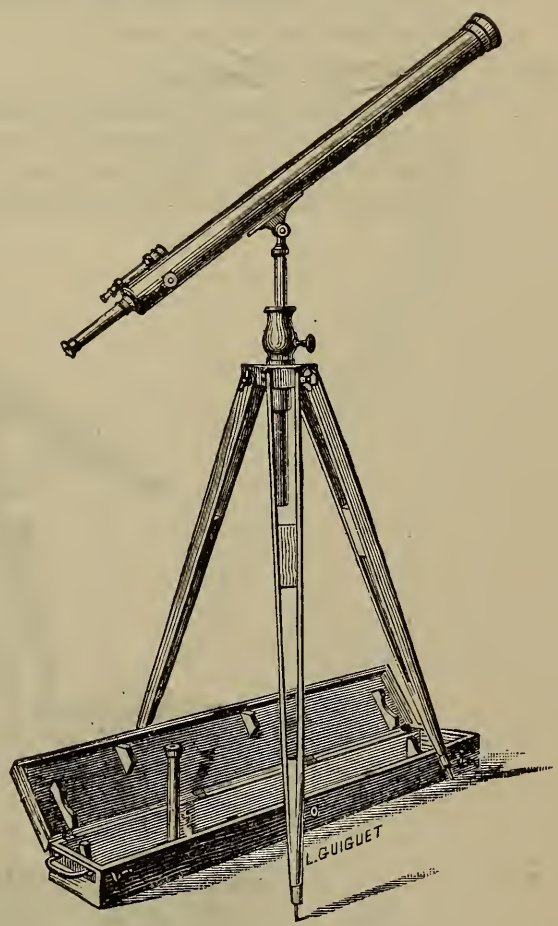
# ASTRONOMICAL AND TERRESTRIAL TELESCOPES,

By Bardou, Paris.

## ACHROMATIC REFRACTORS.



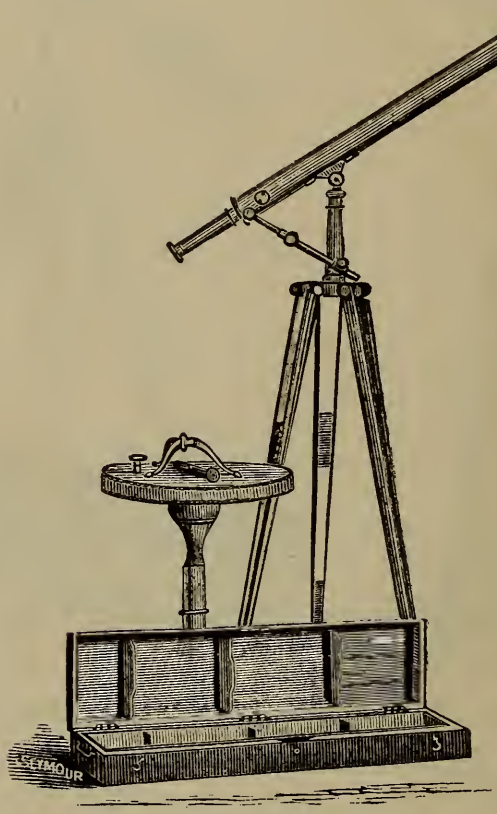
No. 1399* to 1404 without Finder.




No. 1399* to 1404 with Finder.

| No. | | Price. |
|---|---|---|
| 1399*. | ***Achromatic Telescope,*** . . . . . Body and Movements of highly finished brass, with Rack and Pinion adjustment of focus, Object-glass 2 inches in diameter, One Terrestrial and One Celestial Eye-piece with Sun-glass, powers 35 and 70; packed in a strong Walnut wood case, with lock and key. The Telescope is mounted upon a firm Tripod Stand of Mahogany, with prompt altitude and azimuth movements, and arrangement for setting at any desired height for convenient observation. | $ 50 00 |
| 1400. | ***Achromatic Telescope,*** . . . . . Body and Mounting precisely the same as the foregoing. Object-glass 2¼ inches in diameter, One Terrestrial and One Celestial Eye-piece, with Sun Glass; powers 35 and 80; in Walnut case. | 60 00 |

| No. | | Price. |
|---|---|---|
| 1401. | ***Achromatic Telescope,*** . . . . . | $70 00 |
| | Body, Mounting and Casing the same as the preceding. Object-glass 2½ inches in diameter, Two Eye-pieces with powers of 40 and 90 and Sun Glass. | |
| 1402. | ***Achromatic Telescope,*** . . . . . | 100 00 |
| | The same in all respects as the above, but with Object-glass 3 inches in diameter, Two Eye-pieces of 50 and 110 times, with Sun Glass; in Walnut case. | |
| 1403. | ***Achromatic Telescope,*** . . . . . | 175 00 |
| | Body and Mounting all Brass, the same as all the above, mounted on light but firm Mahogany Tripod, Object-glass 3½ inches in diameter, One Terrestrial and One Celestial Eye-piece, with Sun Glass; powers 60 and 135; in Walnut case. | |



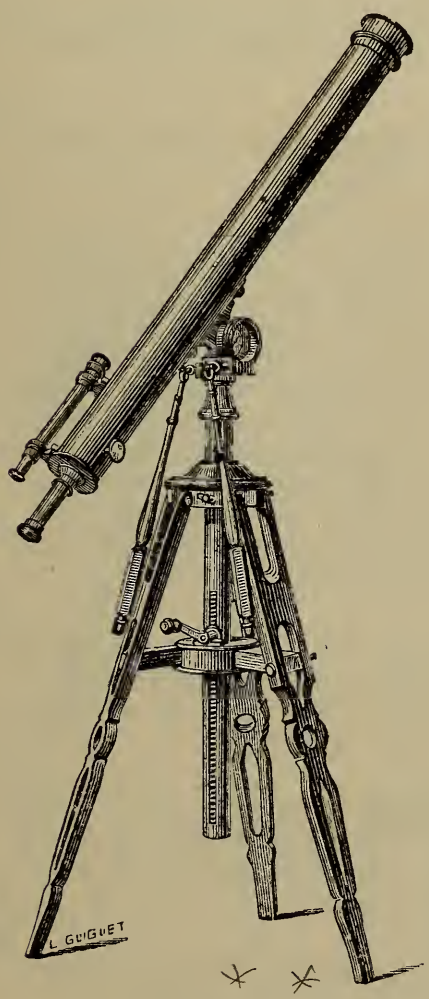

No. 1405–1408.

| | | |
|---|---|---|
| 1404. | ***Achromatic Telescope,*** . . . . . | 275 00 |
| | The same in all respects as the preceding, but with Object-glass 4 inches in diameter, Two Eye-pieces with powers of 70 and 145, and Sun Glass; in Walnut case. | |
| A. | ***Achromatic Finder,*** . . . . . | 18 00 |
| | Fine Brass Mounting, with cross wires, adapted to Telescopes 1399* to 1403. | |
| B. | ***Achromatic Finder,*** . . . . . | 25 00 |
| | Fine Brass Mounting, with cross wires, adapted to Telescope No. 1404. | |

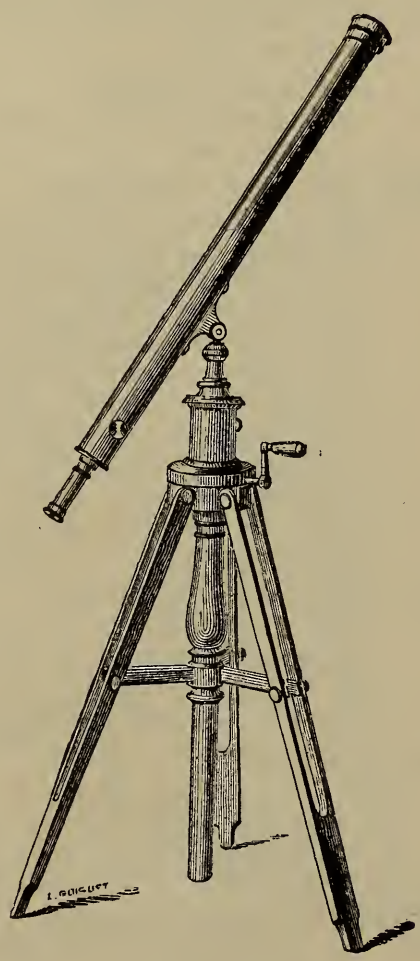
No. Price.

1405. ***Achromatic Telescope,*** . . . . . $150 00

Body of finely finished brass, mounted on a solid pillar of the same material with claw feet, focal and altitude adjustments by Rack and Pinion, the connecting rod of the latter entirely preventing all usual vibrations, making the instrument very steady; azimuth adjustment by turning on a smoothly finished plate, Object-glass three inches in diameter: two Terrestrial Eye-pieces, powers 50 and 68, and Two Celestial ditto, powers 75 and 150, with Sun-glasses. The whole packed in a strong Walnut wood case, with lock. A firm Mahogany Tripod, for out-door use, accompanies this Telescope as shown in the illustration.




No. 1409—11.



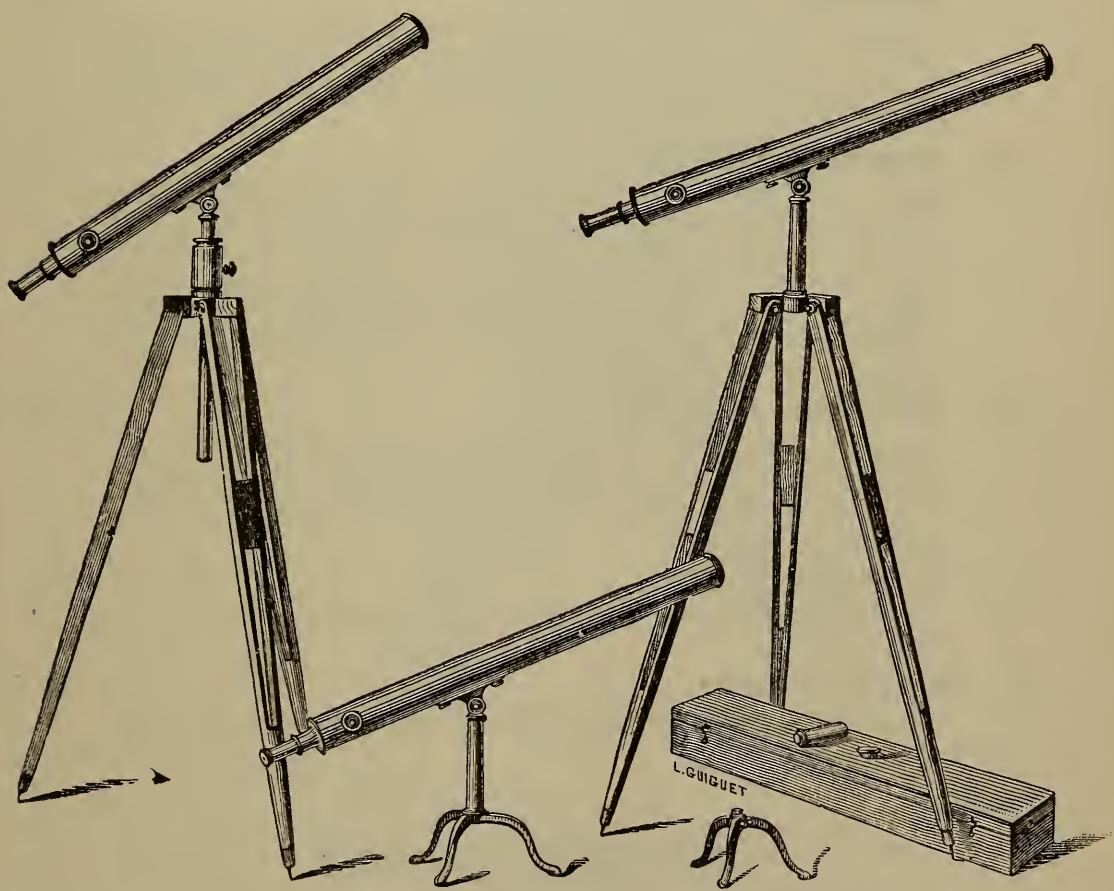
No. 1409*—11*.

1406. ***Achromatic Telescope,*** . . . . . 250 00

Body and Mounting and all movements precisely the same as in 1405. Object-glass 3½ inches in diameter, Two Terrestrial Eye-pieces, powers 60 and 80, and Two Celestial ditto, powers 100 and 175, with Sun-glasses; in Walnut wood case, with lock, and with firm Mahogany Tripod.

| No. | | Price. |
|---|---|---|
| 1407. | ***Achromatic Telescope,*** . . . . . Body, Mounting and all movements the same as in 1405; Object-glass 4 inches in diameter, Two Terrestrial Eye-pieces, powers 70 and 90, and Three Celestial ditto, powers 110, 145 and 185, with Sun-glasses; in Walnut wood case, with lock, and Mahogany Tripod. | $350 00 |
| 1408. | ***Achromatic Telescope,*** . . . . . Body, Mounting and all movements the same as in 1405; Object-glass 4¼ inches in diameter, Two Terrestrial Eye-pieces, powers 75 and 95, and Three Celestial ditto, powers 115, 150 and 190, with Sun-glasses; in Walnut wood case, with lock and firm Mahogany Tripod for out-door use. | 425 00 |
| A. | ***Achromatic Finder,*** . . . . . Fine Brass mounting, with Cross Wires, adapted to Telescopes 1405 and 1406. | $ 18 00 |
| B. | ***Achromatic Finder,*** . . . . . Fine Brass mounting, with Cross Wires, adapted to Telescopes 1407 and 1408. | 25 00 |
| 1409. | ***Achromatic Telescope,*** . . . . . Body of finely finished brass with Rack and Pinion adjustment of focus, and very steady and smooth altitude and azimuth movements. The Telescope is mounted upon a very firm and steady Tripod of Mahogany and can be raised to any desired height by a Rack and Pinion worked by a crank so that observations may be made either sitting or standing, as desired. The construction of the Tripod stand, allows the folding of the legs, rendering the whole instrument very portable, for carrying, without dismounting the tube. The Object-glass is three inches in diameter, and there are four Eye-pieces, two Terrestial, with powers of 50 and 68, and two Celestial, with powers of 75 and 150, with Sun-glasses. In Walnut case with lock. | 175 00 |
| 1410. | ***Achromatic Telescope,*** . . . . . Body, stand, and all appliances the same as in 1409. Object-glass 3½ inches in diameter, two Terrestial Eye-pieces giving powers of 60 and 80, and two Celestial ditto, with powers of 100 and 175, with Sun-glasses. In Walnut wood case with lock. | 250 00 |
| 1411. | ***Achromatic Telescope,*** . . . . . Body, stand, and all appliances the same as the preceding. Object-glass 4 inches in diameter, two Terrestial Eye-pieces, powers 70 and 90, and three Celestial ditto, powers 110, 145, and 255, with Sun-glasses. In Walnut wood case with lock. | 350 00 |
| 1409*. | ***Achromatic Telescope,*** . . . . . Fine Brass body, with solid joint for inclination, Rack and Pinion adjustment of focus, and vertical and horizontal movements by tangent screws. Heavy, solid Mahogany Tripod, with mechanical arrangement for raising the Telescope to any desired height. Object-glass 3 inches in diameter, two Terrestial Eye-pieces, powers 50 and 68, and two Celestial ditto, powers, 75 and 150, with Sun-glasses. In Walnut wood case with lock. | 250 00 |
| 1410.* | ***Achromatic Telescope,*** . . . . . Body, stand, and all appliances the same as in 1409*. Object-glass | 350 00 |

| No. | | Price. |
|---|---|---|
| | 3½ inches in diameter, two Terrestial Eye-pieces with powers of 60 and 80, and two Celestial ditto, with powers of 100 and 175, with Sun-glasses. In Walnut wood case with lock. | |
| 1411*. | ***Achromatic Telescope,*** . . . . . | $550 00 |
| | Body, stand and all appliances the same as the preceding. Object glass 4 inches in diameter, two Terrestial Eye-pieces, powers 70 and 90, and three Celestial ditto, powers 110, 145 and 255, with Sun-glasses. In Walnut wood case with lock. | |
| A. | ***Achromatic Finder,*** . . . . . | 18 00 |
| | Fine Brass mounting, with Cross Wires, adapted to Telescopes 1409-10 and 1409*-10*. | |
| B. | ***Achromatic Finder,*** . . . . . | 25 00 |
| | Fine Brass mounting, with Cross Wires, adapted to Telescopes 1411 and 1411*. | |



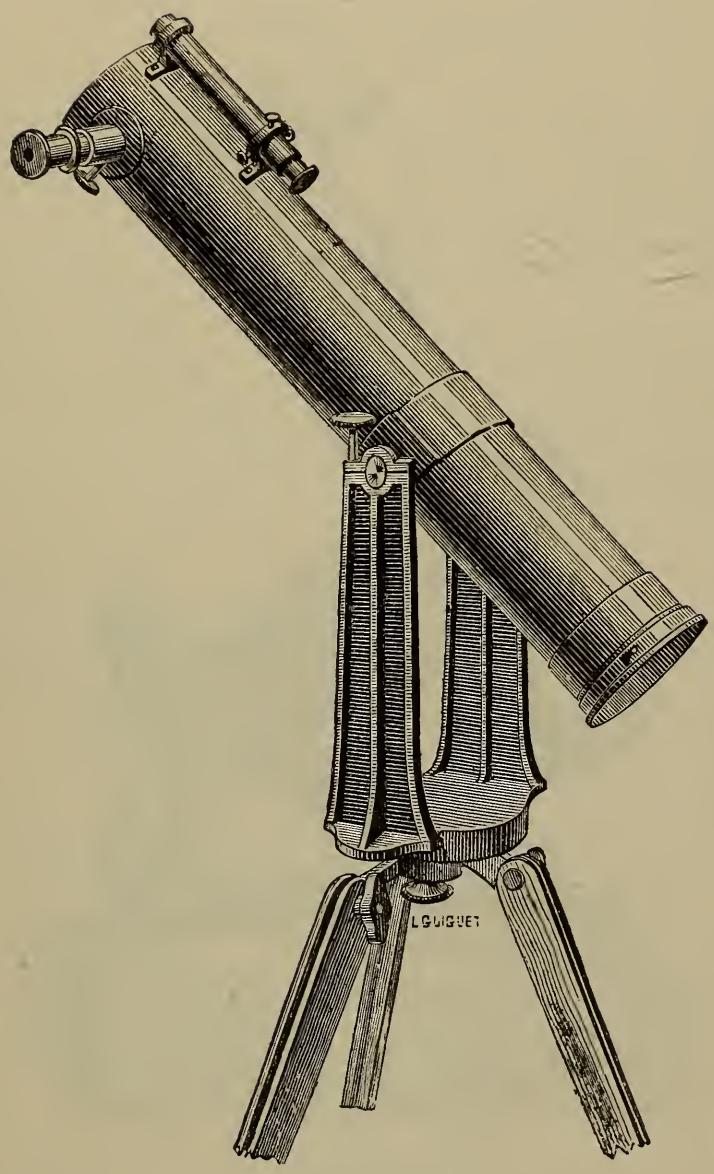

1414-15. 1412-13. 1416-17.

| | | |
|---|---|---|
| 1412. | ***Achromatic Telescope,*** . . . . . | 60 00 |
| | In this instrument and those immediately following, whilst the optical portions are *First Class*, the mountings have been specially designed and constructed to combine excellence of workmanship with great moderation in price. 1412 has metallic body with Rack and Pinion adjustment of focus, with vertical and horizon- | |

| No. | | Price. |
|---|---|---|
| | tal movements, mounted upon a cast-iron Tripod, neatly japanned. The Object-glass is 3 inches in diameter, and there are three Eye-pieces, one Terrestial, power 50 times, and two Celestial, powers 110 and 150, with Sun-glasses. Packed in strong Deal case. | |
| 1413. | ***Achromatic Telescope,*** . . . . . Body, Mounting and all appliances precisely the same as with 1412; Object-glass 4¼ inches in diameter, One Terrestrial Eye-piece, power 60, Two Celestial ditto, powers 140 and 300, with Sun-glasses; in Deal case. | $225 00 |
| 1414. | ***Achromatic Telescope,*** . . . . . Body and Movements the same as the preceding, but mounted upon a strong, firm Tripod of hard wood for out-door use; Object-glass 3 inches in diameter, One Terrestrial Eye-piece, power 50 times, and Two Celestial ditto, powers 110 and 150, with Sun-glasses; in strong Deal case. | 65 00 |
| 1415. | ***Achromatic Telescope,*** . . . . . , Body, Mounting and all appliances the same as with 1414; Object-glass 4¼ inches in diameter, One Terrestrial Eye-piece, power 60 times, and Two Celestial ditto, powers 140 and 300, with Sun-glasses; in Deal case. | 230 00 |
| 1416. | ***Achromatic Telescope,*** . . . . . , . . Body with Rack and Pinion adjustment of focus, and prompt movements in Altitude and Azimuth, is mounted on a firm Tripod of hard wood for out-door use, having in addition a small Tripod Stand of Japanned cast-iron for use upon a table; Object-glass 3 inches in diameter, One Terrestrial Eye-piece, power 50 times, and Two Celestial ditto, powers 110 and 150, with Sun-glasses; in strong Deal case. | 75 00 |
| 1417. | ***Achromatic Telescope,*** . . . . . Body, Mounting and all appliances the same as with 1416; Object-glass 4¼ inches in diameter, One Terrestrial Eye-piece, power 60 times, and Two Celestial ditto, powers 140 and 300, with Sun-glasses; in Deal case. | 250 00 |
| A. | ***Achromatic Finder,*** . . . . . Fine Brass Mounting, with Cross Wires, adapted to Telescopes 1412–14–16. | 18 00 |
| B. | ***Achromatic Finder,*** . . . . . Fine Brass Mounting, with Cross Wires, adapted to Telescopes 1413–15–17. | 25 00 |

## REFLECTING TELESCOPES.

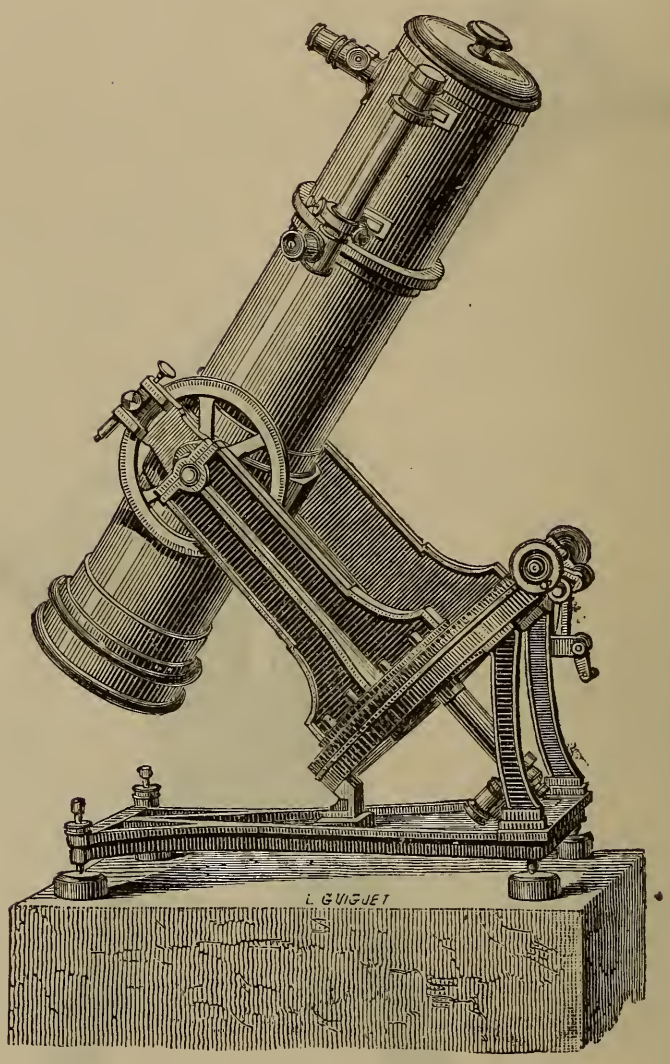
| | | |
|---|---|---|
| 1418. | ***Alt-Azimuth Reflecting Telescope,*** . . . . . With Finder, Glass Parabolic Silvered Mirror 4 inches in diameter, mounted on firm Tripod of Cast-iron, Three Eye-pieces, giving powers from 50 to 200 times. | 225 00 |
| 1419. | ***Alt-Azimuth Reflecting Telescope,*** . . . . . With Finder, Glass Parabolic Silvered Mirror 6½ inches in diameter, mounted on Solid Iron Tripod, Three Eye-pieces, with powers from 60 to 300 times. | 525 00 |




Nos. 1418–19.

| No. | | Price. |
|---|---|---|
| 1420. | ***Equatorial Reflecting Telescope,*** . . . . . With Finder, Glass Parabolic Silvered Mirror 6½ inches in diameter, declination circle 8 inches in diameter, hour circle 14½ inches ditto, Four Eye-pieces, giving powers from 60 to 300 times. | $925 00 |
| 1421. | ***Equatorial Reflecting Telescope,*** . . . . . With Finder, Glass Parobolic Silvered Mirror 8 inches in diameter, declination circle 13 inches in diameter, hour circle 18½ inches ditto, Four Eye-pieces, powers from 65 to 400 times. | 1800 00 |
| | ***Driving Clock for the above,*** . . . . . | 300 00 |

These Telescopes are only Imported *To Order.*




No. 1420–21.

