ILLUSTRATED AND DESCRIPTIVE

Catalogue of

PHILOSOPHICAL, METEOROLOGICAL,

MATHEMATICAL,

SURVEYING,

OPTICAL AND PHOTOGRAPHIC INSTRUMENTS,

MANUFACTURED BY

L. P. CASELLA,

SCIENTIFIC & METEOROLOGICAL INSTRUMENT MAKER

To the Admiralty,

BOARD OF TRADE, BOARD OF ORDNANCE, THE GOVERNMENTS OF INDIA, SPAIN, PORTUGAL, THE UNITED STATES, AND THE BRAZILS;

THE ROYAL OBSERVATORIES AT KEW, CAPE OF GOOD HOPE, AND OF THE WAR DEPARTMENT;

THE UNIVERSITIES OF OXFORD, CAMBRIDGE AND LONDON;

AND THE OBSERVATORIES OF ARMAGH, WASHINGTON, VICTORIA, TORONTO, CALCUTTA, THE MAURITIUS, ETC. ETC.

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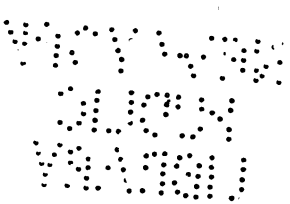

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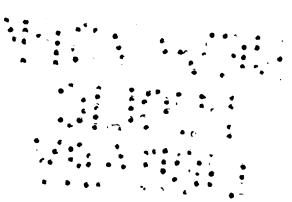


ADDRESS.

In presenting a new and extended catalogue to the public, my chief desire has been that it should fairly represent the various instruments connected with my establishment, including such recent additions as should efficiently meet the scientific and manufacturing wants of the day.

The extensive alterations lately made in my premises, enable me to manufacture much more under my own care, and to carry out more efficiently many modifications and improvements in the various branches of my establishment, whilst gentlemen desiring to superintend or construct new arrangements of their own, can do so with perfect confidence, either personally or by forwarding drawings with instructions, and thus obtain the aid of practical workmen on most of the scientific subjects with which they may be engaged.

To the METEOROLOGICAL DEPARTMENT I beg to direct particular attention, with the full belief that in many of its branches an excellence is attained unequalled by that of any other house in London, in proof of which I may state that

The STANDARD THERMOMETERS for the late important investigations at the Royal Observatory, Kew, as well as for the equally important and recent inquiries of the leading Professors of London, Cam-

bridge, Oxford, etc., have been made at my establishment; the height of the Demavend, 21,520 feet, has just been decided with instruments of my construction; whilst my Maximum and Minimum Thermometers are found to possess a degree of excellence and durability, with a facility in use, and extent of application, as yet unequalled by those of any other principle or make;—statements that are fully verified by the daily additions to the extended patronage enumerated on the title page, including as it does every scientific department of our own Government, the Governments of India, America, Spain, Portugal, the Brazils, etc., as well as the leading OBSERVATORIES and INSTITUTIONS OF SCIENCE throughout the world.

An extensive intercourse with the leading Opticians and Scientific Bodies enables me to introduce every novelty of interest as soon as it appears, and thus, though not made by myself, or in this country, to obtain it at once from the Continent or whatever distance it may have to come.

The increasing desire to introduce Instruments and Apparatus in private tuition, as well as their general adoption in public schools, has induced the arrangement of several portions of the Apparatus into sets; so that persons desiring to use them in teaching, or to commence the practice of any particular branch, as Chemistry, Photography, Meteorology, etc., may at once see the cost and easiest means by which they can do so.

A TABLE OF CONTENTS, and carefully arranged general index, referring to the number of each article, together with ample illustrations, will enable the reader to find with ease any instrument or apparatus required.

With orders from the country, or abroad, instructions should be given as to the mode of conveyance, shipment, etc.; and, in all first transactions, it is requisite to send an approximate remittance, reference, or order for payment in London.

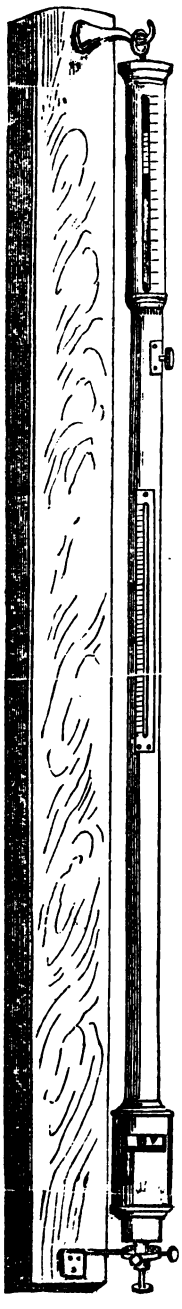
MERCHANTS, SHIPPERS, AGENTS, ETC., sending orders, will find the best care given to packing, shipping, etc., and the most liberal attention to meet their interest and views.

LOUIS P. CASELLA.

23, HATTON GARDEN, LONDON, E.C.

January, 1860.

Fig 1.*



STANDARD METEOROLOGICAL INSTRUMENTS.

The general arrangement of the following Catalogue places each description of instrument under separate and appropriate headings, nevertheless it may be convenient for those requiring standard instruments, either singly or in sets, to have such placed as much as possible together. With this view, the following list will materially aid in making such selections; the numbers in each case referring to the number in the body of the catalogue, where a general description of the instrument may be found.

Standard Barometer, *(fig.* 1, p. 6) on Fortin's principle, with brass body and glass cistern; or the same suspended from the top, to revolve to any angle of light, with jointed reflector and vertical screw adjustment at the base *(fig* 1*), with Kew verification 8 10 0

Or, with additional scale of French millemetres, extra 0 16 6

STANDARD BAROMETER, with extra large tube, viz., ·75 inch internal diameter 21 0 0

Standard Thermometer, Kew Observatory and Ordnance pattern *(fig.* and No. 54), with divisions etched on the stem figured on metal or porcelain, with Kew verification 1 15 0

STANDARD THERMOMETER,* with expanded graduations, viz., ¾ to 1-inch to each degree (No. 56) . 1 15 0

HICK'S newly invented self-registering mercurial MINIMUM and MAXIMUM THERMOMETER. By this arrangement, the great desideratum is obtained of having both temperatures registered by mercury and the graduations of its low temperatures tested, not by measurement or calculation, as in spirit thermometers, but by actual experiment. For registering both extremes of temperature, particularly cold, by means of mercury, this is certainly the only practical instrument that is made . 1 [illegible] 0

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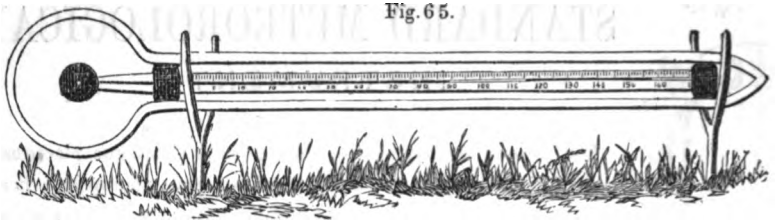
* "DEAR SIR,—You have full liberty to express my highest approval of all the instruments I have had from you. I consider your thermometers most excellent, and cannot conceive anything to be more sensitive than those with expanded graduations you sent me last January."—From the Rev. Professor Walker, F.R.S., Oxford, dated Oct., 1859.

DEAR SIR,—I have been so well satisfied with all you have done for me that I have much pleasure in authorising you to mention my name, if you wish it, as highly approving of all the thermometers I have used of your make."—From W. Hopkins, Esq., F.R.S., Cambridge, dated Oct., 1859.

Fig. 65.



Standard Maximum Thermometers,* on Professor Phillips's principle respecting which L. CASELLA cannot but remark on the extent to which this important arrangement of thermometer may be applied. As instruments of precision for meteorological purposes, they are simple, certain, easy to use, and not liable to derangement from windy or unsteady situations; for medical and manufacturing purposes, they are the only thermometers which can be made to register inverted, erect, or in any other position; whilst for travelling, being free from metallic indices, or objectionable obstructions in the bore, they are unquestionably the safest for carriage, and best suited for all climates, of any registering thermometers in use.—See also p. 17.

No. 1 and 2. MAXIMUM THERMOMETER, for ordinary registration (Nos. 62 and 63) 16s. 6d. and 0 17 6

No. 3. **Solar Radiation Thermometer** (No. and *fig.* 64) . . 0 17 6

VACUUM SOLAR RADIATION THERMOMETER, *(Casella's)* (No. and *fig.* 65) with black bulb, in stout glass tube, exhausted of air to within $\frac{1}{10}$-inch on the gauge; thus, being protected from vapour and all external influences, uniformity of readings are obtained for the comparison of solar radiation, which greatly surpass those obtained by any other arrangement . 1 5 0

No. 1. **Minimum Thermometer** (No. 70), Ordnance pattern . 0 16 6

" 2. MINIMUM THERMOMETER, (No. and *fig.* 71) . . 0 14 6

" 3. MINIMUM THERMOMETER, for the grass (No. and *fig.* 72) . 0 16 6

Hygrometer, wet and dry bulb (No. and *fig.* 103) . . . 2 2 0

HYGROMETER, ditto, for suspension (No. 134) 1 17 6

HYGROMETER, Regnault's, with double aspirator (No. 137) . . 6 6 0

HYGROMETER, Regnault's, CASELLA'S improved (No. and *fig.* 138) . [illegible] 0

HYGROMETER, Daniell's, with spirit test (No. and *fig.* 138) . . 3 0 0

Rain Gauges† (Nos. 140, 141 and 142), 16s. 6d. to . . . 3 3 0

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* "The great advantages of these thermometers are their non-liability to break either in transit or in use; the ease with which they are set, and the satisfaction of being able to render them non-registering at pleasure, by which they can at all times be brought to the same condition as a standard thermometer for purposes of comparison. Your minimum thermometers have also proved the best suited for this climate of any which have come under my notice. The anemometer, which I took, had a fair trial in the Red Sea and Indian Ocean; at times we had dead calms, and were gratified to find it really doubtful whether your gauge or the usual instruments gave best indications of the ship's speed."—From Dr. HALLEUR, M.D., Prof. of Natural Philosophy and Astronomy, Presidency College, Calcutta. Dated April, 1859.

† "Tell Casella that the portable rain gauge he arranged for me has been of great service to us here, and opportunities have not been wanting for testing its capabilities."—Vide Dr. Livingstone's Report to the Royal Geographical Society, 1859.

Dr. Babington's Atmidometer, for measuring the evaporation from water, *ice or snow* (exhibited at the meeting of the Royal Society by Dr. Babington, F.R.S., and explained to the Society in his paper on the spontaneous evaporation of various fluids, November 24, 1859). It consists of an oblong hollow bulb of glass or copper, beneath which, and communicating with it by a contracted neck is a second globular bulb, duly weighted with mercury or shot. The upper bulb is surmounted by a small glass or metal stem, showing a scale graduated to grains and half grains; on the top of which is fixed horizontally a light, shallow metal pan, of about five inches area. This instrument being immersed in a vessel of water through a circular hole in the cover of which, the stem rises, distilled water is gradually poured into the pan above, which is thus caused to sink, until the zero of the stem is brought to a level with the cover of the vessel. Thus adjusted, as the water in the pan evaporates, the stem ascends, and the amount of evaporation is indicated in grains. These indications would appear to be the most delicate we have, and are certainly the only satisfactory means we possess of measuring evaporation from *ice* or *snow*. An adjustment for temperature is furnished with each instrument, £2 to 3 10 0

EVAPORATING DISH (No. 143) 0 15 6

Anemometer, Dr. Robinson's (see p. 2*, No. and *fig.* 147) . . 4 4 0

MOUNTAIN BAROMETER, with gauge point (No. 3) . . . 7 10 0

Hypsometrical Apparatus,* for mountain measurement, with two tubes divided to fifths of degrees (No. and *fig.* 6) 5 10 0

DITTO, with two tubes divided to tenths 5 5 0

DITTO, with three tubes subdivided to twentieths of degrees, No. 1. ranging from 180 to 192; No. 2, 192 to 203; and No. 3, 203 to 214 (see note, p. 7) 7 10 0

Marine Barometer,† standard, as made by L. CASELLA for the Board of Trade and Admiralty, in case, with lock (No. and *fig.* 16) . . . 4 5 0

*** This instrument can also be had less contracted in the tube, to use as a standard on land, with Kew verification, £4 10s.

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* "The last part of the ascent was extremely painful from the rarefaction of the air. * * * We experienced great difficulty even when at rest in drawing breath. * * * * Having recovered a little from our fatigue, we proceeded to take observations of the height of the mountain (with Casella's apparatus), this we ascertained to reach the enormous height of 21,520 feet."—See paper read before the Royal Geographical Society on a journey through the mountainous districts north of the Ellbûrz and ascent of the Demavend, in Persia, by R. F. Thompson, Esq., and Lord Shomberg Kerr, of Her Majesty's Mission, Teheran, communicated by the Earl of Malmesbury, Vide proceedings of the Royal Geographical Society, No. 1, Vol. III., 1859.

"I have the fullest confidence in the measurement obtained of the height of the Demavend by means of your instrument, and have had much pleasure in applying its capabilities to measuring the height of a room."—Lord S. Kerr to L. Casella.

† "MY DEAR SIR,—I have always felt pleasure in expressing my thanks for the services rendered by your faithful barometer. I shall never forget the fearful gale I encountered when in command of the "Windsor," bound for Calcutta, and about two days sail from Liverpool, the notice of which, in the papers of the day, best show the advantages derived by proper attention to its truthful indications.—Ever faithfully yours, JAMES FURNELL, Sailors' Home, Poplar, Dec., 1859."

Ozonometer, Schonbien's, consisting of strips of paper prepared with iodide of potassium and starch. The papers are suspended so as to be exposed to the free access of air, but sheltered from wet and the direct rays of the sun; when affected by ozone, the papers become tinged with various shades of blue or light brown, the intensity of which is measured by a graduated scale of twelve tints, which accompany the ozonometer . . . 0 6 6

OZONOMETER, Moffatt's, on the same general principle as above . . 0 8 6

OZONE CAGE, of fine wire gauze, as recommended by Sir James Clarke, . 0 15 6

DITTO, of copper gauze 1 2 0

OZONE BOX, 12s. 6d. to 0 18 0

PAPERS, for registering ozonometer indications for one year . . 0 1 6

CASELLA'S ECONOMIC SERIES OF
SCIENTIFIC GARDEN INSTRUMENTS.

The increasing demand for a simple and reliable means of obtaining early notice of approaching changes of the weather, has induced L. CASELLA to arrange a series of economic yet trustworthy instruments for this purpose; his first intention being to meet the wants of the gardener and agriculturist, he has generally classed them under the name of scientific garden instruments. The anxious attention, however, which has been recently directed to the weather along our shores induces the remark that the barometer, hygrometer and rain gauge are particularly suited for either purpose, and that the high commendations bestowed upon them apply alike for both uses.

AGRICULTURAL OR COTTAGE BAROMETER (No. 41) . . . 0 11 6

DITTO, of larger size, with oak, mahogany or rosewood frame, ivory plates and portable screw (No. 40) 1 5 0

GARDEN REGISTERING MINIMUM THERMOMETER (No. 75) . . 0 4 6

GARDEN REVOLVING WINDOW THERMOMETER (No. 123) 5s. 6d. and 0 6 0

" " MAXIMUM THERMOMETER (No. 68) . . 0 8 6

HOT-BED THERMOMETER (see No. 102), 18s. 6d. to . . . 1 5 0

MASON'S HYGROMETER (No. 136) 0 12 6

GARDEN RAIN GAUGE (No. 141) 0 15 6

SIX-INCH GARDEN SUN DIAL, adapted to any locality to order . 0 15 6

GARDEN or SCHOOL MICROSCOPE (No. 482) 1 1 0

" DEAR SIR,—My barometer, as made by you, was reported by the jurors of the Great Exhibition of 1851, to be the best of its class, and I have much pleasure in testifying to the great improvements you have since made in it, and now known as the agricultural or cottage barometer.

" D. S. BROWN, 2, Alexandrian Lodge, Old Kent Road."

" London, 20th August, 1857."

" The barometer is equal to one in our possession at ten times the price. The thermometer self-registering and accurately graduated, has proved, upon trial, to be equally efficient."—GARDENER'S CHRONICLE, Sept. 19th, 1857.

" These instruments should be in the hands of every farmer." " My next month's observations will be made with them."—MARK LANE EXPRESS, Sept. 14th and Oct. 5th.

" Would adorn alike the gardener's cottage or the hall of the mansion. We are much obliged to Mr. Casella for thus popularising these useful instruments. His name is a guarantee for the character of any instrument."—COTTAGE GARDENER, Oct. 27, 1857.

" Casella's cottage barometer has lately been brought under our notice, very much to our delight and profit. They have registered with unerring faithfulness the recent changes in the weather."—THE FIELD, Nov. 7, 1857.

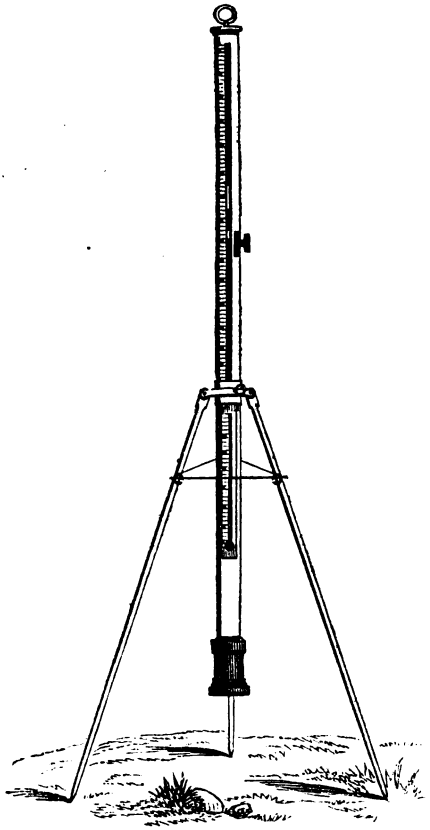
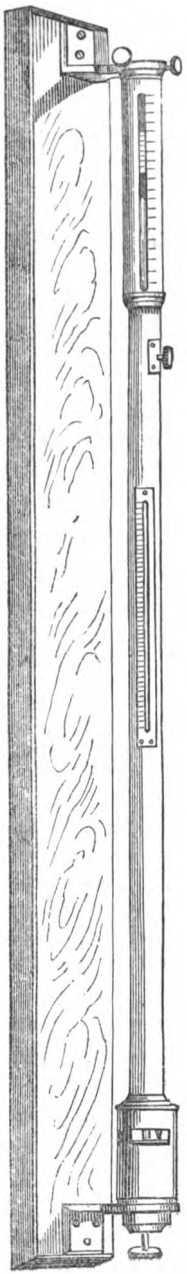


Fig. 4.

METEOROLOGICAL INSTRUMENTS.

THE important results of the Brussels Conference for ensuring uniformity of observations in every department of Meteorology, both on land and at sea, especially in the construction of instruments so far superior to those hitherto in use as to have produced a marked progress during the last few years in meteorological science, and L. CASELLA having been appointed by Her Majesty's Government, in conjunction with that of the United States, to construct a large number of *authenticated* instruments, and also the recent extensive acknowledgments of the superiority of these and similar instruments, induces L. CASELLA to submit the following list of first-class instruments, which may be implicitly relied on as indicating correctly the pressure, temperature, and humidity of the atmosphere; as well as the direction and force of its various currents.

Fig. 1.



STANDARD AND MOUNTAIN BAROMETERS.

1. **Standard Barometer,** *(fig. 1)* on Fortin's principle; with brass body and glass cistern, mounted to revolve in brass brackets on mahogany frame, with vertical screw adjustment; the mercury boiled in the tube of average internal diameter of 0·34 inch; fixed ivory adjusting point in cistern of 2·6 inch diameter, in which the mercury is maintained at a constant level by means of a thumb screw, the plate of which pressing upon a leather bag which forms the bottom of the cistern, keeps the mercury in bare contact with the ivory point which forms the zero of the scale; rack adjustment, scale vernier reading to ·002, or the 500th of an inch, and, by estimation, to a 1000th; engine divided, attached thermometer etched on the stem, the bulb in contact with the mercurial column, and accompanied with verification from the Royal Kew Observatory . . £8 10 0

Or with scale divided into French millimetres extra 0 16 6

2. **Standard Barometer,** the same as above, with extra large tube, viz., 0·75 inch, the cistern 3 inches internal diameter, with mountings, etc., increased in proportion, mercury boiled in tube, engine divided, etc. . . £20 0 0

3. **Mountain Barometer** (Superior), with gauge line on glass cistern, attached thermometer, table of altitudes as arranged by Colonel Sykes, F.R.S., and expressly adapted by L. CASELLA for portability and precision in mountain measurement, the vernier reading to the 500th of an inch, price, with tripod stand and sling case £7 10 0

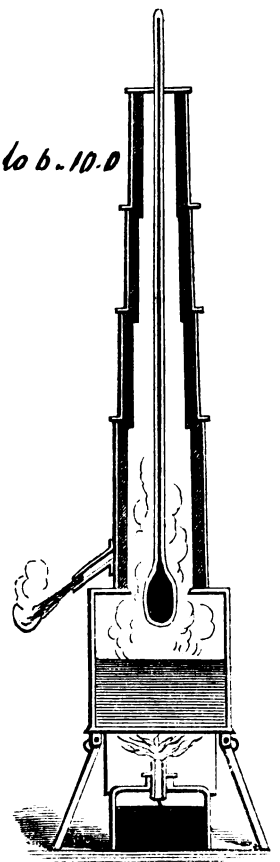
4. **Mountain Barometer (Casella's much Improved),** especially arranged for the vicissitudes of mountain travel, with the improved iron cistern, the scale reading to about 22,000 feet of elevation, and double vernier reading to 500th of an inch, the cistern and scale adapted by calculation for the varying height of the mercury, by which the greatest amount of accuracy is obtained, as well as a degree of hardihood surpassing that of any other mercurial mountain barometer, with metal tripod stand and leather sling case, *(fig. 4, p. 5)* £6 6 0

5. **Mountain Barometer (Englefield's),** round mahogany, with revolving brass cover and ivory scale in centre, and compass attached £5 5 0

HYPSOMETRICAL APPARATUS.

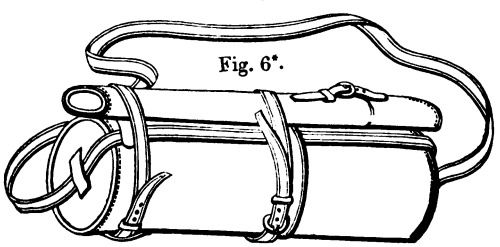
Fig.6.

6. CASELLA'S MUCH IMPROVED, for measuring mountain altitudes by the boiling point of water on Dr. Wollaston's principle, arranged and modified by Colonel Sykes, Dr. Halleur, Regnault, etc., (*fig.* 6), the thermometers to 5ths of degrees £4 10 0 *to 6.10.0*



This instrument is hardy and portable, affording a ready and accurate means of measuring heights by temperature, where varying circumstances may prevent the employment of the mercurial barometer. The annexed design shows its general construction, consisting, first, of a strong and very sensitive enamelled thermometer, the scale ranging from 180° to 214° Fahrenheit, being engine divided on the stem, so as to show distinctly the tenth of a degree; secondly, a copper boiler attached to a small tripod stand; to the top of the boiler a telescopic three-draw tube is attached, which is again surrounded by a second tube and screwed to the top of the boiler. The inner tube has perforations near the top, which allows the steam readily to fill the outer chamber and escape freely by the side tube. The thermometer is supported at about one inch from the water in the inner chamber by means of a cork or India-

Fig. 6*.



rubber washer sliding on the stem; and is immersed in the steam to any required point by sliding the telescopic tube to any desired height. A metallic spirit lamp, with slide to protect the flame in the open air, is packed along with the instrument, which has two thermometers in case of accident. The tables employed are those arranged by COLONEL SYKES for his extensive surveys with this instrument in India, extended by GENERAL BOILEAU. The whole, when packed in a leather sling case (*fig.* 6*), presents a most hardy and portable instrument.

*** The efficiency and portability of this instrument is such as to have induced L. CASELLA to apply a series of tubes, giving an expansion of scales of about one inch to a degree Fahrenheit, and subdivided on their stem to the 20th of a degree, by means of which an elevation of two or three feet may easily be estimated.

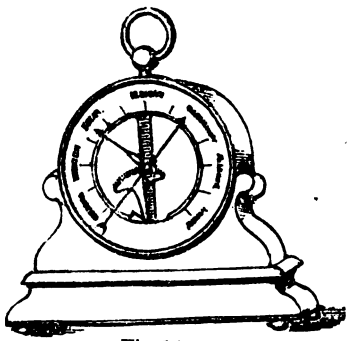


Fig. 14.