## BARDOU'S ACHROMATIC OBJECT-GLASSES,

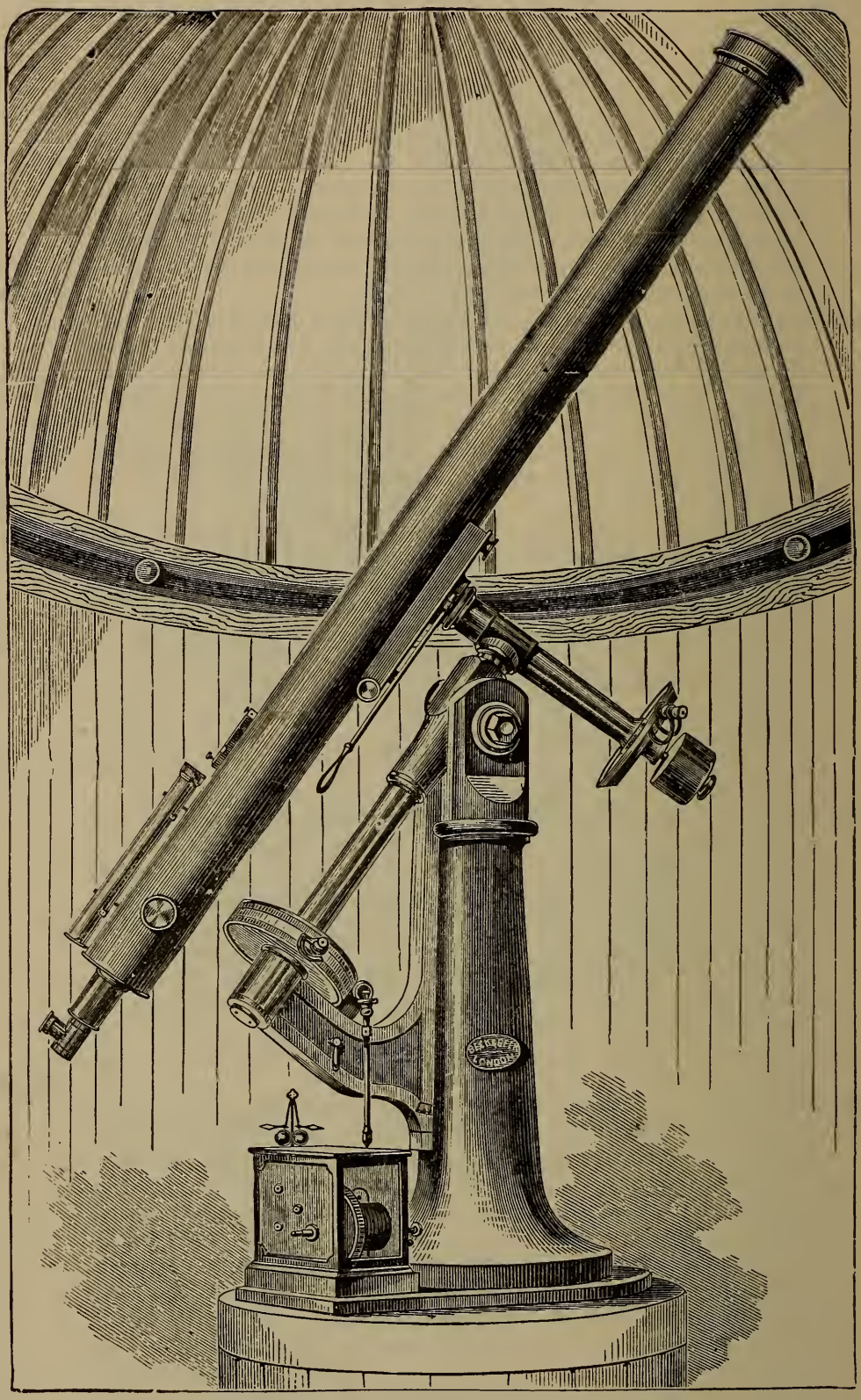
MOUNTED IN BRASS CELLS.

| No. | | | | | | | | Price. |
|---|---|---|---|---|---|---|---|---|
| 1475. | Achromatic Object-glass, | 3 | inches, | 75mm., | diameter, | . . . | | $ 25 00 |
| 1476. | " " | 3¼ | " | 81 " | " | . . . | | 35 00 |
| 1477. | " " | 3½ | " | 88 " | " | . . . | | 50 00 |
| 1478. | " " | 3¾ | " | 95 " | " | . . . | | 75 00 |
| 1479. | " " | 4 | " | 102 " | " | . . . | | 100 00 |
| 1480. | " " | 4¼ | " | 109 " | " | . . . | | 125 00 |
| 1481. | " " | 4½ | " | 115 " | " | . . . | | 150 00 |
| 1482. | " " | 5 | " | 128 " | " | . . . | | 200 00 |
| 1483. | " " | 6 | " | 149 " | " | . . . | | 350 00 |

## ASTRONOMICAL TELESCOPES.

OUR OWN MANUFACTURE.

| No. | | Price |
|---|---|---|
| 1422. | ASTRONOMICAL TELESCOPE ON PILLAR-AND-CLAW STAND. Achromatic Object-glass 2¼ inches in diameter. Focal length 3 feet. One Terrestrial Pancratic Eye-piece, magnifying from 15 to 30 linear; one Astronomical Eye-piece with Sun-shade, magnifying 60 linear. Focal adjustment by Rack and Pinion. Mounted on handsome Pillar-and-Claw Stand. The whole packed in a strong Mahogany case. . . . . | $115 00 |
| 1423. | ASTRONOMICAL TELESCOPE ON PILLAR-AND-CLAW STAND. Achromatic Object-glass 2¾ inches in diameter. Focal length 3½ feet. Pancratic Terrestial Eye-piece, magnifying from 20 to 40 linear. Three Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 20, 60 and 100 linear: Rack-and-Pinion Adjustment to the focus. Telescope mounted on handsome Pillar-and-Claw Stand as No. 1422. The whole packed in a strong Mahogany case, . . . , . . . . . | 175 00 |
| 1424. | ASTRONOMICAL TELESCOPE ON PILLAR-AND-TRIPOD STAND. Achromatic Object-glass 2¾ inches in diameter, Focal length 3½ feet. Pancratic Terrestrial Eye-piece, magnifying from 20 to 40 linear. Three Astronomical Eye-pieces, with Sun-shade, magnifying respectively about 20, 60 and 100 linear. First-surface Diagonal Reflector for observing the Sun, Rack-and-Pinion Adjustment to the focus. Finder same as No. 1425, and Dew-shade. Telescope mounted on Pillar-and-Tripod Stand, with Vertical and Horizontal movements by Rack and Screw, and Steadying-rods. The whole packed in a strong Mahogany case, . . . . . | 225 00 |
| 1425. | ASTRONOMICAL TELESCOPE ON PILLAR-AND-TRIPOD STAND. Achromatic Object-glass 3½ inches in diameter, Focal length 4 feet. Pancratic Terrestrial Eye-piece, magnifying from 20 to 40 linear. Four Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 20, 40, 60 and 100 linear. First-surface Diagonal Reflector for observing the Sun, Rack-and-Pinion Adjustment to the focus. Finder and Dew-shade. Telescope mounted on Pillar-and-Tripod Stand, with Vertical movement by Rack and Pinion, and Horizontal movement by an endless Screw. Sliding Steadying-rods. The whole packed in a strong Mahogany case, . . . . . | 350 00 |
| 1426. | ASTRONOMICAL TELESCOPE ON AN EQUATORIAL STAND. Achromatic Object-glass 3½ inches in diameter, Focal length 4 feet. Pancratic Terrestrial Eye-piece, magnifying from 20 to 40 linear. Four Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 20, 40, 60 and 100. First-surface Diagonal Reflector for observing the Sun. Finder as in No. 1427, Rack-and-Pinion Adjustment to the focus. Telescope mounted on a strong Equatorial Stand. Declination Circle 4 inches in diameter, divided to 30′, with two Verniers reading to 30″. The Hour Circle 4 inches in diameter, divided to 2 minutes, with two Verniers reading to 2 seconds of time. The Polar Axis and Declination Axis of brass, fixed on a strong cast-iron Column, with adjustments for Latitude, Azimuth, etc. The Telescope and Equatorial part packed in Mahogany cases, . . . . | 475 00 |




No. 1427.

No. PRICE.

1427. ASTRONOMICAL TELESCOPE ON AN EQUATORIAL STAND. Achromatic Object-glass 4½ inches in diameter, Focal length 5½ feet. Four Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 20, 40, 70 and 140. First-surface Diagonal Reflector for observing the Sun. Finder. Rack-and-Pinion Adjustment to the focus. Complete Illuminating apparatus. Telescope mounted on a strong Equatorial Stand. The Declination Axis fitted into a cast-iron Socket, bolted on to the Polar Axis. The Declination Circle 8 inches in diameter, divided to 30′, and reading to 30″ of arc. The Polar Axis, working in a fitting and on a Steel Ball, and attached to it a Right-Ascension Circle, 8 inches in diameter, divided to minutes, with two Verniers, reading to seconds of time. This Circle is arranged so that the Telescope can be set in Right Ascension without any calculation. A Driving Circle connected with the Clock, whose rate is governed by Balls and Fans: this can be detached at pleasure. A fine adjustment in Declination fixed to the Telescope, and all other necessary adjustments supplied. The whole mounted on a strong cast-iron Column, with ready adjustments for Latitude, Azimuth, etc., . . . . . $1000 00

1428. ASTRONOMICAL TELESCOPE ON AN EQUATORIAL STAND. Achromatic Object-glass 5 inches in diameter, Focal length about 6 feet, 6 inches. Five Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 40, 60, 100, 150 and 200. First-surface Diagonal Reflector for observing the Sun. Position Circle at Eye-end graduated on Silver, with two Verniers and Microscopes, reading to minutes. Finder and Dew-shade, Rack-and-Pinion Adjustment to focus. Parallel Wire Micrometer with Double Movable Lines, four Eye-pieces, magnifying about 200, 300, 400 and 600 linear. Complete Illuminating apparatus. Telescope mounted on a strong Equatorial Stand. The Declination Axis fitted into and working in a cast-iron Socket, bolted on the Polar Axis. The Declination Circle 12 inches in diameter, divided to 10′, with two Verniers and Microscopes, reading to 10″ of arc. To the Polar Axis is fixed a Right-Ascension Circle, divided to 2 minutes, with two Verniers, reading to 2 seconds of time. This Circle is arranged so that the Telescope can be set in Right Ascension without any calculations. A Driving Circle is connected with the Clock, whose rate is governed by Balls and Fans: this can be thrown out of gear at pleasure. Fine adjustments in Right Ascension and Declination by means of Tangent Screws and Hooks' joints, conveniently placed. The whole mounted on a strong cast-iron Pillar, with ready adjustments for Latitude, Azimuth, etc., . . . . . 1500 00

1429. ASTRONOMICAL TELESCOPE ON EQUATORIAL STAND. Achromatic Object-glass 6 inches in diameter, Focal length about 7 feet, 6 inches. Six Astronomical Eye-pieces, with Sun-shades, magnifying respectively about 40, 60, 100, 150, 200 and 400 linear. First-surface Diagonal Reflector for observing the Sun. Position Circle at Eye-end graduated on Silver, with two Verniers and Microscopes, reading to minutes. Finder and Dew-shade, Rack-and-Pinion Adjustment to focus. Parallel Wire Micrometer, with Double Movable Lines, four Eye-pieces, magnifying about 200, 300, 400 and 600 linear. Complete Illuminating apparatus. Telescope mounted on a strong Equatorial Stand. The Declination Axis bolted at right angles to the Telescope, and

| No. | | Price |
|---|---|---|
| | fitted into an iron socket bolted on the Polar Axis. The Declination Circle, 16 inches in diameter, divided to 10′, with Two Verniers and Microscopes, reading to 10″ of arc. To the Polar Axis is fixed a Right-Ascension Circle, divided to 2 minutes, with two sets of Verniers, reading to 2 seconds of time. This Circle is arranged so that the Telescope can be set in Right Ascension without any calculations. A Driving Circle connected with the Clock, whose rate is governed by Balls and Fans: this can be thrown in and out of gear at pleasure. Fine adjustments in Right Ascension and Declination by means of Tangent Screws and Hooks' joints, conveniently placed. The whole mounted on a strong cast-iron Pillar, with ready adjustments for Latitude, Azimuth, etc., | $2400 00 |
| 1431. | Parallel Wire Micrometer, Double Movable Lines, four Eye-pieces, powers varied at pleasure packed in a Mahogany case, | 100 00 |
| 1432. | Double Image-Micrometer, | 100 00 |
| 1433. | Annular Micrometer, with Eye-piece, | 8 00 |
| 1434. | Micrometer, ruled on Glass to parts of an Inch or Metre, fitting any Eye-piece, | 4 00 |
| 1437. | Illuminating Apparatus, | 40 00 |
| 1439. | Driving-Clock and Connecting Gear, | 80 00 |
| 1441. | Diagonal Reflector, First-surface glass for Solar observations, | 15 00 |
| 1443. | Huygenian Eye-piece, any power, | 7 50 |
| 1444. | Sun-Shade, | 2 00 |
| 1446. | Varley's Telescope-Stand, complete fittings, | 100 00 |

Special Estimates given for Mounting Telescopes.

## OBJECT-GLASSES, First Quality, Mounted in Brass Cells.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1451. | Object-Glass, | $1\frac{1}{10}$ | inches | diameter, | Focal | Length, | 9 inches, | 4 00 |
| 1452. | " | " | $1\frac{6}{10}$ | " | " | " | " 1 foot, 6 inches, | 6 00 |
| 1453. | " | " | $1\frac{8}{10}$ | " | " | " | " 2 feet, | 10 00 |
| 1454. | " | " | $2\frac{1}{4}$ | " | " | " | " 3 feet, | 20 00 |
| 1455. | " | " | $2\frac{3}{4}$ | " | " | " | " 3 feet, 6 inches, | 50 00 |
| 1456. | " | " | $3\frac{1}{2}$ | " | " | " | " 4 feet, | 100 00 |
| 1457. | " | " | $4\frac{1}{2}$ | " | " | " | " 5 feet, 6 inches, | 240 00 |
| 1458. | " | " | 5 | " | " | " | " 6 feet, 6 inches, | 320 00 |
| 1459. | " | " | 6 | " | " | " | " 7 feet, 6 inches, | 550 00 |

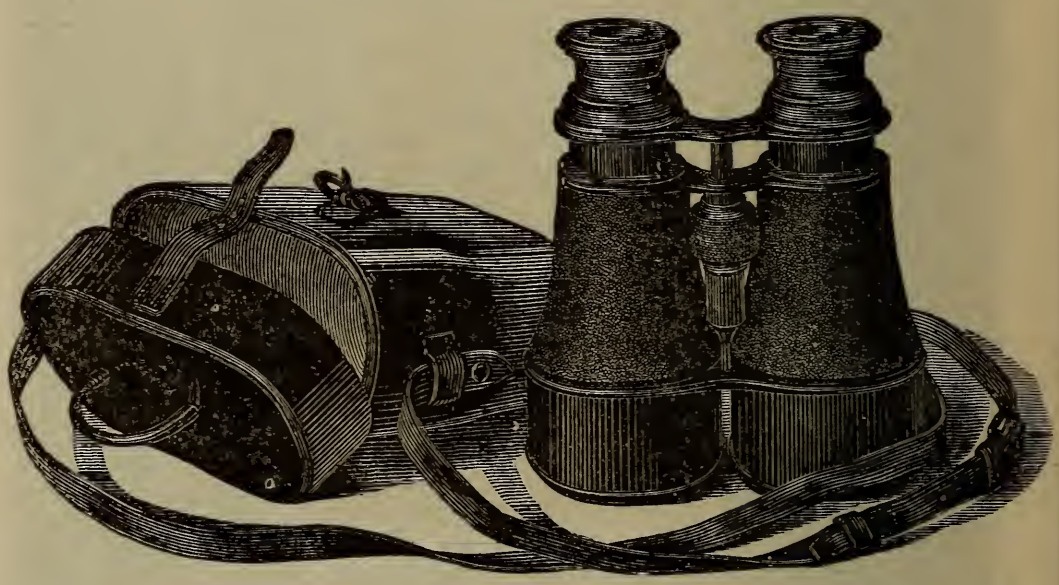
Telescopes 1400 to 1408 are of most excellent construction, with well-corrected Object-glasses, and very finely mounted. Those from 1422 to 1429 are of the very finest quality; no pains being spared to render them first-class in every respect.

## ACHROMATIC MARINE AND FIELD GLASSES.

These Glasses are designated according to the diameter of the Object-glasses in French lines, as follows:

| | | | | |
|---|---|---|---|---|
| 11 | Lines are | equal to | 1 | inch. |
| 13 | " | " | $1\frac{3}{16}$ | inches. |
| 15 | " | " | $1\frac{5}{16}$ | " |
| 17 | " | " | $1\frac{1}{2}$ | " |
| 19 | " | " | $1\frac{11}{16}$ | " |
| 21 | " | " | $1\frac{7}{8}$ | " |
| 24 | " | " | $2\frac{1}{8}$ | " |
| 26 | " | " | $2\frac{5}{16}$ | " |

They are all constructed with six lenses, unless the contrary is specially stated, and are invariably well corrected and adapted to all visions.



1500–1502.

| No. | | Price. |
|---|---|---|
| 1500. | ***Binocular Horizon Sweep,*** in solid Leather sling case, . . | $35 00 |

This glass has been expressly designed and constructed at our own works, for yachting purposes, and to meet the requirements of Captains. The framework, which is of brass, bronzed, and covered with strongly-stitched leather, is made very strong. The Achromatic Object-glasses are carefully corrected, and the Eye-pieces are arranged so as to give the maximum amount of light, thus rendering it especially useful in foggy weather or during twilight. The solid Leather case is of the very best make.

No. Price.

1501. Lemaire's U. S. Army Signal Service Marine or Field Glass, metal body, covered with Turkey Morocco, Sun-shades to extend over the Object-glasses, and heavy Leather case, with strap; very superior.

| | | |
|---|---|---|
| Object-glasses, 19 lines in diameter, | . . . . . | $13 50 |
| " 21 " " | . . . . . | 15 00 |
| " 24 " " | . . . . . | 17 00 |
| " 26 " " | . . . . . | 18 00 |

1502. Bardou's U. S. Army Signal Service Marine or Field Glass, body covered with Turkey Morocco, Sun-shades to extend over the Object-glasses, in fine Leather case, with strap; the best article made. This glass bears our own trade-mark, and is made expressly for our sales.

| | | |
|---|---|---|
| Object-glasses, 19 lines in diameter, | . . . . . | 20 00 |
| " 21 " " | . . . . . | 21 00 |
| " 24 " " | . . . . . | 22 50 |
| " 26 " " | . . . . . | 25 00 |

1503. Bardou's U. S. Army Signal Service Marine or Field Glass, the same as 1502, with addition of a hinge adjustment for varying distance between the eyes, in stiff Leather case, with strap.

| | | |
|---|---|---|
| Object-glasses, 19 lines in diameter, | . . . . . | 22 50 |
| " 21 " " | . . . . . | 24 00 |
| " 24 " " | . . . . . | 26 00 |
| " 26 " " | . . . . . | 27 50 |

1504.

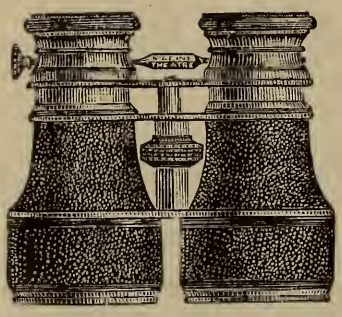
1504. Field Glass, metal body, covered with Morocco, Sun-shades to extend over the Object-glasses, and stiff Leather case, with strap; an excellent glass.

| | | |
|---|---|---|
| Object-glasses, 19 lines in diameter, | . . . . . | 8 00 |
| " 21 " " | . . . . . | 10 00 |
| " 24 " " | . . . . . | 11 00 |
| " 26 " " | . . . . . | 12 00 |

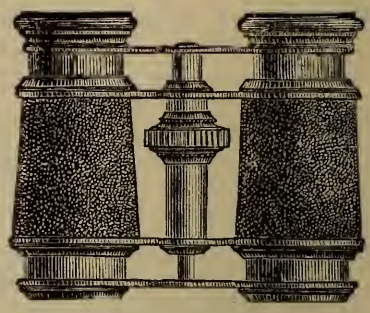
1506. Binocular Glass, with three adjustable Eye-pieces of different powers, Field, Marine or Opera, metal bodies, covered with finest Turkey Morocco, Sun-shades to extend over the Object-glasses, and fine Leather case, with strap.

| | | |
|---|---|---|
| Object-glasses, 17 lines in diameter, | . . . . . | 16 00 |
| " 19 " " | . . . . . | 18 00 |
| " 21 " " | . . . . . | 20 00 |
| " 24 " " | . . . . . | 22 00 |

No. Price



No. 1506.

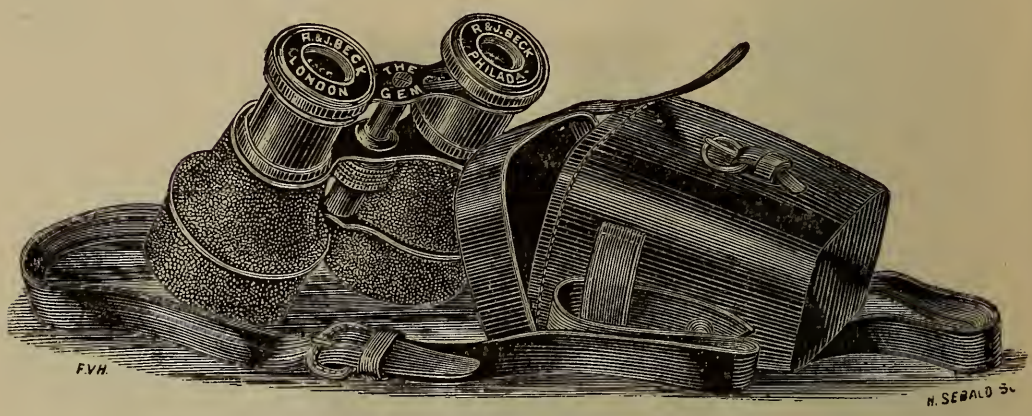


No. 1507.

1507. Field Glass, Rock Crystal Lenses, double adjustment of focus, so that, when closed, the instrument can be conveniently carried in the pocket, in Morocco case, without strap; very powerful, but small field of view.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 10 lines in diameter, | . . . . . | | 14 00 |
| " | 11 " | " | . . . . . | 16 00 |
| " | 15 " | " | . . . . . | 18 00 |
| " | 17 " | " | . . . . . | 20 00 |

## THE GEM.




No. 1510.

1510. The Gem, Field and Opera Glass, Object-glasses 19 lines in diameter, . . . . . $20 00

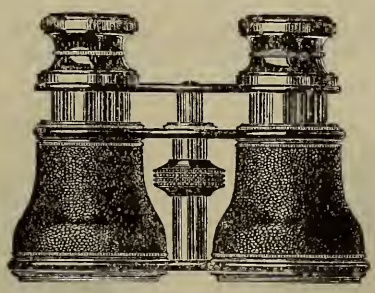
This is the most powerful Glass of its size ever made, combining all the power and scope of a Field or Race Glass, with the portability and neatness of an Opera Glass. It is made in the most thorough manner at our own works, and is furnished either in a stiff Leather case, with sling for field use, or in a soft Leather case for the Opera.

1511. The Gem, Field and Opera Glass, the same in quality and power as 1510, but made with telescope tubes, so that packed in case it occupies a space of only 5 x 2½ inches. In Soft Leather Case, . $25 00

1512. The Pearl, Field and Opera Glass, similar to the Gem in style and case, Object-glasses, 21 lines, . . . . . 15 00

## OPERA GLASSES.

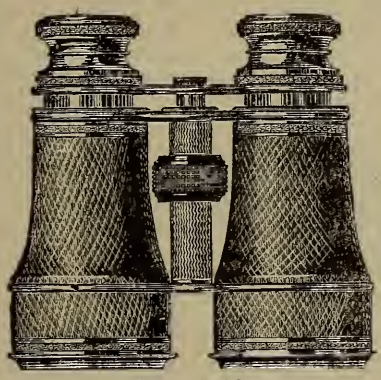
| No. | | Price. |
|---|---|---|
| 1515. | OPERA GLASS, frame work all black, metal bodies covered with black leather, in soft Leather case. | |
| | Object-glasses, 13 lines in diameter, | $3 50 |
| | " 15 " " | 4 00 |
| | " 17 " " | 4 50 |
| | " 19 " " | 5 00 |
| 1516. | OPERA GLASS, black metal frames, very substantial, bodies covered with black Morocco, in soft Leather case. | |
| | Object-glasses, 11 lines in diameter, | 5 00 |
| | " 13 " " | 5 50 |
| | " 15 " " | 6 00 |
| | " 17 " " | 7 00 |
| | " 19 " " | 8 00 |



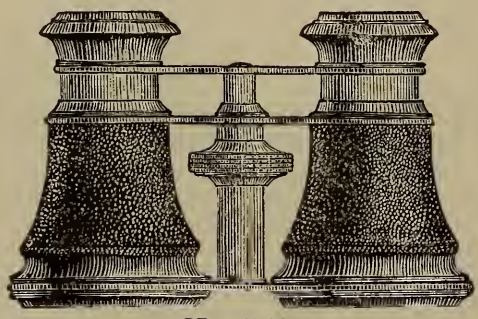
Nos. 1515–1517.

1517. OPERA GLASS, black metal frames, bodies covered with colored Morocco in handsome dark shades, in soft Leather case.

| | |
|---|---|
| Object-glasses, 11 lines in diameter, | 3 50 |
| " 13 " " | 4.00 |
| " 15 " " | 4 50 |
| " 17 " " | 5 00 |
| " 19 " " | 6 00 |



No. 1518.



No. 1519

1518. OPERA GLASS, very substantial, black metal frames, bodies covered with black Morocco, patented Eye-pieces, readily adjustable to the vision of the nearest-sighted person as well as to that of the far-sighted, in soft Leather case.

| | |
|---|---|
| Object-glasses, 15 lines in diameter, | 12 00 |
| " 17 " " | 13 50 |
| " 19 " " | 15 00 |

No. Price.

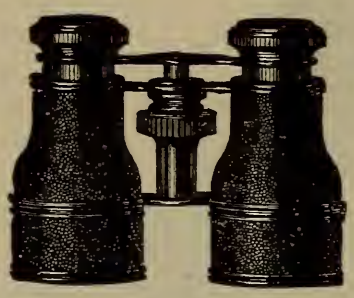
1519. Opera Glass, tops and cross-pieces black, tubes and bottom pieces richly gilt, bodies covered with handsome colored Morocco, with gilt trimmings top and bottom, very handsome and excellent glasses; in soft Leather case.

| | | |
|---|---|---|
| Object-glasses, 11 lines in diameter, | . . . . . | $8 50 |
| " 13 " " | . . . . . | 9 00 |
| " 15 " " | . . . . . | 10 50 |
| " 17 " " | . . . . . | 12 00 |
| " 19 " " | . . . . . | 14 00 |

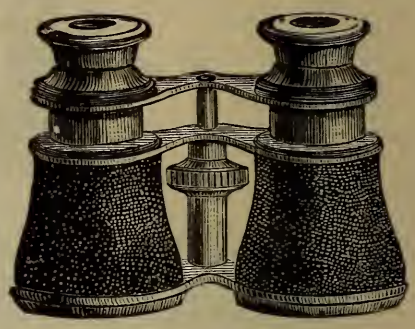
1520. Opera Glass, for the vest pocket, very small but with a large clear field of view, black metal frames, bodies covered with black Morocco with silk sling and in case.

| | | |
|---|---|---|
| Object-glasses, 13 lines in diameter, | . . . . . | 9 00 |
| " 15 " " | . . . . . | 10 00 |

## LEMAIRE'S AND BARDOU'S OPERA GLASSES.



Nos. 1525–1527.



Nos. 1530–1536.

1525. Opera Glass, (Lemaire's), substantial black metal frames, bodies covered with best black Morocco leather, in soft Leather case.

| | | |
|---|---|---|
| Object-glasses, 11 lines in diameter, | . . . . . | $6 00 |
| " 13 " " | . . . . . | 6 50 |
| " 15 " " | . . . . . | 7 00 |
| " 17 " " | . . . . . | 8 00 |
| " 19 " " | . . . . . | 9 00 |

1526. Opera Glass, (Lemaire's), substantial black metal frames, bodies covered with handsome colored Morocco leather of various shades, in soft Leather case.

| | | |
|---|---|---|
| Object-glasses, 11 lines in diameter, | . . . . . | 6 00 |
| " 13 " " | . . . . . | 7 00 |
| " 15 " " | . . . . . | 7 50 |
| " 17 " " | . . . . . | 8 00 |
| " 19 " " | . . . . . | 9 00 |

1527. Opera Glass, (Lemaire's), tops and cross-pieces black metal, tubes richly gilt, bodies covered with handsome colored Morocco leather of various shades, in soft Leather case.

| | | |
|---|---|---|
| Object-glasses, 11 lines in diameter, | . . . . . | 7 00 |
| " 13 " " | . . . . . | 7 50 |
| " 15 " " | . . . . . | 8 50 |
| " 17 " " | . . . . . | 9 00 |
| " 19 " " | . . . . . | 10 00 |

| No. | | Price. |
|---|---|---|
| 1530. | OPERA GLASS, (Bardou's), light but very strong, black metal frames, bodies covered with finest black Morocco leather, in soft Leather case, very superior in power and size of field. | |
| | Object-glasses, 12 lines in diameter, | $8 00 |
| | " 15 " " | 8 50 |
| | " 17 " " | 9 50 |
| | " 19 " " | 11 00 |
| 1531. | OPERA GLASS, (Bardou's), the same in all respects as 1530, but with triple Object-glasses and Eye-pieces, making twelve lenses in all; exceedingly powerful and perfect definition. | |
| | Object-glasses, 12 lines in diameter, | 13 00 |
| | " 15 " " | 14 00 |
| | " 17 " " | 16 00 |
| | " 19 " " | 18 00 |
| 1532. | OPERA GLASS, (Bardou's Conical), very strong, black metal frames, the tapering bodies covered with the finest Turkey Morocco leather, in soft Leather case. These are very superior and powerful Opera Glasses, and are equally well adapted to Field or Marine use. | |
| | Object-glasses, 13 lines in diameter, | 9 00 |
| | " 15 " " | 9 50 |
| | " 17 " " | 11 50 |
| | " 19 " " | 13 50 |
| | " 21 " " | 15 00 |
| 1535. | OPERA GLASS, (Bardou's), tops and cross-pieces all black, tubes and bottoms richly gilt, bodies covered with finest colored leather, in soft Leather case; very superior. | |
| | Object-glasses, 12 lines in diameter, | 12 50 |
| | " 15 " " | 13 50 |
| | " 17 " " | 15 00 |
| | " 19 " " | 17 00 |
| 1536. | OPERA GLASS, (Bardou's), the same in all respects as 1535, with addition of richly gilt trimming at top and bottom of bodies. | |
| | Object-glasses, 12 lines in diameter, | 13 50 |
| | " 15 " " | 15 00 |
| | " 17 " " | 16 00 |
| | " 19 " " | 17 50 |

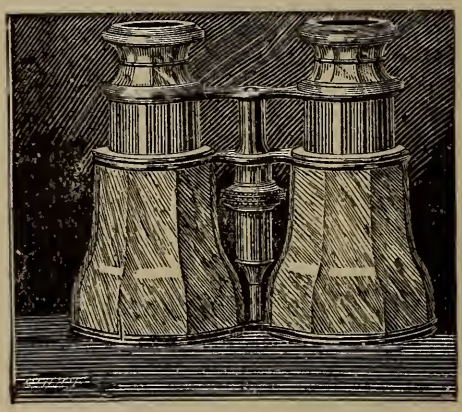
## PEARL OPERA GLASSES.

| | | |
|---|---|---|
| 1540. | OPERA GLASS, (Lemaire's), tubes and cross-pieces richly gilt metal, tops and bodies of the finest pure white Pearl, in fine soft Leather case; elegant glasses. | |
| | Object-glasses, 11 lines in diameter, | 10 00 |
| | " 13 " " | 12 00 |
| | " 15 " " | 13 50 |
| | " 17 " " | 15 00 |
| | " 19 " " | 17 50 |
| 1541. | OPERA GLASS, (Lemaire's), tubes and cross-pieces richly gilt metal, tops and bodies of superb iridescent Oriental Pearl, in fine Leather case; magnificent glasses. | |
| | Object-glasses, 11 lines in diameter, | 12 00 |
| | " 13 " " | 13 50 |
| | " 15 " " | 15 00 |
| | " 17 " " | 17 50 |
| | " 19 " " | 20 00 |

No. Price.

1542. Opera Glass, (Lemaire's), tubes and bottoms of metal, richly gilt, cross-pieces nickel-plated, tops and bodies of rich dark colored Pearl; very elegant, in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 13 | lines in diameter, | . . . . . | $15 00 |
| " | 15 | " " | . . . . . | 17 00 |
| " | 17 | " " | . . . . . | 20 00 |
| " | 19 | " " | . . . . . | 22 50 |



Nos. 1540–1545.

1543. Opera Glass, (Lemaire's), tops, tubes and cross-pieces all black metal, bodies of black Pearl; very rich, in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 13 | lines in diameter, | . . . . . | 10 00 |
| " | 15 | " " | . . . . . | 11 50 |
| " | 17 | " " | . . . . . | 13 50 |
| " | 19 | " " | . . . . . | 15 00 |

1545. Opera Glass, (Bardou's), tubes and cross-pieces of richly gilt metal, tops and bodies of the purest white Pearl; the most elegant glass in the market, in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 12 | lines in diameter, | . . . . . | 20 00 |
| " | 15 | " " | . . . . . | 21 00 |
| " | 17 | " " | . . . . | 22 50 |
| " | 19 | " " | . . . . | 25 00 |

## ALUMINIUM OPERA GLASSES.

The wonderful lightness of this metal admirably adapts it for use in the frames and bodies of *Opera* and *Field Glasses*, no fatigue attending their continued use for hours.

1550. Opera Glass, Aluminium Frame, bodies covered with finest black Calfskin or dark-colored Russia Leather, tops and cross-pieces black, tubes and milled edges Bright Metal, in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 15 | lines in diameter, | . . . . . | $18 50 |
| " | 17 | " " | . . . . . | 22 00 |
| " | 19 | " " | . . . . . | 25 00 |
| " | 21 | " " | . . . . . | 28 50 |

1551. Opera Glass, Aluminium Frame, bodies covered with finest black Calfskin, tops, tubes and cross-pieces all Bright Metal, very handsome; in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 15 | lines in diameter, | . . . . . | 20 00 |
| " | 17 | " " | . . . . . | 23 50 |
| " | 19 | " " | . . . . . | 27 00 |
| " | 21 | " " | . . . . . | 30 00 |

No. Price.

1553. Opera Glass, Aluminium Frame, bodies covered with the finest dark colored Russia Leather, tops, cross-pieces and tubes all of Bright Metal, very rich and elegant; in soft Leather case.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 15 | lines in | diameter, | $21 00 |
| " | 17 | " | " | 24 00 |
| " | 19 | " | " | 27 50 |
| " | 21 | " | " | 31 00 |

## ALUMINIUM FIELD OR MARINE GLASSES.

1555. Marine or Field Glass, Aluminium Frame, bodies—4½ inches long when closed, 5 inches long when fully extended—covered with the finest black Calfskin, tops and cross-pieces black, tubes Bright Metal, with Sun-shades; in stiff Leather case, with sling.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 19 | lines in | diameter, | 32 50 |
| " | 21 | " | " | 36 00 |
| " | 24 | " | " | 43 00 |
| " | 26 | " | " | 47 50 |

1556. Marine or Field Glass, Aluminium Frame, the same size as 1555; bodies covered with finest black Calfskin, tops, tubes and cross-pieces all Bright Metal, very handsome, with Sun-shades: in stiff Leather case, with sling.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 19 | lines in | diameter, | 35 00 |
| " | 21 | " | " | 39 00 |
| " | 24 | " | " | 45 00 |
| " | 26 | " | " | 50 00 |

1557. Marine or Field Glass, Aluminium Frame, bodies—4¾ inches long when closed, 6 inches long when fully extended—covered with the finest black Calfskin, tops and cross-pieces all black, tubes of Bright Metal, with Sun-shades; in stiff Leather case, with sling.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 19 | lines in | diameter, | 35 00 |
| " | 21 | " | " | 40 00 |
| " | 24 | " | " | 45 00 |
| " | 26 | " | " | 50 00 |

1558 Marine or Field Glass, Aluminium Frame, the same size as 1557; bodies covered with finest black Calfskin, with Sun-shades, tops, tubes and cross-pieces all Bright Metal, very elegant; in stiff Leather case, with sling.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 19 | lines in | diameter, | 37 50 |
| " | 21 | " | " | 41 00 |
| " | 24 | " | " | 47 00 |
| " | 26 | " | " | 52 50 |

1559. Marine or Field Glass, Aluminium Frame, with hinge to adapt for various widths between eyes, the same size as 1555; bodies covered with finest black Calfskin, with Sun-shades, tops, tubes and cross-pieces all Bright Metal; the most elegant glass made; in stiff Leather case, with sling.

| | | | | |
|---|---|---|---|---|
| Object-glasses, | 17 | lines in | diameter, | 37 50 |
| " | 19 | " | " | 42 00 |
| " | 21 | " | " | 47 00 |
| " | 24 | " | " | 52 50 |
| " | 26 | " | " | 57 50 |

# SPECTACLES AND EYE-GLASSES.

## INTRODUCTION.

In no branch of Surgery has more advance been made of late years than in that department which treats of imperfections in vision. The careful study of the various portions of the Eye, and the introduction of the use of the Ophthalmoscope, have led to many important discoveries, and the Ophthalmic Surgeon, in order to carry out his necessary prescriptions, has rightly demanded of the Manufacturing Optician that he should pay some attention to the Scientific Construction of Spectacles. Nothing tends more to injure the sight than wearing improper glasses, especially concave ones, whilst nothing preserves vision more than the use of suitable ones.

With a view to make this Part of our Catalogue practically useful, we have given herewith short descriptions of the anatomy of the Eye, and of some of the more frequent forms of defective vision which may be assisted by the use of glasses; and for the convenience of persons residing at a distance we have printed a set of Test Types, and have given a series of queries, accurate answers to which will enable us to supply glasses suited to most imperfections of vision, whilst we have also enumerated some of those Complaints for any of which the patient should at once consult the Oculist, whose directions we are always ready to carry out.

The Illustrations, which have been engraved with great care, will give an idea of the various forms and patterns of the Frames of our Spectacles and Eye-Glasses, whilst the quality of the Glasses with which they are glazed is uniformly *First Class* only. We sell no others, at retail. Spectacles should be made to fit firmly on the face without pinching; much of the comfort attending their use depends on their so doing; and the more complete the information given as to the shape of the head, the better are we enabled to suit the patient.

Fig. II.

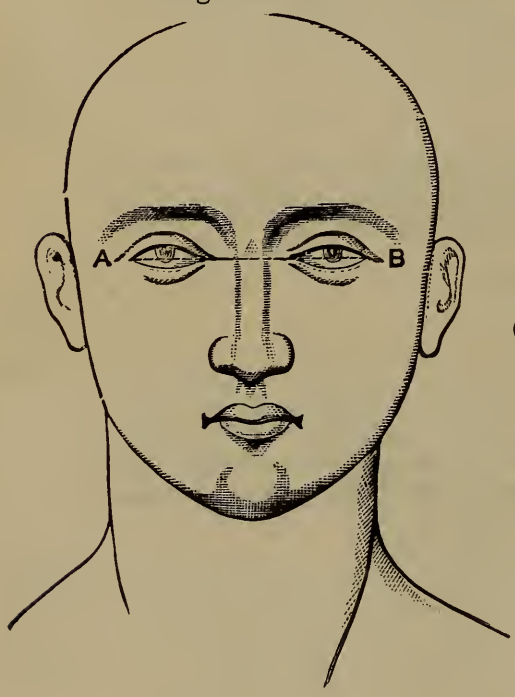
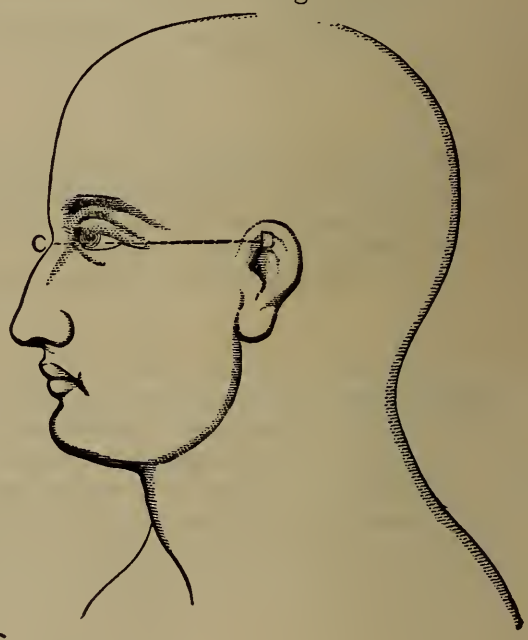
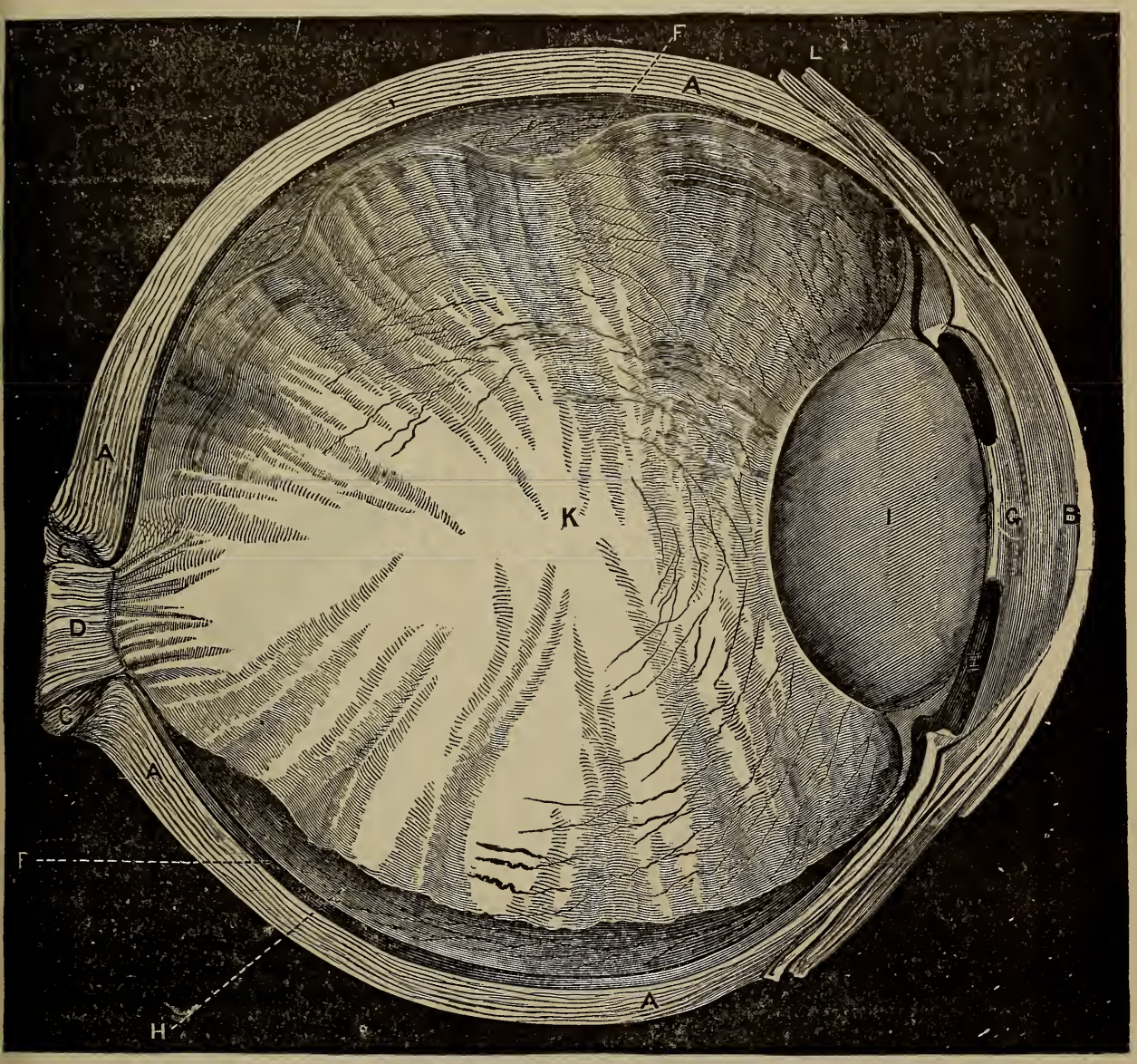



Fig. III.





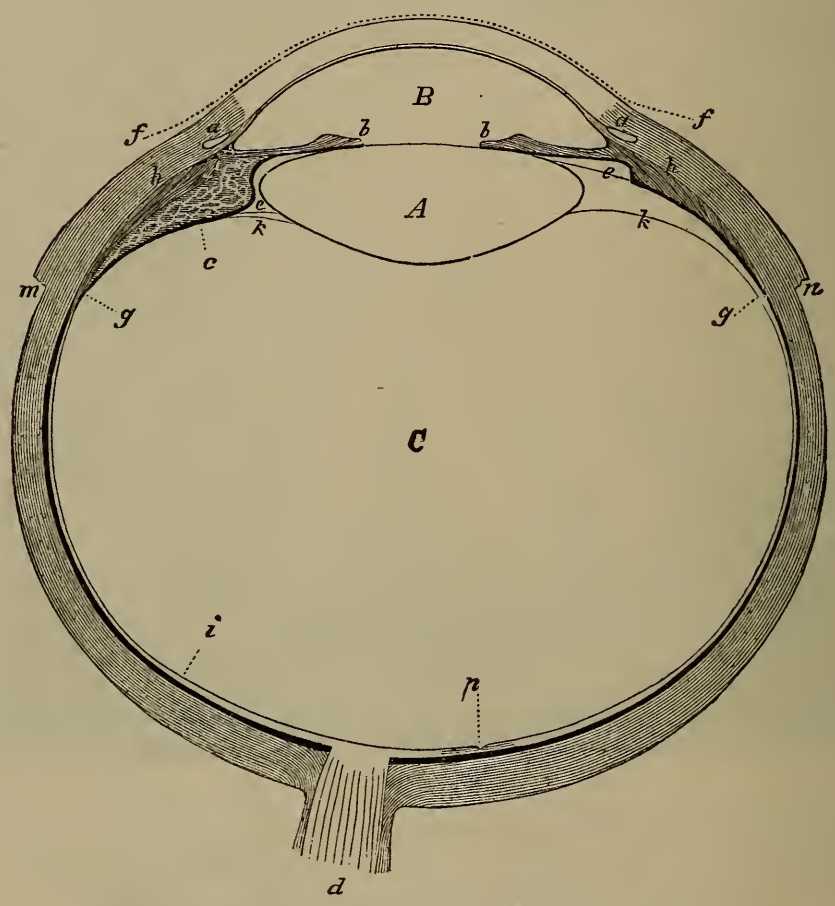

MAGNIFIED VIEW OF A SECTION THROUGH THE MIDDLE OF THE EYE. A, SCLEROTIC COAT; B, CORNEA; I, CRYSTALLINE LENS; K, RETINA; F, CHOROID COAT; D, ENTRANCE OF OPTIC NERVE.

# THE EYE.

We undoubtedly derive more of our knowledge of the world about us through the agency of sight, than through any other member of the group of our special senses, but, although of such great importance to us all, there are comparatively few persons who have definite ideas concerning the eye, either as to its structure or the manner in which it aids in the production of vision.

In the following pages will be found a concise description of the eye itself, and explanations of its mode of action in health, together with a brief outline of the abnormal conditions, which we, as opticians, are called upon to treat.

## ANATOMY OF THE EYE.




SECTION OF A DIAGRAMATIC EYE (AFTER HELMHOLTZ.)

The shape of the eyeball is nearly spherical, with a diameter of almost one inch; viewed from the side, however, we find it to be composed of parts of two spheres, the smaller one being formed of the transparent cornea (F), which projects forward. as may be readily seen in looking at any eye from the side.

The eye is provided with six muscles: two pulling it to the right or left, two up or down, while the remaining two rotate the ball obliquely, at the same time drawing it either up or down. Each eye is provided with its own set of muscles but these act in unison, thus causing both eyes to be directed simultaneously to any object which we view.

f. *The Cornea.* This is the transparent front, through which the "color" of the eye is seen; although it appears clear and structureless, yet under the microscope it shows a complicated structure. The cornea is the first part of the refractive system of the eye.

m. *The Sclerotic* coat is the thickest tunic or covering of the eyeball, and forms the "white" of the eye. It is a tough, elastic membrane, and is well calculated to give form to the organ and protection to the more delicate parts within.

b. *The Iris* is a thin, muscular curtain which hangs in front of the lens (A), and serves the purpose of a diaphragm, cutting off all superflous light. It is perforated in the centre, thus leaving a circular opening known as the "*Pupil.*" The iris is variously tinted, thus causing the diversity in the "color" of eyes; the pupil forms the "black" of the eye. As the iris contracts the pupil becomes smaller, and, on the contrary, as the former dilates, the latter enlarges; this change in size being regulated by the amount and intensity of the light which passes into the eye—the greater the amount of light, the smaller the pupil.

g. *The Choroid* coat is the second tunic of the ball; it is quite thin, and it is the vascular coat of the eye, containing hundreds of minute tortuous blood-vessels. On its inner surface it is covered with a dense layer of black pigment, which absorbs all light which falls upon it, and thus prevents reflection. In many animals, as the cat, tiger, etc., a certain portion of the choroid, called the tapetum, is devoid of this pigment, and has a metallic lustre instead; the reflection of light from this spot gives rise to the well-known glare of the eyes of these animals when approached with a light in the dark.

A. *The Crystalline Lens* is a perfectly transparent, highly refractive body, shaped like a biconvex lens, with the curve of its posterior surface slightly greater than that of the front; it is supported between the iris and the vitreous humor. The lens is capable of having the convexity of its surfaces increased or diminished by the action of the ciliary muscle (H), which change is of the greatest importance, since it enables us to "accommodate," that is, to see far and near objects equally well.

h. *The Ciliary* muscle is a delicate band of muscular tissue, which forms a complete circle, lying just behind the iris. Although small and insignificant in appearance, it is a very essential part of the eye, as by its action, contracting now more, then less, the convexity of the lens is increased or diminished according to the necessity of the moment.

B. *The Anterior Chamber* is the space between the cornea in front, and the iris and lens behind. It is filled with a clear fluid, known as the *aqueous humor.*

C. *The Vitreous Humor* is a transparent, colorless, gelatinous mass, occupying the portion of the ball back of the iris; its principal function is to aid in bringing rays of light to an accurate focus on the retina, and also to contribute to the solidity of the eye.

i. *The Retina* is the nervous portion of the visual organ, and is the part on which the pictures of external objects are received, and thence transmitted through the *optic nerve* (D), to the brain. It is, in health, a very delicate, transparent membrane, of a very highly complicated and intricate structure, in which

very minute nerve fibres from the *optic nerve* and cells form an important part. Not all portions of the retina are equally sensitive, but at one point only—the *macula lutea*, or yellow spot, (p), are sharp and distinct images of objects formed, and, in order to obtain clear images, we instinctively direct our eyes so that the rays coming from the object fall exactly on this sensitive spot.

After having thus briefly considered the structure of the eye, a few remarks on the part which it plays in producing distinct vision, may not be amiss.