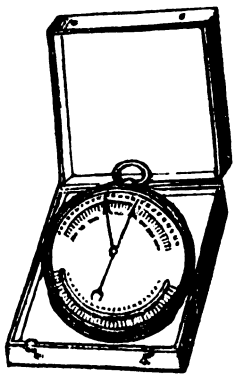


Fig. 9.

ANEROID AND METALLIC BAROMETERS.

Within the last few years these new and elegant descriptions of Barometers have been introduced, the peculiarity of which consists in their being made entirely of metal: the Aneroid, for instance, having a thin circular case, the corrugated diaphragms of which are held in a state of tension by powerful springs; and, as this case is deprived of air, the varying pressure of the atmosphere causes a variation of its surface; this, being multiplied by delicate levers and rack-work, produces an expansion of scale, which being divided by comparison with standard barometers, is found to give most delicate indications of changes of weather, as well as truthful measurements of moderate heights in mountain altitudes; and, also, as in the case of Bourdon's metallic barometer, most sensitive measurements of vacuum and steam pressure. Vacuum and steam pressure gauges on this principle are now most popular in this country. (See pressure gauges.)

ANEROID BAROMETERS.

7.	No. 1.	Card dial, plain, in neat case for portability	£2 10 0
8.	" 2.	Silvered dial, plate glass in front	3 [illegible] 0
9.	" 3.	Silvered dial, do. do. with thermometer (*fig.* 9)	3 6 0
10.	" 4.	" " " " divided to 50ths of an inch, for measuring heights, range 24 inch to 31·5 inch, with detached thermometer, in sling case	3 15 0
11.	" 5.	Same, with double needle or indices, by which the highest and lowest range may be registered	4 4 0

Large size for suspension in halls.

12.	Card dial, £3; same with thermometer	3 10 0
13.	Extra large card dial	4 4 0
14.	**Metallic Barometer (Bourdon's)**, in round brass case, diameter about 5 inches, with plate glass in front, through which the interesting mechanism of the instrument is visible, (*fig.* 14)	4 4 0
15.	METALLIC BAROMETER (*Bourdon's*), of larger size, in handsome ebony frame, for suspension like a dial	5 5 0

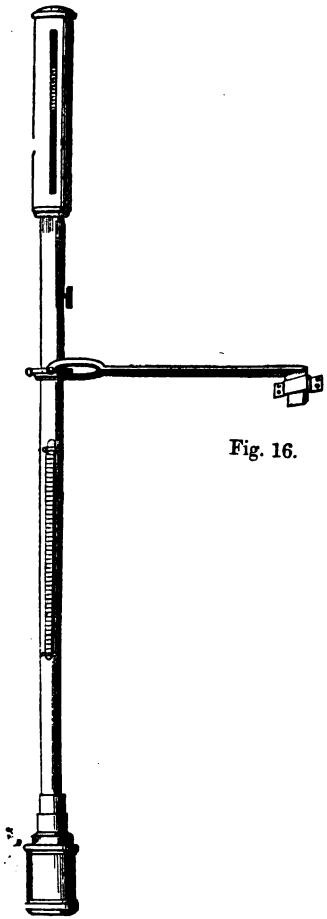


Fig. 16.

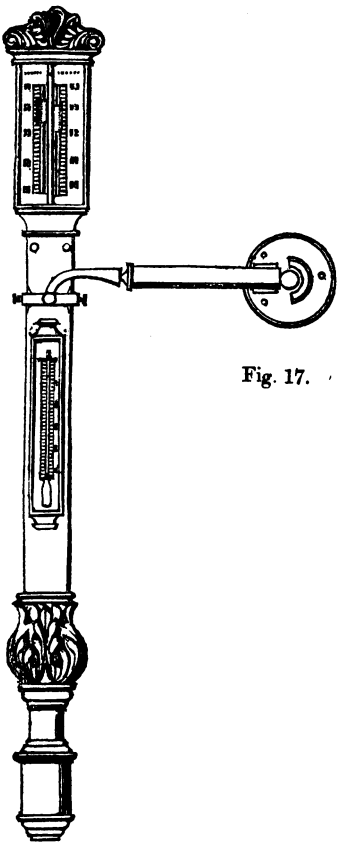


Fig. 17.

MARINE BAROMETERS AND SYMPIESOMETERS.

16. **Standard Marine Barometer** (Board of Trade and Admiralty pattern), round bronzed metal frame, with iron cistern and revolving gimbals, scale reading to 500th of an inch, etc., as required by the Brussels Conference for correct meteorological observations at sea; the tube contracted to prevent oscillation during the most violent storms *(fig. 16)*. £4 5 0

17. **Marine Barometer,** bow front, neatly carved, *(fig. 17)* with thermometer in front, ivory plates, double rack, verniers reading to 100th of an inch, revolving in centre ring and brass gimbals complete, rosewood, mahogany or oak 3 15 0

18. MARINE BAROMETER, bow front, single rack and gimbals, complete 3 5 0

19. **Marine Barometer,** in solid rosewood frame, round top, thermometer in front, double rack, ivory scales, vernier reading to 100th of an inch, protected with stout plate glass, etc. £3 10 0

20. MARINE BAROMETER, complete, with single rack-work . . . 3 3 0

21. " " " of plain simple construction, perfectly reliable, in solid mahogany, with ivory plates and gimbals, complete . . 2 10 0

22. **Marine Station Barometer** for seaports, expressly designed by L. CASELLA, to meet the requirements of the Admiralty and Board of Trade, at fishing stations, harbours, and lighthouses. The body or framework of solid oak, or mahogany, revolving on brass brackets to suit the varying position of light; the scales of ivory or porcelain reading to the 100th of an inch; open scale thermometer and plate glass for protection in front; extra large tube, with bore 0·35 inch, accurately adapted to the capacity of its strong glass cistern, by which the nearest approximation to a perfect standard instrument is obtained . . 5 10 0

23. MARINE STATION BAROMETER, Admiralty pattern, in round bronze metal frame, on mahogany board, with revolving gimbals, and adjusting screws at base, to ensure perfect perpendicularity, CASELLA'S improved cistern and extra large tube of 0·5 inch internal diameter, vernier reading to the 100th of an inch . 5 /5 0

24. **Marine Station Sympiesometer,** for the same purposes, and on the general plan and arrangement of No. 22; the scale elongated to about three times the usual length, adapting it as a valuable guide where more expanded graduation and greater sensitiveness are required 6 10 0

25. **Marine Barometer and Sympiesometer** combined, by which the indications of each are at all times comparable, the tubes of both being contracted, to prevent oscillation; rack-work to sympiesometer, and double rack-work to barometer; very handsome, in rosewood, walnut, etc., with gimbals complete *(fig. 25)* 6 10 0

26. MARINE BAROMETER AND SYMPIESOMETER, with single rack-work 6 0 0

27. " " " " " of smaller size, very neat and equally perfect, with double rack-work 5 5 0

28. MARINE BAROMETER AND SYMPIESOMETER, small size, with single rack-work 5 0 0

29. **Sympiesometer** (CASELLA'S MUCH IMPROVED) especially arranged for use at sea, the tube contracted to prevent oscillation in stormy weather, in solid rosewood case with stout plate glass front, the scale reading to the 50th of an inch *(fig. 29)* 3 3 0

30. SYMPIESOMETER (CASELLA'S IMPROVED), in portable mahogany or metal frame, with straps, for measuring mountain altitudes, as adopted by some leading members of the Alpine Club 3 10 0

31. SYMPIESOMETER (CASELLA'S IMPROVED), in neat portable case, with ivory scale, for the pocket 2 10 0

MINING BAROMETERS.

32. **Mining Barometer** 0 17 6

*** The numerous accidents occurring in coal mines in particular, and the close connection of these with atmospheric pressure, has induced L. CASELLA to modify and arrange his Economic Cottage Barometer, so as to be perfectly applicable for this purpose; and, with a view to its extensive adoption at home and abroad, has fixed the price as above; the instrument being in every way as sensitive, hardy, and reliable as the much more expensive instruments now in use.

33. MINING BAROMETER, of larger construction, more elaborately finished £1 15 0

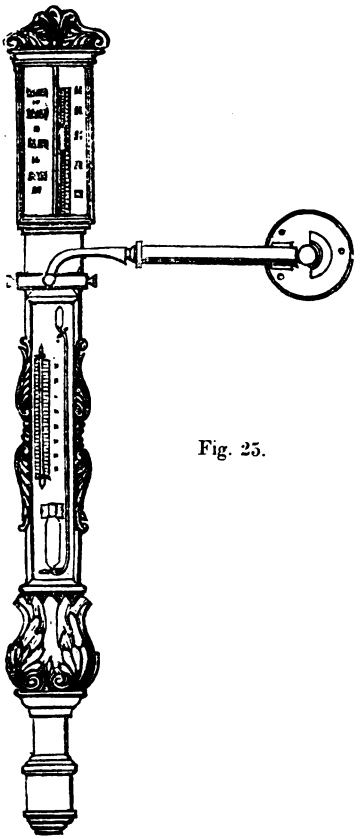


Fig. 25.

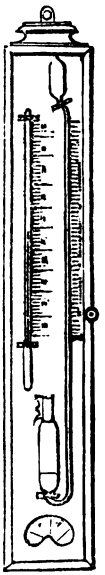


Fig. 29.

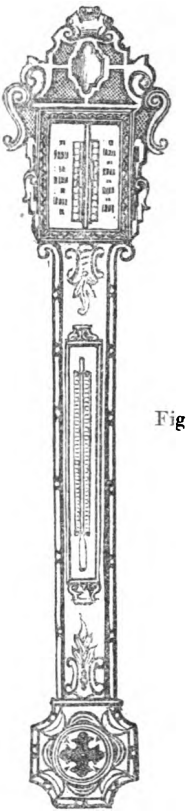


Fig. 34.

PORTABLE OR PEDIMENT BAROMETERS.

In these instruments the action of the mercury is direct and free from mechanical influence; and, when the relative proportions of the cistern and tube are properly arranged on the scale, the nearest approach to a standard barometer is attained.

34. **Portable Barometer,** extra size, very bold, handsomely carved, in rosewood, mahogany or oak, plate glass in front, with extra large tube 0·45 inch internal diameter, double rack-work, ivory plates, and attached thermometer, suited for large halls or public buildings *(fig. 34)* . £7 7 0 and £9 9 0

35. Portable Rosewood Barometer, handsomely fitted up, inlaid with pearl, plate glass in front, double rack-work, and verniers reading to the 100th of an inch £6 6 0 to £8 8 0

36. Portable Barometer, gothic pattern, Casella's design, double rack-work, german silver mountings, and altogether as elegant in arrangement as this description of barometer will allow *(fig. 36, p. 12)* . . £5 10 0


Fig. 41.

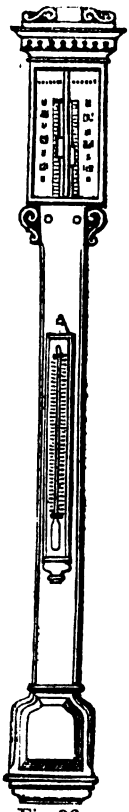


Fig. 36.

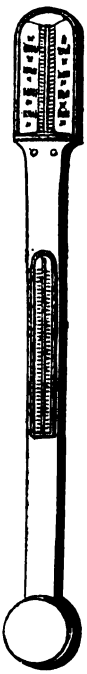


Fig. 39.

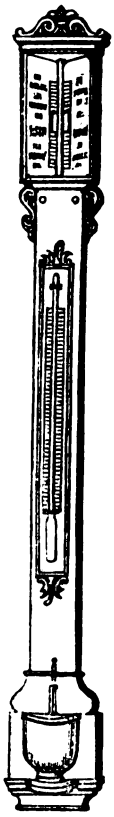


Fig. 37.


Fig. 40.

37. **Portable Barometer,** extra size, tube 0·4 inch internal diameter, and cistern 2·75 inch ditto, ivory plates, with verniers reading to 100th of an inch, carved top and sides; thermometer in front covered with plate glass, floating gauge, etc. *(fig. 37)* £6 6 0

38. PORTABLE BAROMETER, with extra large tube and cistern, the graduation of the scale compensating for variation in the level of the mercury in the cistern; handsomely engraved ivory plates, with german silver mountings, and double vernier, each reading to the 100th of an inch; combining every excellence of which this description of barometer will admit £4 4 0

39. PORTABLE BAROMETER, plain pattern, thermometer in front, ivory plates, rack-work and vernier reading to the 100th of an inch, portable screw and plate glass, in rosewood or mahogany *(fig. 39)* £2 5 0

40. **Portable Barometer,** with open face and ivory plates, vernier reading to 100th of an inch; thermometer at side, and portable screw; in rosewood, oak, mahogany, etc., being a cheap, good and hardy instrument, adapted alike for home use or transmission to all parts of the world *(fig. 40)* . . . £1 5 0

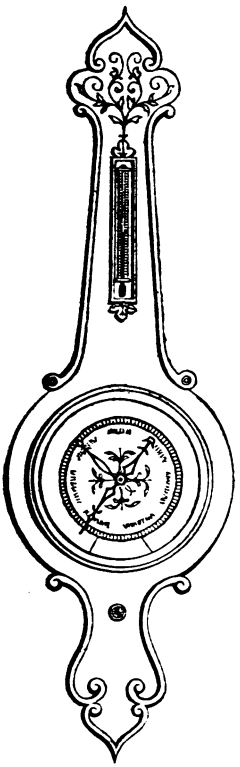


Fig. 43.

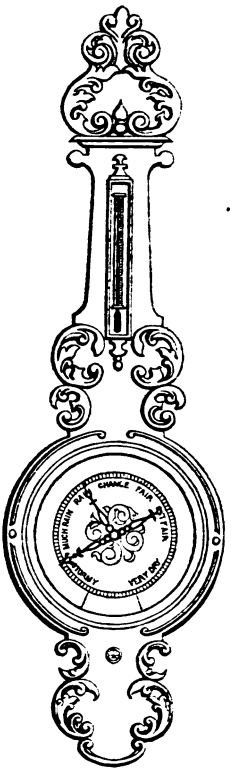


Fig. 49.

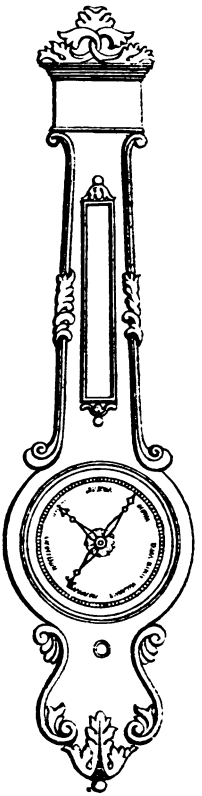


Fig. 44.

41. **Agricultural or Cottage Barometer,** expressly designed by L. Casella as a cheap, hardy, and popular weather glass, accompanied with interesting description and instructions, the portability and accuracy of which has extensively popularized it in this country and is rapidly introducing it abroad *(fig. 41)* 0 12 6

CIRCULAR OR DIAL BAROMETERS.

The advantages of this arrangement of weather glass consist in the greatly extended scale of graduation and the facility of judging of the approaching changes in the weather, by slightly tapping the instrument.

42. **Circular or Dial Barometer,** in various fancy woods—rosewood, walnut, oak, mahogany, etc., either plain or elegantly carved to any style of furniture or architecture for halls, libraries, etc. . . £5 5 0 to £21 0 0

43. **Ten-inch Dial Barometer,** handsomely inlaid with buhl work, plate glass over dial, and attached thermometer *(fig. 43)* . . . £5 5 0

44. Ten-inch Dial Barometer, Egyptian pattern, in rosewood, walnut, oak, etc., very chaste *(fig. 44.)* £4 0 0

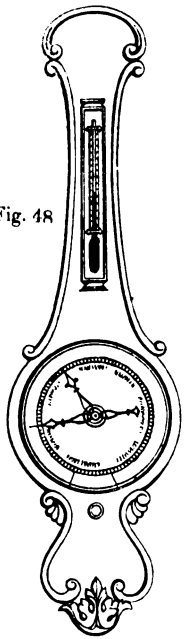


Fig. 48

45. **Twelve-inch Dial Barometer,** best rosewood, elegantly inlaid with variegated buhl work, with best eight-day pendulum time-piece and attached thermometer, particularly suited for mansions and club-houses £21 0 0

46. TEN-INCH DIAL BAROMETER, very chaste, form of eight-day timepiece, with very open graduated thermometer in front 5 5 0

47. **Eight-inch Dial Barometer,** same pattern as No. 43, *(fig.* 43, p. 13*)* 4 10 0

48. EIGHT-INCH DIAL BAROMETER, same pattern as No. 44 or *fig.* 48 . . . . . 3 0 0

49. TEN-INCH DIAL BAROMETER, (CASELLA'S) richly carved in walnut, oak, rosewood, etc., (*fig.* 49, p. 13) 4 4 0

50. TEN-INCH DIAL BAROMETER, very neat, in rosewood or mahogany, with hygrometer, thermometer and level, equal as a sensitive and accurate instrument with any of the above 3 3 0

51. EIGHT-INCH DIAL BAROMETER, same pattern as No. 50 . . . . 2 10 0

52. **Ten-inch Dial Barometer,** a very neat, good, and practical instrument, in rosewood or mahogany 2 0 0

53. EIGHT-INCH DIAL BAROMETER, same pattern as No. 52 . £1 8 0

These instruments are sometimes furnished with double rack-work, by which the index is set without disturbing the preceding day's indication at an extra charge of 5*s.* to 10*s.*; and when the best sorts are required for transmission abroad, they are supplied with rack and pinion movement, instead of silk cord and pulley; also with stop-cock to render them portable, that on reaching their destination they merely require to be suspended and the stop-cock turned, the extra charge being 6*s.* 6*d.* to 16*s.*; or, with chronometer ring and strong bevelled plate glass, 10*s.* to £1 1*s.* extra.

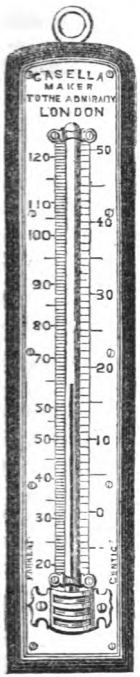


Fig. 112.

Fig. 131.

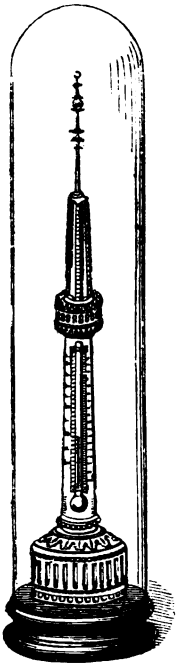


Fig. 120.

Fig. 132.

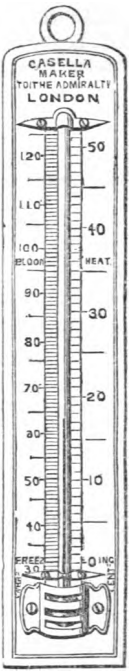


Fig. 113.

THERMOMETERS.

THE recent extended application of the use of Thermometers in various branches of the arts and manufactures, as well as the great delicacy now required in their construction for scientific investigation, renders a general description of all the varieties impossible: yet L. CASELLA having of late been engaged by the Committee of the Royal Kew Observatory, as well as by the various learned societies and manufacturing establishments, in the construction of perhaps the most sensitive and varied adaptations which have yet been made, is prepared to construct these instruments to any practicable design or description.

Fig. 54.

STANDARD THERMOMETERS.

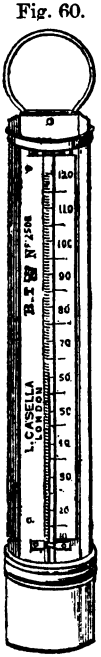
54. **Standard Thermometer** (ORDNANCE PATTERN) *(fig. 54)* divisions etched on the stem and figures on raised piece at side, metal scale, in maroon case about 15 inches; range about 0° to 212°, the tube carefully calibrated throughout the whole range, with verification from Kew £1 15 0

55. STANDARD THERMOMETER, as No. 54, but not verified . . 1 10 0

56. STANDARD THERMOMETER, extra sensitive, about 20 in. long, range from 30° 40° 50° or 60° to 50° 60° 70° or 80°, enamel tube with small bulb and bore, each degree about $\frac{3}{4}$ inch, subdivided to $\frac{1}{10}$ or $\frac{1}{20}$ of a degree, with chamber at top, by which any required zero may be formed, and this exquisitely sensitive instrument used at any heat below 212°, with an India-rubber and brass tube for protection, complete £1 15 0

*** Some thermometers made by L. CASELLA for the investigation of phenomena connected with atmospheric friction, by Professor W. Thompson of the Glasgow University, the degree being about six inches in extent, and the bulb half an inch in diameter, have been described as "the most sensitive thermometers ever used."

Fig. 60.



57. **Sensitive Thermometer,** about eleven inches long, stout tube, with extra fine bore; engine-divided and figured on the stem to tenths of degrees, each degree being about $\frac{1}{4}$ inch, showing 40 degrees in all, adapted to any required temperature for delicate physical investigation, with India-rubber and brass tube complete £1 2 0

58. SENSITIVE THERMOMETER, 35 inches long, for extreme low temperatures, from 60° below zero to 80° above, filled with the purest alcohol specific gravity 720, the tube carefully calibrated; engine divided and figured on the stem, in case . . . £1 10 0

59. **Frictional Thermometers,** two on revolving stand, as arranged by Babinet for observing the increments of temperature obtained by the friction of their rapid rotation in air . £1 15 0

60. **K O Thermometer** (ADMIRALTY PATTERN), metal scale, divisions etched on the stem and figures on the raised metal piece at the side; scale 11 inches, range about 0° to 120° or 140°; in copper case, with verification from the Kew Observatory, from which it takes its name (*fig.* 60) 0 10 6

61. K O THERMOMETER (ADMIRALTY PATTERN), porcelain scale, with divisions, figures, etc., as No. 60 . . . 0 11 6

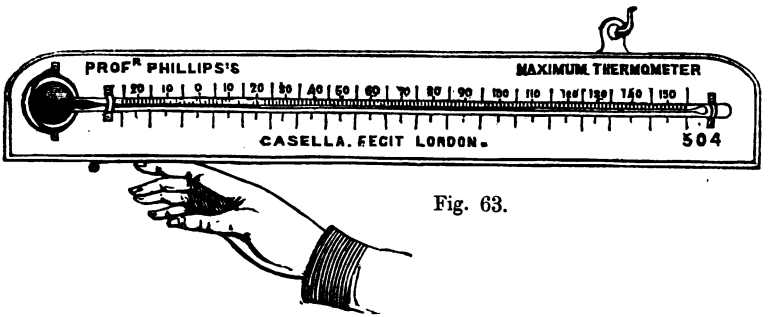
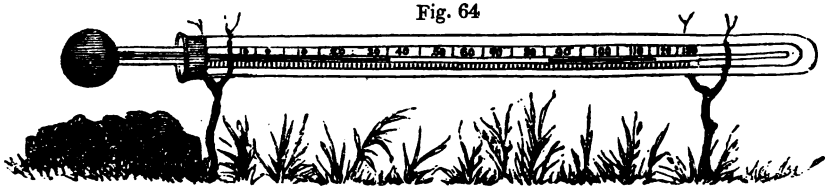


Fig. 63.

Fig. 64



REGISTERING THERMOMETERS.

Maximum Thermometers, on Professor Phillips's principle (CASELLA'S IMPROVED).

These instruments were originally introduced to the notice of the Royal Society by Prof. Phillips, and also exhibited by him in 1856 to the British Association for the Advancement of Science. Their advantages as constructed by L. CASELLA, consist in great facility of use and the means of applying them to various scientific researches, as well as a degree of hardihood and portability equalled by no other instruments of their kind. The principle is described in the report of the Kew Committee to the British Association, as "valuable from its extreme simplicity," and as embodying "the most convenient form of all maximum thermometers;" also, in a letter from Prof. Phillips to L. CASELLA, the Professor says "Your construction of it is excellent; you have done full justice to the principle—all, indeed, that can be desired."