The rays of light coming from any object on this earth are, in reality, divergent, since only rays coming from an infinite distance are parallel; practically, however, all rays coming from objects 20 feet or more away may be considered as *parallel;* those coming from objects nearer than 20 feet are *divergent.*

From an optical standpoint, and that one we have chiefly to consider, the eye is but a camera obscura or dark chamber; in principle, just the same as the one employed by the photographer. The refractive media of the eye—cornea, aqueous humor, lens and vitreous body—form the lens of the camera; the iris, the diaphragm; the interior of the eye, the camera itself; and the retina, the sensitized plate. Since the cornea and aqueous humor, and the vitreous humor are almost identical in refractive power, we can consider the refractive system of the eye as a simple biconvex lens. Now, glancing at the cut, we see the course of the rays of light from external distant objects till they fall on the retina.

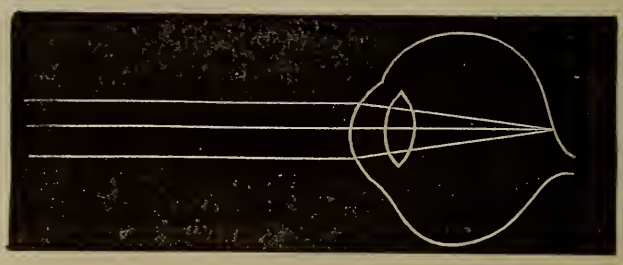


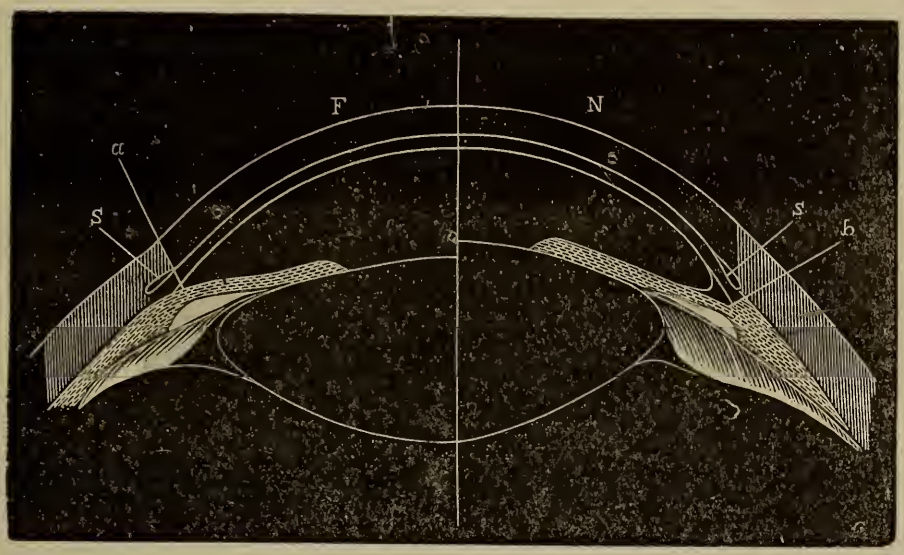
DIAGRAM OF NORMAL EYE.

The parallel rays coming from some distant object, fall on the cornea, pass through the lens and are bent from their course so that they come to a focus on the retina, where a distinct image is formed, and the visual impression conveyed to the brain by the optic nerve.

It is evident, that rays coming from an object, say 20 feet away, and those from an object 20 inches, cannot be brought to a focus at the same point by the same lens, and so it would be with our eyes had we not the power of increasing or diminishing the convexity of our lenses. This change is constantly taking place without our knowledge, if our eyes be healthy, but that it actually does take place is easily proven.

If a piece of netting be held 12 or 14 inches in front of the eyes, and the gaze be fixed intently on some distant object, as long as this is clearly seen, the meshes of the netting will be indistinct; while if these be accurately seen, the distant object is no longer clearly in view; in other words, in bringing our gaze from the far to the near object there has been a change in convexity of our lenses, this being greater for near and less for distant objects.

This power of changing the form of the lens by the action of the ciliary muscle, is known as the "accommodation," while that of bringing the rays of light to a focus on the retina is called the "refraction" of the eye.

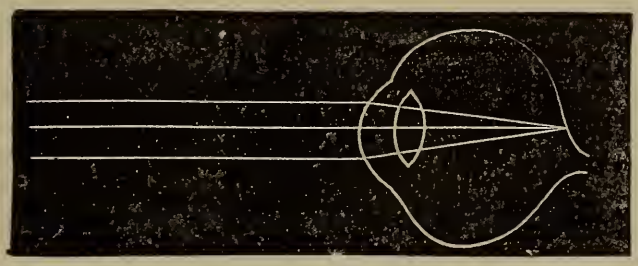



This alteration in the curvature of the lens is shown in the cut, which represents a horizontal section of the anterior part of an eye, the left half of the figure represents the eye when accommodated for distant objects; the right half, when adjusted for small print held as close as possible.

The conditions of the eye which necessitate the use of glasses in order to obtain perfect vision are either those of imperfect refraction or accommodation.

In regard to the state of the refraction, or of the power of bringing rays of light to a focus on the retina, all eyes may be classed under one of three heads: Emmetropic or normal, Myopic or near-sighted, and Hypermetropic.

## THE EMMETROPIC EYE.



EMMETROPIC EYE.

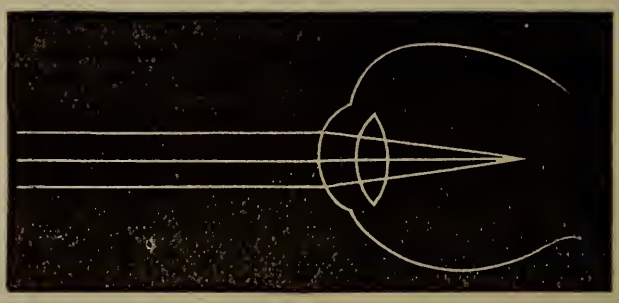
In the Emmetropic or normal Eye, the rays from a distant object are brought to a focus exactly upon the retina, thus giving a distinct image without any artificial aid.

In order to ascertain whether an eye be normal in respect to its optical performance, certain tests are employed, similar to those given on pages 121–124. A normal eye should be able to distinguish readily the letters of No. X at 10 feet, or those of No. XX at 20 feet; this test determines the "acuity" of vision. The condition of the accommodation must next be tested; this is done by finding the *nearest* and *farthest* points at which type as No. 1 can be *distinctly* seen; this gives the "near" and "far" points.

The "far" point remains fixed until about the 45th year, when it gradually recedes. The "near" point, on the contrary, is changing constantly with the advance of life. A child of 10 years should be able to read No. 1 as close as 2½

or 3 inches; a man of 21 years, at 3½ to 4 inches; one of 40 years, at 8 or 9 inches, while a person of 60 years will not be able to see print closer than 24 or 30 inches.

## MYOPIA; OR NEAR-SIGHTEDNESS.



MYOPIC EYE.

It has already been stated that this defect depends upon the refractive condition of the eye; it is that condition in which the rays from distant objects come to a focus *in front* of the retina, and consequently the latter receives but the blurred and indistinct image of external objects. A glance at the cut will explain this. Myopia is usually due to an abnormal lengthening of the eyeball, thus causing the retina to recede from the point where the rays come to an accurate focus. It is a disease which often exists from birth, and is frequently hereditary; but, although frequently this condition is present from birth, and manifests itself in later life, no doubt, many cases are developed by excessive use of the eyes at fine "near work," such as reading or sewing, before the coats of the eye have become fully developed and hardened. Statistics show that the percentage of Myopia increases in proportion to intellectual development, and, that while it may be quite small in the lowest grades of schools, it steadily gains in numbers as the course of study becomes higher, until, in the colleges and universities it reaches a very large percentage.

Among the prolific causes of the development of this disease, is the habit of reading with the head bent forward and over the book, thus preventing the free circulation of the blood, and causing a congestion of the eyes, which tends still further to stretch the coats of the perhaps already weakened organ. The habit of reading with insufficient illumination, or in a reclining posture, is also most injurious.

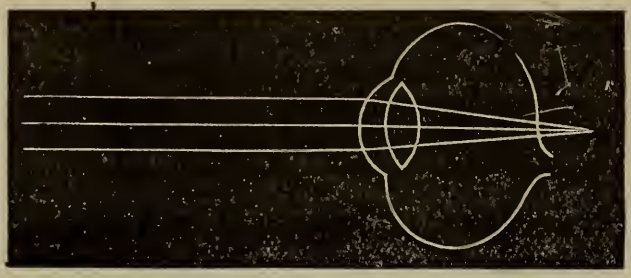
The popular belief that near-sighted eyes are strong ones is not only absolutely incorrect, but also most mischievous, since there is no state of the eye which more urgently demands the use of a proper glass, than does Myopia. Such eyes instead of being strong, are not only absolutely weak, but they are sick eyes, and, if the defect be of a high degree, liable to the most serious accidents, which may result in loss of sight. The danger lies not in the imperfect vision, but in the interocular changes which accompany the defect in its higher grades, and which often are progressive.

Myopic eyes are often very prominent ones, seeming too large for their sockets. Indistinct distant vision, and in reading, holding the print close to the eyes, are the chief symptoms of this defect.

The treatment of near-sightedness is the use of the proper *concave* glasses. By this we hope to attain two objects. The rays are brought to a focus on the retina, and thus distinct vision is insured; and, by wearing the proper glasses, the disease may usually be arrested. In cases where the defect is slight, the cor-

recting-glasses can be given by a good optician, care being taken to select the *weakest* concave lens with which vision is normal; where, however, the defect is high, the advice of an oculist should be sought, who, after careful measurement, will prescribe the proper glasses. These, with the strict observance of the hygienic conditions in regard to posture and illumination, will usually check the progress of the disease.

## HYPERMETROPIA.



HYPERMETROPIC EYE.

This defect is dependent on a condition of the eye exactly the reverse of Myopia. It is the condition in which the rays from distant objects come to a focus *behind* the retina. A glance at the cut will explain this condition. Hypermetropia is due to a formation of the eye, which is present from birth. It is also hereditary, being transmitted through entire families. Hypermetropic eyes are usually flat and shallow in appearance.

Although present from birth, it is often, unless of a high degree, not manifested until the duties of the school-room begin, and, in the slighter grades, it may not be noticed until adolescence or middle-life; nevertheless, the defect has existed all the while, but it has been masked and overcome by the exertions of the little ciliary muscle. Distinct vision is one of the instincts of our senses, and our eyes unconsciously adjust themselves so as best to secure it. As we have before seen, any change of the convexity of the lens is effected by the action of the ciliary muscle; now, since the focus for the rays falls behind the retina, the convexity of the lens of the eye must be increased in order to bring the focal point on the retina, and hence the little muscle is called upon to do the work; but, since this condition of the eye is permanent, so also this muscular contraction is almost constant while the eyes are employed. Besides this constant exertion, the muscle must also act with vigor enough to give the ordinary power of accommodation for near objects.

In youth the ciliary muscle is in its greatest vigor, and it then overcomes this defect even when of considerable degree, but as age advances the power of the muscles diminishes, and then it is that the defect begins to manifest itself.

The boy has passed through school without the slightest cause to suspect himself the possessor of hypermetropic eyes; college is entered, and increased study is necessary. After reading for some time, he now experiences a sense of fatigue about the eyes; he stops and passes his hand across his closed eyes for a few moments, then resumes his study; after a few minutes the same is repeated; in a few months, he is, perhaps, troubled with headaches and pains across the brow and above the eyes; these themselves feel heavy and ache after the duties of the day, and so the symptoms progress until a half-hour's study is purchased at the price of hours of discomfort.

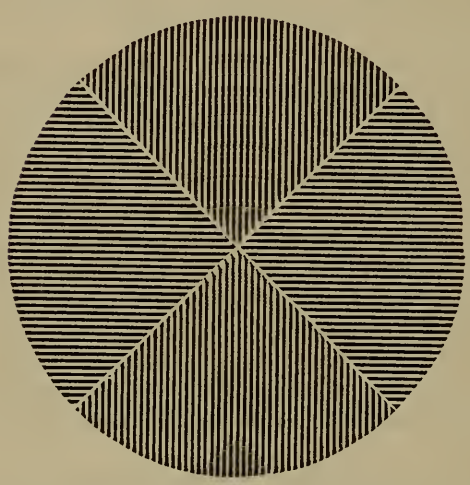
In the higher degrees of Hypermetropia, reading, or other fine work, is often impossible for periods of longer than a few minutes, the page becoming misty, the letters running into each other, and everything appearing blurred.

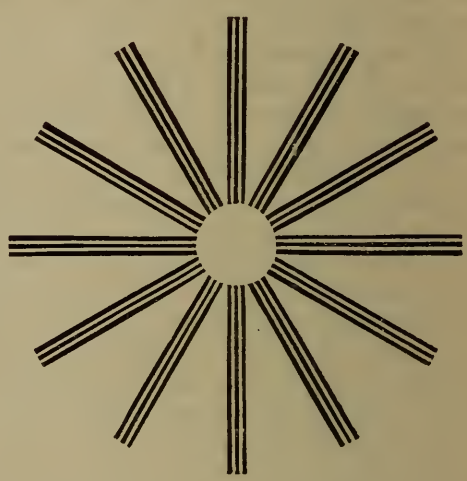
The cause of all these symptoms is the overstrain and eventual exhaustion of the ciliary muscle. So long as it is able to accomplish its excessive task, it overcomes, or rather masks the defect, but as soon as its powers gives out, the accommodation fails and indistinctness of near objects results, in addition to which we have the long train of distressing symptoms which arise from the overstrain; many an obstinate headache has its source in an unrecognized Hypermetropia!

Since in this state of the eye the focus falls behind the retina, the remedy is found in a glass which will increase the refractive power of the eye, thus bringing the focus of the rays of light *on* the retina: such a result is obtained by the proper *convex* glass. As, however, the ciliary muscle is able to mask a certain amount of the defect, even after it has become apparent, the convex lens which most improves distant vision, will correct but the portion of the Hypermetropia which is "manifest," and, indeed, frequently the patient may reject all convex glasses as failing to improve his distant vision, and yet be hypermetropic to a considerable degree.

The glass which corrects the manifest defect will often greatly conduce to the patient's comfort, yet to select the glass which will correct the entire defect, the accommodation of the eye must be temporarily suspended by putting the ciliary muscle at rest by means of a solution of atropia, when the entire defect becomes apparent and may be carefully measured by the oculist.

## ASTIGMATISM.

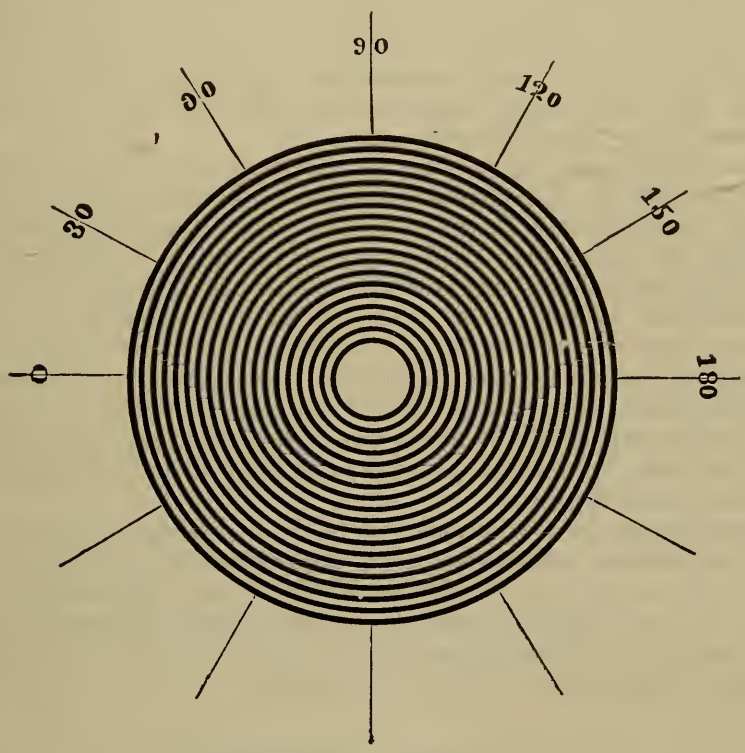




Although this defect is very common, yet not until the last few years were its frequency and importance fully recognized. Astigmatism is a condition in which the curvature of the cornea varies in the different meridians. On examining an ordinary lens we find that all parts of its surface have an equal curvature, and so it should be in a normal cornea; but in an astigmatic eye it is not so, since the vertical curvature differs from the horizontal, thus producing asymmetry of the refractive part of the eye, and, as a result, rays falling on such an eye are not all brought to a single focus, but those in one meridian fall either before or behind the retina, or focal point of the other meridian, thus causing a confused and indistinct picture of the object viewed. Astigmatism is either Myopic or Hypermetropic; it may also be "mixed"—the eye being Myopic in one, and Hypermetropic in another of its meridians.

Vision in astigmatic eyes is usually impaired both for distant and near ob-

jects, since at no point can a distinct image be obtained; but the distinguishing feature of this defect is the fact that certain groups in a series of lines and circles, such as represented in the figures on pages 136 and 137, are seen with more distinctness and blackness than any others. Astigmatism has frequently




been discovered by looking at a clock, it being noticed that when the hands were at certain figures, say III and IX they were seen with difficulty, while when at VI or XII they were distinctly seen.

In the treatment of Astigmatism, recourse must be had to *cylindrical lenses*, as the ordinary lenses would not correct the defect. Since the correcting glasses for Astigmatic eyes are frequently combinations, these lenses are always ground according to formula to correct the defect of each individual eye, which can only be determined after careful measurement.

## PRESBYOPIA.

Presbyopia, "far sight," or "old sight," is an accompaniment of the later years of life; it is a physiological or natural, not an abnormal change, and affects all eyes.

This condition depends almost solely upon the failure of the accommodation, due to a gradual hardening of the lens and decrease of the power of the ciliary muscle as age advances. Although this decrease in the power of adjustment for near objects is not noticed until, perhaps, the 40th or 45th year, yet, from the age of nine or ten, the accommodation is gradually growing weaker, that is, fine print can no longer be seen as close to the eye as formerly.

As soon as the "near point" for small type passes beyond 8 inches, we consider Presbyopia to have set in.

Difficulty in reading fine print or in threading the needle at night are among the first symptoms usually noticed; the page must be held further from the

eyes, and more strongly illuminated; while small type is with difficulty seen. These symptoms usually first show themselves at night, while reading or working by artificial illumination, but gradually they manifest themselves likewise in the daytime.

All eyes undergo these changes producing Presbyopia; we frequently, however, hear of persons, ripe in years, who have never felt the necessity of glasses for reading or other fine work, and whose "strong" eyes are their especial pride. Such persons have been near-sighted, probably, all their lives, their defect neutralizing the normal changes taking place; a weak concave glass before such eyes will usually improve distant vision.

The popular opinion that the use of glasses should be postponed as long as possible, is erroneous. As soon as unpleasant feelings denote the approach of Presbyopia, glasses should be resorted to at once, as the longer the eyes are deprived of the aid which they need, and consequently are subjected to strain, the more rapidly will the changes in the eye become developed.

The treatment of Presbyopia is found in convex glasses, of such strength that fine print may be seen readily at 7 to 8 inches. Here such a glass is employed not to correct the refraction, as in the case of the convex lenses in Hypermetropia, but to aid the power of the eye in accommodating. Presbyopia, in a perfectly healthy eye, does not affect the sharpness of distant vision, although in extreme old age, distant vision also is somewhat diminished, owing to other changes which affect the eye.

The glasses should be used at first only while reading by lamp or gaslight. When the unpleasant sensations show themselves also in the day-time, then the glasses previously worn at night should be used for reading by daylight, and their place supplied by a pair of slightly stronger glasses for night-work. In old persons, when distant vision is improved by weak convex glasses, those of the proper strength may be worn constantly.

## MUSCULAR AFFECTIONS.

Besides the defect depending upon refraction and accommodation, there is a group of eye troubles caused by a want of harmony in the actions of the various muscles by which the eyes are moved, some of which conditions are greatly benefited by the use of a properly ground glass.

The most frequent condition giving rise to fatigue and weariness of the eyes when used at near work, is that in which there is a want of balance between the power of the muscles which move the eyes outwards, and those which draw them together, the latter muscles being too weak to accomplish their task without fatigue; this condition is technically termed Insufficiency of the Interni.

Benefit is usually derived from wearing glasses on which are ground prisms, with their bases turned towards the nose, by means of which the image is displaced, it appearing to be further away, and consequently not requiring the eyes to be converged to the same degree as without them. This condition is also very frequently associated with one of the defects which we have already described; it is then aided by having the glass so ground as to combine the action of both lens and prism.

When there is an absolute breach in the harmony between the muscles, we have Diplopia, or double vision, produced; two images of objects being seen, owing to the pictures of the objects falling on dissimilar points of the retina of each eye.

This condition usually is due to the failing of the power of one or more muscles, and it often denotes very grave disease, situated in the brain or nerves. Under such circumstances, it is evident that the treatment must be

directed to the deep-seated cause of the disease, and that local means as applied to the eye can only relieve, not cure.

When the double images are very marked, by wearing a shade or opaque glass over one eye, we obviate this very annoying symptom; where the images are but very slightly separated, the temporary use of a proper prismatic glass will afford relief.

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# TEST-TYPES.

The following "Test-Types" will enable persons to give information that will greatly assist us in supplying glasses suited to their sight:—

The paper should be held with a good light falling upon it: if by daytime, the person should place himself with his back to a window; or if by artificial light, with the full illumination falling on the page, but not on the Eyes.

Each eye to be tested separately.

## PARTICULARS REQUIRED BEFORE SUPPLYING GLASSES.

What is the *extreme* distance in feet and inches at which you can read Test-Types Nos. 1, 2, 4, 6, 10, 20?

What is the *nearest* distance in feet and inches at which you can read Test-Types Nos. 1, 2, 4, 6, 10, 20?

Have you ever used glasses before?

If so, did they make your eyes ache?

Are the Spectacles required for Reading or Walking?

What is the distance from the *centre* of one pupil to the *centre* of the other, (from A to B, Fig. 11, page 132); measure with a tape or rule across the nose.

Is the bridge of the nose prominent or not?

## AN ASCENT TO THE SUMMUT OF MOUNT BLANK.

### No. 1.

*An Assent to the Summut of Mount Blank.*—It was on the 1st of August—I remember by my wags cumming dew, and I wanted to be riz,—that Me and master maid our minds up to the Mounting. I find Master as oppend an acount with the Keep Seck—but as that is a cut abov. aud rit in by only Lords and Laddies, I am redeuced to a Peer in the pagis of the Comick Anual--Mr H giving leaves.

Wile we waited at Sham Money, our minds sevral tims misgiv, but considdring only twelve Gentlemen and never a footmun had bin up, we determind to make ourselves particler, and so highered gides to sho us up. For a long tim the whether was dout full weather — first it snew — then thew — and then friz—and that was most agrecabil for a tempting. The first thing I did was to change my blew and wite livry, as I guest we shood have enuf of blew and wite on the mounting—but put on a dred nort for fear of every thing—takin care to hav my pokets well cramd with sand witches, and, as proved arterwards, they broke my falls verry much when I slipd on my bred and ams. The land Lord was so kind as lend me His green gaws tap room bliud for my eyes, and I recumend no boddy to go up any Snowhill without green vales—for the hice dazls like winkin. Sum of the gides wanted me to ware a sort of crimpt skaits,—but thoght my feet would be the stifer for a cramp on—and declind binding any think xcept my list garters round my Shews. I did all this by advize of John Mary Cuthay the Chief Gide, who had bin 8 tims up to every think. Thus a tired we sit out, on our feat, like Capting Paris, with our Nor poles in our hands.—Master in verry good sperrits, and has for me I was quit ellivatted to think what a figger the Summut of Mount Blank wood cut down the airys of Portland Plaice.

### No. 2.

Arter sliping and slidding for ours, we cum to the first principle Glazier. To give a correct noshun, let any one suppose a man in fustions with a fraim and glass and puttey and a dimond pensel, and it's quit the revers of that. It's the same with the Mare of Glass. If you don't think of a mare or any think maid of glass you have it xactly We was three ours gitting over the Glazier, and then come to the Grand Mullets, ware our beds was bespoak—that is, nothing but clean sheats of sno,—and never a warmin pan. To protect our heds we struck our poles agin the rock, with a cloath over them, but it looked like a verry litle tent to so much mounting. There we was,—all Sno with us Sollitory figgers atop Nothink can giv the sublime idear of it but a twelf Cake. The Gides pinted out from hear the Pick de Middy, but I was too cold to understand Frentch—and we see a real Shammy leeping, as Master sed, from scrag to scrag, and from pint to pint, for vittles and drink—but to me it looked like jumpin a bout to warm him self. His springs in the middel of Winter I realy beleave as uncredible. Nothink else was muving xcept Havelaunches, witch is stupendus Sno balls in high situations, as leaves their plaices without warnin, and makes a deal of mischef in howses and families. We shot of our pistle, but has it maid little or no noise, didn't ear the remarkably fine ekko.

No. 3.

We dind at the Grand Mullets on cold foul and a shivver of am, with a little O de Colon, agen stomical panes. Wat was moor cumfortble we found half a bottel of brandey, left behind by sum one before, and by way of return we left behind a little crewit of Chilly Viniger for the next cummer, whoever he mite be or not. After this repass'd, we went to our subblime rests, I may say, in the Wurld's garrits, up 150 pare of stares. As faling out of Bed was dangerus, we riz a wal of stons on each side. Knowing how comfortble Master sleeps at home, I regretted his unaccommodation, and partickly as he was verry restless, and evry

No. 4.

tim he stird kickd me about the Hed. I laid awack a good wile thinking how littel Farther, down in Summerset Sheer, thoght I was up in Mount Blank Sheer; but at long and last I went of like a top, and dremt of Summuts. Won may sleep on wus pillers than Nap Sacks. Next mornin we riz erly, having

No. 5.

still a good deal to git up, and skrambled on agin, by crivises and crax as maid our flesh crawl on hands and nees to look at. Master wanted to descend in a crack, but as he mite not git up in a crack agin, his letting himself down

No. 6.

was unrecomended. Arter menny ours work, we cum to the Grand Plato. Master called it a vast Amphi-Theater; and so it is, except Du-Crow and the Horses and evry thing. Hear we brekfisted, but

No. 7.