62. **No. 1 Maximum Thermometer,** for ordinary registration, engine divided on the stem, and figured on metal scale, Ordnance pattern . . . 0 17 6

63. No. 2 MAXIMUM THERMOMETER, as No. 1, on boxwood scale (*fig.* 63) . 0 16 6

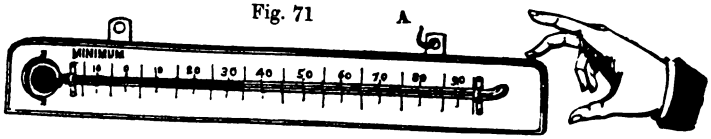
64. No. 3 MAXIMUM THERMOMETER *(fig.* 64*)* for solar radiation, stem enclosed in glass cylinder, also engine divided and figured on the stem 0 17 6

65. No. 4 MAXIMUM THERMOMETER for solar radiation, insulated in stout glass cylinder and sealed in vacuo, agreeably to the suggestions of Sir John Herschel, Bart., (see "Admiralty Manual of Scientific Enquiry," second edition, p. 295) ~~0 18 6~~ 25/

66. No. 5 MAXIMUM THERMOMETER, for registering high temperatures *in any position,* whether erect or inverted, as used by Professor Phillips in physical and chemical researches . . . . . 15s. 6d. to £1 10 0

67. **No. 6 Maximum Thermometer** (Portable) in small brass case, with India-rubber lining for the pocket, about 7 in. long, engine divided and figured on the stem, expressly arranged by L. CASELLA for Dr. Livingstone's Zambesi expedition, in which hardihood, portability, and precision were of equal importance 0 15 6

Fig. 71



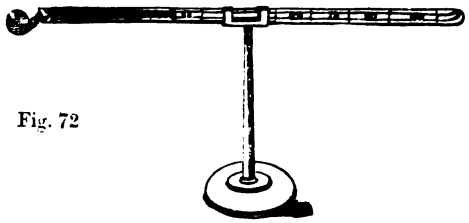


Fig. 72

68. **No.7 Maximum Thermometer,** for garden purposes; arranged by L. CASELLA expressly for the object of *popularizing* the admirable and important principle of Maximum Thermometers invented by Professor Phillips, 0 8 6

*** This instrument is constructed in a portable and economic form for gardeners' use, and is the most hardy maximum thermometer in existence. It is warranted to carry with perfect safety to all parts of the world.

69. **Helio-pyrometer,** as arranged by T. Southall, Esq., at his observatory, near Birmingham, by which the following extraordinary results were obtained:

July 11th, 1859, Maximum Temperature of Air 87° — in the Sun 216°
" 12 " " " " 89·1— " " 231·5
" 13 " " " " 80·5— " " 217

It is thus described by Mr. Southall—"The helio-pyrometer is an instrument which I have adopted for ascertaining as far as practicable the heating power of the sun's unconcentrated rays. A self-registering maximum thermometer with black bulb, made by Casella, on Professor Phillips's principle, is fixed on a cushion at the bottom of a box, the sides of which are also cushioned, and a thick piece of plate-glass is laid upon the top to prevent currents of air carrying off the heat, also with the view of preventing the cooling effects of terrestrial radiation. The box is placed in such a position as that the sun's rays may fall as nearly as possible perpendicularly on the glass, and it may require a change of position two or three times in the day to accomplish this: if, however, the sky be free from clouds from 11½ to 12½, the maximum heat will be then obtained, and no change of position will be required. A portion of the sun's heat, the amount of which may be calculated, is necessarily lost by reflection from the two surfaces of the glass, but, as this amount bears an uniform proportion to the intensity of the sun's rays, its loss is of no practical importance. A black bulb thermometer placed on grass, according to the usual method, is much influenced by the cooling effects of evaporation from the grass and soil, and the effect of the sun's direct rays is sometimes nearly lost by the counteracting power of strong currents of air, and at all times the reading of the thermometer is lowered by a current which is generated by the heat of the thermometer itself, as well as by terrestrial radiation.

Price, complete, ... £2 5 0

Minimum Thermometers, for registering extreme cold on Rutherford's principle, improved and modified by L. CASELLA, by which condensation of fluid at the top, and adhesion of the index to the stem is effectually prevented.

70. No. 1 MINIMUM THERMOMETER, Ordnance pattern, engine-divided on the stem. with metal or porcelain raised slabs for the figures . 0 14 6 to 0 16 6

71. No. 2 MINIMUM THERMOMETER, on boxwood scale, divided on the stem to correspond with No. 2 maximum *(fig. 71)* 0 14 6

72. No. 3 MINIMUM THERMOMETER, *Casella's, (fig. 72)*, engine-divided and figured on the stem, which is insulated, with brass pedestal for the grass 0 16 6

73. No. 4 MINIMUM THERMOMETER, small size for the pocket, expressly arranged for Dr. Livingstone's Zambesi expedition, as a companion to the maximum thermometer No. 6.* 0 13 6

* The two thermometers, Nos. 67 and 73, on metal scales in mahogany case for the pocket (as supplied to Dr. Livingstone) . . £1 [illegible] 0

Fig. 76 A Fig. 76 B

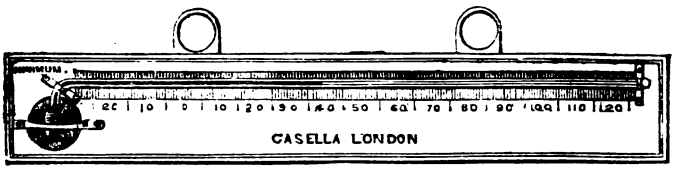


Fig. 74

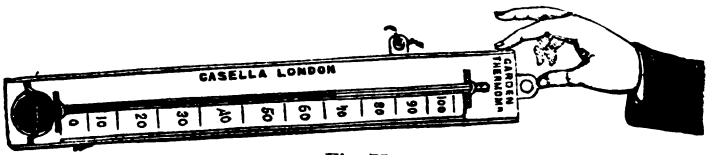


Fig. 75.

74. **No. 5 Minimum Thermometer,** with enamelled tube and polished boxwood scale for general use *(fig. 74)*. . . . 0 6 6

75. No. 6 MINIMUM THERMOMETER, for garden purposes, to correspond with CASELLA's popular garden Maximum Thermometer, No. 7 *(fig. 75)* . 0 4 6

Maximum and Minimum Thermometers, on Sixe's principle *(fig. 76A)*.

This description of instrument consists of an oblong bent tube, terminating at one end with a cylinder filled with *alcohol*, which occupies a position about half way the space between the two branches, and at the other with a bulb containing compressed air. The lower part of the bent tube is occupied by *mercury* which stands about half way from and above the bend, the remainder of the two branches above the mercury being filled with alcohol. It is furnished with two steel indices, enclosed in delicate glass tubes and placed above each column of mercury, which being brought, by means of a magnet (*fig.* 76B) to rest upon the mercury, any expansion by heat or contraction by cold will be shown by their positions: for example, an expansion by heat of the spirit in the centre will depress the mercury on the left, causing it to rise in proportion on the opposite side, the spring retaining the left index in its place, whilst the right is propelled by the mercury, where it is left on the spirit contracting with cold, which now in turn raises the left-hand index to whatever degree the cold may attain. One excellency of this instrument consists in the bulb containing the greatest possible amount of compressed air, this being the only force by which the mercury is made to recede on the contraction of the spirit.

76. **No. 1 Sixe's,** 10-inch, with magnet, on boxwood scale, in japanned case 0 15 6

77. No. 2 " 12-inch, " " " " " 0 18 6

78. No. 3 " 14-inch, " " " " " 1 1 0

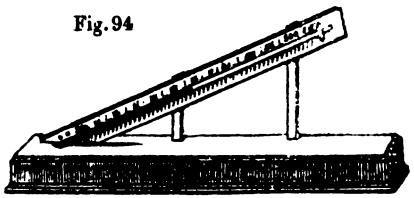
79. No. 4 " 10-inch, on porcelain scale for the weather . . 1 2 0

80. **Deep Sea Thermometer,** on SIXE's principle, in strong copper case, with valves, fourteen-inch 1 15 0

81. **Scott's Compensation Self-registering Maximum Thermometer,** for deep-sea observations, for which the silver medal of the Society of Arts has this year been awarded, and which has also been exhibited and approved at the meteorological department of the Board of Trade and Admiralty, by Rear-Admiral FitzRoy, F.R.S. in strong metal case for protection 3 10 0

82. **Ordinary Sea Thermometers,** etched on their stems, protected in round copper cases, with doors, etc., eight-inch, 10s. 6d.; ten-inch, 14s. 6d.; twelve-inch, 0 16 6

Fig. 94



OVEN THERMOMETER.

83. **Fluctuation Thermometer,** invented by Mr. Stewart, of the Royal Observatory, Kew 0 15 6

*** In this instrument the tubes employed are of unequal bore, with a small ball filled with mercury in the centre; it is mounted on a boxwood scale, and graduated similar to an ordinary thermometer, and used in a perfectly horizontal position. On an increase of temperature the mercury rises in the large bore only, whilst a decrease of temperature causes it to recede in the small bore only, and this action continues until the mercury has altered its position as far as the length of the tube will allow. To set the instrument, hold it perpendicularly till the mercury on each side of the ball is nearly coincident, and note the extent at which each column stands from the ball. This instrument illustrates an interesting principle well worthy of extended investigation.

84. **Differential Thermometer** (LESLIE'S) for experiments on radiation 0 12 6

CHEMICAL & MANUFACTURING THERMOMETERS.

85. **Chemical Thermometers,** etched on the stem, 8 and 10 inch, range about 0° to 140°, 212°, and 400°, in cases . . . . . 4*s.* to 7*s.* each

CHEMICAL THERMOMETERS, enamel tubes, divided and figured on the stems, with cylindrical bulbs for sand baths, etc., in cases.

86. No. 1, range 0° to about 212°, eight-inch 0 6 6

87. No. 2, range 0° to about 400°, ten-inch 0 9 6

88. No. 3, range 0° to about 600°, fourteen-inch . . . 0 12 6

89. CHEMICAL THERMOMETER, 25 inches long, filled with pure alcohol, tube very carefully calibrated, divided and figured on stem from 100° below zero to 90° above, in brass case 1 8 0

90. **Chemical Registering Thermometer,** an improved instrument, on Professor Phillips's principle, for registering high temperatures in any position, 0 15 6 to 1 10 0

91. **Manufacturing Thermometer,** for determining the temperature of oil, tallow, stearine, etc., the scale in copper case about 14 inches long, ranging from 212° to 660°, and furnished with a long projecting copper tube for the preservation of the lower part of the stem, about 4 feet below the scale £2 5*s.* 0*d.*; five feet below the scale £2 10 0

*** Extra lengths at prices increasing in proportion.

92. **Vatting Thermometer** for brewers and sugar refiners, with wooden frame and metallic scale, range 30° to 212°, or as required, 3 feet below scale 1 8 0

93. VATTING THERMOMETER, as No. 90, 4 feet below the scale . 1 12 0

94. **Oven Thermometer,** on cast iron base, to equalize the temperature *(fig. 94)* range 60° to 450°, with baking heats marked on the scale . . 0 12 6

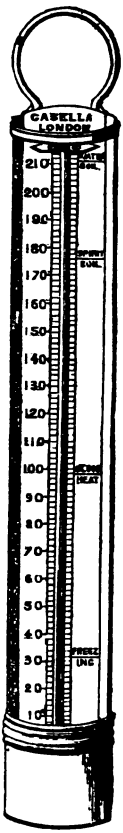


Fig. 99.

Fig. 102.

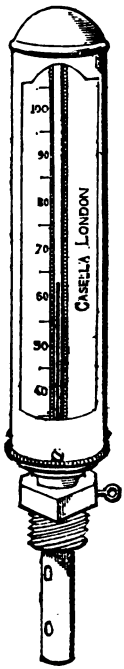


Fig. 97.

95. **Oven Thermometer,** the same as No. 94, to register extreme heat, on Professor Phillips's principle £0 17 6

96. **Daniell's Pyrometer** for measuring the expansion of metals, being the most perfect instrument for ascertaining high temperatures 4 4 0

97. **Gas Thermometer** for attachment to gas pipes, etc., (*fig.* 97) range from 20° to 120° 0 15 6

98. **Steam Thermometer,** same pattern as No. 97, range from 20° to 212° 17s. 6d. to 1 4 0

BREWING THERMOMETERS, (*fig.* 99)

With plain and enamel tubes on metal or porcelain scales. In these instruments the utmost care has been taken to prevent error, so that all enumerated below may be used with perfect confidence either for baths or brewing purposes.

99. **Brewing Thermometers,** plain tubes and metal scales, in japanned cases, range 20° to 212°; eight-inch, 4s. 0d.; ten-inch, 5s. 0d.; fourteen-inch . £0 6 6

100. **Brewing Thermometers,** enamel tubes, metal scales and japanned cases, eight-inch, 5s. 6d.; ten-inch, 6s. 0d.; fourteen-inch . . . £0 8 0

101. **Brewing Thermometers,** enamel tubes, metal scales and copper cases, eight-inch 5s. 6d.; ten-inch, 7s. 0d.; fourteen-inch 0 10 6

*** Any of the above may be had with porcelain instead of metal scales, at an average of from 8*d.* to 1*s.* 6*d.* extra.

HORTICULTURAL AND GARDEN THERMOMETERS.

102. **Hot-bed Thermometer** (*fig.* 102, p. 21,) especially adapted for pine and melon pits, as well as ground temperature to 18 in. below the surface, with pointed copper tube for protection and plunging into the earth; a small thermometer is also affixed to the door, by which a comparison of internal and external heat is obtained . . . . . 18s. 6d. to £1 5 0

103. **Green-house or Garden Thermometers,** enamel tubes, box-wood scales and japanned cases, range from 0° to 120°, eight-inch, 3s. 0d.; ten-inch, 4s. 0d.; twelve-inch 0 5 6

*** The above green-house thermometers may be had with porcelain scales, from 1*s.* to 1*s.* 6*d.* each article extra.

104. **Maximum Thermometer** for ascertaining the greatest heat of a green or hot house on Professor Phillips's principle (see No. 68) . . 0 8 6

105. **Minimum Thermometer** for ascertaining the lowest temperature (see No. 75, and *fig.* 105, p. 23,) 0 4 6

106. **Dairy Thermometer** manufactured for the express purpose of ascertaining the temperature of milk, tubes filled either with mercury or spirit, and sunk in strong oaken scale for protection 0 3 6

107. **Stable Thermometer** fitted with wooden frame and zinc scale; the tube being perfectly protected by a moveable zinc cover. . . . 0 4 6

DRAWING-ROOM AND HOUSE THERMOMETERS.

Drawing Room Thermometers, ivory on ebony or boxwood, double scales, either Fahrenheit and Reaumur, Centigrade or De Lisle, enamel tubes and german silver mountings:

108	Six-inch . .	0	6	6	110.	Eight-inch .	0	9	0
109.	Seven-inch .	0	7	6	111.	Ten-inch . .	0	12	6

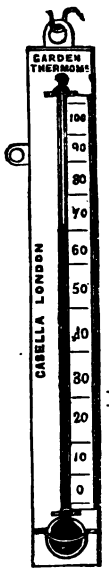


Fig. 105

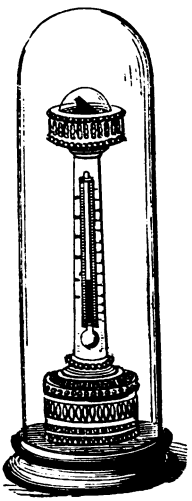


Fig. 119.

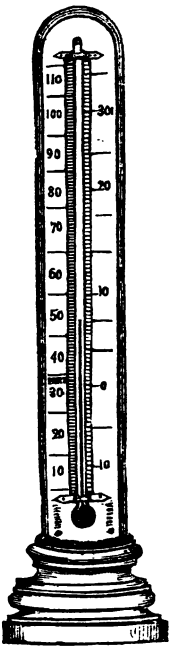


Fig. 117

112. **Drawing-Room Thermometers,** ivory scales upon papier maché, in various colours, exquisitely chaste, designed by L. Casella; double graduations, viz., Fahrenheit and Reaumur, De Lisle or Centigrade, *(fig.* 112, p. 15*)* seven-inch, 9s. 6d.; eight-inch £0 10 6

113. Drawing-Room Thermometers, polished boxwood, elliptic form, bevelled edges, very neat german silver or fancy mountings, graduations as above, eight-inch 4s. 6d.; ten-inch, 6s. 6d.; twelve-inch, *(fig.* 113, p. 15*)* . 0 9 6

114. Drawing-Room Thermometer divided to half-degrees, very sensitive, mountings, etc., as above, twelve-inch 0 14 0

115. **Boxwood Thermometer** polished, for ordinary use, double scale and enamel tube *(fig.* 115, p. 24*)* eight-inch 0 3 0

116. Boxwood Thermometer plain, for ordinary use, range from 0° or 30° to 110° or 130°, eight-inch 0 2 0

117. **Pedestal Thermometer** with ivory scale, on neat ebony base (*fig.* 117), with glass shade and german silver mountings, suitable for mantle-pieces, libraries, or bed-rooms, six-inch, 7s. 6d. to 9s. 6d.; seven-inch . . 0 10 6

118. Pedestal Thermometer, ivory on papier maché, on ebony base with glass shade, graduations, etc., as No. 112, very beautiful . . 0 15 6

119. Pedestal Thermometer, ivory, handsomely carved, with universal magnetic sun-dial, arranged to order for any part of the globe (*fig.* 119.) 1 8 0

120. Pedestal Thermometers in various neat and elegant designs, handsomely carved in ivory, with ebony base and glass shade *(fig.* 120, p. 15.*)*
£1 1 0 to 3 3 0

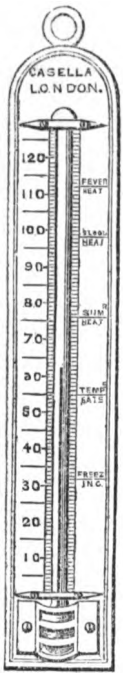


Fig. 115.

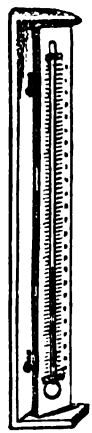


Fig. 123.

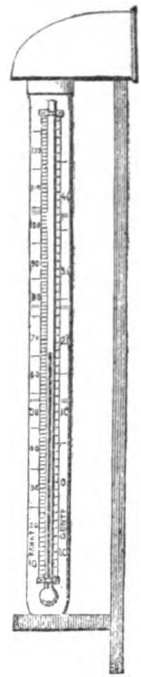


Fig. 121.

WINDOW THERMOMETERS.

121. **Window Thermometers,** ivory scales, enclosed in glass cylinders, mounted to revolve to any angle of sight, in mahogany frames, with copper roofs for protection from rain, *(fig.* 121*)*, eight-inch, 15s. 6d.; nine-inch, 18s. 6d.; ten-inch, ... £1 5 0

122. WINDOW THERMOMETERS, self-registering on SIXE'S principle, porcelain scales for the weather, mounted in mahogany frames as above, ten-inch 1 2 0

123. **Cottage window Thermometer,** spirit or mercurial, with boxwood scale, revolving in mahogany frame, arranged by L. CASELLA for extensive general use, 5s. 6d., or, with double graduations, *(fig.* 123*)* . . 0 6 0

TRAVELLING OR POCKET THERMOMETERS,

In neat morocco cases, with ivory scales, range 0° to 130° more or less, as required for climate, graduated according to Fahrenheit, Reaumur, etc., or to any language,

IVORY SCALES:

124.	Three-inch . .	0	6	0	127.	Six-inch . .	0	9	6
125.	Four-inch . .	0	7	0	128.	Seven-inch .	0	10	6
126.	Five-inch . .	0	8	6	129.	Eight-inch .	0	11	6

130. Eight-inch metal scale, 8s. 6d.

131. Delicate ivory or metal scales, 3½-inch, in cylindrical ivory or german silver cases, about $\frac{3}{8}$ inch diameter, *(fig.* 131, p. 15*)* . 8s. 6d. to 0 10 6

132. The same, in revolving german silver cases, $\frac{5}{8}$-in. diameter, *(fig.* 132, p. 15*)* 0 9 0

*** In ordering thermometers from a distance, it is well to state the country or general purposes they are for, when care will be taken to send them in every way suitable.

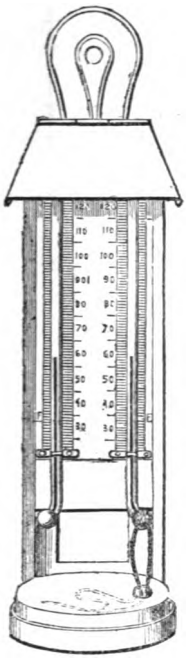


Fig. 135.

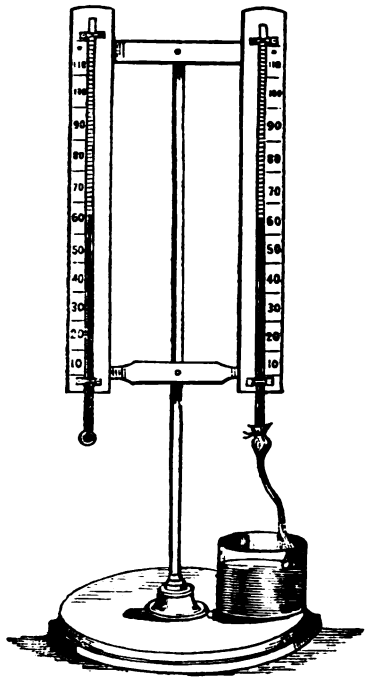


Fig. 133.

HYGROMETERS.

The dry and wet bulb, or Mason's hygrometer, consists of two thermometers placed parallel, as nearly identical as possible, and about four inches apart; the bulb of one being covered with thin muslin or silk, from which projects a few threads of lamp or darning cotton; this passing into a small vessel of water, at two or three inches distance, the cotton and bulb being first wetted, the bulb is thus kept continually moist causing this thermometer to indicate a lower temperature than the other, in proportion to the humidity of the atmosphere, the tendency of objects to dry, or the evaporating moisture from surrounding substances; thus, a difference of one degree only would indicate much moisture in the air, whilst a difference of ten to twelve degrees would show the air to be very dry. In taking these observations, caution is required to prevent the influence of breath or personal heat affecting the instrument.

133. **Mason's Hygrometer** *(fig. 133)* metal scales, with stand; the tubes etched on the stems, of the best construction, as supplied by L. CASELLA to the leading observatories at home and abroad, including neat case for travelling £2 2 0

134. MASON'S HYGROMETER, metal scales, mounted on mahogany frame for suspension, thermometers etched on the stems, and figured upon raised metal or porcelain pieces at side 1 17 6

135. MASON'S HYGROMETER, in neat plain case, especially adapted for conservatories and green-houses *(fig, 135)* . . £0 15 6 to £1 1 0

Fig. 136

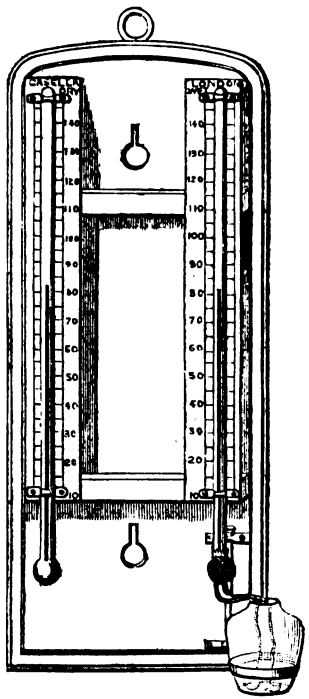
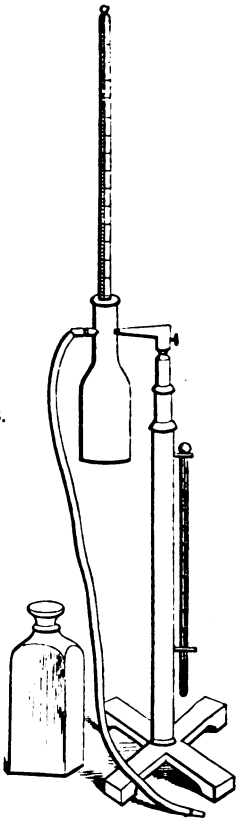


Fig. 138.



136. **Mason's Hygrometer,** with fountain complete, for general gardening purposes, forming one of CASELLA'S popular series of garden instruments, *(fig.* 136*)* £0 4 0

*** Table for the above hygrometers 2s. 6d.

137. **Regnault's Dew-Point Hygrometer,** with double aspirator, complete £6 6 0

138. **Regnault's Condensing Dew-Point Hygrometer** (CASELLA'S IMPROVED) *(fig.* 138*)* with ether bottle, etc., complete, in mahogany case . 4 14 0

This portable and elegant instrument is at once simple in its construction and *certain* in its indications. Consisting essentially of *two* sensitive thermometers — one exposed to the action of the atmosphere, the other to the influence of a current of air passing through ether contained in a well-polished silver bottle—it marks with unerring precision the exact temperature at which the aqueous vapour suspended in the atmosphere is condensed in the form of dew, and thus gives by direct observation the existing "*dew point.*" An important part of this *Condensing Hygrometer* is the polished silver bottle, about an inch in diameter, the neck being contracted to about five-eighths. Into this silver bottle a very sensitive thermometer, divided on its stem to *half-degrees*, is inserted, the stem passing through an ivory stopper fitted with a cork which renders the bottle *air-tight* at the neck. On one side, and *within* the silver bottle, a small, slender silver tube descends to nearly the bottom. This tube passes outwards, and is connected with an India-rubber aspirating tube. Upon nearly filling the large part of the silver bottle with *ether*, and *breathing* through this tube, the air rises through the ether in bubbles, and carries with it a portion of the ether in *vapour*. This evaporation of the ether causes such a degree of refrigeration, that when the surface of the silver bottle is sufficiently cooled, it becomes covered with dew. The supporting stem of the instrument being *hollow*, a ready means is provided for the egress of the air.

*** By the kind suggestion of Col. Sykes, F.R.S., and Dr. Miller, F.R.S., L. Casella has adapted a black glass bottle, with silver neck and tube, which may be had instead of the silver bottle, or extra at an additional charge of 15s. 6d.

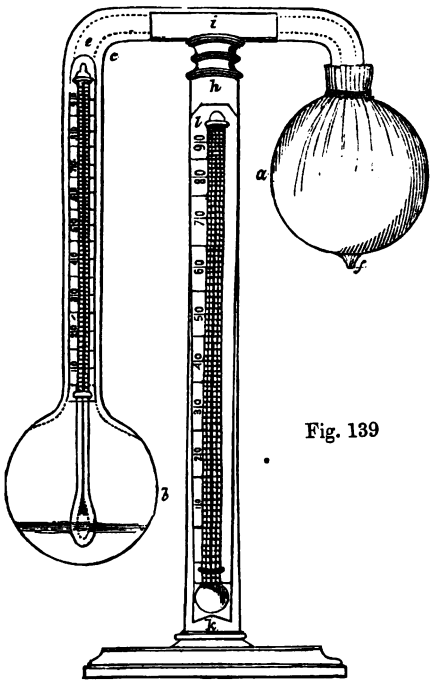


Fig. 139

Fig. 141.

139. Daniel's Hygrometer, in mahogany case, with ether test complete, £3 0 0

This instrument consists chiefly of a bent glass tube terminating with two balls—a *black* one containing a sensitive thermometer as in *fig.* 139, the bulb of which is placed in the centre, and the ball half filled with ether, and a white one covered with thin muslin, the interior of the tube being thoroughly deprived of air. Upon pouring ether upon the muslin enveloping the white ball *a*, such a degree of cold is produced as to condense on the blackened ball *b* the moisture in the atmosphere, the internal thermometer marking the precise degree of temperature at which the deposition takes place: this degree of temperature is called the dew-point.

RAIN GAUGES.

The increasing importance attached to a knowledge of the quantity of water which falls on, or evaporates from various localities, has contributed to the exercise of considerable judgment in the construction of the most suitable instruments for this purpose. The mechanism of these rain gauges is generally of a simple character, various areas being preferred. L. CASELLA has however, after extended experiments and much consideration, decided in favour of small rather than large surfaces, and, agreeably to Howard & Stratton, his general size is of five inches diameter.

140. Rain Gauge (Dr. Livingstone's portable), expressly arranged by L. CASELLA for the Zambesi expedition, with receiving surface of 3-inch diameter, whereby (See *Stratton, "New Edinburgh Philsophical Journal,"*) the greatest accuracy is obtained, with graduated jar, in maroon case for the pocket £0 16 6

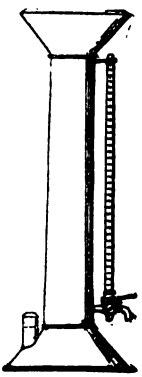


Fig. 142.

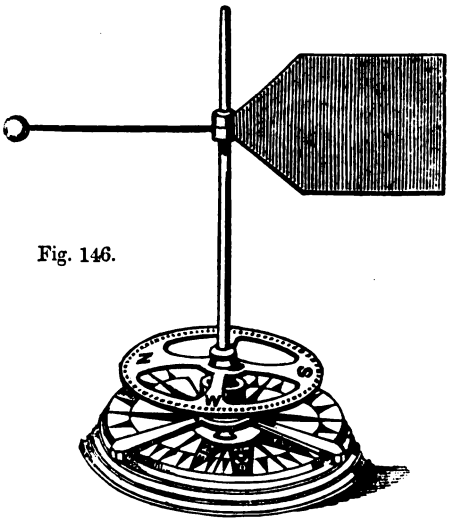


Fig. 146.

141. **Rain Gauge,** as described by Howard in his "Climate of London" *(fig.* 141, p. 27*)* in which evaporation is prevented and the rain collected in a stone bottle by a copper funnel of five inches diameter; turned brass ring, and strong glass measure divided to 100th of an inch depth of rain . £0 15 6

142. **Rain Gauge** (CASELLA'S), pedestal form, three feet high, made of stout copper, japanned (suitable for gardens, lawns, etc.), with strong glass tube graduated to two inches of rain in 100ths of an inch, with extra stop-cock for frost *(fig.* 142*)* 3 3 0

*** Rain gauges of any size made to order.

143. **Evaporating Dish,** five inches in diameter, with overflow-pipe a little below the surface, arranged to fit a receiving bottle, as in Howard's rain gauge, furnished with wire-work cover 0 15 6

*** The amount of evaporation is ascertained by first filling the dish, to overflowing, with a *constant* quantity of water, *viz.*, four inches; and at any given time afterwards the water remaining in the dish is to be measured, as well as any that may be found in the bottle. Should there have been during the interval a fall of rain, the amount is to be ascertained by the ordinary rain gauge and added to the four inches already placed in the dish. From this amount the quantities of water remaining in the dish and contained in the bottle are to be deducted, the difference being the amount of evaporation.

144. EVAPORATING DISH of copper, five inches diameter, with wire-work cover, and graduated glass measure 0 10 6

145. EVAPORATING DISH AND COVER, without glass measure . 0 6 6

*** When this is used with Howard's rain gauge, the glass measure supplied with that instrument answers for both purposes.

146. **Anemoscope,** or Dr. Halleur's portable wind vane *(fig.* 146*)*, with compass, bar needle, etc., showing the direct course of the wind to half degrees £2 7 0

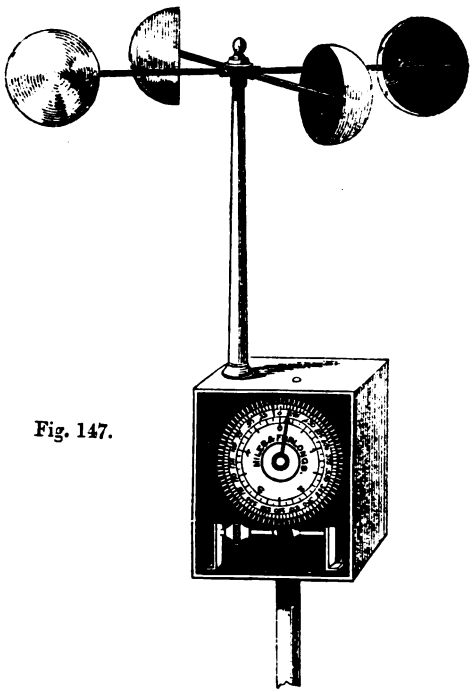


Fig. 147.

147. Anemometer, for registering the velocity of the wind in miles and furlongs as improved by L. P. CASELLA, in case, with stem for support *(fig. 147)* £4 4 0

*** This instrument is a modification of the anemometer devised by Dr. Robinson of Armagh, which consists essentially of four hemispherical cups, having their diametral planes exposed to a passing current of air; they are carried by four *folding* horizontal arms attached to a vertical shaft or axis, which is caused to rotate by the *velocity* of the wind. Dr. Robinson found that the cups, and consequently the axis to which they are attached, revolve *one third the winds' velocity*. A simple arrangement of wheels and screws is appended to the instrument, which, by means of *two* indices, shows on inspection the space traversed by the wind. The outer or front wheel, one revolution of which is equal to the transit of *five* miles of wind, is furnished with two graduated circles, the interior being divided to the eighth part of a mile, so that each division is equal to a furlong, while the exterior is divided into one hundred parts, each being equal to *five* miles. The stationary index at the top of the dial marks the number of miles (*under five*) and furlongs that the wind may have traversed in addition to the miles shown by the traversing index, which revolves with the dial and indicates the transit of every five miles. The graduation is to five hundred. The traversing index is furnished with a milled-headed screw at the back of the instrument, which is employed for bringing its extremity to the Zero point when the instrument is set, which consists in merely turning it by means of the milled-headed screw, and bringing the end of the index to point to Zero. By means of the folding arms which carry the cups, this anemometer is rendered extremely portable. When in use, it may be screwed on a shaft or ordinary piece of gas pipe, which accompanies it, and elevated to any desirable altitude. It is particularly adapted for occasional as well as constant observation on shore, and meets an acknowledged and wide-felt want, being a suitable instrument for measuring the force of the wind at sea. It may readily be set up on the highest part of a building, or suitably elevated on board a vessel. When inspected, it will show alike the winds' present velocity, as well as the rate at which it has passed since it was set or last read. With this instrument also the ventilation of public buildings or dwellings may at once be ascertained by a mere inspection of its dial in combination with a watch or clock, by which the exact rate of the progress of ventilation may be seen.

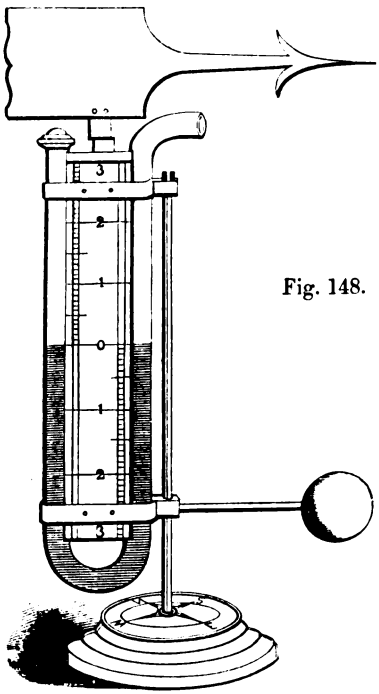


Fig. 148.

148. **Lind's Anemometer,** for showing the direction and force of the wind *(fig.* 148*)* £2 2 0

149. LIND'S ANEMOMETER, (improved and modified by Sir W. Snow Harris, F.R.S.) for showing the velocity and force of wind from a gentle breeze to the heaviest gale. 2 5 0

*** In this elegant little instrument a column of fluid descending in a tube of about ½-inch bore, and ascending in one of ⅛-inch bore, shows on a graduated scale the pressure of the wind on the square foot, and by consequence its velocity. A light arrow-shaped vane is placed, when required, upon a pivot on the upper edge of the instrument to indicate the coincidence of the mouth-piece with the direction of the wind, and a small plumb line, protected by plate glass in the body of the scale, indicates the true perpendicular position of the instrument.

150. **Whewell's Registering Anemometer,** consisting of a series of wheels and pinions, carrying a tracing pencil, set in motion by a small fly, connected with an ordinary vane; the pencil descends $\frac{1}{20}$ of an inch for every 10,000 revolutions of the fly, and presses against a cylinder carrying a registering paper, or other material £20 0 0

*** This instrument gives the integral effect of the wind, *i. e.*, its velocity combined with its direction.

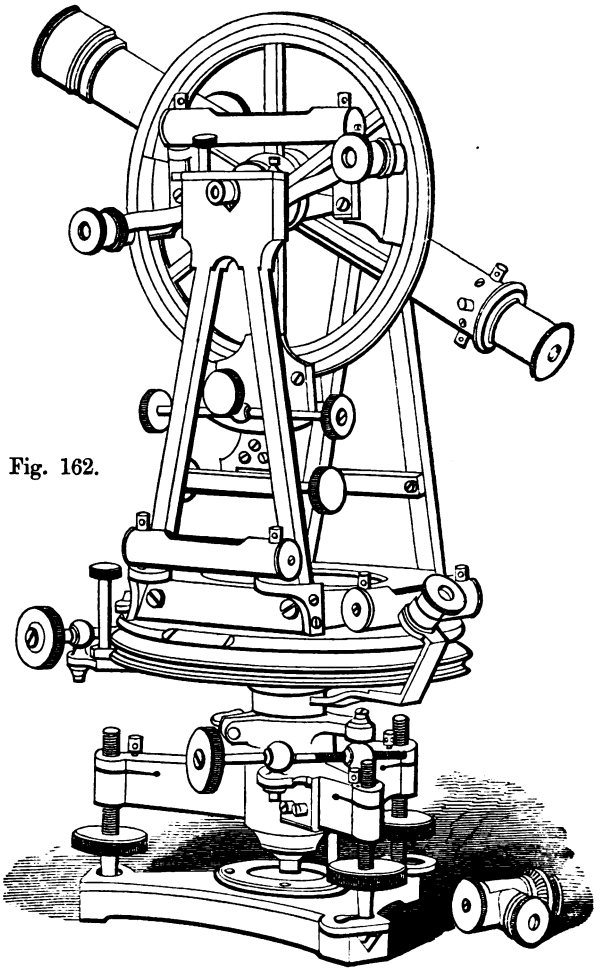


Fig. 162.

SURVEYING INSTRUMENTS.

In submitting a list of these instruments to the notice of surveyors, engineers, architects, etc., L. CASELLA begs to remark that, owing to the recent extensive surveys under the direction of the Board of Ordnance, and for various other purposes, as English and foreign railway engineering, drainage, etc., many improvements have been introduced, and important modifications effected; it has accordingly been his endeavour to render all the instruments constructed by him *simple*, *efficient*, and *hardy*—so that, by embodying all the improvements they are susceptible of, in accordance with the present advanced state of mechanical science, they may be fully relied on as at once simple in their construction, efficient in use, and accurate in their indications.

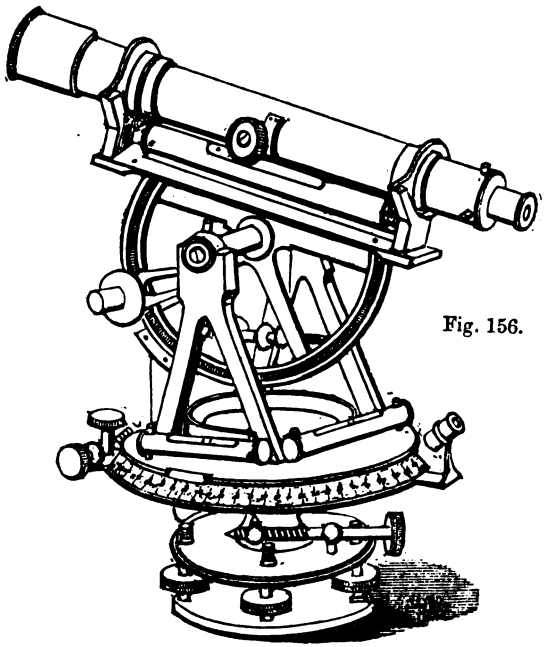


Fig. 156.

THEODOLITES.

151. **Theodolite,** 3-inch, of the most approved construction, reading to one minute, divided on silver, in mahogany case, with tripod stand, complete £18 0 0

152. THEODOLITE, 4-inch ditto ditto . . 19 10 0

153. " 4-inch ditto, with two telescopes 25 10 0

154. " 5-inch ditto, with one telescope 22 0 0

155. " 5-inch ditto, with two telescopes 27 10 0

156. " 6-inch, verniers reading to 20 seconds, divided on silver, with one telescope, in mahogany case and tripod stand, complete *(fig.* 156*)* 29 10 0

157. THEODOLITE, 6-inch ditto, with two telescopes 36 0 0

158. " 7-inch, with extra large telescope, verniers reading to 15 seconds, divided on silver, with case and stand as above . . . 32 0 0

159. " 7-inch ditto, with two extra large telescopes . . 40 0 0

160. **Transit Theodolite,** 4-inch, with vertical circle, reading to one minute, divided on silver, in mahogany case and tripod stand, complete . . 26 0 0

161. " " 5-inch, verniers reading to 30 seconds, divided on silver, complete as above 29 10 0

162. TRANSIT THEODOLITE IMPROVED, 6-inch, with locking plate for stability, transit axis and vertical circle, (may be used as an altitude and azimuth instrument,) in mahogany case, with tripod stand, complete, *(fig.* 162, p. 31*)* £33 0 0

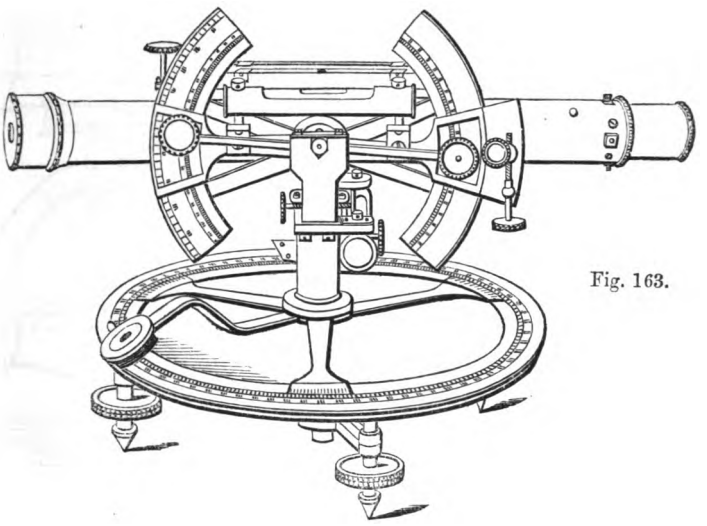


Fig. 163.

163. **Everest's Theodolite** *(figs.* 163 and 163**)* 4-inch, verniers reading to one minute, divided on silver, with triple adjusting screws, separate triangular locking plate, mahogany case and tripod stand, complete . . £20 0 0

164. EVEREST'S THEODOLITE, 5-inch, as above 24 10 0

165. " " 6-inch, verniers reading to 20 seconds, divided on silver, complete as above . . 28 0 0

166. " " 7-inch, as No. 165 . . . . . 32 0 0

167. **Metford's Theodolite,** 5-inch, verniers reading to 12 seconds, divided on silver, in mahogany case, with tripod stand, complete . . . 24 0 0

*** The important features of this instrument, claimed by the inventor, are its traversing stage, by which it may be moved one inch from the centre, in any direction, without altering the legs or disarranging the level adjustment; and the adoption of a strong curved arm, by means of which the telescope is allowed a transit motion, bisecting the horizontal limb, rendering it equal to an altitude and azimuth instrument.

168. METFORD'S THEODOLITE as above, with check telescope . . 27 10 0

CIRCUMFERENTORS.

*** Circumferentors are now much employed in woody countries and mining districts; the last three in particular being so constructed as to replace the ordinary plain Theodolite, and may be used for obtaining either horizontal or vertical angles.

169. **Circumferentor,** 4-inch, with folding sights, in mahogany case, and jointed oak stand for using at half-length 4 10 0

170. CIRCUMFERENTOR, 5-inch, as above 6 10 0

171. " " 5-inch, with divided circle to compass, sights, cross levels, stand, etc., complete as above £8 10 0

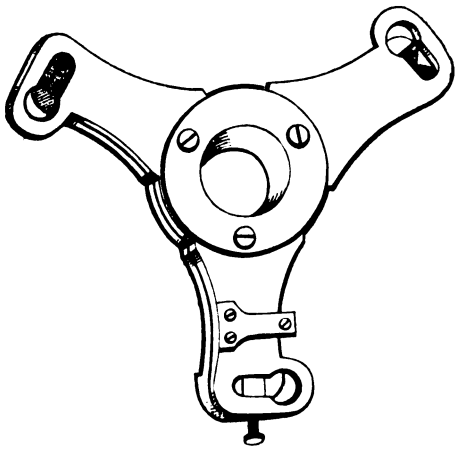


Fig. 163*.

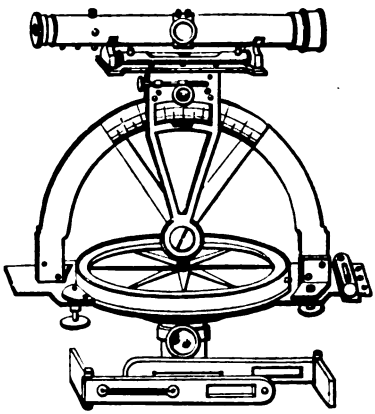


Fig. 173.

172. **Circumferentor,** 6-inch, improved, with rack adjustments, divided circle to ring, vernier reading to three minutes, cross levels, folding sights, ball-and-socket joint and jointed legs, with spare points to use at half length £10 0 0

173. CIRCUMFERENTOR, 5-inch, improved, with telescope, rack adjustments, divided vertical arm and divided circle to compass, with vernier reading to three minutes, cross levels and folding sights, ball-and-socket joint and stand, with jointed legs and spare points to use at half length (*fig.* 173) 15 0 0

174. CIRCUMFERENTOR, 6-inch, improved, as above 16 10 0

LEVELS.

175. **Y Level,** 12-inch, with parallel plates, divided silver ring to compass, tripod stand, etc., complete in mahogany case 11 10 0

176. Y LEVEL, 15-inch, complete as above 14 10 0

177. " " 18-inch, Ditto, ditto 15 15 0

178. " " 20-inch, Ditto, ditto 17 10 0

179. **Gravatt's, or Dumpy Level,** 10-inch, with parallel plates, divided silver ring to compass, tripod stand, etc., complete in mahogany case (*fig.* 179) 14 15 0

180. GRAVATT'S LEVEL, 12-inch, complete as above 15 10 0

181. " " 14-inch, Ditto, ditto 16 10 0

*** Either of the above three levels, without compass, £1 10s. less.

182. **Troughton's Level,** 14-inch, with compass and tripod stand complete 12 0 0

183. " " 20-inch, complete as above £14 0 0

GRAVATT'S LEVEL.

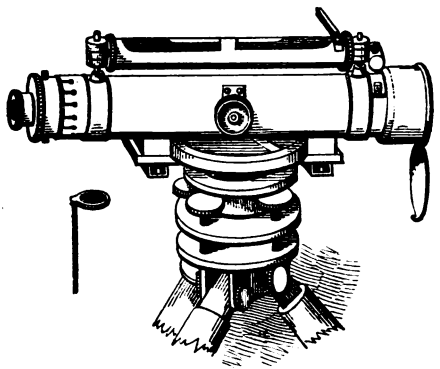


Fig. 179.

184. **Drainage Level (Improved),** with superior telescope, cross lines etched on the glass, ball-and-socket joint, tripod stand, and station staff complete, as strongly recommended by the Royal English, the Royal Irish, and the Highland Agricultural Societies, in mahogany case *(fig.* 184*)* . . . £4 10 0

IMPROVED DRAINAGE LEVEL.

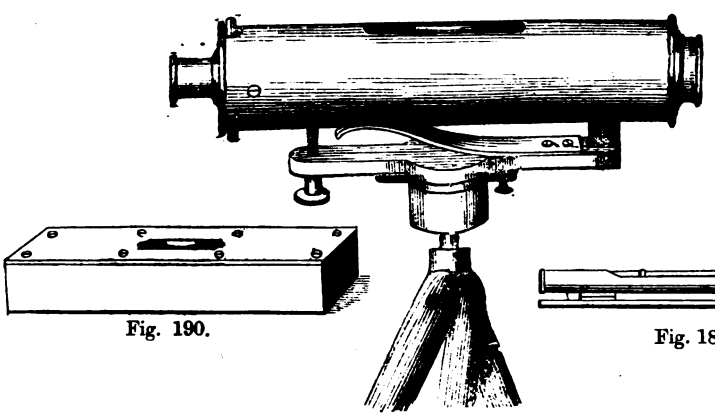


Fig. 184.

Fig. 190.

Fig. 185.

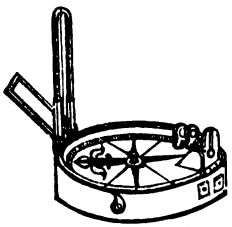
MOUNTAIN BAROMETERS and CASELLA'S IMPROVED HYPSOMETRICAL APPARATUS, being now much used for determining heights, may be classed as surveying instruments, although essentially meteorological. For prices, etc., consult the meteorological department of this catalogue, pages 6 and 7.

Brass Pocket Levels, with adjusting screws, in Maroon cases *(fig.* 185.*)*

185. Four-inch . . . 0 7 6 | 187. Eight-inch . . 0 13 6
186. Six-inch . . . 0 10 6 | 188. Ten-inch . . . 0 18 0
189. Twelve-inch £1 5 0

190. **Spirit Levels,** *(fig.* 190*)* mounted in mahogany frames, with brass plates, 6-inch, 3*s.* 0*d.*; 8-inch, 3*s.* 8*d.*; 10-inch, 4*s.* 6*d.*; 12-inch . . . 0 6 0

Fig. 199.