**was sirprizd at our stomicks not having moor hedges, Master only eting a Chickin wing, and me only eting all the rest.**

No. 10.

**We had littel need to not eat, --- the most uneasy part to go**

No. 20.

APORFD

No. 30.

EZBA

No. 50.

PTEH

## TO OCULISTS.

Having unsurpassed facilities for the careful and accurate filling of prescriptions of all characters, *at the shortest notice*, and at *prices much more reasonable* than those heretofore prevailing, we solicit the same of you, with our guarantee of giving perfect satisfaction.

We glaze cylindrical and prismatic lenses to Eye-glass frames of any form, and in order to allow your patients at a distance to choose what may suit their fancy, will send by mail several pairs for selection.

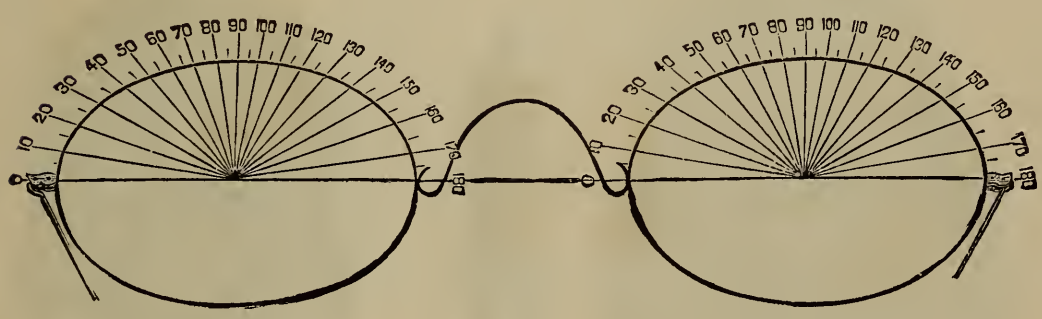
We will also furnish to Oculists blank prescription papers as below, which will merely require filling up with the figures of the formula and name of the patient.

PHILADELPHIA,.....18

## PRESCRIPTION FOR SIGHT.

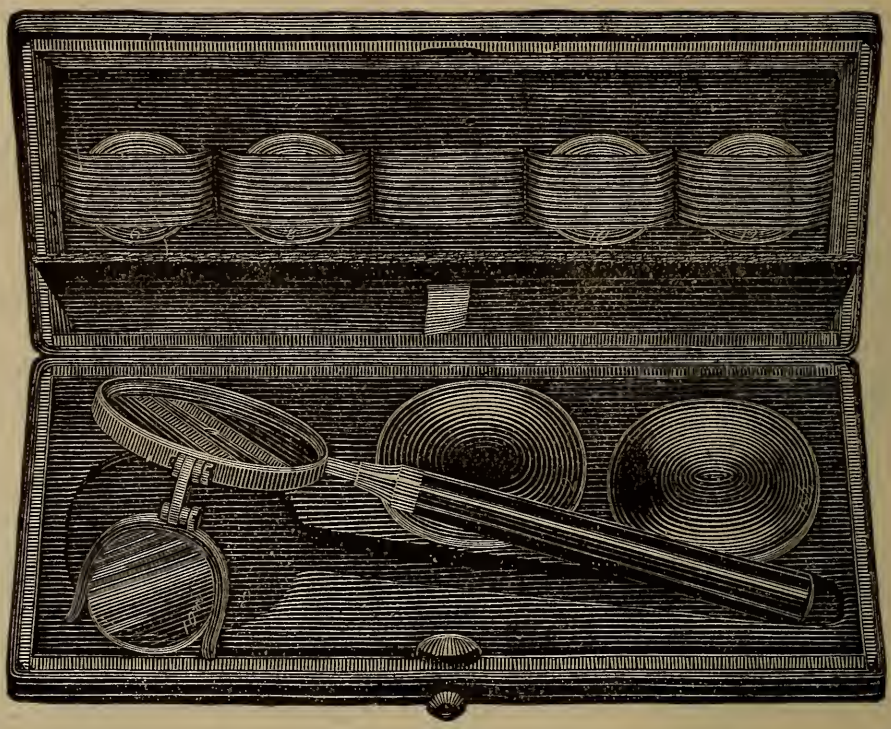
FOR.....

.....

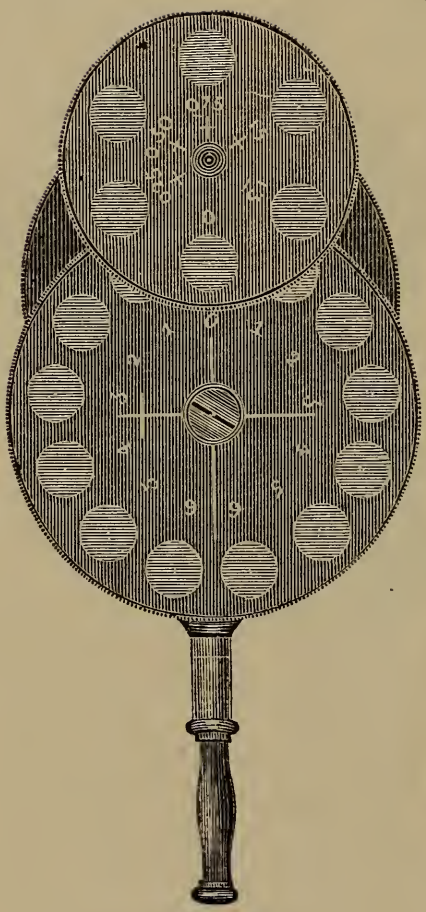



DISTANCE. { R.= L.=

READING. { R.= L.=



No. 2010.



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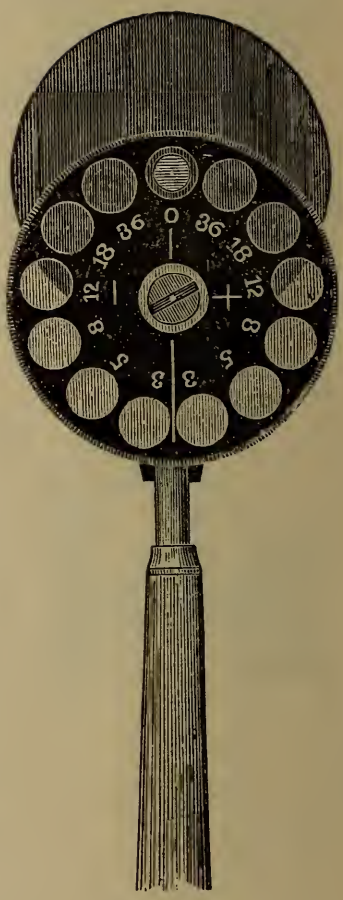


No. 2015.

No. PRICE

2000. THE HUMAN EYEBALL, Enlarged Size, the upper portion of which (containing a microscopical representation of the layers of the retina,) is to be taken off, when the cornea and iris, the lens and the vitreous body may be taken out, . . . . . $6 50

2005. DR. PERRIN'S MODEL OF THE EYE, for the practice and study of the *Ophthalmoscope*, with twelve colored shells, representing normal and diseased conditions of the eye, as seen with that instrument. Packed in handsome Morocco case, . . . . . 25 00

2010. LIEBREICH'S OPHTHALMOSCOPE, with two convex condensing lenses, and a series of five lenses of different foci, fitted to an arm behind the perforated mirror; in Morocco case, . . . 6 00

2012. DR. KNAPP'S OPHTHALMOSCOPE, with two mirrors, 1½ inches in diameter, with revolving disc containing fifteen lenses, eight convex from 2 to 48 inches focus and seven concave from 4 to 48 inches focus, with condensing lens; in Morocco case, . . . 17 50

2014. BECK'S IMPROVED ADJUSTING BINOCULAR OPHTHALMOSCOPE, in fine Morocco case, . . . . . 32 50

2015. LORING'S OPHTHALMOSCOPE, with mirror 1¼ inches in diameter, and revolving disc at back containing twelve lenses, six each convex and concave, of 3, 5, 8, 12, 18, 36 inches focus; double convex condensing lens 1½ inches in diameter in hard rubber frame; in Morocco snap case, . . . . . 14 00

2016. LORING'S OPHTHALMOSCOPE, similar in form and size to No. 2015, with one mirror and one condensing lens, and a series of ten convex and eleven concave lenses of the Dioptric System, set in a revolving disc, covered with metal to preserve them from dust, . 17 50

2017. LORING'S OPHTHALMOSCOPE, similar in size and form to the preceding, but with two mirrors, two condensing lenses of 2¼ and 3 inches focus, and three revolving discs containing a series of twenty-three lenses, convex and concave, from 2 to 60 inches focus, of the Inch System, . . . . . 20 00

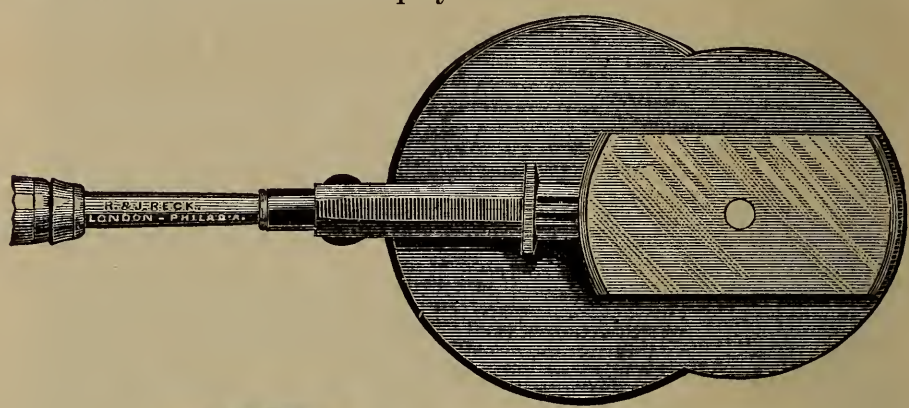
2017*. LORING'S OPHTHALMOSCOPE, the same as 2017, with the addition of a rectangular mirror, swung on two pivots, to tilt both ways to angles of 20° or 25°, which can be readily substituted for the ordinary circular mirror; in snap Morocco case, . . . . 25 00

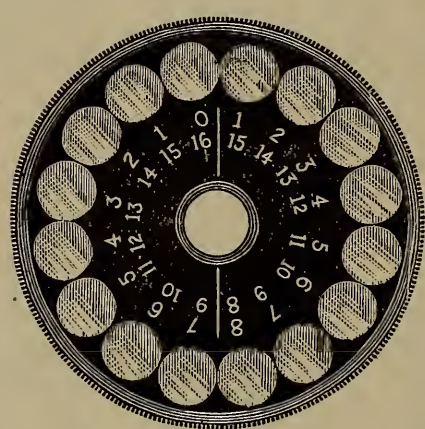
2018. LORING'S NEW OPHTHALMOSCOPE, in Morocco Case, . . . . 35 00
This instrument consists of a disc, and a quadrant of a disc carrying the lenses.

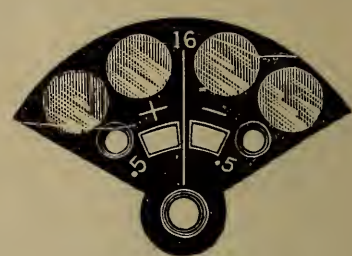
The single disc contains sixteen glasses on the metric system, the plus being numbered in white, and the minus in red. The first row of numbers, or that just beneath the glass, shows the real value of the glass; the second or inner row shows the result of the combinations when the quadrant is in position. The quadrant rotates immediately over the disc and around the same centre, and contains four glasses, —5—16, and +5+16. When it is not used the quadrant is beneath its cover. The instrument then represents a simple Ophthalmoscope with sixteen perforations, the series running with an interval of I D, and extending from I to 7 plus, and from I to 8 minus. This is ample for all ordinary work, as the interval of I D, is as close as even an expert usually desires, and can, with a little experience, be used for even very minute discrepancies. For if in a given case the fundus is seen distinctly with I D and a little to spare, while 2 D blurs the picture, we know at once that the refraction must be between the two, or I 5 D. If, however, for any reason we wish to prove this conclusion, we can bring up 0 5 D. From this glass we get successive half-dioptic from I to

8 plus, and from I to 9 minus. In this way we have, so to speak, a fine and coarse adjustment, as in the microscope. If the higher numbers are desired, these are obtained by combinations with those of the quadrant. These progress regularly up to 16 D, every dioptric being marked upon the disc; above this, up to +23 D and —24 D, we have to simply add the glass which comes beneath the 16 D, turning always in the same direction.

The mirror shown in the drawing is the "tilting" form. If preferred, the common circular mirror can be employed.



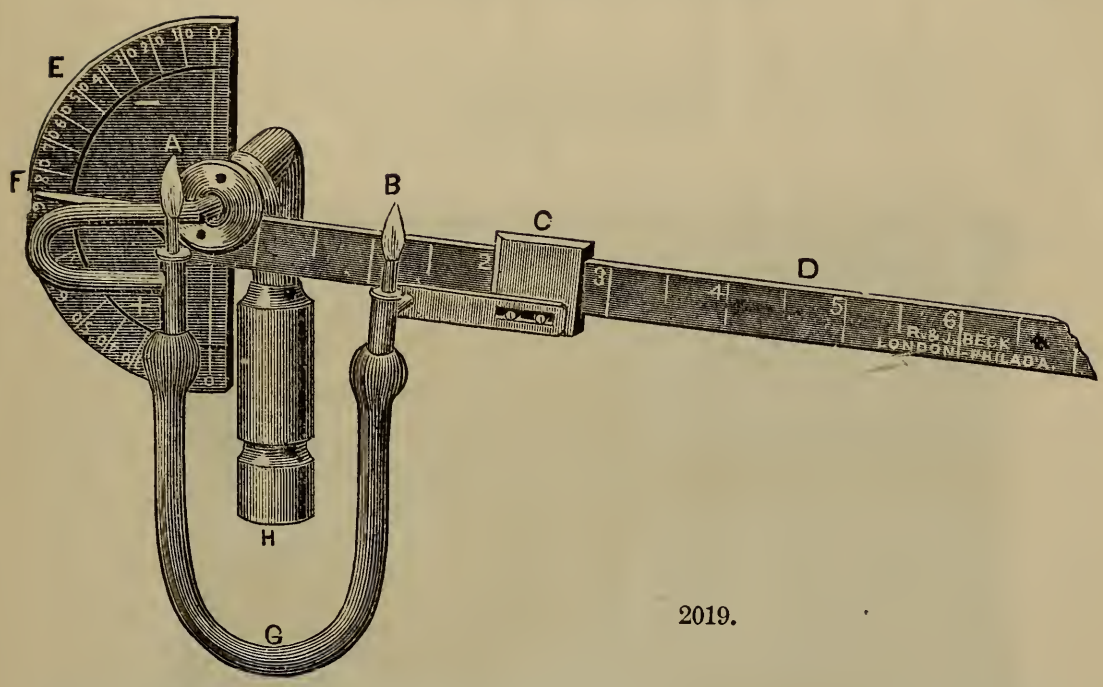



2018.

2019. Dr. Thomson's Ametrometer, in Morocco Case, . . . . . $11 00

This instrument, as shown in the illustration, consists of a small fixed gas-jet A, a second one B, attached to a box C, which slides upon a bar D, the jets connected by a flexible rubber tube G; the end of the bar F forms a pointer, which, by elevating or depressing the other end of the bar, can be placed at any part of the graduated half-circle E, which is fixed firmly to the thimble H, by which means the entire instrument can be attached to a common gas-burner, and the lights regulated by its stop-cock.

The jets having been lighted and turned down into two small flames about 5 mm. in diameter, the patient, placed 5 metres away, is directed to observe the flames, and to say whether he sees them as small points of light separated, or as diffused enlarged circles, which can be made to come in contact at their margins by sliding movements of the box on the bar, by the hand of the surgeon; bearing in mind that an emmetropic or corrected ametropic eye will resolve the lights into two until they pass, one behind the other, and become fused, whilst in ametropia the circles will seem to touch; whilst a distance, depending upon the degree of ametropia, remains between the small light points. To determine the kind of ametropia, the patient is directed to pass slowly in front of the eye under examination a slip of red glass in such a manner as to color half of each diffused circle, and if the red half seems to be on the same side with the red




2019.

glass, myopia is recognized, and if on the other side, hypermetropia; this may be as well done by passing before the eye a card or paper in such manner as to exclude from view one-half of each circle.

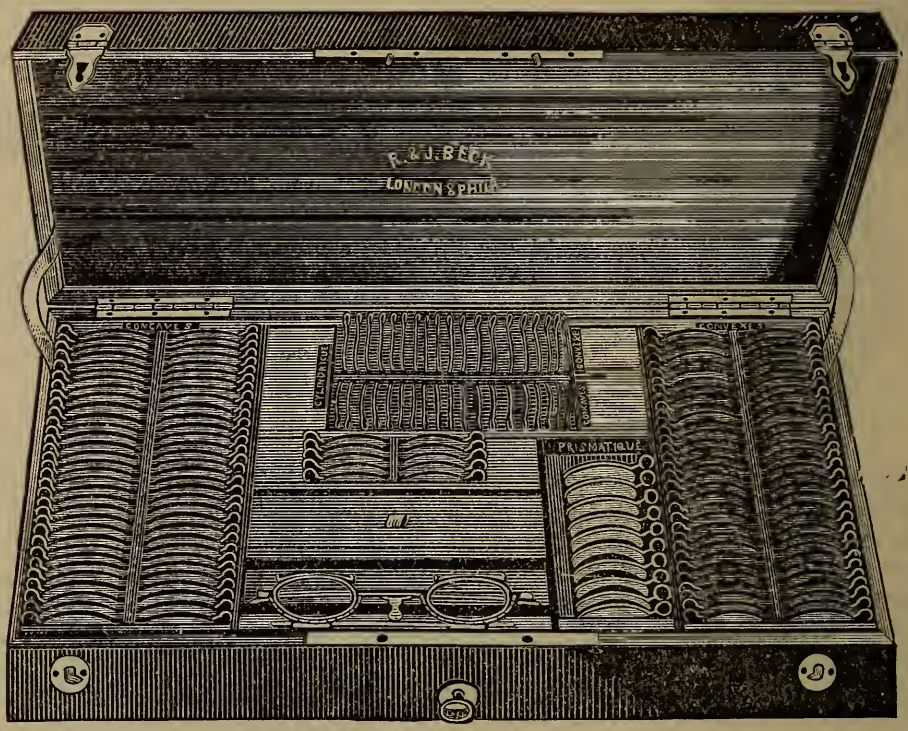
To determine the degree of ametropia, the bar has been divided on one side into spaces of 2.5 cm. with a half space between, and on the other into English inch and half-inches, and it will be found that each space of 2.5 cm. will indicate an ametropia of one dioptric, metric system, and each inch $\frac{1}{40}$ of the old system. The cut represents the two flames as apart 2 d., and they would appear to a person having M. or H. of 2 D. or $\frac{1}{20}$ as two circles of light, with their margins in contact at one point, separating on the removal of light B, and overlapping when it is placed nearer to light A.

For those who prefer the old system to the metric, it will be remembered that the old glasses are not based upon their exact powers of refraction, but are ground on *radii* of Paris inches, and that, owing to the index of refraction of the glass commonly used, they by a happy chance correspond in focal length almost exactly with the English inch; hence, each inch of distance between the test-lights as determined by the use of the inch scale on the bar, will indicate an ametropia of very nearly $\frac{1}{40}$; and the higher degrees can be found instantly by dividing 40 by the number of inches between the lights when their margins seem to have come into contact.

When astigmatism is suspected, the patient should be directed to observe whether the flames are longer in one direction than the other, and if so, by the rotation of the bar on a pivot opposite to light A, the two lights being placed some distance apart so that they do not appear to touch, we have one of the most accurate means of ascertaining the meridians of greatest and least refraction, since it will become easy for the patient to say when two elongated points or ovals of light are placed so as to have the same direction; and when this has been fixed, the pointer F will indicate on the half-circle the exact angle at which the lights are placed, and hence the position of the meridian of greatest ametropia.

On bringing the flames into contact at this angle, the real distance of the lights apart will indicate the degree of ametropia, and having thus found one meridian, the lights can be placed at right angles to it and the refraction of the second be ascertained. In difficult cases, or with poor observers, it may be an aid to color one of the flames by placing a slip of red glass in front of it.

# TRIAL SIGHTS.




No. 2020.

| No. | | Price. |
|---|---|---|
| 2020. | NACHET'S COMPLETE SERIES OF TRIAL SIGHTS, comprises 32 *pairs each* of Spherical convex and concave lenses from 2 to 72 inches focus; 19 *pairs each* of plane Cylindrical convex and concave lenses from 6 to 60 inches focus; 9 Prisms, of angles from 2 to 10 degrees; 4 plane *colored* glasses; 1 *white* glass disc; 1 half-ground surface; 2 metal discs, with stenopaic slit; 1 metal disc, with hole, and one ditto solid; 1 adjustable spectacle frame with revolving graduated fittings for holding the various lenses; and one ditto not graduated. The whole packed in a first-class Morocco-covered or Rosewood case, with lock, . . . . . | $110 00 |
| 2021. | NACHET'S SERIES OF TRIAL SIGHTS, the same in all particulars as 2020, excepting the cylindrical lenses, which are single and not in pairs, . . . . . | 90 00 |
| 2022. | SERIES OF TRIAL SIGHTS, mounted and packed precisely the same as Nachett's, Set No. 2021, containing the same number of lenses, spherical and cylindrical, with two adjustable trial frames, one graduated to 180° (No. 2030), in Rosewood case, . . . . | 85 00 |
| 2023. | SERIES OF TRIAL SIGHTS, mounted the same as the preceding, consisting of 27 *pairs each* of spherical convex and concave lenses from 2 to 72 inches focus; 12 *each* convex and concave cylindrical lenses, from 8 to 60 inches focus; 7 prisms of angles from 2 to 10 | |

No. Price.

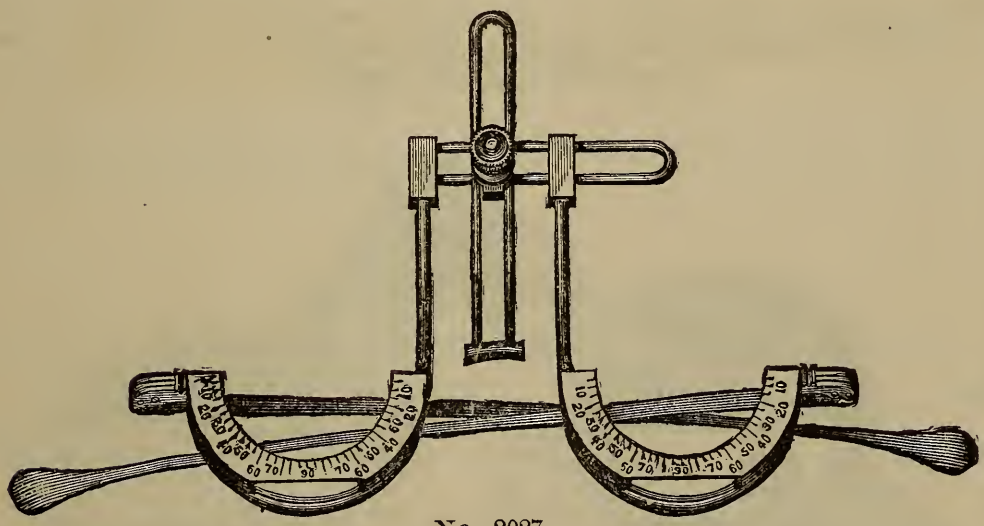
degrees; 3 *plane*, colored glasses; 1 *white* glass disc; 1 half-ground ditto; 1 metal disc with hole in centre; 1 ditto with stenopaic slit, and one adjustable trial frame, No. 2030; the whole packed in a Morocco covered case, with clasps, . . . . . $70 00

2024. Series of Trial Sights, consisting of 23 *pairs each* of spherical convex and concave lenses, from 2 to 72 inches focus; 12 *each* cylindrical *convex* and *concave* lenses, 8 to 60 inches focus; 6 *prisms* 2 to 10 degrees; 2 metal discs; 1 plane glass; 1 ground glass, all mounted in neat metallic frames; 3 colored glasses, and a graduated frame for holding the various lenses; the whole packed in a fine Morocco covered case, . . . . . 60 00

*Any of the foregoing Series of Trial Sights can be furnished in either the dioptric or inch system of numbering.*

2025. "Our Own", Complete Series of Trial Sights, comprises 30 *pairs each* of spherical convex and concave lenses from 0.25 to 20 Dioptric; 18 *pairs each* of cylindrical convex and concave lenses from 0.25 to 6 Dioptric, 10 prisms of angles from 1° to 12°; 4 plane *Colored* glasses; 2 metal discs with stenopaic slits; 2 metal discs, with holes, and one ditto solid, with new adjustable and graduated spectacle frame for holding the lenses, No. 2027. The whole packed in an elegant solid Mahogany case, with detachable lid and lock, . . . . . 110 00

The above series of Trial Sights are the most perfect and reliable ever made, and are recommended by us as Standard. Each lens receives the most rigid scrutiny before leaving our works, and is guaranteed to be absolutely correct. The new *Trial Frame* is altogether the best ever made.

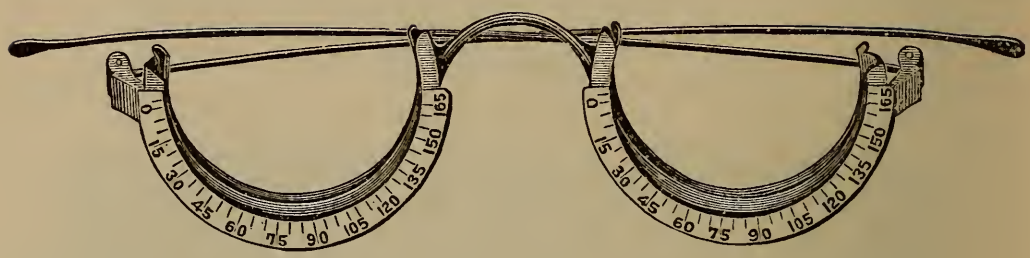


No. 2027.

2027. "Our Own", Graduated Adjustable Trial Spectacle Frame. This instrument in which the Trial Sights are placed in grooves, with graduations for the cylindrical lenses, is placed on the head like an ordinary pair of spectacles, and has adjustments for determining the distance between the centres of the eyes, and the height of the bridge of the nose, . . . . . 10 00

2028. "Our Own", Graduated Adjustable Trial Spectacle Frame, the same in all respects as No. 2027, excepting the sides or temples, which are made to hook behind the ears and have sliding adjustment for distance from front of face, . . . . . 12 50

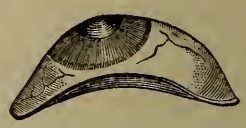
No. Price.




No. 2030.

2030. Trial Spectacle Frame, with double grooves to each eye, graduated to 180°. Any desired combination of spherical and cylindrical lenses can be adjusted in a moment to this frame, and given to the patient for trial, . . . . . $5 00

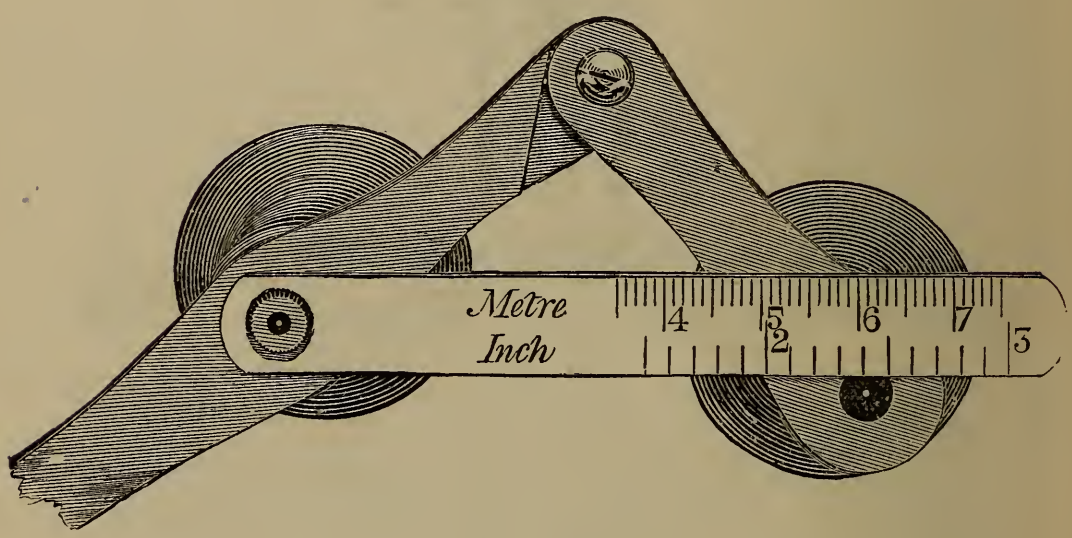
No. 2032.



No. 2032.

2032. Artificial Human Eyes of very superior make, and in every variety of size and color. Carefully fitted to any case, . . 10 00

*Liberal discounts to Oculists.*




No. 2033.

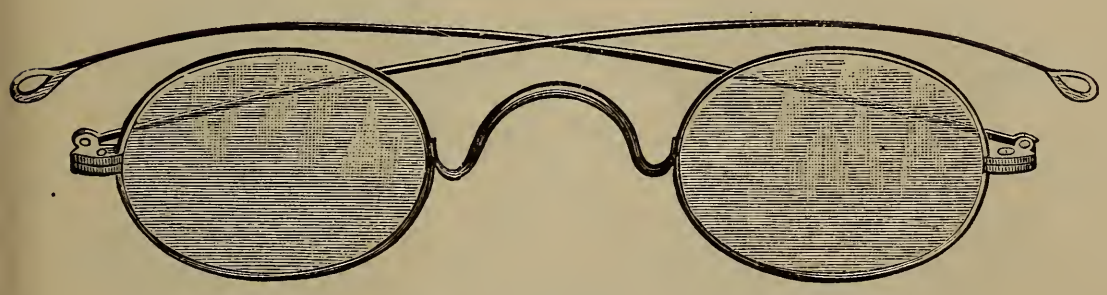
2033. Adjusting Cone, for Measuring the Distance between the Eyes. Holding the instrument in the right hand, a *distant* object should be looked at with the right eye through the hole in the

| No. | | Price. |
|---|---|---|
| | right hand cone; the other cone, fixed to an adjusting arm, should be moved backwards and forwards until the left eye sees the same object through the aperture in the left cone, and the two holes appear as one. The distance between the eyes is then indicated on the cross bar, one side of which is divided to inches and tenths, the other to millimetres, . . . . . | $5 00 |
| 2035. | Dr. Thomson's Metal Discs, for determining the degrees of Ametropia, . . . . . | 4 00 |
| 2037. | Trial Glasses, Hard Rubber Frames, 5 to 48 inches focus. *Convex*, . . . . . | 12 00 |
| 2038. | Trial Glasses, Hard Rubber Frames, 5 to 48 inches focus. *Concave*, . . . . . | 13 00 |
| 2040. | Green's Test Diagrams, for the detection of Astigmatism. This set consists of a card-board dial 12 inches in diameter, divided into 12 equal parts as in a clock dial, to which can be attached separately a series of 14 diagrams of lines and circles made to revolve at pleasure against the face of the dial, . . . . . | 5 00 |
| 2041. | Snellen's Series of Test Types, bound in paper, . . . . | 2 00 |
| 2042. | Dr. Oliver's Color Sense Measurer. This contrivance consists of a perforated disc, which can be so regulated by the rotation of a series of cards, and the movement of a graduated slide as to expose known areas of colors, . . . . . | 3 50 |

## GOLD SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White*, or *Plane Blue* or *Smoke*-colored Glasses.

### SINGLE TEMPLES.

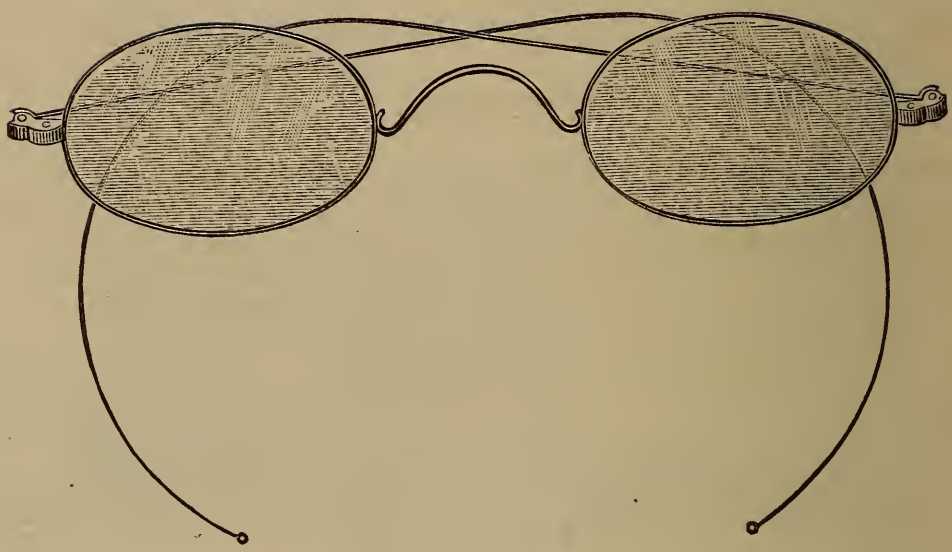


Nos. 2050–2055.

| | | |
|---|---|---|
| 2050. | Single Temples, 8 karat, per pair, . . . . . | $5 [illegible] |
| 2051. | " " 10 " " . . . . . | 6 00 |
| 2052. | " " 12 " " . . . . . | 7 50 |
| 2053. | " " 14 " " . . . . . | 9 00 |
| 2054. | " " 16 " " . . . . . | 11 00 |
| 2055. | " " 18 " " . . . . . | 12 00 |

# GOLD SPECTACLES.

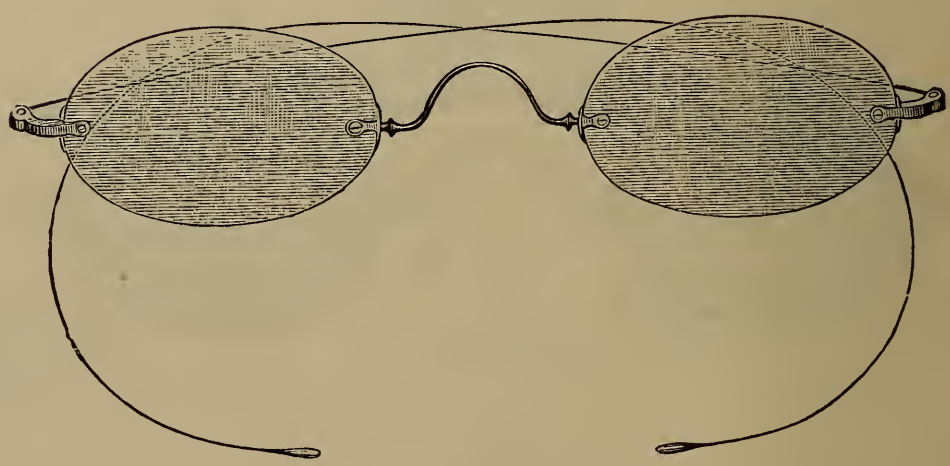
## HOOK TEMPLES.



Nos. 2056–2058.

| No. | | Price. |
|---|---|---|
| 2056. | Hook Temples, 10 karat, very light, | $5 00 |
| 2057. | " " 14 " " | 6 00 |
| 2058. | " " 16 " " | 8 50 |

## HOOK TEMPLES (FRAMELESS).

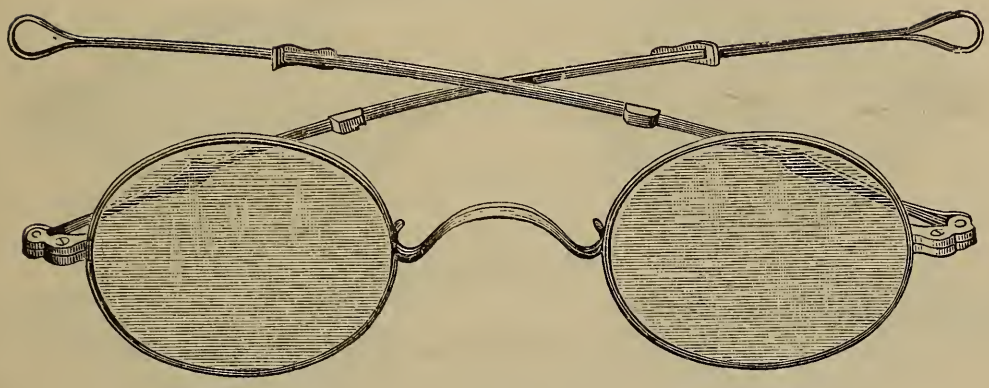


No. 2060.

2060. Hook Temples, frameless, . . . . . $6 00

## GOLD SPECTACLES.

### SLIDING TEMPLES.



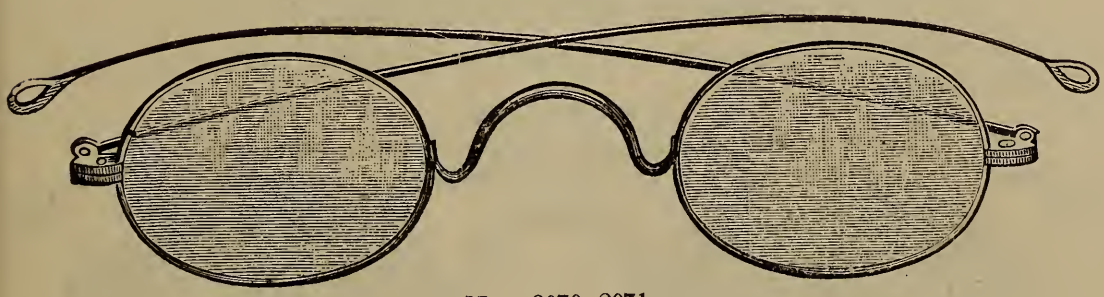
Nos. 2064–2068.

| No. | | | | | | Price. |
|---|---|---|---|---|---|---|
| 2064. | Sliding Temples, | 10 karat, | per pair, | | | $9 00 |
| 2065. | " " | 12 " | " | | | 10 00 |
| 2066. | " " | 14 " | " | | | 11 00 |
| 2067. | " " | 16 " | " | | | 13 00 |
| 2068. | " " | 18 " | " | | | 15 00 |

## COIN SILVER SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

### SINGLE TEMPLES.

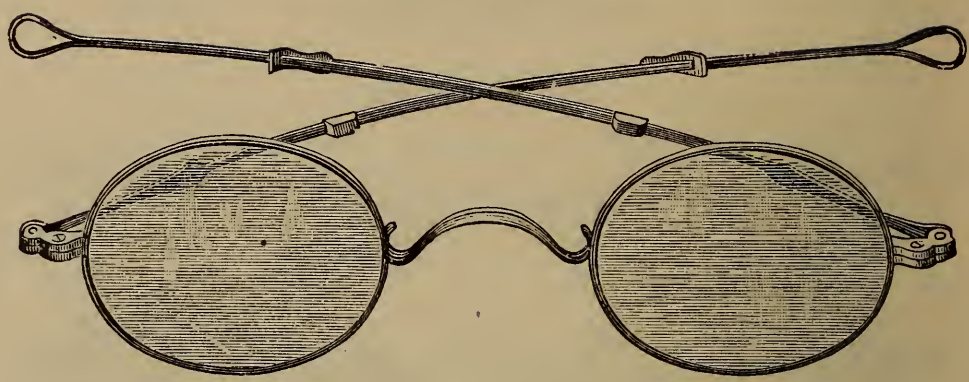


Nos. 2070, 2071.

| | | |
|---|---|---|
| 2070. | Single Temples per pair, | $2 50 |
| 2071. | " " fitted with divided glasses for reading and distant vision, | 3 50 |

## COIN SILVER SPECTACLES.

SLIDING TEMPLES.



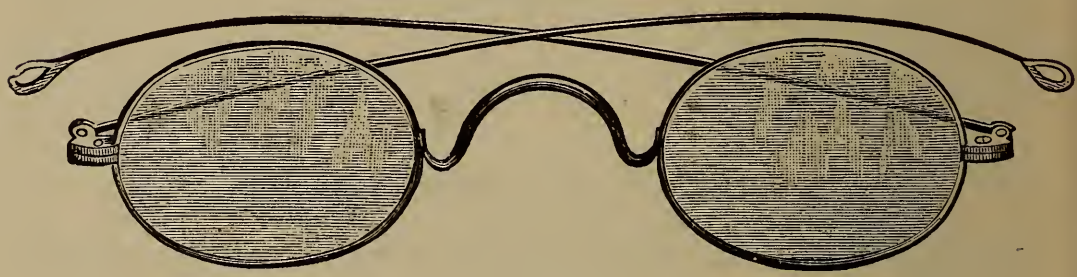
Nos. 2072–2073.

| No. | | Price. |
|---|---|---|
| 2072. | Sliding Temples, per pair, | $3 00 |
| 2073. | " " fitted with divided glasses for reading and distant vision, | 4 00 |

## ARUNDEL TINTED SPECTACLES.

Fitted with *First Quality only* of *Arundel Tinted*, Periscopic Convex or Concave Glasses.

SINGLE TEMPLES.



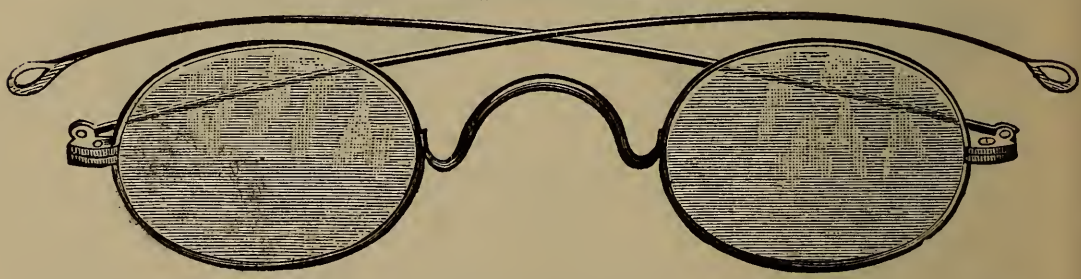
No. 2075.

2075. Single Temples, Finest Steel Frames, . . . . . $2 00

## ELASTIC STEEL SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

SINGLE TEMPLES.



Nos. 2080–2083.

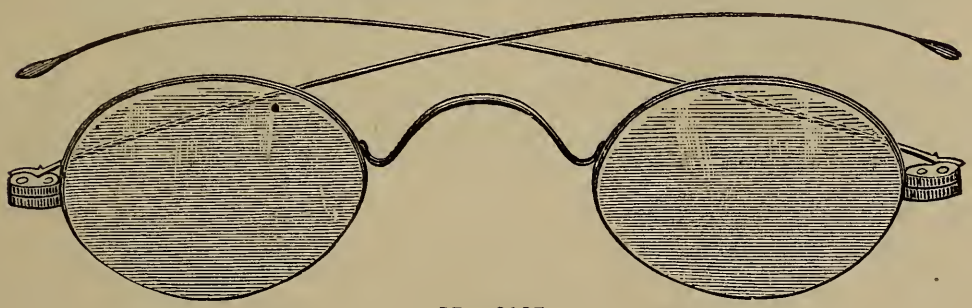
2080. Finest Finished Steel Frames, per pair, . . . . . $2 00

| No. | | Price. |
|---|---|---|
| 2081. | Fine Finished Steel Frames, per pair, | $1 50 |
| 2082. | Medium " " " " | 1 00 |
| 2083. | " " " " fitted with divided glasses for reading and distant vision, | 2 00 |

## PULPIT SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

**SINGLE TEMPLES.**



No. 2085.

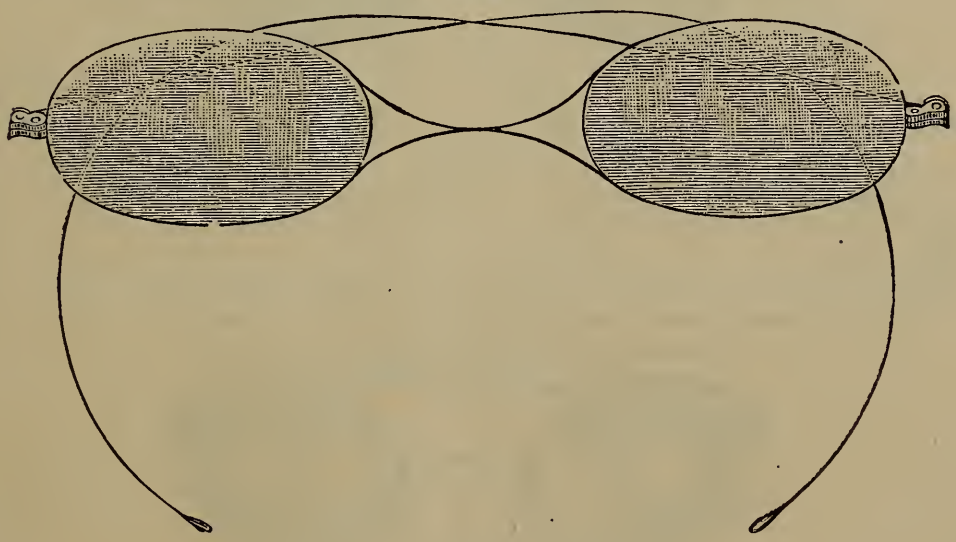
2085. Finest Finished Steel Frames, per pair, . . . . . $2 00

This form of Spectacle Frame is very convenient for public speakers who are obliged to use glasses in reading their notes; as the top being nearly straight allows the wearer to look *over* it when the eyes are directed toward the audience.

## INVISIBLE SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

**HOOK TEMPLES.**



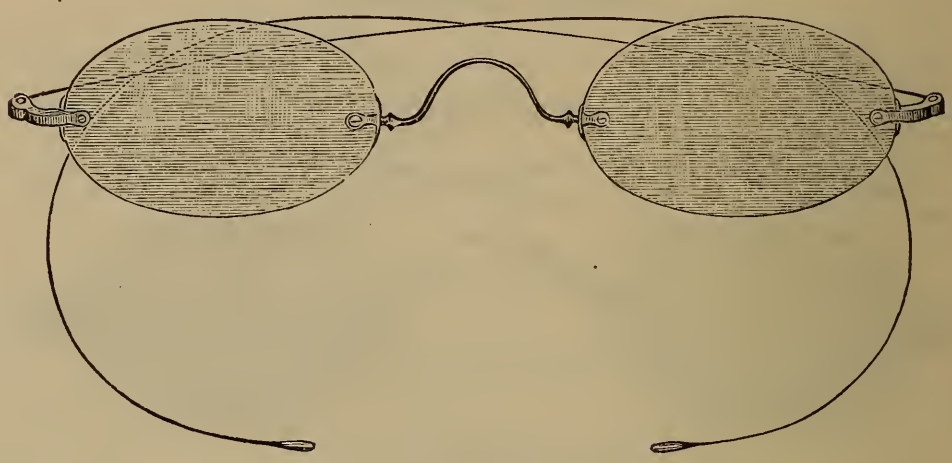
No. 2086.

2086. Finest Finished Hook Temples, of Steel; the frames set in a groove in the glasses, almost invisible, . . . . . $2 50
2087. Finest Finished Hook Temples, of Steel, . . . . . $2 50

## FRAMELESS SPECTACLES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

### HOOK TEMPLES.



No. 2088.

| No. | | Price. |
|---|---|---|
| 2088. | Finest Finished Steel Hook Temples, . . . . . | $2 50 |

## EYE-PROTECTORS.

Nos. 2090–2092.

| | | |
|---|---|---|
| 2090. | Coquille Spectacles, with large egg-shell shaped glasses, either blue or smoke color, for protecting the eyes against an intense glare of light, or from dust. Steel Frames, light Hook Temples, | 2 00 |
| 2091. | Coquille Spectacles, Medium Finish, Single Temples . | 1 00 |
| 2092. | " " Ordinary " " " . . | 75 |
| 2093. | Miller's or Turner's Spectacles, strong frames and large plane white glasses, to guard the eyes against chips, etc., . . | 50 |

Nos. 2095–2096.

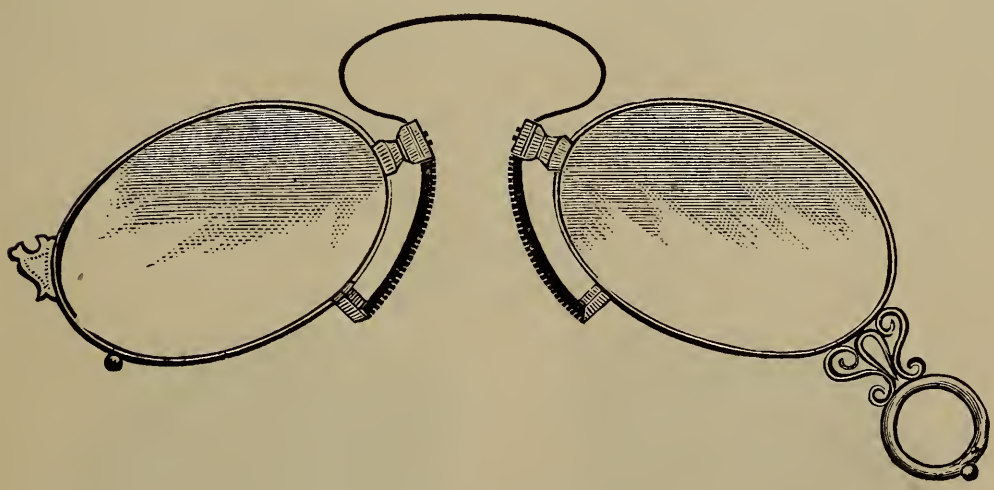
2095. Wire Gauze Eye-Protectors, with Plane Green, Blue, Smoke

| No. | | Price. |
|---|---|---|
| | or White Glasses, and Steel Temples, as in ordinary Spectacles; finest finished frames and glasses, . . . . . | $2 00 |
| 2096. | Wire Gauze Eye-Protectors, similar in style to No. 2095, but with medium finished frames and glasses, . . . . . | 1 50 |
| 2097. | Wire Gauze Eye-Protectors, similar in form and style to No. 2095, but with frames and glasses finished in a more ordinary manner, . . . . . | 75 |
| 2098. | Wire Gauze Eye-Protectors, similar to the preceding, but fitted with an elastic band in place of the steel temples, . . . | 50 |
| 2099. | Eye-Shades, with light wire frame fitting on the head like a cap; for both eyes or for one, . . . . . | 35 |

All the Spectacles herein described are furnished with a handsome leather case, without charge, and any of the frames will be fitted with plane green, blue or smoke-colored glasses, at the prices given.