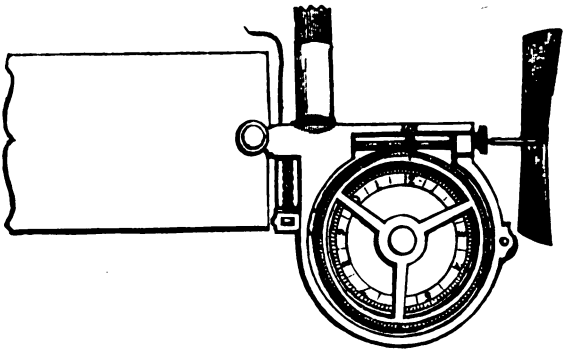


Fig. 225.

LEVELLING STAVES.

191. **Metford's Improved Levelling** Staff, with solid folding joints, £4 4 0

192. **Gravatt's Levelling Staff** 2 15 0

193. Sopwith's Levelling Staff . . . 2 8 0

194. **Surveyor's Cross,** 10 links long 0 14 6

195. „ „ 10 feet long, ... 0 18 0

196. **Optical Square** 7s. 6d. to 1 1 0

*** The last three instruments are useful for setting out perpendiculars, the optical square being convenient and portable: a survey involving right angles only may be effected very expeditiously by means of it.

PRISMATIC AND SURVEYING COMPASSES.

197. **Prismatic Compasses,** plain, in maroon cases, 2½-in, £2 17s. 6d.; 3½-in. £3 5 0

198. " " with azimuth glasses, in case, 3-inch . 3 5 0

199. " " with azimuth glasses, in case, 3½-inch (*fig.* 199) 3 15 0

200. " " with silver divided ring, in sling case, 3½-inch 4 17 6

201. Prismatic Compass, Stand for, with ball-and-socket joint, . 1 12 0

202. **Surveying Compass,** 4-inch, with sights, bar needle, and divided card, in mahogany case, and floating card . 1 8 0

203. Surveying Compass, 4-inch, as above, with silver divided ring, and metal plate, and bar needle . . 1 15 0

204. Surveying Compass, 4-inch, as No. 202, with two levels . . 2 0 0

205. " " 6-inch, with floating card, divided ring, and compass plate, in mahogany case 2 0 0

206. Surveying Compass, 6-inch, as No. 205, with two levels . . 2 12 6

207. " " 8-inch, complete as above 3 5 0

208. " " 3-inch, plain brass, with sights and floating card 1 8 0

209. " " 4½-inch, as above £1 14 0

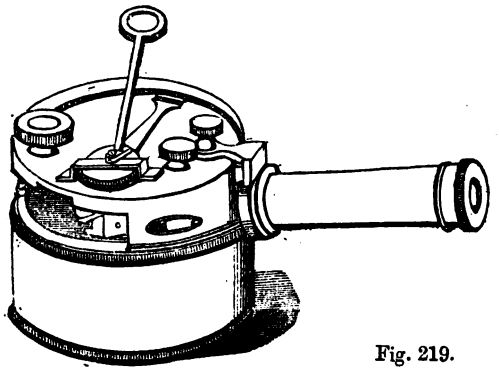


Fig. 219.

210. **Geological Compasses,** in mahogany cases, two-and-a-half-inch, 6s. 0d.; three-inch, 7s. 6d.; four-and-a-half-inch 0 9 6

INCLINOMETERS AND BOX SEXTANTS.

211. **Inclinometer,** in boxwood, for geological tourists . . . 0 6 6
212. " " brass, in case, with compass and stop, 2-in. 10s. 6d.; 2½-in. 0 16 6
213. " " as above, with bar needle to compass, 2-in. 15s. 0d.; 2½-in. 0 18 6
214. " " rule for the pocket, with level, in morocco case . 1 4 0
215. " " " " " " with two levels, and scale of fathoms 1 7 0
216. " " " " " " with level, sights, scale of inclination, etc., in morocco case 1 17 6
217. INCLINOMETER, brass, 6-inch level, with sights, scale of inclination, etc., in case 2 2 0
218. **Box Sextant,** plain, in maroon case 3 10 0
218* " " with telescope, in case 4 10 0
219. " " with telescope and supplementary arc, in case (*fig.* 219). 5 5 0
220. " " as above, with levels, in case 5 15 0
221. LEATHER SLING CASE FOR BOX SEXTANT, with strap for portability 0 7 6
222. **Perambulator.** An instrument of great utility for measuring the distance of places from each other, the length of roads, etc. It consists of a large wheel of known circumference, having its axis attached to a frame and handle; a system of wheels connected with the axis of the large wheel registers the number of its revolutions upon a dial in English measure, or it may be divided to any foreign measure if required. Plain mahogany . 9 0 0
222* SAME, with metal-bound wheel, for hot climates 12 12 0
223. **Perambulator,** with metallic wheel, East India Company's pattern, expressly for India and tropical climates £14 10 0

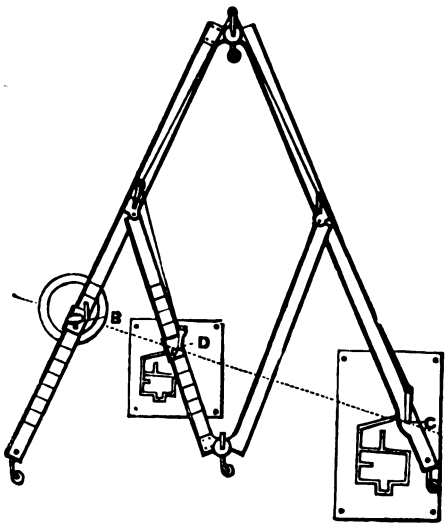


Fig. 263.

224. **Trochcameter,** for registering the revolutions of a carriage wheel, and thereby determining the distance travelled; applicable also for counting the rotations of machinery with certainty, however high the velocity, (see also engine counters and steam gauges) £2 18 0

225. **Current Meter,** for showing the rate of flow or tide in any stream or river, and the amount in gallons per hour flowing off (*fig.* 225, p. 36). . 5 10 0

226. CURRENT METER (DOUBLE), in case 7 inches by 2, circuit representing 12 miles, answering also for ascertaining the rate of a ship's speed 6 10 0

LAND CHAINS.

227. **Land Chain,** 50 feet, and arrows, 12s. 6d.; 100 feet, and arrows, 1 5 0

228. " " 66 feet, with two round rings between each link, and arrows, ... 0 14 6

229. LAND CHAIN, 66 feet, with three round rings, etc., 16s.; with two oval rings, etc. 0 17 6

230. LAND CHAIN, 66 feet, best, with three oval rings, etc. . . £1 0 0

TAPE MEASURES,

OF THE BEST CONSTRUCTION, IN STRONG LEATHER CASES, WITH FOLDING HANDLES:

231.	Divided to 25 feet, and links		6*s.* 6*d.*;	Ditto, decimals or palmos			7*s.* 6*d.*
232.	" " 33 " "		7 6	"	"	"	8 6
233.	" " 50 " "		9 0	"	"	"	11 0
234.	" " 66 " "		11 0	"	"	"	13 0
235.	" " 100 " "		14 6	"	"	"	17 6

Improved Spring Pocket Tape Measures, with linen or electro-typed steel tapes, in brass, german silver, pearl or shell cases, with or without stops, three to six-feet tapes:

236. BRASS, from 1s. to 2s. 6d. each; german silver, . 2s. 6d. to 0 5 0

DRAWING INSTRUMENTS.

(SURVEYORS').

Under this head, are included all those instruments that are used especially by surveyors, engineers and architects, in the preparation of their plans and sections; and, as these are in fact drawing instruments, this division of the catalogue will terminate with drawing instruments generally.

SCALES.

237. **Hetford's** improved set of four pocket scales, for architects and surveyors, in maroon case, £2 16s., or two in separate cases . . . £1 10 0

Each scale is six inches in length, and a right-angled triangle in form; two of them are divided into decimals or tenths, and the other two into duodecimals or twelfths. Their contents are marked on the ends of each. In the triangular form the divisions are placed on the edges, the most useful scales on the acute angles, and a table of constants on the rectangles. The scales thus obtained are seventeen in number, fully divided, and reading off at the edges, viz., 1, 2, 3, 4, 6, 8, and 10 chains of 66 feet to the inch, and 6 inches to the mile: the mechanical scales are $\frac{1}{16}$ $\frac{1}{8}$ $\frac{1}{10}$ $\frac{1}{5}$ $\frac{1}{4}$ $\frac{1}{2}$ and $\frac{3}{4}$ inch. The French metre, the Spanish vara, or any other foreign measure may be had if required.

Plotting Scales.—*Ivory, divided upon both sides.*

238. Twelve-inch, 10 to 50, 7s. 6d.; six-inch, ditto . . 0 5 0
239. " " 60 to 70, 8s. 6d.; " " . . . 0 6 0
240. " " 80 to 100, 13s. 6d.; " " . . . 0 8 0
241. OFFSET SCALES, ivory, 2-inch, 2s. to 3s. 9d.; boxwood, 1s. 6d. to . 0 2 0
242. **Engineer's or Architect's Scales,** fully divided, boxwood, 12-inch . 0 6 6
242* " " " " ivory, twelve-inch, 12s. 6d.; 6-inch 0 6 6
243. TEBAY'S UNIVERSAL PLANNING RULE, in ivory, 16s. 6d.; in boxwood 0 8 6

Marquois Scales.—*In mahogany cases.*

244. Boxwood . . 0 10 6 | 246. Brass . . 2 10 0
245. Ivory . . 2 2 0 | 247. Electrum . . 3 15 0

Gunter's Scales.—*Boxwood.*

248. Twelve-inch . . 0 1 6 | 250. Eighteen-inch . . 0 2 4
249. Fifteen-inch . . 0 2 0 | 251. Twenty-four-inch . 0 3 0

Slide Rules.

252. Routledge's, with book 0 10 0 | 253. Hawthorn's, with book 0 12 6
254. Boxwood . . . 0 5 0

Pocket Rules.

255. 1 foot, four fold, ivory, 3s. 6d. to 8s. 0d.; ditto, boxwood, 2s. to 0 4 0
256. 2 " " " 7s. 0d. to 11s. 6d.; " " 2s. 0 5 0
257. 3 " " " bevelled edges, 15s.; boxwood . . 0 7 6
258. **Sectors,** *ivory,* 4s. 0d. to 0 8 6

PENTAGRAPHS.

COMPLETE, IN MAHOGANY CASES.

259. Eighteen-inch £5 0 0 | 261. Thirty-inch . . 6 17 6
260. Twenty-four-inch 5 17 6 | 262. Thirty-six-inch . . 7 16 0
263. Forty-two-inch (*fig.* 263) . £8 18 0

*** Larger sizes to order.

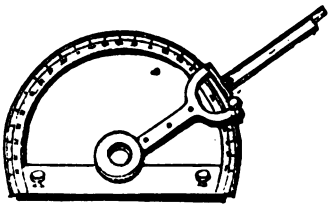


Fig. 277.

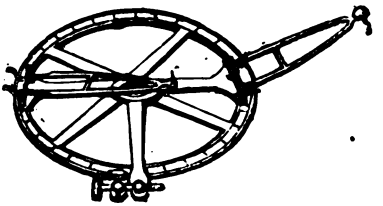


Fig. 283.

Fig. 272*.

Fig. 273.

STATION POINTERS.

264. Twelve-inch . £6 6 0 | 266. Twenty-four-inch £8 10 0
265. Eighteen-inch . . 7 0 0 | 267. Thirty-inch . . 11 0 0
268. Thirty-six-inch . . £16 16 0

PROTRACTORS.

IVORY, SIX-INCH.

269. With plain scale, etc. 0 3 0 | 271. Best, fully divided 0 5 6
270. Same, more fully divided 0 4 0 | 272. Same, with roller 0 15 6
272.* Horn Semicircular (*fig.* 272*), 3 to 8-inch 0s. 6d. to . . 0 2 0
" " " " Circular, 1s. 0d. to . . 0 3 6

Brass, Semicircular, (*fig.* 273).

273. Six-inch . . 0 8 0 | 275. Ten-inch . . 0 11 0
274. Eight-inch . . 0 10 0 | 276. Twelve-inch . . 0 12 0
277. Eight-inch, with vernier and arm, in mahogany case, (*fig.* 277) ~~1. 3. 0~~ ~~2. 15. 0~~

Brass, Circular.

278. Six-inch . . 0 16 0 | 280. Ten-inch . . 1 0 0
279. Eight-inch . . 0 18 0 | 281. Twelve-inch . 1 4 0
282. **Brass, Circular,** six-inch, with one vernier, reading to one minute, in mahogany case 3 0 0

Brass Circular Protractors,

Furnished with clamp and tangent screws, folding arms, and double verniers, divided to twenty seconds, in mahogany cases (*fig.* 283)

		Divided on brass.	Divided on silver.
183.	Six-inch	£5 10 0	£6 0 0
284.	Seven-inch	6 6 0	7 0 0
285.	Eight-inch	7 0 0	7 15 0

286. **Architect's Curves** in great variety, from 6s. 6d. the set of 12 (*fig.* 286).

287. **Triangles and Set Squares,** from 3s. 6d. per dozen (*figs.* 287, 287*)

Steel Straight Edges of the best make.

288. Three feet . . 0 11 0 | 290. Five feet . . £1 1 0
289. Four feet . . 0 13 0 | 291. Six feet . . 1 7 0
292. Seven feet . . £1 15 0

*** Larger sizes made to order.

Fig. 286.

Fig. 293.

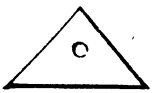


Fig. 287.

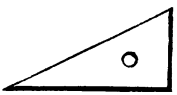


Fig. 287*.

Fig. 300.

Fig. 309.

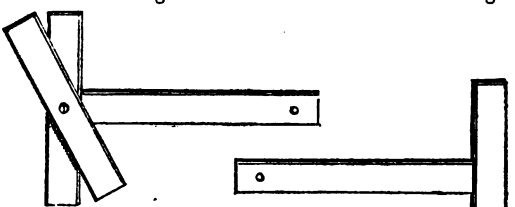


Fig. 308.

PARALLEL RULES.

EBONY, (*fig.* 293.)

293.	Six-inch	.	.	0	0	8	296.	Fifteen-inch	.	0	3	6
294.	Nine-inch	.	.	0	1	6	297.	Eighteen-inch	.	0	4	3
295.	Twelve-inch		.	0	2	3	298.	Twenty-one-inch	.	0	5	0

299. Twenty-four-inch . . 0 6 0

Rolling Parallel Rules, ebony, (*fig.* 300.)

		Plain edges.			Divided edges.				Plain edges.			Divided edges.		
300.	Six-inch	0	3	9	0	6	0	302.	Twelve-inch	0	7	0	0	10	6
301.	Nine-inch	0	5	6	0	8	0	303.	Fifteen-inch	0	9	0	0	13	0
304.	Eighteen-inch									0	11	0	0	15	6

305. ROLLING PARALLEL RULES, *ebony*, with brass astrical, same price as those above with divided edges.

306. ROLLING PARALLEL RULES, *ebony*, with brass astrical and divided edges, 2d. per inch extra, and with ivory roller 1s. 4d. each extra.

307. ROLLING PARALLEL RULES, *brass*, from 6 to 9 inches long, per inch, 3s. 0d. from 12 to 24 inches long, per inch, 2s. 8d.

*** The above (307), with divided edges, the figures engraved, 6d. per inch extra.

T SQUARES, EBONY.

		Plain heads. (Fig. 308.)			Shifting bevel piece and clamp screw. (Fig. 309.)				Plain heads. (Fig. 308.)			Shifting bev. piece and clamp screw. (Fig. 309.)		
308.	18-inch	0	4	0	0	5	0	311.	33-inch	0	6	8	0	8	6
309.	24-inch	0	5	0	0	6	0	312.	36-inch	0	7	6	0	9	6
310.	27-inch	0	5	6	0	6	6	313.	42-inch	0	9	6	0	11	6

314. 30-inch 0 6 0 0 8 0

*** The above sizes, in mahogany, with plain heads, one quarter less in price than the ebony.

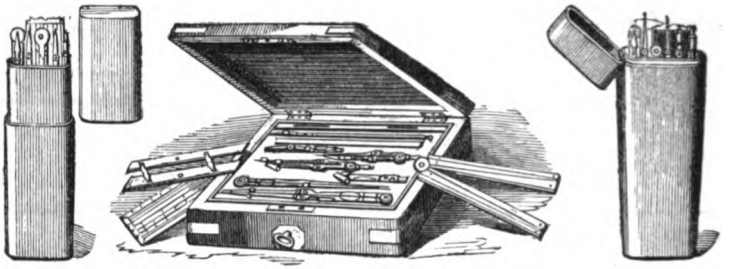


Fig. 315. Fig. 335. Fig. 322.

MATHEMATICAL DRAWING INSTRUMENTS.

IN COMPLETE SETS.

315. No. 1. Consisting of brass jointed large compasses, pen and pencil point, feeder, pencil and scale, of a plain and good quality, suitable for schools, colleges and public institutions, in *black case* 3*s.* 6*d.*, *(fig.* 315) in *cabinet case* 0 5 0

316. No. 2. Same as No. 1, with steel joints, *black case* 4*s.*, *cabinet case* 0 5 6

317. No. 3. Consisting of two pairs of brass jointed compasses, long and short pen and pencil points, feeder and box scale, *black case* 5*s.* 6d.; *cabinet case* 0 7 0

318. No. 4. Same as No. 3, with steel joints, dotting pen, and three rules extra, *fish-skin case*, 9*s.*, *cabinet case* 0 10 6

319. No. 5. Same as No. 4, with turn cheeks, *fish skin case* 10*s.*, *cabinet case* 0 11 0

320. No. 6. Same as No. 5, with bow pen extra, *fish skin case*, 11*s.* *cabinet case* 0 12 6

321. No. 7. Consisting of large compasses, with pen and pencil points, plain dividers, bow pen, ivory scale, ebony parallel rule, horn or brass protractor, pencil and feeder, *fish-skin case*, 14*s.*; *cabinet case* . . . 0 18 0

322. No. 8. Same as No. 7, with ivory sector extra, *fish-skin case (fig.* 322) 18*s.*; *cabinet case* 1 0 0

323. No. 9. Same as No. 8, with round shanks, *fish-skin case*, £1; *cabinet case* 1 2 0

324. No. 10. Same as No. 9, with double joints and springs in the nibs, *fish-skin case*, £1 4*s.* *cabinet case* 1 6 0

*** This set, in german silver and rosewood case, with three ivory scales, £1 15*s.*

325. No. 11. Same as No. 10, *viz.*, 2 pairs of compasses, with long and short pen and pencil points, bow pen, dotting pen, ivory sector and scale, brass protractor, and ebony parallel rule, with lengthening bar extra; *fish skin case*, 1 5 0 *cabinet case* 1 9 0

*** This set in german silver and rosewood case, with three ivory rules, £2 2 0

326. No. 12. Same as No. 11, with hair dividers, and three ivory rules, *fish-skin case* £1 11*s.* 6d., *cabinet case* £1 15*s.*, *german silver, in rosewood case* 2 2 0

327. No. 13. Same as No. 12, with bow pencil extra, *cabinet case* . £1 18 0

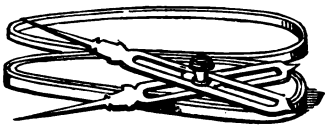


Fig. 340.

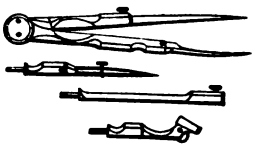
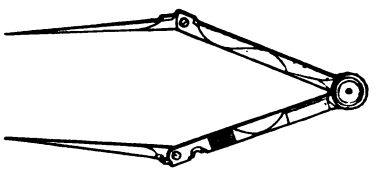


Fig. 342.

Fig. 343.



328.	**Set of Instruments,** in skin cases (sappers' and miners') . .	0	12	6
329.	Ditto, ditto, East India Company's pattern	1	4	0
330.	Ditto, ditto, Woolwich pattern	1	12	6
331.	Ditto, ditto, Ordnance pattern	2	15	0
332.	Ditto, in mahogany case, Addiscombe pattern . . .	3	0	0
333.	Ditto, ditto, Admiralty pattern	3	10	0

*** The above six sets of instruments, in german silver will be one third extra.

334.	**Set of Instruments** (best) in german silver, consisting of large compasses with pen and pencil point and bar, hair dividers, bow pen and pencil, knife key, two ivory-handle pens, and best ivory scales, in rosewood case	3	15	0
335.	SET OF INSTRUMENTS (best) in german silver, same as No. 334, with double jointed instruments, and rosewood case, clamped with german silver for hot climates, *(fig.* 335)	4	10	0
336.	SET OF INSTRUMENTS (best), as No. 335, with needle points, and set of spring bows, case, etc., complete	6	0	0
337.	SET OF INSTRUMENTS as No. 336, with dotting wheels, pens, needle holder, and road pen extra, in case, complete	7	7	0
338.	SET OF INSTRUMENTS, large magazine, in german silver, from £7 to	20	0	0

DRAWING INSTRUMENTS,

IN ELECTRUM.

339.	**Proportional Callipers,** 12-inch, £2 5*s.* 0*d.*; 9-inch, . .	1	18	0
340.	PROPORTIONAL COMPASSES, in maroon case *(fig.* 340) . .	1	12	0
341.	Same, with adjustment	2	5	0
342.	**Single-Jointed Compasses,** best plain, with pen and pencil points, and lengthening bar *(fig,* 342)	1	0	0
343.	**Double-Jointed Compasses,** best, with pen and pencil points and lenthening bar, *(fig.* 343*)*	1	10	0
343*.	DITTO DITTO, extra best, with needle points . . .	2	7	6

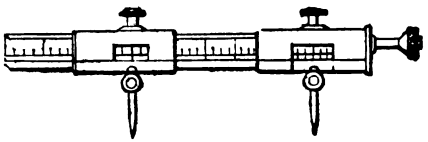


Fig. 347.

Fig. 360.

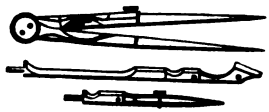


Fig 361.

Fig. 355.

344. **Beam Compasses,** plain, with electrum mountings, pen and pencil point, 21-inch limb £1 15 0

345. Same, 30-inch limb, with adjusting screw . . . 2 8 0

346. Same, Ordnance pattern, 24-inch bar, £2 5*s.* 30-inch bar . 2 10 0

347. Same, with divided beam, *(fig.* 347) £3; with tubular beam, £4 4*s.* to 8 8 0

348. Triangular Compasses in case, £1 1*s.*; tubular ditto . 2 0 0

349. Pocket Dividers, turn-in, 15*s.* 0*d.*; Hair Dividers . 0 9 6

350. **Pillar Compasses,** best, in case 1 5 0

351. Ditto ditto with lengthening bar and small ivory scales 1 15 0

352. **Napier Compasses,** best small, for the pocket . . 1 1 0

353. **Bow Pen and Pencil,** best double jointed, each . . 0 9 6

354. Ditto ditto with needle point " . . . 0 12 0

355. **Spring Bows,** best set, viz., bow pen, pencil, and dividers, in case *(fig.* 355) 0 15 0
Or each separately . . 0 4 6

355*. Ditto Ditto, with needle points, 6s. 6d. each, or three in case 1 1 0

356. **Ivory-handle Drawing Pens,** best plain, 3*s.* Ditto, jointed . 0 4 0

357. Ditto ditto with 6 dotting wheels, in ivory box 0 8 6

358. Six pens, assorted, with one handle, in case . . . 1 4 0

359. **Needle Pricker,** best ivory handle 0 3 6

---

360. **Plain Brass Compasses,** steel joints, with pen and pencil legs *(fig.* 360) 0 4 0

361. **Dividers,** brass *(fig.* 361) 0 2 0

*** For Cameras and Claude Lorraine Glasses, see Optical Instruments, pages 63 and 64.

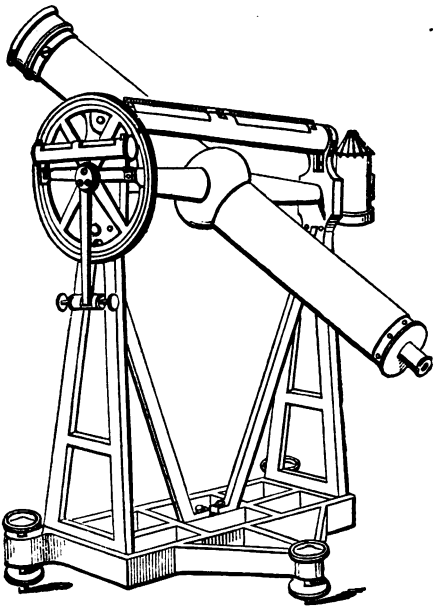


Fig. 368.

ASTRONOMICAL INSTRUMENTS.

TRANSITS AND CIRCLES.