## GOLD EYE-GLASSES.

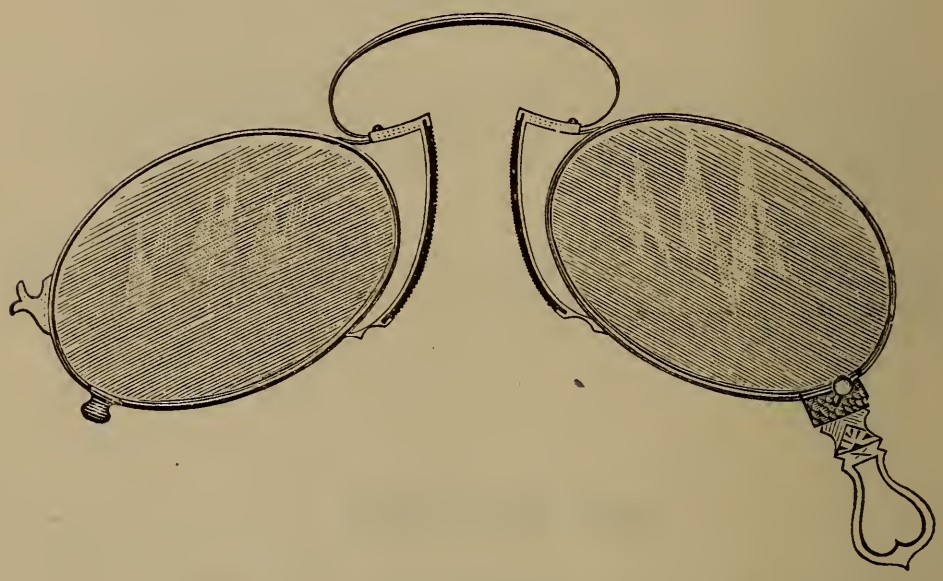
Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.



Nos. 2100–2105.

| | | |
|---|---|---|
| 2100. | Compound Spring Pattern, 8 karat, . . . . . | $5 00 |
| 2101. | " " " 10 " . . . . . | 5 50 |
| 2102. | " " " 12 " . . . . . | 6 50 |
| 2103. | " " " 14 " . . . . . | 7 50 |
| 2104. | " " " 16 " . . . . . | 9 00 |
| 2105. | " " " 18 " . . . . . | 10 00 |

## GOLD EYE-GLASSES.



Nos. 2106–2111.

| No. | | Price. |
|---|---|---|
| 2106. | Anatomical Pattern, 8 karat, | $5 00 |
| 2107. | " " 10 " | 6 00 |
| 2108. | " " 12 " | 7 00 |
| 2109. | " " 14 " | 8 00 |
| 2110. | " " 16 " | 10 00 |
| 2111. | " " 18 " | 12 00 |

No. 2112.

2112. Frameless, with 14 karat Spring and Handle, . . . . . $6 00

## ARUNDEL TINTED EYE-GLASSES.

Fitted with *First Quality only* of *Arundel Tinted* Double or Periscopic Convex or Concave Glasses.

No. 2115.

| No. | | Price. |
|---|---|---|
| 2115. | Arundel Pattern, very comfortable, . . . . . | $2 00 |

These glasses, together with the Arundel Tinted Spectacles, No. 2075, are fitted with slightly tinted glasses, so graduated, that the tint remains of the same density in all foci. They are particularly agreeable for reading by artificial light, and a great help to weak eyes. Being very carefully made and finished they are the handsomest and most desirable of all steel-framed Glasses. If desired they can be furnished in Gold, Shell or Hard Rubber frames.

## STEEL EYE-GLASSES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

No. 2120.

| | | |
|---|---|---|
| 2120. | Anatomical Pattern, . . . . . | $1 25 |

## STEEL EYE-GLASSES.

No. 2121.

| No. | | Price. |
|---|---|---|
| 2121. | Compound Spring Pattern, . . . . . | $2 00 |
| 2122. | " " " very light grooved glasses, . . . | 2 50 |

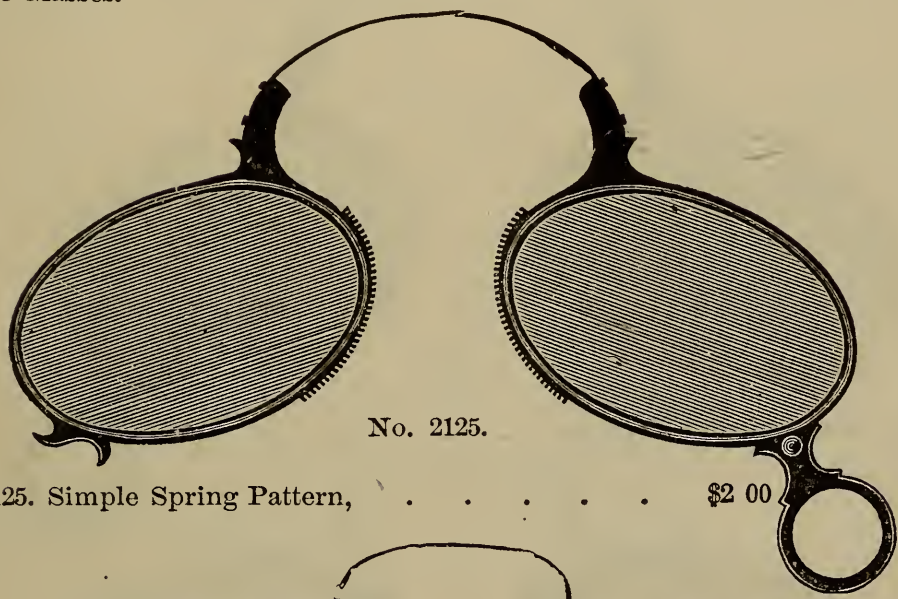
No. 2123.

2123. Frameless Pattern, with Steel Spring and Handle, . . . . . $1 50

All of our Steel Eye-glass Frames are of the lightest possible weight, but so exquisitely tempered as to be much stronger and more durable than those usually sold. They are furnished either blued or of the light bronze or straw-color now so much used, as may be desired.

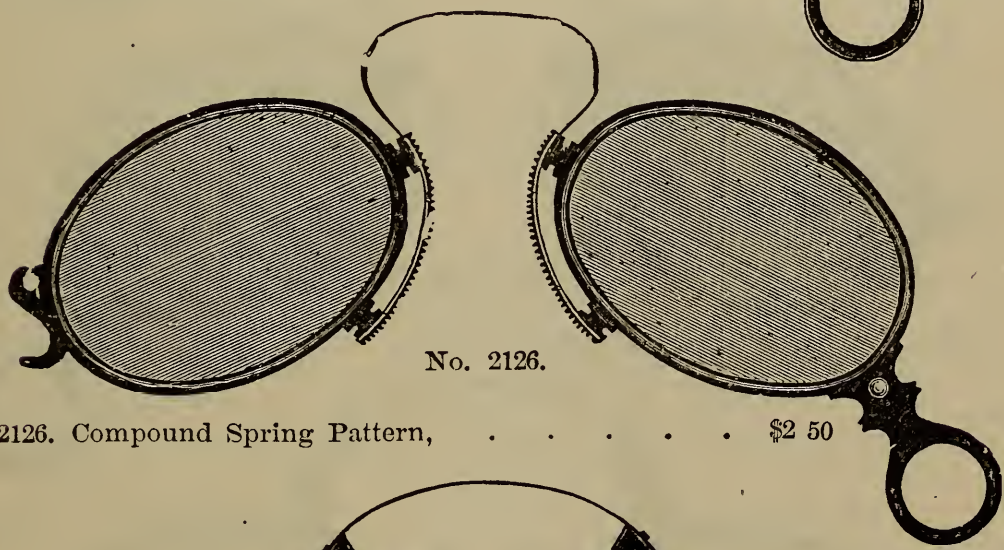
## SHELL EYE-GLASSES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concav *White* Glasses.



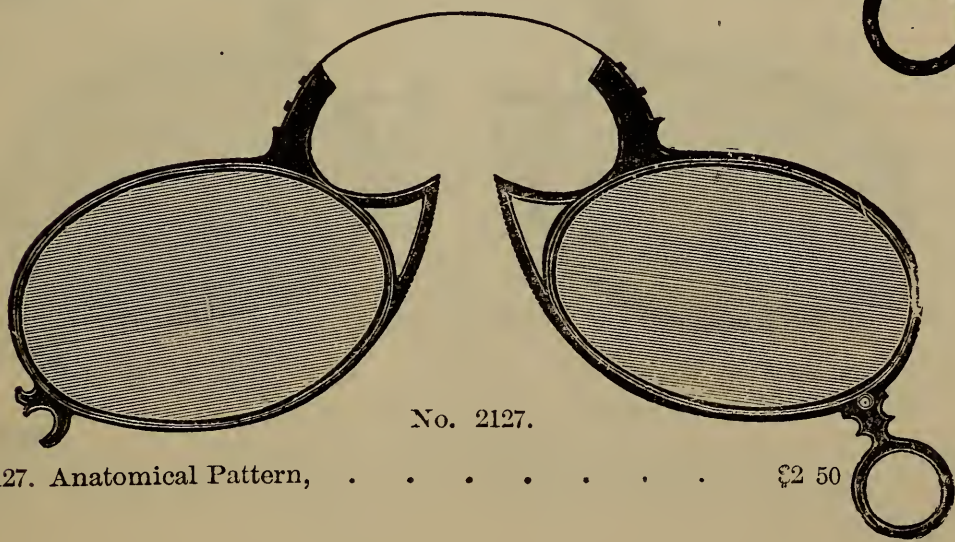
No. 2125.

2125. Simple Spring Pattern, . . . . . $2 00



No. 2126.

2126. Compound Spring Pattern, . . . . . $2 50



No. 2127.

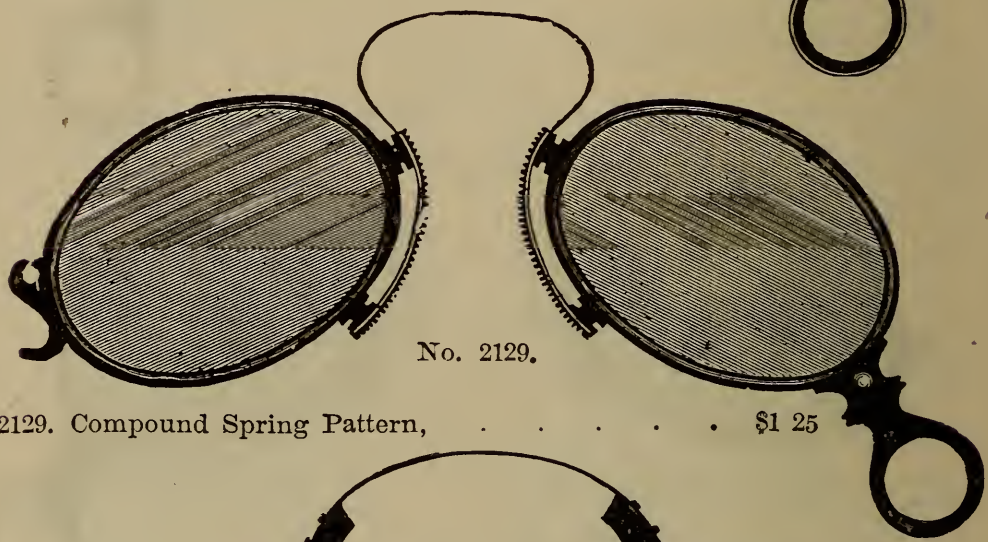
2127. Anatomical Pattern, . . . . . $2 50

## HARD RUBBER EYE-GLASSES.

Fitted with *First Quality only* of Double or Periscopic Convex or Concave *White* Glasses.

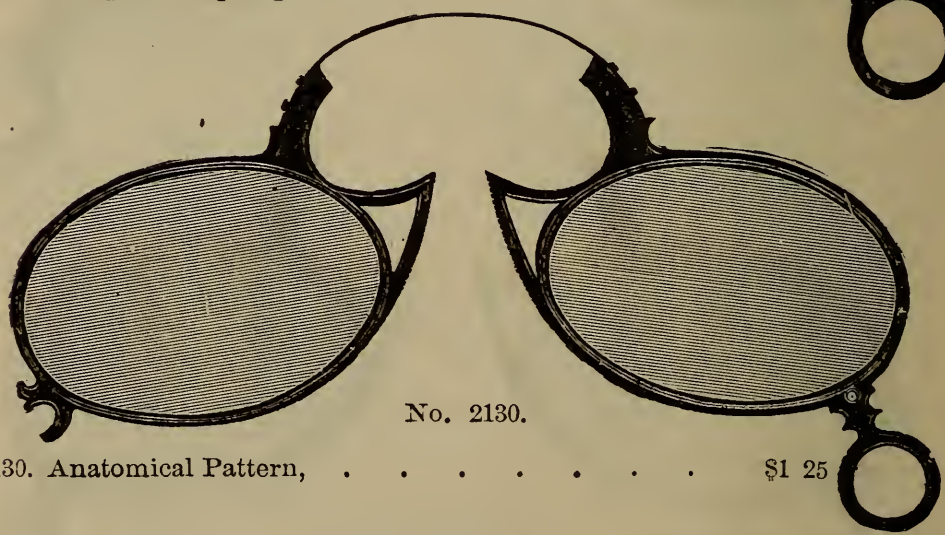
No. 2128.

2128. Simple Spring Pattern, . . . . . $1 00



No. 2129.

2129. Compound Spring Pattern, . . . . . $1 25



No. 2130.

2130. Anatomical Pattern, . . . . . $1 25

All the foregoing Eye-glass Frames will be fitted with either *plane blue* or *smoke-colored* glasses, and furnished with a case and silk guard, without increase of cost.

## SPHERICAL SPECTACLE LENSES.

Spherical, Cylindrical or Prismatic Lenses, of the *First Quality only* fitted to frames at the following prices:

| No. | | Price. |
|---|---|---|
| 2135. | Periscopic or Double Convex White Lenses, from 5 to 72 inches focus, per pair, | 75 |
| 2136. | Periscopic or Double Convex White Lenses, from 1 to 4¼ inches focus, per pair, | $1 25 |
| 2137. | Double Convex White, Divided or Franklin Lenses, per pair, | 1 50 |
| 2138. | " " " Lenses, two foci on one glass, " | 1 50 |
| 2139. | Periscopic or Double Convex Tinted Lenses, Blue, Pink, Green or Smoke, per pair, | 1 50 |
| 2140. | Periscopic or Double Concave White Lenses, from 5 to 72 inches focus, per pair, | 75 |
| 2141. | Periscopic or Double Concave White Lenses, from 1 to 4¾ inches focus, per pair, | 1 25 |
| 2142. | Periscopic or Double Concave Tinted Lenses, Blue, Pink, Green or Smoke, per pair, | 1 50 |
| 2143. | Plane, Blue, Green or Smoke-colored Glasses, per pair, | 1 00 |

## CYLINDRICAL SPECTACLE LENSES.

| | | |
|---|---|---|
| 2145. | Plano-Convex or Concave Cylindrical White Lenses, per pair, | 2 00 |
| 2146. | " " " " " single lens, | 1 25 |
| 2147. | Sphero-Convex " " " " per pair, | 4 00 |
| 2148. | " " " " " single lens, | 2 50 |
| 2149. | Plano-Convex or Concave Cylindrical and Prismatic White Lenses, per pair, | 4 00 |
| 2150. | Plano-Convex or Concave Cylindrical and Prismatic White Lenses, single lens, | 2 50 |
| 2151. | Sphero-Convex or Concave Cylindrical and Prismatic White Lenses, per pair, | 5 50 |
| 2152. | Sphero-Convex or Concave Cylindrical and Prismatic White Lenses, single lens, | 3 00 |
| 2153. | Crossed Cylindrical Lenses, Convex or Concave, White, per pair, | 7 00 |
| 2154. | " " " " " " single lens, | 4 00 |

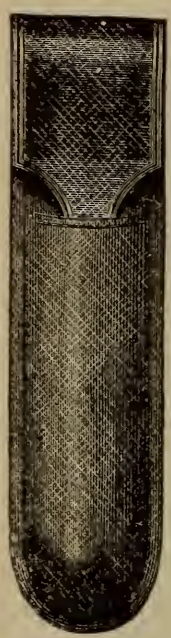
## PRISMATIC SPECTACLE LENSES.

| | | |
|---|---|---|
| 2160. | Plane Prismatic Lenses, White, per pair, | 2 00 |
| 2161. | " " " single prism, | 1 25 |
| 2162. | Sphero-Prismatic " " per pair, | 4 00 |
| 2163. | " " " single prism, | 2 50 |

## PEBBLE SPECTACLE LENSES.

| | | |
|---|---|---|
| 2165. | Periscopic or Double Convex Pebble Lenses, per pair, | 3 00 |
| 2166. | " " Concave " " " | 3 00 |

## SPECTACLE AND EYE-GLASS CASES.



No. 2170.

No. 2171.

No. 2173.

Nos. 2175–2176.


No. 2181.

| No. | | Price. |
|---|---|---|
| 2170. | Spectacle Case, Morocco, with tuck, | 20 |
| 2171. | " " " open end, | 20 |
| 2172. | " " Fine English Leather, | 75 |
| 2173. | " " Scotch Plaid Frog Mouth, | 50 to 1 50 |
| 2174. | " " German Silver, Plated, | 1 25 to 1 75 |
| 2175. | Velvet Chatelaine Case, | 1 00 to 3 00 |
| 2176. | Morocco " " | 75 to 2 00 |
| 2180. | Eye-Glass Case, Morocco, open end, | 15 |
| 2181. | " " Finest Russia Leather, | 35 |
| 2182. | " Hooks, Gold, | 1 50 to 5 00 |
| 2183. | " " Gilt, | 25 |
| 2184. | " " Steel, | 15 |
| 2185. | " Chains, Gold, with Hook, | 4 00 to 6 50 |
| 2186. | " Guard, Pure Silk, | 10 |
| 2187. | " " Catgut, | 10 |

## NICOL'S PRISMS.

| No. | | Price. |
|---|---|---|
| 2200. | Nicol's Prism of Iceland Spar, 8 millimetres across face, | $2 25 |
| 2201. | " " 9 " " | 2 75 |
| 2202. | " " 10 " " | 3 50 |
| 2203. | " " 11 " " | 4 00 |
| 2204. | " " 12 " " | 4 75 |
| 2205. | " " 14 " " | 6 75 |
| 2206. | " " 16 " " | 9 75 |
| 2207. | " " 20 " " | 20 00 |

*Larger sizes imported to order.*

## CLAUDE LORRAINE, or LANDSCAPE MIRROR.

Claude Lorraine, or Landscape Mirror. A pleasing and beautiful instrument, for viewing clouds, landscapes, etc. As the mirror condenses or diminishes the view into a true perspective effect, the instrument is invaluable to the artist, and a very desirable companion for tourists. Six sizes, as follows:

| | | |
|---|---|---|
| 2220. | Mirror, 6¼ inches long by 5¼ inches wide, in strong morocco case, each, | 5 50 |
| 2221. | " 7½ " 5¼ " " " | 6 00 |
| 2222. | " 7½ " 6¼ " " " | 7 50 |
| 2223. | " 8½ " 6¼ " " " | 9 00 |
| 2224. | " 8½ " 7½ " " " | 10 00 |
| 2225. | " 9½ " 7½ " " " | 11 00 |

## HAND MIRRORS, IN BLACK WOOD FRAMES.

| | | |
|---|---|---|
| 2230. | Mirror Magnifying on one side, diminishing on the other, 6 inches diameter, | 5 00 |
| 2231. | Mirror, Cylindrical (elongating and shortening), 6 inches diameter, | 3 00 |
| 2232. | " Multiplying (producing several images), 6 inches diameter, | 5 00 |
| 2233. | " Magnifying on one side, plane on the other, 3½ in. diameter, | 1 75 |
| 2234. | " " " " 5 " | 2 50 |
| 2235. | " " " " 6 " | 3 00 |

## HAND MIRRORS, IN FINE MAHOGANY FRAMES.

| | | |
|---|---|---|
| 2238. | Mirror, Magnifying on one side, diminishing on the other, 5 inches diameter, | 3 00 |
| 2239. | Mirror, Magnifying on one side, diminishing on the other, 6 inches diameter, | 4 00 |

## MAGIC LANTERNS.

In Japanned Tin, with Coal-Oil Lamps.

| | | |
|---|---|---|
| 2245. | Magic Lantern, 6 inches high, with 6 glass and 3 movable slides, | 5 00 |
| 2246. | " " 7 " " 6 " 3 " " | 6 00 |
| 2247. | " " 8 " " 6 " 3 " " | 7 50 |
| 2248. | " " 9 " " 6 " 3 " " | 9 00 |

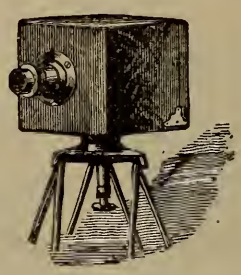
## KLAEGER INSECT PINS.

| | | |
|---|---|---|
| 2250. | The Genuine Klaeger Insect Pins, five sizes, per 100, | 15 |
| | " 1000, | 1 25 |
| 2255. | Zoetrope, or Wheel of Life, | 3 00 |

A mechanical and optical exemplification of the persistence of vision, and a valuable aid in illustrating the wonders of optics. The turning of the drum or cylinder brings into view the varying form or position of a figure in rapid succession, until they blend into a perfect image full of motion and natural action.

| | | |
|---|---|---|
| 2256. | Extra views for Zoetrope, per set of six, | 1 00 |
| 2260. | Parlor Kaleidoscope, on Stand with Brass Front, | 2 00 |

## WALKER'S AMATEUR PHOTOGRAPHIC OUTFIT.



No. 2300.

| No. | | Price. |
|---|---|---|
| 2300. | WALKER'S COMPLETE AMATEUR PHOTOGRAPHIC OUTFIT, . . | $12 50 |

This outfit comprises a Camera complete with Achromatic Lens, ground focusing glass in frame, 2 Diaphragms, and Folding Tripod with Walker's Tripod Head.

1 Walker's Patent Hard Rubber Double Plate Holder.
1 Light-tight Box for storing 24 Plates or Negatives.

| | |
|---|---|
| 1 Ruby Developing Lamp. | Proto-Sulphate of Iron, ¼lb. |
| 1 Copper Developing Tray. | Hypo-Sulphite of Soda, ½lb. |
| 1 Graduating Glass. | 2-oz. Bottle Intensifier. |
| Oxalate of Potash, ½lb. | 2 Camel's Hair Brushes. |
| 1 Book of Instructions. | 12 Gelatine Bromide Dry Plates. |

The above Outfit comprises all that is necessary *for making Negatives. The Chemicals are sufficient for developing* 100 *Negatives.*

*The requirements for making prints from negatives are as follows:*

| | | |
|---|---|---|
| 2302, | 1 Printing Frame, . . . . . | 60 |
| 2303. | 1 2-oz. Bottle Negative Varnish. . . . . | 50 |
| 2304. | 1 2-oz. Bottle Permanent Toning Bath, sufficient for toning 800 to 1000 prints, . . . . . | 1 00 |
| 2305. | Permanent Silvered Albumen Paper, cut to proper size for Pocket Camera Negatives, per doz., . . . . . | 15 |

### EXTRAS.

| | | |
|---|---|---|
| 2310. | Extra Hard-Rubber Double Plate Holders, . . . . . | 3 25 |
| 2311. | Drop Shutter for Instantaneous Views, . . . . . | 2 25 |
| 2312. | Extra Lens and Mount, for near and small objects, . . . | 2 25 |
| 2313. | Light-tight Boxes, for storing 24 plates or negatives, each, . . | 35 |
| 2314. | Copper Developing Pans, each, . . . . . | 30 |
| 2315. | Ruby Developing Lamp, . . . . . | 65 |
| 2316. | Graduating Glass, . . . . . | 25 |
| 2317. | Spirit Level, . . . . . | 25 |
| 2318. | Proto-Sulphate of Iron, . . . . . ℔ | 10 |
| 2319. | Hypo-Sulphite of Soda, . . . . . ℔ | 10 |
| 2320. | Oxalate of Potash, . . . . . ℔ | 65 |
| 2321. | Prepared Intensifier, . . . . . 4-oz bottle | 30 |
| 2322. | Sensitized Blue Paper, for Proofs, . . . . . ℔ doz. | 10 |
| 2323. | Gelatine Bromide Dry Plates, . . . . . ℔ doz. | 65 |
| 2324. | Leather Pouches, . . . . . | 4 50 |

The Leather Pouches are for carrying Camera, Developing Pan, Graduating Glass, Ruby Lamp and Chemicals. These pouches are for tourists who can thus carry everything necessary for developing in *one package* on the hip as a field-glass is carried.

The Hard Rubber Double Plate Holders are superior to any heretofore produced, as the frames are in *one piece.* The material is non-absorbent, unaffected by moisture and temperature, and therefore *adsolutely light-tight.* They are very light, perfectly accurate and uniform in size and elegant in appearance. A half-dozen can be stowed away in one's pockets with ease.

*The whole apparatus is guaranteed to be practical and perfect in every particular. The workmanship is of the best throughout.*

# S. P. C.

# FERRO. PRUSSIATE PAPER.

## OUTFITS FOR 4 X 5 PICTURES.

1 4x5 Printing Frame.
1 4½x5½ S. P. C. Vulcanite Pan.
3 Dozen 4x5 S. P. C. Ferro Prussiate Paper
2 " sheets 6½x8½ Card Board.
1 Glass Form (for trimming prints.)
1 Robinson's Straight Trimmer.
½ Pint Jar Parlor Paste.
1 1 inch Paste Brush.

PRICE COMPLETE, $2.80

Securely packed in a Paper Box.

## S. P. C.

### Ferro Prussiate Paper Outfit for 5 x 8 Pictures.

1 5x8 Printing Frame.
1 5x8 S. P. C. Vulcanite Tray.
3 Dozen 5x8 S. P. C. Ferro Prussiate Paper.
2 " sheets 9x11 Card Board.
1 Glass Form (for trimming prints.]
½ Pint Jar Parlor Paste.
1 1½ inch Paste Brush.
1 Robinson's Straight Trimmer.

PRICE COMPLETE, $3.50

Securely packed in a Paper Box.

## S. P. C.

## Sensitized Albumen Paper Outfit for 4 x 5 Pictures.

1 4x5 Printing Frame,
1 5x7 Porcelain Pan Deep.
1 5½x4½ S. P. C. Vulcanite Tray.
2 Dozen 5x8 S. P. C. Sensitized Albumen Paper.
1 Bottle French Agotate, } for toning
1 " Chlo. Gold, 7½ grains. } for toning
1 2 Ounce Graduate.
1 Lb. Hyposulphate of Soda.
2 Dozen sheets 6½x8½ Card Board with Gilt Form.
1 ½ Pint Jar Parlor Paste.
1 1½ inch Bristle Brush.
1 Glass Form (for trimming prints.)
1 Robinson's Straight Trimmer.

PRICE COMPLETE, $4.75

Securely Packed in a Paper Box.

## S. P. C.

### Sensitized Albumen Paper Outfit for 5 x 8 Pictures.

1 5x8 Printing Frame.
1 7x9 Porcelain Pan Deep
1 5½x8½ S. P. C. Vulcanite Tray.
2 Dozen 5x8 S. P. C. Sensitized Albumen Paper.
1 Bottle French Agotate } for toning.
1 " Chlo. Gold, 7½ grains. } for toning.
1 2 Ounce Graduate,
1 Lb. Hyposulphate of Soda.
2 Dozen sheets 9x11 Card Board, with Gilt Form.
1 ½ Pint Jar Parlor Paste.
1 1½ inch Bristle Brush.
1 Glass Form (for trimming prints.)
1 Robinson's Straight Trimmer.

PRICE COMPLETE, $6.00

Securely packed in a Paper Case.

**FOR SALE BY**

R. & J. BECK,

1016 CHESTNUT STREET,

PHILADELPHIA, PA.

(OVER)

# TO MEET WITH SUCCESS

## USE

# Ferrous Oxalate Developer

FOR

# KEYSTONE GELATINE DRY PLATES.

Provide two bottles and in them mix the following solutions:

| | | |
|---|---|---|
| Solution I. | Bromide of Potassium | 20 grains. |
| | Neutral Oxalate of Potash, | 5 ounces. |
| | Water, | 20 " |
| Solution 2. | Sulphuric Acid, | 20 drops. |
| | Protosulphate of Iron, | 5 ounces. |
| | Water, | 20 " |

A large supply of these may be made, as it keeps good for a long time. Shortly before developing a negative, mix together the above in the following proportions:

**SOLUTION 1, 4 OUNCES.**
**" 2, ½ OUNCE.**

Pour into a flat dish and immerse the exposed plate, the image upon which will rapidly appear and continue to acquire density.

If Solution No. 1, does not turn Blue Litmus paper slightly red, then add to it a few drops of Oxalic Acid Solution until it does.

## FIXING BATH.

When the image is fully developed, wash with water and immerse in the following until the milky appearance entirely disappears. If however, it be inconvenient to use it in a bath, the Solution may be poured upon the plate from a bottle.

| | |
|---|---|
| Hyposulphite of Soda, | 3 ounces. |
| Water, | 20 " |

After fixing, wash the plate in clean water, then immerse for five minutes in a saturated solution of Alum, wash in one or two changes of water and set up to dry, then varnish, after which the negatives are ready for the frame in which the printing is done.

READ THE PHOTOGRAPHIC AMATEUR

By J. TRAILL TAYLOR, Price 50 cents per copy.

Old Style Equipment.

# THE SCOVILL Portable DRY PLATE OUTFITS

## FOR AMATEURS.

New Style Equipment.

The increasing interest in Dry Plate Photography, and the impetus given by it to the work of the amateur, has created a demand for a special apparatus which is light, compact, and easily carried about. We are, as usual, up to the requirements of the times. The Cameras and Apparatus of our make are known to be in every respect the most accurate and of the lightest weight of any in the world.

We beg to call your attention to the following Price Lists of

## NE PLUS ULTRA APPARATUS OUTFITS,

### All Articles of which are Warranted Accurate in every Respect.

**OUTFIT A, complete, price $10 00, comprises**

A View Camera (black) with rubber bellows and rigid platform, for making 4 x 5 inch pictures.

1 Patent Patent Double Dry Plate Holder.

1 Tripod Camera Stand.

1 "Waterbury" Achromatic Nickel Plated Lens with Standard English Flange.

1 Carrying Case.

**OUTFIT B, complete, price $12 00, comprises**

A View Camera for taking 5 x 8 inch pictures. Same style as A Camera.

1 Patent Double Dry Plate Holder.

1 Tripod Camera Stand.

1 "Waterbury" Achromatic Nickel Plated Lens with Standard English Flange.

1 Carrying Case.

**OUTFIT C, complete, price $18 50, comprises**

A View Camera (black) for making 5 x 8 inch pictures.

This Camera is constructed so as to make either a *Cabinet Picture* on the full size of the plate (5 x 8 inches), or by substituting the extra front (supplied with the outfit) and using the pair of lenses of shorter focus, it is admirably adapted for taking *stereoscopic* negatives, also by the same arrangement two small pictures, 4 x 5 inches each, of dissimilar objects can be made on the one plate. Included in this outfit are also—

1 Patent Double Dry Plate Holder.

1 Large "Waterbury" Achromatic Nickel Plated Lens with Standard English Flange.

1 Pair "Waterbury" Achromatic Nickel Plated Matched Stereoscopic Lenses.

1 Tripod Camera Stand

1 Carrying Case.

# American Optical Company's Apparatus Outfits.

For a choice of lenses suitable to these outfits, see next page.

This apparatus is manufactured in New York City under our immediate personal supervision; and, as we employ only highly skilled workmen, and use nothing but the choicest selected materials, we do not hesitate to assert that the products of our factory are unequaled in durability, excellence of workmanship, and style of finish. This fact is now freely conceded not only in this country but throughout Great Britain, France, Germany, Australia, and South America.

Quality being considered, our prices are moderate, as the same grade of apparatus cannot be supplied for less price.

**OUTFIT No. 201, complete, price $26 50,**

CONSISTS OF

A MAHOGANY POLISHED CAMERA for taking pictures 4 x 4 inches, with *Folding Bellows Body*, single swing, hinged bed, and brass guides. It has a shifting front for adjusting the sky and foreground, also—

1 Patent Double Dry Plate Holder.
1 Taylor Folding Tripod.
1 Canvas Case to contain Camera and Holder.

**OUTFIT No. 202, complete, price $27 00,**

CONSISTS OF

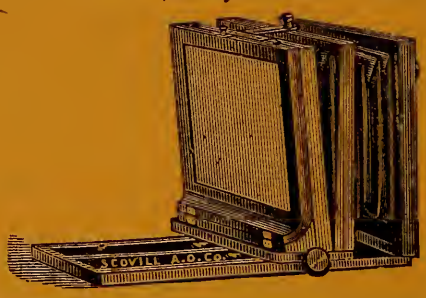
A FOLDING MAHOGANY CAMERA for taking 4 x 5 pictures, same style as 201 Camera, also—

1 Patent Double Dry Plate Holder.
1 Canvas Carrying Case.
1 Taylor Folding Tripod.

**OUTFIT No. 203, complete, price $41 00,**

CONSISTS OF

A FOLDING MAHOGANY CAMERA, fully described in the American Optical




Company's Catalogue, and well known as the '76 Camera (see illustration.) It is adapted for taking 5 x 8 pictures, and also for stereoscopic views—together with

1 Patent Double Dry Plate Holder.
1 Canvas Carrying Case.
1 Taylor Folding Tripod.

Cameras in Outfits 202 and 203 have shifting fronts, and are equal in style and finish to the best of the American Optical Company's make.

Our **New PATENTED Double Dry Plate Holders** are the best made, and answer the demand in dry plate work for something that will exclude all light. Prices of EXTRA *Patent double Dry Plate Holders* are as follows:

| | | | | | |
|---|---|---|---|---|---|
| 4 x 4 | Holders for | two | Plates..... | ...each, | $3 00 |
| 4 x 5 | " | " | " ..... | " | 3 00 |
| 5 x 8 | " | " | " ..... | " | 4 00 |

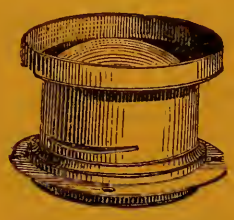
For a choice of lenses suitable to these outfits, see next page.

UNDOUBTEDLY THE BEST PHOTO. LENSES YET PRODUCED.

# MORRISON'S

# Wide-Angle View Lenses.

**PATENTED MAY 21, 1872.**



These Lenses are absolutely rectilinear; they embrace an angle of fully 100 degrees, and are the most rapid *wide-angle* lenses made. We recommend them for use with the foregoing outfits.

## PRICE OF MORRISON'S WIDE-ANGLE LENSES.

| | | | | | | | | Price. |
|---|---|---|---|---|---|---|---|---|
| No. 1, | $\frac{3}{4}$ diam. of lens, | 4 x 4 in. plates, | 3 in. equiv. | focus, | each, | | | $25 00 |
| No. 2, | 1 " " | 4 x 5 " | $3\frac{1}{2}$ | " | " | " | | 25 00 |
| No. 3, | 1 " " | $4\frac{1}{2}$ x $7\frac{1}{2}$ " | $4\frac{1}{4}$ | " | " | " | | 25 00 |
| No. 4, | 1 " " | 5 x 8 " | $5\frac{1}{4}$ | " | " | " | | 25 00 |

## *Morrison's Rapid Stereoscopic Lenses*

FOR INSTANTANEOUS VIEWS OR LAWN GROUPS

Are entirely different in many particulars from any other lenses in the market. They are 6 inches focus and $1\frac{1}{4}$ inch in diameter, and of course can be obtained in matched pairs, if desired. By using a set of diaphragms provided they are adapted for making 5 x 8 views.

A novel and ingenious instantaneous drop is also provided, passing through the brasswork, on the same principle as a central stop, by which *absolutely instantaneous views*, 4 x 5 inches, may be made, sharp all over to the very edges, without being diaphragmed down.

**PRICE** ..... ... .....each, $40 00

## "Peerless" Quick Acting Stereoscopic Lenses,

FOR PORTRAITURE OR VIEWS.

We can also furnish the following, either single or in pairs:

The Lenses are especially designed for Stereoscopic Photography, and are so constructed that they will work well for interiors or exteriors.

They are particularly adapted for instantaneous work.

Diameter of Lenses, $1\frac{1}{2}$ inch; focal length, $3\frac{1}{2}$ inches.

By removing the back lens and substituting the front combination, a focal length of $5\frac{1}{2}$ inches is obtained.

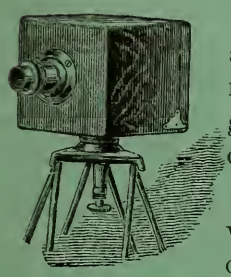
They are supplied with six Waterhouse diaphragms in morocco case.

Price, per pair..... .....$25 00

Imitation Dallmeyer Lenses for Landscapes. Price, per pair.....$17 00

AMATEURS WILL FIND THESE LENSES PERFECTLY ADAPTED TO THEIR USE.

# PRICE LIST
OF
# WALKER'S POCKET CAMERA
WITH COMPLETE
# PHOTOGRAPHIC OUTFIT.



ONE seldom gazes upon the beauties of nature or art without at least a desire to perpetuate in more substantial form than mere memory the thing of beauty, and that photography offers greater facilities for a rapid and accurate record than any other process, few will question.

The discovery of Daguerre startled the entire scientific world. But the process began and ended with one image upon one plate without hope of reproduction except by photographing the original plate.

Then came the "*Negative*," a permanent semi-transparent reversed picture on glass. It is obvious if paper sensitive to light be placed under a negative and exposed to light, such paper will undergo a chemical change in direct proportion as the negative shields from or exposes it to the light, and thus an indefinite number of prints, or as they are commonly known photographs, are produced.

The old, or as is commonly known the "*Wet*" process of producing a negative involves tedious and dangerous methods which but few amateurs have zeal enough to master and fewer still the patience to follow. But a great change has come and while the negative is still the medium of reproduction, the amateur has the last obstacle removed to the successful practice of photography by the use of the new Dry Plates.

When WALKER'S POCKET CAMERAS were first placed upon the market, the over-wise scouted the idea of the Art of Photography being mastered by amateurs from any printed instructions; such belief being based undoubtedly upon their knowledge of the various text books upon the subject, which, though plain enough to the professional, were worse than Greek to the uninitiated.

WALKER'S POCKET CAMERAS are designed *especially for amateurs*, and are the outgrowth of a demand for light, compact and accurate apparatus; the photograph taken being $2\frac{3}{4}$ x $3\frac{1}{4}$ inches, and the entire *Field* Outfit weighing but *two pounds.* The *Complete* Outfit consists of Camera, Tripod, *Double* Dry Plate Holder, Dark Box, Ruby Lamp, 1 Dozen Dry Plates, Printing Frame, Sensitized Paper, and other articles enumerated on following page. A carefully prepared Instruction Book, free from technicalities and ambiguities, is also furnished with each outfit, and so simplifies the art of Photography, that it is readily acquired by any one without previous experience.

The so called "*Outfit*" heretofore offered consists simply of a Camera, Tripod and Plate Holder, a totally inadequate aid to the would be photographer, who really needs everything necessary for the production of a finished photograph, including *complete instructions*, or he is as helpless with his "*Outfit*" as a ship without a helm.

The year 1882 opens with a large number of instruments in the hands of amateurs who, with very few exceptions, were totally ignorant of apparatus or

processes, previous to purchase. Exchange Clubs have been formed and a generous rivalry to excel in excellence has resulted in a development of skill and artistic taste beyond the fondest hopes of the most sanguine. What the future of the art will be none are so bold as to predict, but that it possesses rare powers of stimulating observation, and will mould the latent taste for the true and the beautiful into something tangible and permanent, none will question.

## A COMPLETE PHOTOGRAPHIC OUTFIT

Consists of the following necessary articles, and with them any person following the instructions can easily master the art of photography in a short time. The Chemicals supplied are sufficient for developing 100 negatives and finishing, with an additional supply of Sensitive Paper, 500 to 1000 photographs:

| | |
|---|---|
| *Camera, complete, with Achromatic Lens, nickel plated mount, 2 Diaphragms, ground focusing glass in frame, Walker's Patent Tripod Head, and Walker's Patent Hard Rubber *Double* Dry Plate Holder | $10 00 |
| Light-Tight Box, for storing 24 plates or negatives | 35 |
| *Ruby Lamp, for use in developing negatives | 50 |
| 2 Developing Trays, at 25 cents each | 50 |
| Graduated Glass | 25 |
| 2 Camel's Hair Brushes, at 10 cents each | 20 |
| *Oxalate of Potash, in ¼ lb. boxes | 20 |
| *Hypo-Sulphite of Soda, in ½ lb. boxes | 15 |
| *Proto-Sulphate of Iron, " ¼ " " | 15 |
| *Bottle of Intensifier, 2 oz., | 25 |
| *Gelatine Bromide Dry Plates, package of 1 doz., | 65 |
| Printing Frame | 60 |
| *Bottle of Negative Varnish, 2 oz., | 50 |
| *Bottle of Permanent Gold Toning Bath, 2 oz., sufficient for toning from 500 to 1000 Pocket Camera prints | 1 00 |
| Package 50 Sheets Permanent Sensitized Paper | 50 |
| Package 50 Card Mounts, size 4 x 5 inches, assorted colors, with chocolate border line | 50 |
| Book of Instructions | 1 00 |
| **The above Complete Outfit sold for $16.00.** | $17 30 |

Boxed and delivered at Express office here *without extra charge.*

The Camera in above outfit is supplied in either of three styles, Mahogony finish, Ebonized or Cherry, as desired, at same price. The Dry Plates, also are of two varieties known as Rapid and Instantaneous, the Rapid requiring in an average light about three seconds exposure, the Instantaneous, about one-half that time, fully explained in Instruction Book. The Dry Plates, Sensitive Paper, and Card Mounts, are put up in packages as above and cannot be sold in less quantities.

## PRICE LIST OF ACCESSORIES.

In addition to the above necessities to a photographic outfit, some persons desire a few of the conveniences or luxuries in the way of accessories, we therefore quote the following :

| | |
|---|---|
| Walker's Patent Hard Rubber *Double* Dry Plate Holders, each | $ 3 00 |
| Leather Pouches and Shoulder Strap, for carrying Camera on hip, with nickel name plate, clasp, and attachment for tripod legs | 4 00 |
| Water-proof gossamer, focusing cloth | 1 00 |
| Velvet " " | 1 00 |
| Album Case, representing a closed book, for Pocket Camera Photographs, an ornament to any library table | $1 50 |
| Absorbent Cotton, for filtering, per box | 25 |
| Camel's Hair Brushes, 1 inch wide, each | 30 |

## PRICE LIST OF PARTS.

Walker's Pocket Camera is made on a system of interchangable parts, in case therefore of accident any breakage can be readily replaced at a trifling expense:

| | |
|---|---|
| Camera Boxes, corrugated, and blackened, with frame and focusing glass, complete | $3 00 |
| Lenses, with nickel plated mount, complete | 3 00 |
| " without mount | 2 00 |
| Ground Focusing Glass, cut to Pocket Camera size | 25 |
| *Tripod Legs, each | 75 |
| " Heads and Sockets, complete | 75 |
| Hoods, or Lens Tube Caps, each | 25 |
| Diaphragms, two sized openings | 25 |
| Light Excluding Shutter, for Plate Holder, each | 25 |
| Clasps, for Plate Holder, each | 25 |

All articles enumerated in above lists, *except* those marked thus * can be sent by mail to any part of the U. S. or Canada; those *marked, must positively* be shipped by express. In ordering goods to be forwarded by mail, add 5 cents extra to price of each article for pre-payment of postage, and 10 cents additional for each package if same is to be registered.

## THE AMATEUR PHOTOGRAPHER.

A complete and comprehensive essay on Modern Photography, explaining the greatest improvement of later years in the art, known as the Gelatine Dry Plate Process, and beautifully illustrated with *sample photograph* produced with Walker's Pocket Camera in the hands of amateurs totally ignorant of the art of photography. Price, 10 cents.

## TERMS OF SALE.

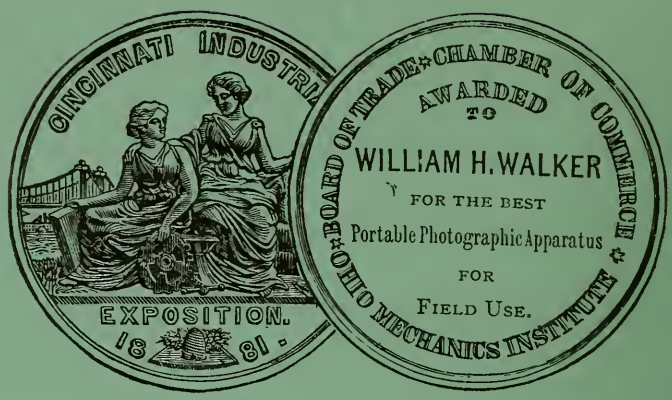
Our terms are inveriably Net Cash by draft on New York, Registered Letter, or P. O. Order made payable to us. Checks of parties unknown to us not accepted unless certified, all checks must include 25 cents to cover exchange.

C. O. D. orders, with privilege of inspection, will always be honored when accompanied by one-half the value of the goods ordered. The return charges to be paid by the person ordering the goods.

## SHIPMENTS.

All goods are carefully packed, marked in exact accordance with instructions and delivered at Express office here *without charge.*

We will not be responsible for breakage, accident or delay after the goods leave our possession.




# TESTIMONIALS.

At the Exhibition of scientific apparatus made before the American Association for the advancement of Science, and the ninth Cincinnati Industrial Exposition, 1881. The jury reported as follows: To William H. Walker for "Best Portable Photographic Apparatus for field use."

The jury concur in making the award of the silver medal for the intrinsic merit and superior excellencies in the following particulars, viz: Economy, Portability, Convenience, Corrugated lining, Tripod Head.

[Signed] H. B. Furness, G. M. Allen, F. W. Langdon, } *Jury.*

*UNIVERSITY OF ROCHESTER—CHEMICAL LABRATORY.*

Rochester, N. Y., Nov. 15, 1881.

Walker's Pocket Camera and its accessories constitute a marvel af mechanical ingenuity. It reduces a whole photographic outfit to the very minimum of bulk. Every part down to the most hidden detail, shows the highest skill of contrivance and the most thorough workmanship.

It so happily overcomes the difficulties of manipultion that any careful person, who will faithfully follow the directions, although without previous experience, may be satisfactorily successful from the very start. S. A. LATTIMORE.

*ROCHESTER ACADEMY OF SCIENCE.*

Rochester, N. Y., Nov. 30, 1881.

Walker's Pocket Camera is a marvel of compactness and excellent workmanship, and does its work in a surprisingly beautiful and perfect way. I have used it under all sorts of difficulties, and the more I use it the better I like it. It is invaluable to any one who wishes to preserve fine landscapes, and may be adapted to a variety of other uses as occasion requires. In brief, it is perfectly satisfactory. MYRON ADAMS.

Delaware, Ohio, Oct. 7, 1881.

On the whole, your little Photographic outfit is very cheap, accurate and reliable. With its help *I have learned the art of Photography*, and this is fully worth fifteen dollars.

With a larger instrument the cost of this lesson would have been double. I shall always speak a good word for your outfit to any who may wish to learn the art.

H. W. JONES.

# R. & J. BECK,

## MANUFACTURING OPTICIANS,

1016 Chestnut Street, PHILADELPHIA.

AGENTS FOR "WALKER'S POCKET CAMERAS,"

AND ALL AMATEUR PHOTOGRAPHIC SUPPLIES.

CATALOGUES FREE TO ANY ADDRESS.

# Books on the Microscope

AND OTHER

# SCIENTIFIC INSTRUMENTS.

---

Any work in the following list, will be mailed free to any address in the United States or Canada, or receipt of the price.

1000. Nugent. A Treatise on Optics. By E. Nugent. Profusely illustrated, . . . . . $2 00

1001. Dick. The Telescope and Microscope. By Rev. Thomas Dick. 192 pages, . . . . . 50

1002. Wood. Common Objects of the Microscope. With 400 illustrations, printed in colors, . . . . . 50

1003. Cooke. 1000 Objects for the Microscope. With 400 illustrations. By M. C. Cooke, . . . . . 50

1004. Cooke. Microscopic Fungi: An Introduction to the Study of Rust, Smut, Mildew and Mould. Illustrated by nearly 300 figures, colored. By M. C. Cooke, author of British Fungi, etc., 2 50

1005. Hogg. The Microscope: Its History, Construction and Application. Being a familiar Introduction to the Use of the Instrument and the Study of Microscopical Science, with Directions for Collecting, Preserving and Mounting Objects. Illustrated with upwards of 500 engravings and colored illustrations. 750 pages, 3 50

1006. Beale. How to Work with the Microscope. By Lionel S. Beale, M.D., F.R.S. Fourth edition, greatly enlarged, . . . . . 7 50

1007. Beale. The Microscope, and its Application to Clinical Medicine. By Lionel S. Beale, M.D., F.R.S. Fifth edition, 1880, . . . 7 50

1008. The Aneroid Barometer. Its Construction and Use. Compiled from several sources, and reprinted from Van Nostrand's Magazine. 106 pages, . . . . . , 50

1009. Carpenter. The Microscope and its Revelations. By Dr. W. B. Carpenter. Latest edition, 25 plates and 449 wood engravings, 848 pages, . . . . . 5 50

1010. Griffith. Elementary Text-Book of the Microscope, with a Description of the Methods of Preparing and Mounting Objects, etc. With 12 colored plates, 451 figures. By J. W. Griffith, M.D., F.R.S., . . . . . 3 00

1011. Davies. Hand-Book on Preparing and Mounting Microscopic Objects. Latest edition, fully illustrated and brought up to the present time. By Thomas Davies, . . . . . 1 25

1012. LANKESTER. Half hours with the Microscope. A Popular Guide to the use of that instrument, 130 pages. Profusely illustrated. By Edwin Lankester, M. D., . . . . . $1 25

1013. STOWELL. The Student's Manual of Histology. A Text-Book for the Student, and a Complete Guide for the Practitioner and Microscopist. By Prof. Charles H. Stowell, of the University of Michigan. 300 pages, octavo, with 192 engravings, . . . . . 2 00

1014. GIBBES. Practical Histology and Pathology, 107 pages. *New.* By H. Gibbes, London, . . . . . 1 00

1015. SUFFOLK. On Microscopical Manipulation. Being the subject-matter of a Course of Lectures delivered before the Queckett Microscopical Club. By W. T. Suffolk, F.R.M.S., with 49 engravings and 7 lithographs, . . . . . 2 00

1016. GOSSE. Evenings at the Microscope, 477 pages. Profusely illustrated. By Philip Henry Gosse, F.R.S., . . . . . 1 50

1017. SEILER. A Compendium of Microscopical Technology, for the use of Students and Physicians. 130 pages and numerous illustrations of Apparatus. By Dr. Carl Seiler, Philadelphia, . . 1 00

1018. MARTIN. A Manual of Microscopic Mounting. Profusely illustrated with wood-cuts and drawings on stone. By John H. Martin, . . . . . 3 00

1019. PHINN. Practical Hints on the Selection and Use of the Microscope, By John Phinn. 131 pages, illustrated, . . . . . 75

1020. SLACK. Marvels of Pond Life. Fourth edition, with colored plates and numerous wood-cuts, . . . . . 2 00

1021. SMITH. How to see with The Microscope. By Prof. J. Edwards Smith. With profuse illustrations, . . . . . 2 00

1022. BECK. A Treatise on the Construction, Proper Use and Capabilities of R. & J. Beck's Achromatic Microscopes. By Richard Beck. Royal 8vo., with 27 plates, . . . . . 5 00

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