Portable Transit Instruments with divided circles and double verniers, illuminating lanterns, graduated scales to levels, adjusting screws, etc., complete, *(fig. 368)*:

WITH IRON STANDS:

362.	Fourteen-inch, 1½-inch object glass	£18 10 0
363.	Twenty-inch, 1¾-inch " "	23 0 0
364.	Twenty-four-inch, 2-inch " "	25 0 0
365.	Thirty-inch, 2½-inch " "	38 0 0

WITH BRASS STANDS:

366.	Twenty-inch, 1¾-inch object glass	24 0 0
367.	Twenty-four-inch, 2-inch " "	27 10 0
368.	Thirty-inch, 2½-inch " "	43 0 0
369.	**Transit Instrument** of superior construction, furnished with two circles, divided to minutes, and especially adapted for mounting on stone piers, thirty-two-inch, 3¼-inch object glass	£74 0 0
370.	**Reflecting and Repeating Circles,** of various construction to order.	
371.	**Altitude and Azimuth Instruments** with circles, divided on silver, reading micrometers, etc., complete to order.	

*** For astronomical telescopes, see "Telescopes," pages 61 and 62.

Fig. 372.

Fig. 383.

Fig. 375.

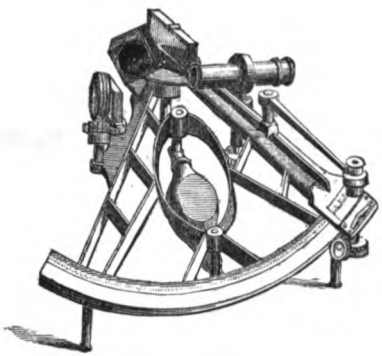


Fig. 389.

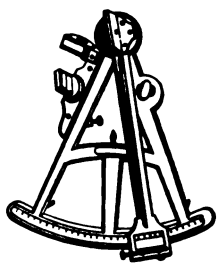


Fig. 394.

SUN DIALS.

372. **Universal** *(for north or south of the line as required)*, in maroon case for the pocket, with joints to circle, gnomen and rising divided arc, by which it is set to any latitude as above, 2½-inch, £1 6*s.* 0*d.*; 3-inch, £1 10*s.* 0d.; 3½-inch *(fig* 372) . . . . . 1 14 O

373. Ditto, with two levels and adjusting screw, 4½-inch . . 4 4 O

374. Ditto, with improved gnomen . . . . . 4 12 O

374*. Universal Sun Dial, in the form of a ring, answering for both latitudes, in polished mahogany case, 3-inch to 5 minutes, £1 12*s.*; 4-inch ditto, £1 18*s.*; 6-inch to 2 minutes . . . . . 2 10 O

Horizontal, for Gardens or Lawns, *Brass (fig.* 375),

375. Six-inch . . £1 4 0 | 377. Twelve-inch . . 4 4 O
376. Eight-inch . 42/ ~~2 10 0~~ | 378. Fifteen-inch . . 5 15 O

Horizontal, with Equation Table, *Brass.*

379. Ten-inch . . £3 12 0 | 381. Fifteen-inch . . 7 10 O
380. Twelve-inch . 5 5 0 | 382. Eighteen-inch . . 12 15 O

**** Vertical dials made to order.

Magnetic Dials, for the pocket, suitable for any latitude:

383. No. 1. In hard-wood box, with cover and best agate cap *(fig.* 383*)*, 2-inch 0 5 6

IN MAHOGANY CASES.

384. No. 2, 6*s.* 6*d.*; No. 3, 7*s.* 6*d.*; No. 4 . . . . 0 9 0

385. No. 5. Large size, improved, with indian-rubber spring, for hot climates 0 11 0

TWO-INCH, IN BRASS CASES.

386. No. 6, 7*s.* 6*d.*; No. 7 with stop 0 9 6

NAUTICAL INSTRUMENTS.

SEXTANTS.

387. **Metal Sextants,** of the best construction, with double frames, eight-inch radius, verniers reading to ten seconds, four telescopes, etc., in mahogany case, complete, divided on silver £14 14 0

388. Ditto, Ditto, divided on platinum, £16; divided on gold, . 16 0 0

389. Metal Sextant, best, triangular or diamond limb, seven-inch radius, divided on silver to ten seconds, £10 10s.; six-inch radius, £10; five-inch radius, £9; four-inch radius *(fig.* 389) 8 10 0

390. **Metal Sextant** with solid frame, divided on silver, reading to ten seconds, seven-inch, in case 9 9 0

391. Metal Sextant, black or bronzed, divided on silver, reading to fifteen seconds, with three telescopes, etc., in mahogany case, complete . 9 0 0

392. **Ebony Sextant,** divided on ivory, reading to fifteen seconds, metal centre, and three telescopes, in case 5 10 0

393. Box Sextants—(See Surveying instruments, p. 37.)

QUADRANTS.

394. **Metal Quadrant,** divided on silver, reading to 15 seconds, best centre, seven shades, index magnifier, two telescopes, etc., complete, in mahogany case, *(fig.* 394) 5 10 0

395. Metal Quadrant, black or bronzed, divided, etc., as No. 394, with six sun shades 5 0 0

396. **Ebony-handle Quadrant,** divided on ivory, with two telescopes, in case 4 4 0

397. Ebony Quadrant, with back shade, two telescopes, in mahogany case 3 15 0

398. Ditto Ditto, double tangent, with vertical screw, in oak case 2 10 0

399. Ditto Ditto single tangent, ... 2 2 0

ARTIFICIAL HORIZONS.

400. **Artificial Horizon** of perfectly parallel black glass, with level and adjusting screw, in mahogany case, for the pocket, 2¼-inch reflector, £1 10s.; 2½-inch ditto 1 15 0

401. Artificial Horizon, plain, mercurial, with hard-wood bottle, trough, etc., in mahogany case, ... 2 15 0

402. Artificial Horizon, mercurial, of the best construction, Ordnance pattern, metal-roof, trough and iron bottle 4 0 0

403. Same, smaller size, ... £3 10 0

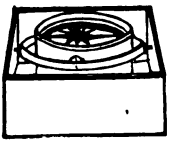


Fig. 404.

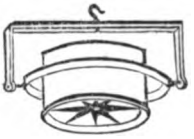


Fig. 410.

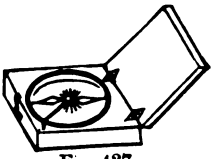


Fig. 427

Fig. 412.

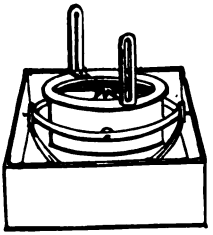


Fig. 417.

Fig 439

COMPASSES.

Ship's Compasses, with agate caps, plain brass bowls, in gimbals and oak cases, *(fig. 404)*:

404. Six inch outside . . £0 12 6 | 407. Nine inch outside . 0 16 6
405. Seven inch " . . 0 13 6 | 408. Ten-inch " . . 0 18 6
406. Eight inch " . . 0 15 0 | 409. Eleven inch " . . 1 0 0

410. **Hanging Compass** *(fig. 410.)* 1 8 0

411. Amplitude Compass, in oak case, with shifting sights, ten inch outside 1 5 0

412. " " " " "eleven inch *(fig. 412)* 1 6 6

413. Storm Compass, with gimbals, cap and needle, 10 in., £1 10s.; 11 in. 1 12 0

414. Dipping Needle Compass, in oak case, 10-inch £2 2s. 0d.; 11-inch 2 4 0

415. Transparent Compass, for skylights, with arms, 7-in. £1 18s.; 7½-in. 2 0 0

416. Transparent Dipping Needle Compass, 7-inch £2 12s. 6d.; 7½-inch 2 14 0

417. **Knight's Azimuth Compass,** in mahogany case *(fig. 417)* . 4 15 0

418. Tripod Stand for ditto 1 4 0

419. Prismatic Azimuth Compass, admiralty pattern, for iron ships, in mahogany case, with stand, complete 7 10 0

420. **Sir Snow Harris's Compass,** especially arranged for iron ships, with stout copper ring, in mahogany case 6 0 0

421. Do. do. transparent, with mounting for binnacle . 6 6 0

Boat Compasses, small and very portable, brass, with gimbals, agate caps, etc.:

422. No. 1, . . 0 12 6 | 424. No. 3, . . 0 16 6
423. No. 2, . . 0 15 0 | 425. No. 4, . . 0 17 6

426. No. 5 . . £1 1 0

*** For surveying compasses see page 36.

Pocket Compasses, of a perfectly reliable character and superior manufacture, either plain or ornamental, with steel needles:

		Mahogany cases* with stops (fig. 427).	Leather cases†	Brass cases†	Electrum cases†	Ivory cases†
427.	No. 1.	3s. 0d.	3s. 0d.	3s. 0d.	3s. 6d.	4s. 6d.
428.	" 2.	3 4	3 4	3 6	4 6	7 0
429.	" 3.	3 6	3 6	4 6	5 6	9 0
430.	" 4.	4 0	4 0	5 0	6 6	
431.	" 5.	4 6	5 6			
432.	" 6.	6 6	7 0			

* In mahogany cases with rounded edges, french polished, 6d. extra.

† Stops to any of those thus marked (†) 2s. each extra.

POCKET COMPASSES with floating cards, or with bar needles and best agate caps and stops:

		Mahogany cases.		Leather cases.	Brass cases.		Electrum cases.	
		Floating card.	Bar needle.	Floating card.	Floating card.	Bar needle.	Floating card.	Bar needle.
433.	No. 1.	6 6	6 6	4 6	5 6	6 6	7 6	7 6
434.	" 2.	7 0	7 6	4 6	6 0	7 6	8 0	8 6
435.	" 3.	7 6	7 6	5 0	6 6	8 6	9 0	10 6
436.	" 4.	8 6	8 6	6 0	8 0	10 0	11 0	12 0
437.	" 5.	9 6	9 6					
438.	" 6.	11 6	12 0					

Pocket Compasses, in the form of a watch *(fig. 439)*, with best bar needles, stops, and enamel plates:

		Gilt or Electrum.	Silver.			Gilt or Electrum.	Silver.
439.	No. 1. .	0 14 6	£1 2 0	441.	No. 3. .	0 17 6	£1 8 0
440.	" 2. .	0 15 0	1 5 0	442.	" 4. .	1 0 0	1 11 0
443.	" 5. .	1 2 0					

Or with fully divided plates 6s. 6d. each extra.

444. **Trinket Compasses,** in gold mountings, in neat and chaste designs, small, yet reliable, from 10s. 6d. upwards.

445. **Time Glasses,** in plain oak frames, 2 hours, 3s. 6d.; 1 hour, 1s. 8d.; ½ hour, 1s. 6d.; ¼ hour 0 1 6

*** These glasses, if with metal sand or fancy hardwood frames, will be about double the above prices.

446. **Log Glasses,** 14 or 28 seconds, with best metal sand, per pair . 0 2 6

447. " " brass framed, hermetically sealed, per pair . . 0 5 0

448. **Massey's Patent Log,** in box, with directions . . . 2 15 0

449. MASSEY'S PATENT LEAD 3 3 0

450. **Friend's Patent Log,** in box 5 0 0

451. FRIEND'S PATENT LEAD 3 10 0

452. **Burt's Patent Sounding Machine** 1 11 6

453. CURRENT METER (DOUBLE), to be used as a log (see surveying instruments, No. 226 page 38, and *fig.* 225, p. 36).

454. **Ship's Binnacle,** improved construction, of french-polished mahogany, with best lanterns, lamps, shade and turned pillar, complete . . £9 10 0

*** Any size made to order.

In addition to the preceding List of Nautical Instruments, there are several others of equal importance referred to under their respective classes, thus—

Marine Barometers and **Sypiesometers**—See "Meteorological Instruments," pages 9 and 10, *figs.* 16, 17, 25 and 29.

ANEROID BAROMETERS—(now much required for marine purposes)—See same department, page 8, *fig.* 9.

ORDINARY MARINE AND DEEP-SEA THERMOMETERS—See page 19.

Hygrometers—(now extensively used at sea, especially in connexion with the barometer, the best form for marine purposes being Mason's)—See pages 25 and 26, and *figs.* 133, 135 and 136.

Anemometers—(for measuring the force and velocity of the wind)—See pages 29 and 30.

*** Casella's improved Anemometer, on Dr. Robinson's principle, viz., that of four hemispherical cups, will be found a most interesting instrument at sea, *fig.* 147, page 29.

Marine Telescopes—A suitable assortment of these will be found on pages 59 and 60.

Also, the IMPROVED BINOCULAR NIGHT GLASSES, most highly approved for coasting purposes.—See page 62.

In connexion with Nautical Instruments may be mentioned the most approved maps, charts, sailing directions, and books bearing upon the theory and practice of navigation, great circle sailing, the law of storms, etc., including the most recent surveys and discoveries as well in the geographical as in the hydrographical department.

*** Maps, charts and books supplied to order by L. CASELLA, among which may be specified—

Maps of the Ordnance Survey of Great Britain, and others of acknowledged repute.

The most approved and highly valuable charts published by the Admiralty, as well as the most approved publications of the leading chart publishers of the day.

The important publications of the meteorological department of the Board of Trade, under the superintendence of Admiral FitzRoy, F.R.S., viz., Wind and Current charts, etc.

The EPITOMES OF NAVIGATION by Mrs. Janet Taylor and Norie, each published at	0	16	0
MRS. TAYLOR'S "Lunar Tables." 7s. 6d.; "Planispheres of the Stars"	0	7	6
HAND BOOK to the local Marine Board Examination . (Mrs. Taylor's)	0	3	0
CAPTAIN LIDDLE'S "Seamanship" . . . . " "	0	1	0
RUSSEL'S Great Circle Sailing, diagram and chart of the world " "	0	5	0
REID, SIR WILLIAM, on Rotatory Storms, 2 vols. £1 1s. Each vol. may be had separately, vol. 1, 12s.; vol. 2	0	9	0
PIDDINGTON'S "Horn-Book of Storms"	0	10	6
BIRT'S "Hand Book of the Law of Storms," 5s. 0d.; BIRT'S "Hurricane Guide"	0	3	0
BIRT'S "Sailor's Guide"	0	0	6

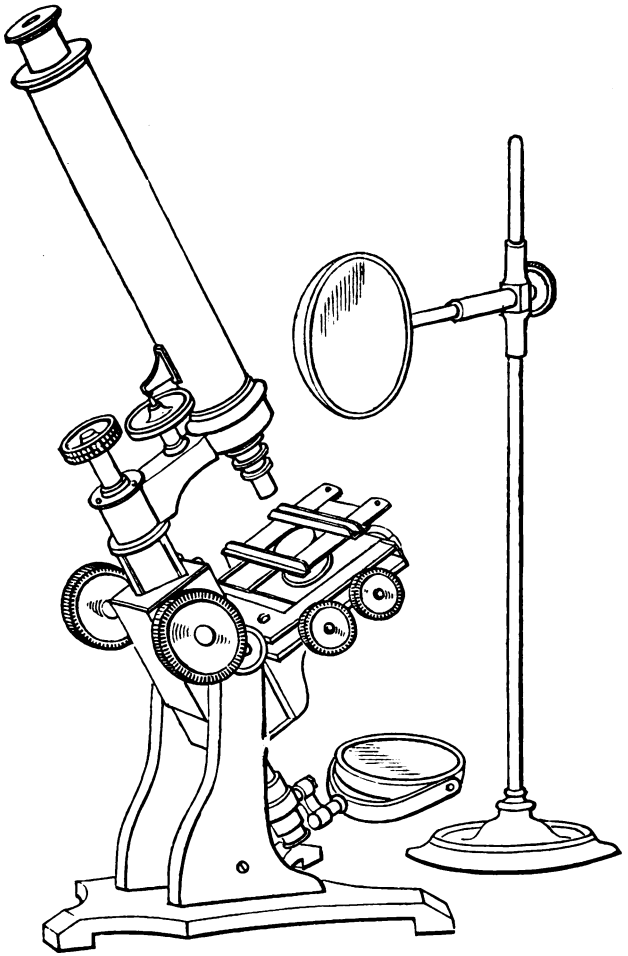


Fig. 488.

OPTICAL INSTRUMENTS.

In the following enumeration of Optical instruments, the manufacture of which may be depended on as of very superior character, every modification and improvement which science has indicated and art accomplished has received its due attention; and, at the same time, the price of each article is so regulated as to place all perfectly within reach of the youthful student or the philosopher, or to meet the more extended requirements of the Government and other important public bodies and institutions.

Fig. 465.

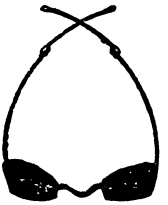


Fig. 464.

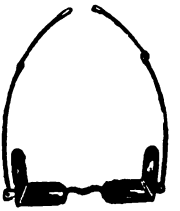


Fig. 457.

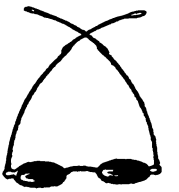


Fig. 468*

Fig. 469.

Fig. 467

Fig. 468. Fig. 470.

SPECTACLES AND EYE GLASSES.

In selecting these to order, the utmost attention is given, even with the plainest, to adapt them properly to the sight, too high or too low a power being equally objectionable, as errors on these points are calculated to cause most serious injury.

SPECTACLES.

455. **Blue Steel** (best), single joints, best glasses . . . 0 8 6

456. " " " " " Brazillian pebbles . . 0 15 0

457. BLUE STEEL (best), double joints, best glasses, 10s.; Brazillian pebbles (*fig.* 457) 0 16 6

458. **Pantoscopic** or angular, in blue steel frames, single joints, best glasses, 0 9 6

459. " " " " " " Brazillian pebbles 0 15 6

460. DITTO, ditto, double joints, best glasses, 11s. 6d.; Brazillian pebbles 0 17 6

*** These spectacles are particularly adapted for reading, writing, sewing, etc., indeed, for any sitting occupation which requires assistance for the eye, leaving it at the same time free for viewing distant objects.

461. **Perlevesian Spectacles,** the frames being extra fine, and fitting into grooves in the glasses or pebbles, by which the frames are rendered almost invisible, single joints, best glasses, 13s.; Brazillian pebbles . . 0 19 0

462. DITTO DITTO, best glasses, double joints, 15s.; Brazillian pebbles 1 1 0

463. PLAIN BLUE STEEL SPECTACLES from 3s. 6d. per pair.

464. **Eye-protecting Spectacles,** in blue steel, with folding side glasses, for defending the eyes from the sun, wind or dust (*fig.* 464), 15s. 6d. to 1 5 0

465. SAME, with convex eyes of wire gauze, and neutral tint glass fronts, (*fig.* 465) 0 12 6 to 1 1 0

466. WIRE GAUZE GOGGLES, or eye protectors, admirably suited for railway travelling and general protection to the eyes against wind, dust, or intense light, whether of snow or the sun, with elastic bands, adapting them to large or small features, 5s. 0d. to 0 12 0

Fig. 472. Fig. 473. Fig. 471

Fig. 476.

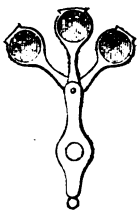


Fig. 481.

EYE GLASSES.

467. Blue Steel (best) single 3s. 6d.; double, with springs *(fig.* 467) 5s. to 0 10 6

468. Tortoise Shell, single, 2s. 6d. to 4s. 6d. *(fig.* 468); double, 5s. 6d. to 8s. 6d.; with springs, *(fig.* 468*) 5s. 6d. to . . . 0 10 6

469. Horn, single, 2s.; double, *(fig* 469) 3s. 6d. to . . . 0 5 0

470. Eye Glass (frameless), with hole for suspension *(fig.* 470), 2s. 6d. to 0 3 6

471. **Reading or Map Glasses,** with handles, in tortoise-shell mountings, *(fig.* 471), 7s. 6d. to 0 15 0

472. Reading Glasses, round or oval, in best horn folding frames, *(fig.* 472) from 2s. 6d. to 0 9 6

473. Same, in best hardwood circular frames, with brass sockets *(fig.* 473), three-inch glass, 7s. 0d.; 3½-inch, 9s. 0d.; four-inch, 11s. 6d.; 4½-inch, 15s. 0d.; five-inch 0 18 6

474. **Magnifying Lenses,** *single,* in horn or shell mountings, folding, convenient for the pocket, 2s. to 0 4 6

475. Magnifying Lenses, *double,* in similar mountings, 3s. to . 0 7 6

476. " " *triple,* from 4s. to 12s. 6d., according to the style of mounting *(fig.* 476).

*** The last two are very suitable for geologists, botanists, naturalists, and all whose business or amusement leads them to examine *small* objects. They can be carried conveniently in the waistcoat pocket, so as to be at hand when wanted; and by combining the lenses, a very considerable power may be obtained; thus, No. 475 will furnish three degrees of power, and No. 476 five.

477. **Coddington Lenses,** of high magnifying powers, very useful for opaque objects, as minerals, etc., mounted in ivory, german silver, or silver, 4s. to 0 15 0

478. Stanhope Lenses, in ivory mountings, from . . . 0 2 6

479. " " " german silver, from 0 3 0

480. Linen or Cloth Provers, to fold for the pocket, 2s. to . 0 4 6

481. Watchmakers' Eye Glasses *(fig.* 481) 1s. 6d. to . . . 0 2 6

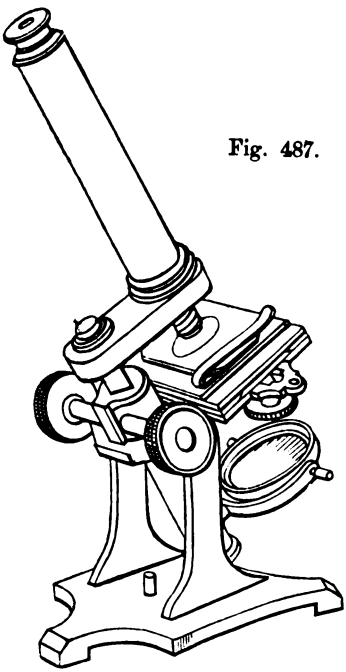


Fig. 487.

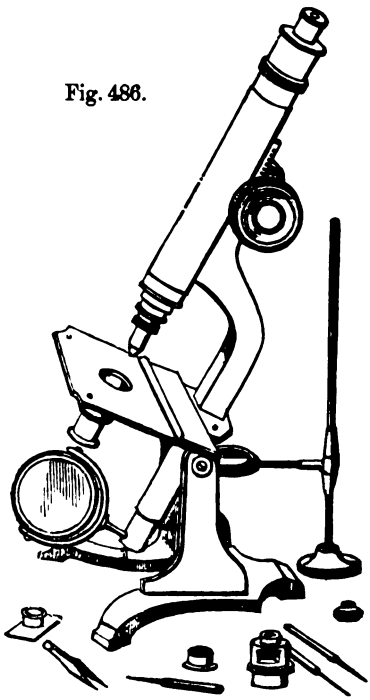
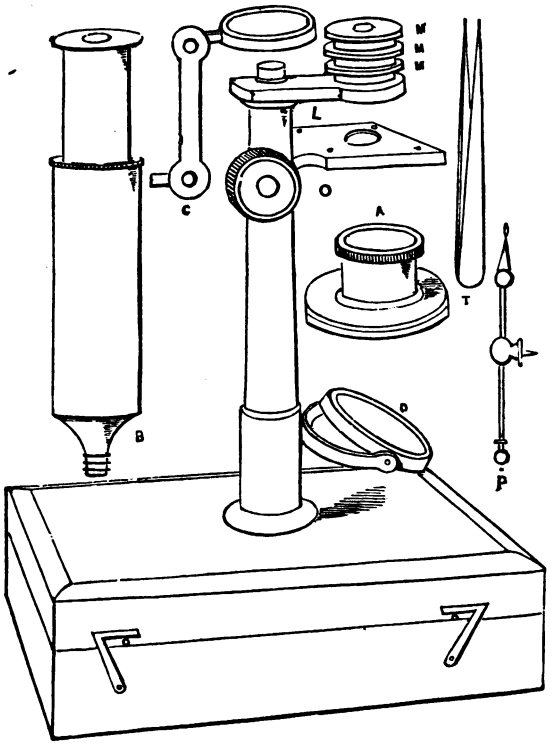


Fig. 486.

MICROSCOPES.

The extraordinary changes and progression made within the last few years in improving and simplifiying the microscope, enable L. CASELLA to present the following brief list of instruments divested of every superfluity, combining only such appliances as will render them really useful for the purposes required. The high price at which the best achromatics and eye-pieces are usually sold in this country, and the great extent to which they are manufactured abroad, has drawn L. CASELLA'S particular attention to the introduction of those parts of foreign manufacture, for which purpose he has arranged with some of the best makers for the *exclusive* supply of their productions, at prices varying from one third to one half of those usually charged for articles of English manufacture, the power and defining qualities of which, though they do not quite accord in description with those of English make, are in many cases quite equal, and even superior, to those charged so highly for. Where power is quoted it is given in simple linear measure of the diameters, and the capabilities described will be found fully verified by the use of the instruments.

Fig. 482.



EDUCATIONAL MICROSCOPES.

482. **School or Garden Microscope,** simple and compound, with rack-work, six powers, mirror, condenser, infusoria box, forceps, object and glasses; expressly arranged by L. Casella as one of his popular series of garden scientific instruments, in mahogany box, with instructions *(fig.* 482). . £1 5 0

483. **Student's Microscope,** in cabinet case, with compound body, achromatic object glass, range 30 to 120 diameters, two simple powers, rack-work, condenser, mirror, and joint to incline the body to any angle . . £2 15 0

484. **Educational Compound Microscope,** with achromatic object glasses to separate, ranging from 30 to 250 diameters, condenser, double mirror, animalculæ cage, forceps, etc., in mahogany case, with drawer . . . £5 5 0

485. Educational Compound Microscope, as above, with quick and slow motion to the body, large stage, best triple object glass, with powers ranging from 40 to 300 diameters, stage condenser, large double mirror and forceps, in mahogany case, with drawer £7 0 0

*** The above, with single rack-work to stage, 10s. 6d. extra. To this and the following microscopes are frequently added a polarizing apparatus, or a spotted lens, or both. See page 57.

486. **Achromatic Compound Microscope,** *(fig. 486)* with two Huygenian eye-pieces, two superior achromatic powers of about $\frac{3}{16}$ and $\frac{3}{4}$-inch, separable into five powers, range about 40 to 450 diameters, with fine adjustment, rectangular stage motion, double mirror, stand condenser, forceps and infusoria box, in cabinet case £11 0 0

487. SAME, of more solid construction, with two eye-pieces, universal stage motion, two best treble achromatic powers of $\frac{1}{4}$ and $\frac{1}{8}$-inch, in combination, and separable to about $\frac{1}{2}$, $\frac{3}{4}$, 1 and 1½-inch, with range of powers from 30 to 500 diameters, large double mirror, stage forceps, and infusoria box; diaphragm with revolving and moveable fittings, large condensing lens on stand, plate glass with covers, in strong cabinet case with drawer *(fig. 487)*. . £16 10 0

488. **Achromatic Compound Microscope,** large size, *(fig. 488, p. 51)* very superior, and of great solidity, the stage having 1-inch motion; plain and concave mirrors, fine adjustment (100 turns to the inch), secondary stage for holding achromatic condenser, spotted lens, etc., to which is applied the horizontal and vertical adjustments for insuring the perfect centricity of all its parts £21 0 0

*** The above can be fitted with the following apparatus:—Parabolic condenser, £1 10s.; Achromatic ditto, £3; Spotted Lens, 15s.; Condenser on brass stand, £1; Polariscope, with selenite stage, £2 5s.; Camera Lucida, £1; Animalculæ Cage, 6s.; extra deep Eye-piece, 15s.; Mahogany Cabinet, with box for apparatus and one for objects, £2 15s. It may also have added any object glasses required. See pages 57 and 58.

489. **Dissecting Microscope** (Professor Quekett's) portable, with drawer £2 10 0
Compound body for making the above a portable sea-side microscope, £1.

490. CHILDREN'S MICROSCOPE, with sliding tube, adjustment mirror, eye-piece and magnifying power, forceps, and one microscopic object, 10s.; same, with two powers and two objects 0 15 0

491. FLOWER AND INSECT MICROSCOPES 0 6 6

MICROSCOPIC APPARATUS AND ACCESSORIES.

Lieburkuhn or Silver Cup Reflectors, *packed in brass boxes.*

492. 2-inch . . £1 0 0 | 494. 1-inch . . 0 15 6
493. 1½-inch . . 0 17 6 | 495. ½-inch . . 0 10 6
495*. ¼-inch . . . 0 7 6

496. REFLECTOR, for illuminating opaque objects . . . 1 2 0

497. MICROMETER EYE-PIECE £1 1 0
498. ERECTING EYE-PIECE, for dissecting with the compound microscope 0 17 6
499. A., B., C., and D. EYE-PIECES, each 0 15 0
500. CAMERA LUCIDA (Wollaston), plain . . 0 18 0 to 1 4 0
501. DITTO, best, with double frame 1 8 0
502. PLATE, for fixing fish, frogs, etc., for exhibiting the circulation of the blood 0 10 6
503. ANIMALCULÆ CAGES with best screwed caps, 5s. 6d. to . . 0 12 0
504. SET OF THREE ANIMALCULÆ TUBES, in case . . . 0 2 0
505. " " SIX " TUBES " . . . 0 4 0
506. STAGE MICROMETERS, each 0 6 0
507. CONDENSING LENS on stand, from 10s. 6d. to . . . 1 0 0
508. POLARIZING APPARATUS £1 4s. to 1 10 0
509. " " best, with extra large prisms, packed in box, 2 2 0
510. REVOLVING SELENITE STAGE, with set of three revolving selenites in brass box 2 5 0
511. PLAIN SELENITE STAGE, with one tint, 2s. to . . . 0 6 0
512. STAGE FORCEPS, 6*s.* 6*d.* Glass Stage Plates, each . . 0 0 8
513. GLASS TROUGHS, for holding Polyps, etc. . . . 0 4 6
514. **Achromatic Condenser** (Gillett's), on a new combination of principles, for the illumination of transparent objects 5 5 0
515. PLAIN ACHROMATIC CONDENSER, with adjusting tubes . 1 18 0
516. **Illuminator** (Rev. C. Kingsley's), in setting, with diaphragms. 2 11 6
517. PARABOLOID, in setting, for dark ground illumination . . 1 10 0
518. LIGHT MODIFIER (Rainey's) 0 5 6
519. **Side Condensing Lens,** with double joints . . . 0 15 0
520. LISTER'S DARK WELLS, and fittings 0 12 0
521. **Compressoriums,** best lever, 7*s.* 6*d.*, 14*s.*, and . . . 1 8 0
522. SPOTTED LENS, for dark ground illumination, from 8s. 6s. to 0 14 0
523. CURVED PHIAL FORCEPS, per pair 0 7 6

Achromatic Object Glasses, of superior French or German manufacture, with adapter and brass box engraved

524. 1½-inch, large aperture £1 10 0
525. 1-inch, large aperture 1 8 0
526. ½-inch ditto . . 1 6 0
527. ¼-inch, triple combination to separate . . 1 15 0
528. ⅛-inch ditto . . 2 0 0
529. $\frac{1}{10}$-inch, ditto . 2 2 0

Achromatic Object Glasses of the finest English manufacture, the increase of the angle of aperture of which, as shown in the following table, is more especially worthy of notice in the low powers, which, when adjusted through any considerable thickness of glass or some depth of water, will exhibit objects with a definition which a small angle of aperture cannot give.

	Object glasses.	Angular Aperture.	Magnifying Power with the various Eye Glasses. A	B	C	D	
530.	2-inch.	15 degrees	20	30	40	60	£2 10 0
531.	1½ "	20 "	40	55	70	90	2 15 0
532.	1 "	25 "	60	80	100	120	2 18 0
533.	½ "	65 "	120	130	180	220	4 0 0
534.	¼ "	95 "	220	350	500	620	4 0 0
535.	⅙ "	135 "	320	510	700	910	5 10 0
536.	⅛ "	150 "	400	670	900	1200	7 0 0

MISCROCOPIC OBJECTS.

Owing to the difficulty of giving anything like a complete list of these objects, a few only are enumerated, yet all new varieties are made up as they appear, and specimens supplied, or suggested, are prepared to order.

537. **Human Bone,** a set of twelve slides, illustrating its growth and structure, each slide 0 1 6

538. **Urinary Deposits,** set of twelve, each slide. . . . 0 1 6

539. INJECTED PREPARATIONS, and other animal tissues, each slide . 0 1 9

540. **Recent and Fossil Bones** of mammals, reptiles, birds and fishes, tranverse and vertical sections, each slide 0 1 3

541. RECENT AND FOSSIL TEETH, transverse and vertical sections, each slide 0 1 3

542. **Blood Discs,** pigment cells, skin, etc., each slide . . 0 1 3

543. BLOOD DISCS—Syren and lepidosyren " . . 0 1 9

544. **Sections of Lime-stones,** oolites, flints, agates, etc., each slide . 0 1 3

545. SPICULES AND GEMMULES of sponges and gorgonias " . 0 1 3

546. **Shells,** sections of various species of, each slide . . 0 1 3

547. ECHINI SPINES, sections of, in great variety, each slide . 0 1 3

548. **Entomological Preparations**—antennæ, eyes, feet, hairs, scales, skins, spiracles, stings, stomachs, tongues, tracheæ, wings, acari, and parasites, each slide 0 1 3

549. **Vegetable Preparations**—sections of woods, petals, siliceous cuticles, spiral and other vessels, ducts, spores, pollens, hairs, etc., each slide . 0 1 3

550. **Fossil Woods,** sections of various exogenous and endogenous woods, each 0 0 8

551. COAL, sections of (many varieties), each slide . . . 0 8

552. DIATOMACEÆ, recent and fossil, in great variety, each slide . 0 1 3
553. TEST OBJECTS, each slide 0 1 3
554. **Test Objects,** for $\frac{1}{8}$ and $\frac{1}{16}$ object glasses, each slide . . 0 2 0
555. **Polariscope Objects,** selected from vegetable, animal, and mineral substances, each slide 0 1 3
556. **Set of Three Selenites,** each slide 0 4 9
557. EDUCATIONAL SERIES of thirty-six objects in mahogany case 2 0 0

MICROSCOPIC PHOTOGRAPHS,

Comprising upwards of one hundred interesting subjects, including the following personages and living celebrities :—The Queen, the Prince Consort and the Royal Family, the Emperor and Empress of the French, the Prince and Princess Royal of Prussia, the late Baron Humboldt, Sir Isaac Newton, Sir J. Herschel, and Sir H. Davy, Drs. Livingston and Faraday, Sir D. Brewster, Albert Smith, and Charles Dickens; also the the Lord's Prayer, £20 Bank Note, numerous views, etc. etc., in the very best style of art, each slide 0 1 8

MICROSCOPIC REQUISITES.

559. Canada balsam, asphalt, gold size, glycerine, etc., in 1s. and 2s. bottles.
560. Deane's gelatine medium, in 2s. bottles.
561. Thin glass, in circles, 3s. per oz.; in squares, 4s. per oz.; ditto, mixed, 6s.
562. Plate-glass slips, 3 inches by 1 inch, with ground edges, 1s. per dozen.
563. Glass cells, square, round, oblong, oval, and with solid bottoms, 2s. 6d. and 3s. per dozen.
564. Labels for covering objects, 3s. per hundred.

TELESCOPES.

MARINE TELESCOPES.

565. **Day or Night Telescopes,** specially for use at sea, being so arranged as to admit the greatest amount of light in dark or foggy weather, with mahogany bodies and spray shades, one, two, or three-draw *(fig 565, p. 60.)* . 1 10 0
566. SAME, of superior quality, with larger object glass . . 1 15 0
567. DITTO, DITTO, very superior, with larger object glass, and increased means of illumination, covered with leather 3 0 0
568. **Marine Telescope,** much improved, 30 inches when shut, drawing out to 36 inches, with extra large eye piece for increase of light, 2¼-inch object glass and caps, portable strap and merchant signals attached, as thoroughly useful and good an instrument as a naval officer need have . . 4 10 0
569. **Marine Telescope,** with mahogany body, suitable for pilot stations and light-houses, 34 inches when shut, drawing out to 41 inches, 2¼-inch object glass, power forty times 6 0 0
570. SAME, covered with leather and with merchants signals attached, 17s. 6d. extra.

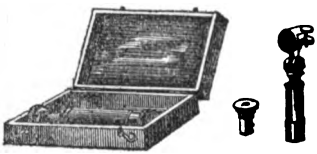


Fig. 581.

Fig. 565.

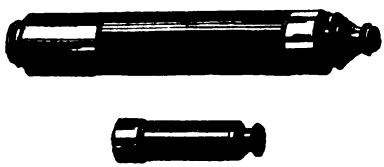


Fig. 574.

571. **Marine Telescope,** improved, the same as used in the East India navy, with two eye pieces, viz., one for clear and the other for dark and hazy weather, with magnifying powers of thirty-five and twenty times respectively, 1⅞-inch object glass, the body covered with black leather, in mahogany case, with lock 5 5 0

572. **Marine Telescope,** improved, etc., etc., as above, the two eye pieces magnifying sixty and thirty-five times respectively, 2¼-inch object glass, covered body, three feet when closed, in mahogany case, as excellent a form of marine telescope as is made 7 10 0

573. **Sea-Coast or Station Telescope,** with four feet brass body and pillar, vertical rack, and horizontal motions, two terrestrial and one astronomical eye piece, with powers varying from 35 to 120 times, 3-inch object glass and sun shade, in strong case with lock, and strong mahogany stand, admirably suited for observation over an extensive range of country, for telegraphic or sea coast stations, or for occasional astronomical observation . 18 10 0

Portable or Military Telescopes, three-draw, usually called one-foot-eighteen-inch and two feet, of the following dimensions and prices, *(fig. 574)*

	Length when shut.	Length when in use.	Aperture of object glass.	Magnifying power in diameters.	Price in plain mountings.
574.	5½-inches	15 inches	1¼-inches	15 times	£1 8 0
575.	8-inches	22 "	1⅜ "	23 "	1 15 0
576.	13 "	28 "	1½ "	27 "	2 12 0

*** The eight and thirteen-inch telescopes, as above, are sometimes covered with black leather, and slings with end caps added for portability and protection, at an additional cost of 7s. 6d. and 10s. respectively. A pancratic eye-draw is also frequently applied to either of the two, by means of which an additional amount of power of 7½ to 10 diameters is obtained, at 10s. extra charge.

577. **Improved Taper Telescope,** two-draw, being 12-inches long when closed, and 30 inches when drawn out, magnifying power 25 times, 2¼-inch object glass, with end caps and straps *(fig. 577)* . . . 3 5 0

578. THE SAME, with pancratic eye-draw, by which the power may be increased at pleasure to thirty and thirty-five times; admirably suited for tourists, deer stalking, etc., as perfect a telescope as a traveller can have 4 4 0 3 15 0

*** To this instrument a micrometric eye-piece, price 12s. 6d., is sometimes added, by means of which the distances of objects within the range of twelve hundred feet can be easily estimated. For reconnoitering purposes in the Crimea and India, this arrangement has met with the highest praise.

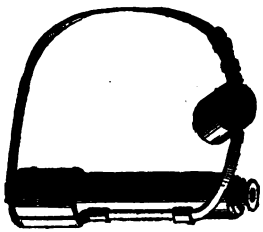


Fig. 579.

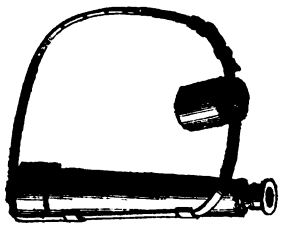


Fig. 577.

579. **Improved Telescope,** four-draw, being 11 inches when closed, and 39 inches when drawn out, magnifying power thirty-five times, 2-inch object glass, with leather end caps, and strap *(fig.* 579) . 4/4/- 3 12 6

580. SAME, with pancratic or extra eye draw, increasing the power to forty and forty-five times 4 10 0

581. **Portable Pocket Telescope,** six-draw, clip and screw for window-sill or garden-post, and an extra power to show the satellites of Jupiter, in neat morocco case, 4×3½, *(fig.* 581) 2 10 0

582. **Pocket Telescope,** for terrestrial or astronomical purposes, four-draw, being 8 inches when closed, and drawing out to 29 inches, object glass 1¾-inch aperture, astronomical eye-piece to 100, sun shade, clip and stand, in mahogany case 5 10 0

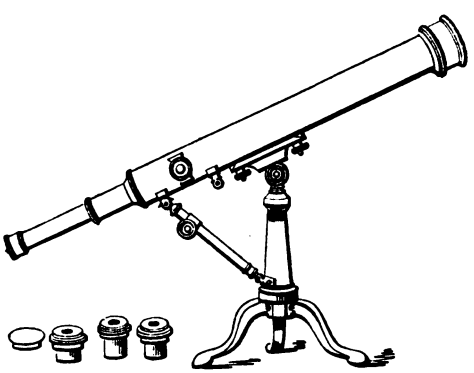


Fig. 584.

ASTRONOMICAL TELESCOPES.

583. **Astronomical Telescope,** with brass body, 30 inches, object glass 2⅛-inch aperture, two terrestrial and two astronomical eye-pieces of 30 and 40, 80 and 110 powers respectively, rack, sun shades, vertical rack, and horizontal motion, with tripod stand, in mahogany case, complete . 11 10 0

584. **Astronomical Telescope,** 30-inch focal length, 2¼-inch aperture, rack adjustments, etc., as No. 583, two terrestrial and two astronomical eye-pieces, with powers to 120 times, mahogany case and stand complete *(fig.* 584.) 13 10 0

585. ASTRONOMICAL TELESCOPE, 34-inch focal length, 2½-inch aperture, finder, double rack, two astronomical and two terrestrial eye-pieces, with powers to 140, sun-shade, diagonal eye-piece, stand, etc., complete . . 18 0 0

586. **Astronomical Telescope,** 3½ feet focal length, 2¾-inch aperture, powers to 200, rack adjustment, finder, elevating rack and horizontal motion, sun shade and diagonal eye-piece, mahogany case and tripod table stand complete 24 0 0

*** If without the finder (in which form it is mostly supplied) £2 less.

586.* ASTRONOMICAL TELESCOPE, 3½ feet focal length, same as No. 586, 3-inch aperture, two terrestrial and three astronomical eye-pieces, with powers to 230, 30 0 0

587. ASTRONOMICAL TELESCOPE, 3½ feet focal length, 3½-inch aperture, two terrestrial and three astronomical eye-pieces, powers to 260, finder etc. as No. 586 37 0 0

587.* THE SAME, with horizontal rack 40 0 0

*** a plain stout tripod garden stand, for any of the above astronomical instruments from £1 5s. to £1 15.

588. **Astronomical Eye-pieces,** ordinary powers, each 15s. 6d.; extra high powers, each 1 5 0

589. TELESCOPIC HOLDERS, to be applied to window frames, from £1 1s. to 2 2 0

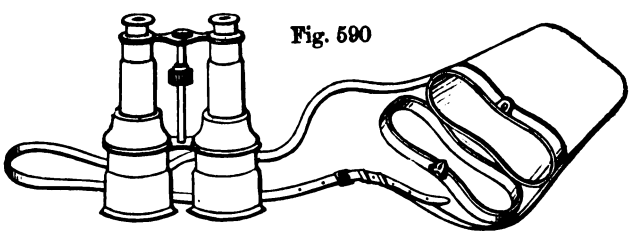


Fig. 590

BINOCULAR FIELD, OR PILOT GLASSES.

The greatly extended use of these glasses by tourists, pilots, naval and military officers, as well as for the race-course and opera, has induced L. CASELLA to adopt such only as are thoroughly suited for these purposes; and, whilst in most cases neatness and optical excellence form the first consideration, yet where ornament or expensive mounting is wished for, they may be had in every variety of elegant design.

590. **Race or Pilot Glass,** large size, of the best quality, black japanned, with sliding sun shades and sling case *(fig.* 590) . . . 3 15 0

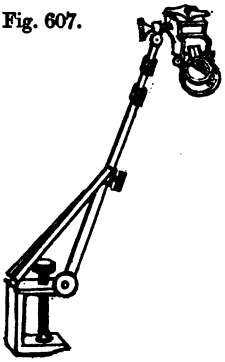
591. RACE GLASS, as above, with shades, etc., the body covered with black leather 4 0 0

592. RACE GLASS, bronzed body, twenty-six lines, etc., as above, in brown leather sling case, particularly adapted for India . . . 4 4 0

593. **Race Glass,** very superior, with twelve lenses, by which its size is much reduced, with japanned, bronzed or covered body, twelve lines, £3 12s.; fifteen lines, £3 16s.; nineteen lines . . . . . 4 /0 0

594. RACE GLASS, twenty-four lines, very superior, with twelve glasses, as above, emperor's pattern, admirably suited for coasting purposes . 6 16 0

Fig. 607.



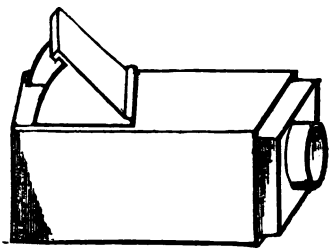


Fig. 609.

Race Glasses, of extra high power, but with the field of view rather less than in the preceding glasses:

595.	Twelve lines	.	3	5	0	597. Nineteen lines	.	4 4 0
596.	Fifteen lines	.	3	15	0	598. Twenty-one lines		4 15 0

*** Race Glasses made to bend, so as to suit varying width of the eyes, 6s. 6d. each extra.

599. **Binocular or Double Telescopes,** of larger size than the above but of greater power, and of more extended field, in case, with strap, £7 7s.; if made to bend 8 0 0

Binocular Achromatic Opera Glasses, of the very best make, in folding leather cases:

Diameter of Object Glass.	Japanned Black.						Covered in leather.			Ivory and Gilt.						Tortoiseshell and Gilt.					
	6 Glasses			12 Glasses.			12 Glasses.			6 Glasses.			12 Glasses.			6 Glasses.			12 Glasses.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
600. 12 lines				2	15	0	2	18	0				3	0	0				3	8	0
601. 15 "	1	10	0	3	0	0	3	3	0	2	0	0	3	6	0	3	3	0	3	12	0
602. 17 "	1	15	0							2	8	0				3	12	6			
603. 19 "	2	0	0	3	3	0	3	5	0	3	3	0	3	12	6	4	0	0	4	10	0
604. 21 "	2	8	0	3	12	0	3	15	0	4	0	0	4	12	6	4	10	0	6	6	0
605. 24 "	3	3	0	5	0	0	5	5	0	4	12	6	6	10	0	5	5	0	7	0	0
605.* " "	3	8	0							5	0	0				6	6	0			

*** Any of the above, if bending, 6s. 6d. extra.

606. **Small Single Opera or Exhibition Glass,** for the waistcoat pocket, of very great benefit in picture galleries or public assemblies 8s. 6d. to 0 15 0

CAMERAS, PRISMS, MIRRORS, ETC.

607. **Camera Lucida** (Wollaston's), by means of which objects are shown on a sheet of paper, so that a correct drawing can be made even by those unaccustomed to use the pencil. In sketching from nature it is of the greatest use, as by its means an indifferent draughtsman may correctly portray the view before him. Portraits may also be taken the size of life, or to any less size; whilst paintings, prints, maps, drawings, machinery, etc., may be drawn in true perspective to any scale. Price, in maroon case, for the pocket, with instructions, *(fig.* 607) . . . . . £1 12 6 and £2 5 0

608. Portable Mahogany Drawing Board and Tripod Stand, occasionally used with the camera lucida . . . £1 5 0 and 1 15 0

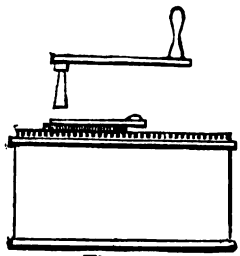
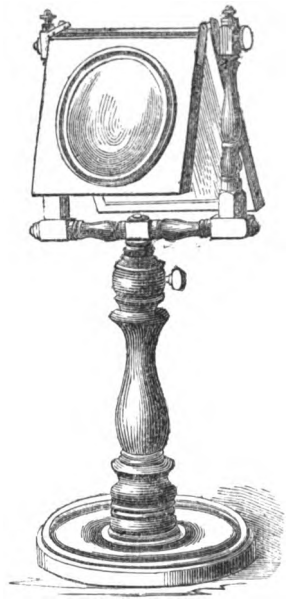


Fig. 620.



Fig, 612

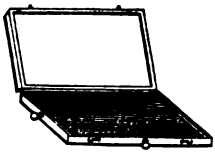


Fig. 611.

609. CAMERA OBSCURA, for making sketches and portraits from nature, small size 4s. 6d. to 8s., superior ditto, best make, for pictures, 7 by 5 *(fig.* 609) 1 10 0

610. **Portable Field Camera,** for sketching from nature direct upon the drawing paper . . . . . £3 0 0 to 5 10 0

*** Photographic cameras, etc.—see photographic apparatus, page 68.

611. **Claude Lorraine or Convex Black Glass Mirrors,** in morocco cases, much used to facilitate the delineation of landscapes in perspective *(fig.* 611), 17s. 6d., £1 5s., £1 12s. 6d. 1 18 0

612. CLAUDE LORRAINE, OR COLOURED GLASSES, to illustrate the effect of colours on pictures, in horn or tortoiseshell case, 3s. 6d. to . . 0 12 6

612.* **Optical Diagonal Mirror,** for viewing prints in perspective, and increasing their size to an extent almost approaching to nature, on richly turned mahogany pedestal *(fig.* 612) 2 2 0

613. INTERESTING COLOURED PRINTS, for the above, consisting of views of the chief cities in Europe, showing their principal forts, public buildings, etc., per dozen 0 15 0

614. **Dental Mirror** (*concave*), for magnifying and examining at pleasure the inner surface of the teeth, in folding silver frame, for the pocket 0 18 6

615. OPHTHALMOSCOPE, of much importance, for viewing the interior and back surface of the eye, 15s. 6d. to 1 5 0

616. **Optical Model of Pyramid,** proving that the intensity of light must be inversely as the square of the distance 1 2 0

616* OPTICAL MODEL, showing long-sighted, short-sighted, and perfect vision. Nine rays of light, from an object entering a 3½-inch glass eye are refracted by its lens, showing the object inverted on the retina . . £4 0 0

617. **Optometer** (Smee's), for assisting to ascertain the power of glasses required to remedy defective vision, with instructions for use . . 2 10 0

618. GLASS PRISMS, plain, from 2*s.* to 0 5 0

619. GLASS PRISMS, of superior flint glass, for illustrating the decomposition of light, on stand with ball-and-socket joint, 15*s.* to . . . 1 1 0

620. **Photometer** (Wheatstone's), for estimating the relative value of two lights. It is founded on the principle of their intensities decreasing according to the squares of their distances, so that the bead disc being made to revolve, and the distance of each measured from the instrument, the relative value of each light may at once be known *(fig. 620)* . . 1 8 0

621. THE SAME, with a variety of silvered bead discs, which, when applied, present an almost endless variety of eliptical curves and brilliant lines of light 1 15 0

STEREOSCOPES.

These admirable instruments are now well known and valued, alike for their scientific worth and the means they afford for viewing objects and scenes from all parts of the world, with an interest only next to seeing the real object, or being on the spot; thus, in union with photography, Palestine, Syria, China and Japan, hitherto known as it were but in name, may now be regarded as almost brought to our dwellings, whilst the daily increasing demand and supply seems to bid fair for its becoming almost as noble a means of instruction, in geographical and physical science, as printing itself.

622. **Stereoscope,** plain, transparent, with best cosmoramic fixed lenses and reflector, in mahogany 0 7 6

623. STEREOSCOPES, as above, in walnut or rosewood . . . 0 /0 6

624. STEREOSCOPE, of superior make, transparent, etc., as above, with hinged top, mahogany, 11s. 6d.; walnut, 13s. 0d.; rosewood, 14s. 0d.; zebra wood 0 16 6

625. **Stereoscopes,** of the best quality, with silvered reflectors, and german silver mountings, in the following fancy woods, viz., walnut, rosewood, zebra, tulip, Hungarian ash, etc. 1 1 0

626. STEREOSCOPE, cosmoramic, square, with sliding body for focal adjustment, hinge, front and best reflector, in various fancy woods, as above, mahogany £1 13*s.*; walnut, £1 18s.; rosewood 2 0 0

*** Stands for the above, with vertical, horizontal and elongating motion, clamps, etc., in brass 12s. 6d., or richly turned wood 17s. 6d. to £1 10s.

626.* **Stereoscope** (extra size), panoramic, holding nine dozen slides, revolving at pleasure and admitting two persons to look at the same time, very elegant, in walnut or mahogany. Price, without slides 4 0 0 to 7 10 0

STEREOSCOPIC SLIDES.

The great and interesting variety of stereoscopic slides now before the public receiving as it does daily additions, which, if possible, are more interesting than their predecessors, prevents a general and fixed price list being given,—the following, however, will convey a general idea of their prices and kinds up to the present time, every interesting variety being added as it appears.

627. **Stereoscopic Slides**—interesting coloured groups 10s. 6d., 12s. 6d., and 15s. per dozen; best ditto, 18s. per dozen.

628. **Landscapes, Cattle, Water Scenes, etc.,** from leading localities of interest in Great Britain and Ireland, the Continent, etc., plain, from 9s. to 10s. 6d. per dozen; coloured, from 10s. 6d. to 15s. per dozen.

629. **Views in Egypt,** comprising one hundred varieties, 15s. per dozen; transparent glass 5s. each.

630. VIEWS IN THE HOLY LAND sixty varieties, per dozen, 15s.; transparent glass, each 5s.

631. **Views in India,** twenty-four varieties, 15s. per dozen.

632. VIEWS IN LONDON, one hundred varieties, 11s. per dozen.

633. **Crystal Palace Views** showing the various courts and points of greatest interest, 13s. per dozen; transparent on glass 5s. each.

634. **Transparent Glass Views in Switzerland** 5s. each; Spain, etc., 5s. 8d.; Paris 3s. 6d.; Cairo 5s.;—Waves of the Sea on glass, interesting, 5s.

635. **Illuminated Slides** from 15s. per dozen.

*** Elegant fancy boxes, to hold from three to six dozen slides, 1s. 6d. to 10s. 6d.

PHOTOGRAPHIC APPARATUS.

The great and increasing interest now taken in the art of photography, and the continual desire to know at what cost a complete and practical set of apparatus may be obtained, has induced L. CASELLA to arrange the following list of apparatus in complete sets—the lower priced, including chemicals and every requisite appliance, together with a plain specimen of what the apparatus is capable of doing. In every instance the lenses, etc., are carefully tested, and warranted capable of doing at least all that is said of them.

636. **No. 1. A complete Set of Apparatus for the Collodion process,** to take portraits 4¼-inch by 3¼-inch, including mahogany expanding camera, with double achromatic lens (tested), rack and pinion adjustment, tripod stand, gutta percha bath and dipper, plate box and glasses, measure, funnel, box of scales with weights from one grain to two drachms; collodion, nitrate of silver bath, developing solution, fixing solution, and black and white varnishes in stoppered bottles; the whole in packing box . . . 4 ~~12~~ 6

636.* **No. 2. Set of Apparatus,** of the same description as No. 1, with double achromatic lenses (tested), to take portraits 6½ by 4¼ inches, and under ~~6 15 0~~

637. No. 3. SET OF APPARATUS, of the same description as No. 2, with double achromatic lenses (tested), to take portraits 8½ by 6½ inches, and under 13 10 0

638. **No. 4. Complete set of Photographic Apparatus,** of the best possible manufacture, for portraits and views, by the positive and negative collodion processes, consisting of very superior french-polished spanish mahogany expanding camera, fitted with a double combination of achromatic lenses of the *very best quality*, handsomely mounted, with rack and pinion adjustments, to take portraits 4¼ by 3¼, and views 5 by 4 inches, improved portable folding tripod stand, tight top, gutta percha bath and dipper, plate box, graduated measure, glass funnel, printing frame with jointed back, albumenized paper, porcelain dish, extra iodized collodion, cyanide of potassium, glacial acetic acid, nitric acid, pyrogallic acid, hyposulphite of soda, protosulphate of iron, gold solution, black and amber varnishes, glass plates, glass pan, scales and weights from one grain to two drachms, complete, in painted deal case with lock and handle 8 10 0

639. **No. 5. Set of Apparatus** as above, of the very best quality, arranged for portraits 6½ by 4¼ inches and under, and for views 8 by 6 inches and under, in case, complete 14 0 0

640. **No. 6. Set of Apparatus,** ditto ditto, as above, arranged for portraits, 8½ by 6½ in. and under, and for views 10 by 8 inches and under . 27 0 0

*** The last three sets adapted for the waxed paper process, with an extra double slide fitted to the camera to hold the paper, one dozen waxed papers, and extra supply of nitrate of silver, gallic acid, glacial acetic acid, bibulous papers, etc., at 35s. 0d., 60s. 0d., and 92s. each extra respectively.

641. **No. 7. Apparatus for taking Stereoscopic Views,** comprising spanish mahogany camera of the best construction, with parallel table on Clark's principle, and adjusting screw; the camera is fitted with view lens, having rack adjustment, tripod stand, tight top gutta percha bath and dipper, graduated measure funnel, filtering paper, glass plates and plate box, papers, and all the necessary chemicals in stoppered bottles, packed in painted deal case, with lock and handle 9 9 0

642. DITTO, fitted with portrait lens in addition . . . 11 12 6

643. **No. 8. A complete Set of Photographic Apparatus,** for taking stereoscopic views, consisting of a box stereoscopic camera so arranged as to allow the operator to take six views without returning to his operating room, fitted with view lens, stand, bath, glass plate, and all the requisite apparatus and chemicals, packed for home use or travelling 14 0 0

*** Any of the above sets, if metal clamped, especially adapting it for India and other tropical climates, from 15s. to 35s. extra.

LENSES.

The lenses specified below are confidently recommended as the best that can be produced, possessing the greatest rapidity of action, and giving a clear and sharp definition, the visual and chemical foci being warranted coincident.

644. **Portrait Combinations of Achromatic Lenses,** best quality, quarter-size, 4½ by 3¼ inches 1 8 0

645. DITTO DITTO, half-size, 6½ by 4¾ inches 3 5 0

646. DITTO DITTO, whole-size, 8½ by 6½ inches 7 10 0

647. **Twin Achromatic Lenses,** for taking stereoscopic portraits, arranged so that both pictures are taken at the same time 3 10 0

Portrait Combinations of Achromatic Lenses, best quality, mounted with stop, and adapted to reverse the front combination, by which means they are applicable to taking views, etc., the stops rendering them equally useful in bright or dull weather:

648. FOR PORTRAITS, 4¼ by 3¼ inches, and views 5 by 4 inches . 2 10 0

649. " " 6½ by 4¾ inches, " " 8 by 6 inches . 4 14 0

650. " " 8½ by 6½ inches, " " 10 by 8 inches . 11 10 0

651. **Achromatic Lenses,** arranged for taking landscapes, with one achromatic combination, rack and pinion movement, the lens 1¾-inch diameter, for pictures 5 by 4 inches 1 0 0

652. DITTO DITTO, lens 2¼-inch diameter, for pictures 6½ by 4¼ inches . 1 15 0

653. DITTO DITTO, lens 3¼-inch diameter, for pictures 12 by 10 inches 3 0 0

CAMERAS.

Sliding-body Cameras (one body sliding in the other), of best seasoned mahogany, french polished, with single back, and two inner frames for collodion, silver-wire corners, focus screen, etc., for hot climates:

		Horizontal or Vertical.	Square Cameras
654.	No. 1. For plates 5 by 4 inches . . .	£1 5 0	£1 10 0
655.	" 2. " 6½ " 4½ " . . .	1 15 0	2 0 0
656.	" 3. " 8½ " 6½ " . . .	3 13 0	4 0 0
657.	" 4. " 10 " 8 " . . .	4 7 6	5 0 0
658.	" 5. " 12 " 10 " . . .	5 0 0	6 6 0
659.	" 6. " 15 " 12 " . . .	8 10 0	9 0 0
660.	" 7. " 18 " 16 " . . .	11 0 0	15 10 0
661.	" 8. " 22 " 20 " . . .	14 10 0	18 0 0
662.	" 9. " 24 " 22 " . . .	17 0 0	23 0 0
662*	" 10. " 26 " 24 " . . .	23 0 0	26 0 0

Folding Cameras, *(portable)* mahogany french polished, with double action sliding fronts, one double paper holder, one dark slide, two holders for collodion plates, and focussing glass:

		With two openings for slides.	With Brass Bindings
663.	FOR PICTURES up to 7 in. by 6 inches . .	£4 0 0	4 16 0
664.	" " " 9 " 7 " . .	5 0 0	6 6 0
665.	" " " 10 " 8 " . .	6 0 0	7 7 0
666.	" " " 12 " 10 " . .	8 0 0	9 9 0
667.	" " " 15 " 12 " . .	10 10 0	12 0 0
668.	" " " 18 " 16 " . .	15 15 0	16 16 0

669. **Camera Tripod Stand,** ash, 6s. 0d., 7s. 6d., 12s. 6d. . . 0 16 0

670. STRONG CAMERA STANDS, for the operating room, with adjustments, 13s. 1 6 0

671. CAMERA STANDS, ash legs, brass triangular tops, 13s. 0d., £1 6s. 0d. 1 15 0

672. **Printing Frames, jointed backs,** for viewing the development, without disturbing the paper, 6 by 5 inches, 4s. 0d.; 8 by 6 inches, 6s. 0d.; 10 by 8 inches 7s. 0d.; 11 by 9 inches 0 16 6

673. **Porcelain Washing Dishes,** with flat shallow bottoms, 6 by 4½ inches 9d.; 8 by 6 inches, 1s.; 10 by 7½ inches, 1s. 3d.; 12 by 9 inches, 2s. 3d.; 13 by 10 inches. 3s.; 14 by 10½ inches 0 3 9

PAPERS, CHEMICALS, ETC.

674. **Canson Frere's** Negative paper, 22⅕ in. by 17⅕ in., per quire . 0 2 6

675. " " " " waxed and prepared for Le Gray's process, 11 in. by 9 in. per sheet 0 0 6

676. Albumenized Paper, for positives, 11 in. by 9 in., per quire . . 0 1 6

677. Highly Albumenized Paper, for ditto, 11 in. by 9 in., per quire . 0 3 0

678. Salted paper, for positives, 11 in. by 9 in., per quire . . . 0 1 0

679. White Blotting Paper, per quire, 1s.; extra thick ditto, . . 0 2 0

680. Round Filtering papers, 9d., 1s., 1s. 2d., and 1s. 8d. per 100 sheets.

681. **Plate Boxes to hold Glass Plates,** 24 grooves each, 2½ by 2, 1s. 8d.; 3¼ by 2¾ 1s. 9d.; 4¼ by 3¼, 2s.; 5 by 4, 2s. 4d.; 6½ by 4¾, 3s.; 8½ by 6½, 3s. 6d.

682. **Glass Plates for Collodion Pictures:**

	Per Dozen. Flatted Crown.	P. Plate.		Per Dozen. Flatted Crown.	P. Plate.
2½ by 2 .	0 0 3	0 0 10	5 by 4 .	0 0 10	0 2 8
3¼ by 2¾ .	0 0 4	0 1 2	6½ by 4¾ .	0 1 3	0 4 0
4¼ by 3¼ .	0 0 8	0 1 10	8½ by 6½ .	0 2 4	0 8 0

Stereoscopic, size, 6¾ in. by 3¼ in., 10d. and 3s. per dozen.

683. **Chemicals of Absolute Purity,** prepared expressly for photography:

Best negative collodion	per oz.	0 8	Nitrate of silver, per oz.		4 0
Best positive "	"	0 6	Pyrogallic acid, per dram 1s.	per oz.	7 0
Iodizing solution	"	1 0	Gun cotton	"	3 6
Sulphuric ether	"	0 6	Hyposulphite of soda, lb. 8d.	"	0 1
Iodide of potassium	"	2 6	Protosulphate of iron " 8d.	"	0 1
Iodide of ammonium	"	2 6	Sel d'or	per bottle	2 6
Bromide of Potassium	"	2 6	Chloride of gold	"	2 6
Strong acetic acid	"	0 3	Finest Tripoli	per oz.	0 4
Glacial ditto	"	0 6	Nitric acid	"	0 2
Cyanide of potassium	"	0 4			

*** These prices subject to variation. Every other chemical used in photography.

684. **Varnishes.** — Chloroform varnish, 1s. per oz.; very superior black varnish, will not crack, 4d., 6d. and 1s. per bottle; hard transparent varnish, improves the tone of the picture, per bottle, 6d. and 1s., suitable for positives and negatives.

Morocco Cases, etc.—*Per Dozen.*

	2½ by 2		3¼ by 2¾		4¼ by 3¼		5 by 4		6½ by 4¾	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
685. Morocco cases, gilt inside, silk velvet cushion, best mats and glasses	6	0	8	6	14	0	25	0	44	0
686. Ditto, finest quality	7	6	10	6	15	0	28	0	46	0
687. Ditto, double gilt, for two pictures . . .	8	6	14	0	18	0	36	0	52	0
688. Tray frame, silk velvet	3	0	4	6	5	6				
689. Cases, with clasp, having the appearance of a book	11	6	15	6	20	0				
690. Ditto, double, for two portraits	18	0	24	0	32	0				
691. Ornamental horn union cases, brass hinges and snap	27	0	36	0	48	0				
692. Best quality preservers and mats . . .	0	8	0	10	1	6				

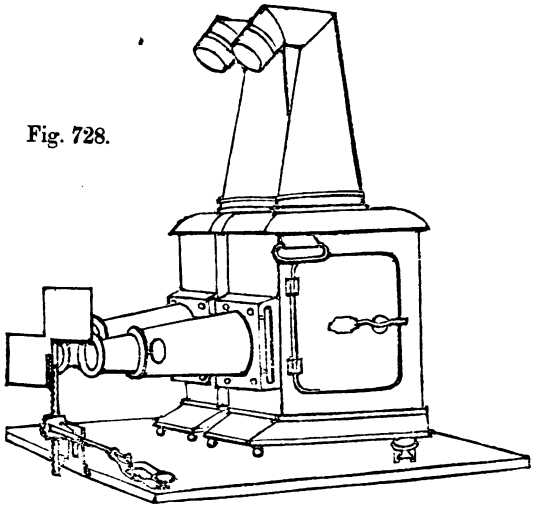
MISCELLANEOUS ARTICLES.

693.	Gutta percha baths, for plates, 4¼ by 3¼ inches, 2s. 0d.; 6½ by 4¾ inches, 3s. 6d.; 8½ by 6½ inches	0	6	0
694.	Ditto, water-tight, screw tops, 7s. 0d.; 10s. 0d.;	0	12	6
695.	Stereoscopic bath, 3s.; ditto, water-tight, for travelling	0	7	6
696.	Gutta percha dippers, 6d., 9d.	0	1	0
697.	Glass measures, minim, 9d.; 1-ounce, 10d.; 2-ounce, 1s. 4d.; 4-ounce	0	1	9
698.	" collodion bottles, graduated, 1s. 6d., 2s. 2d., and	0	3	6
699.	" funnels, 6d., 9d., 10., and	0	1	6
700.	Gutta percha ditto, 8d, 1s. 2d., and	0	1	4
701.	Levelling stands with adjusting screws, 2s. 6d. to	0	5	6
702.	Focussing glasses, japanned tin, 2s. 6d.; best compound ditto, brass	0	8	6
703.	Scales and weights in box, brass pans, 3s. 6d. and 4s.; glass pans	0	5	6
704.	Head rests, plain, 2s, 6d.; jointed, 5s. 6d.; for standing figure	1	1	0
705.	Photographic tents, £1 15s. to	5	10	0
706.	Screw plate holders, 2s. 6d.; 3s. 6d.; 5s. 6d. Pneumatic Lever	0	3	6
707.	Seven colours, in mahogany box, with brushes, gold and silver cups, etc.	0	6	0
708.	Fourteen colours, in mahogany box, with gold and silver cups, brushes and duster	0	10	0
709.	Best prepared colours, per bottle	0	0	6
710.	Sable brushes, mounted in tin, per dozen	0	2	0
711.	India-rubber bellows, for blowing off superfluous colour, each	0	2	6
712.	Vignette plates, from 1s. 0d. to	0	10	6
713.	Tinted glass, for photographic rooms			

Passepartouts, *Per Dozen.*	2½ by 2		3¼ by 2½		4¼ by 3¼		5 by 4		6½ by 4¾		8½ by 6½	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
714. Black or brown ground, bev. sight, oval, dome, or cushion	1	6	2	0	2	6	4	6	6	0	8	6
715 White ground, gold bevelled sight, No. 30	1	8	2	4	3	0	5	0	8	6		
716. White ground, gold bevelled sight, oval, dome, or cushion, No. 43, black line	2	4	2	9	3	6	6	0	7	6	15	0
717. Black or brown ground, porcelain bevelled, oval, dome, or cushion	3	6	4	0	4	6	9	0	11	0	20	0
718. Gold ground, oval, cushion, or dome shaped	6	0	6	6	8	6	12	0	15	0	30	0
719. White ground, white bevelled sight, broad margins, adapted for collodion or calotype pictures, oval, dome, or cushion, No. 97.	3	6	4	0	5	6	7	6	9	0	12	0
720. Stereoscopic Passepartouts, 3s. per dozen.												

NOTE.—Where lenses by any particular maker are required, they will be supplied at their prices, and with the utmost care. For lenses see page 67.

Fig. 728.



PHANTASMAGORIA AND MAGIC LANTERNS,

DISSOLVING VIEW APPARATUS, ETC.

The whole are of the most approved construction, and as each one is carefully tested previous to its being sent out, purchasers may fully rely on their efficiency. The slides also are selected with great care, none being included but those which are calculated to improve the mind or contribute to innocent and mirthful recreation.

721. **Magic Lanterns,** with brass mountings, for exhibiting Humorous, Astronomical and other subjects, giving well-defined pictures of the average size of 3 feet, 3½, 4, 4½, 5, 5½ and 6 feet respectively. *(fig.* 721, p. 72)

No. 1.	Magic Lantern	0	4	6	No. 4.	Magic Lantern	0	14	0
" 2.	Ditto	0	6	0	" 5.	Ditto	0	18	6
" 3.	Ditto	0	9	6	" 6.	Ditto (in box)	1	10	0

No. 7. Magic Lantern (in box) 1 18 0

722. **Phantasmagoria Lantern,** with best solar argand lamp, double condensing lenses, 3 inch diameter, brass mounted in front, in box complete (*fig.* 722, p. 72) 2 15 0

723. PHANTASMAGORIA LANTERN, as above, with 3½-inch lenses . 3 10 0

724. " " " ditto, with 4-inch lenses . . 4 15 6

*** The above show well-defined pictures of 8, 9, and 10 feet respectively.

725. **Phantasmagoria Lantern,** with best solar argand lamp, 3½-inch double condensing lenses and microscope to attach, with one power, six slides, and water trough, in case, complete 4 10 0

726. THE SAME, with a superior microscope, and two powers . 5 10 0

727. BEST PLAIN MICROSCOPE, with two powers, and four slides, fitted to any of the lanterns with 3-inch lenses and above, from £1 10s. to . 3 10 0

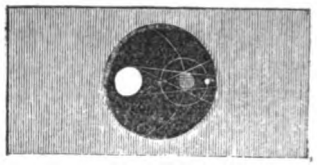
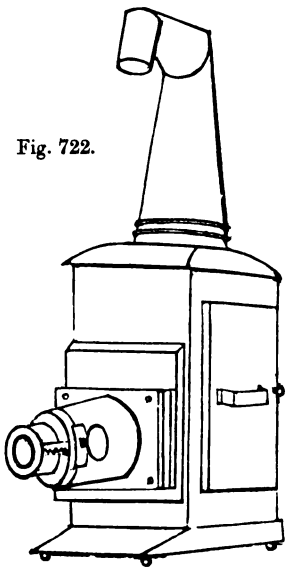


Fig. 737.

Fig. 722.



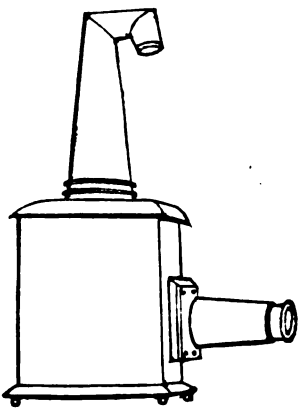


Fig. 721.

728. **Dissolving View Apparatus,** consisting of two phantasmagoria lanterns, with solar argand lamps; the condensing lenses of 3-inches diameter, with dissolving fans, and movement arranged to fit on the strong deal box that contains them *(fig.* 728, page 71) 6 6 0

729. DITTO, with 3½-inch lenses, £8; with 4-inch lenses . . 8 10 0

Either of the above sets of dissolving apparatus or phantasmagoria lanterns, with rack adjustment, 7s. 6d. extra each lantern.

*** The OXY-CALCIUM, or OXY-HYDROGEN lights may be adapted to either of the above lanterns, from No. 6 and upwards; but for private exhibition the improved solar argand lamp is mostly preferred.

730. **Dissolving View Apparatus,** consisting of a pair of lanterns, with 3½-inch lenses, and rack adjustment, in case, arranged for the OXY-CALCIUM light, with two spirit lamps, one gas bag, one pressure board and retort . 15 10 0

731. **Dissolving View Apparatus,** consisting of a pair of lanterns, with 3½ inch lenses rack adjustment and mahogany body, arranged for the OXY-HYDROGEN light 11 0 0

732. Two bags to last two hours 7 0 0

733. Two pressure boards for ditto 1 15 0

734. Retort and purifier for making Oxygen gas . . . 1 1 0

735. Two jets 3 3 0

£23 19 0

736. VERY SUPERIOR MICROSCOPE, for the Oxy-calcium or Oxy-hydrogen light, with three powers, adapting it alike for large or small objects, insects, dust of moth's wings, etc. etc., the magnifying power being immense, and the definition perfect . . . £11 0 0 to £14 10 0

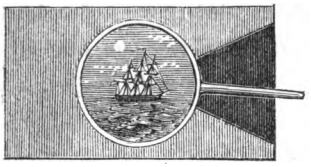


Fig. 742.

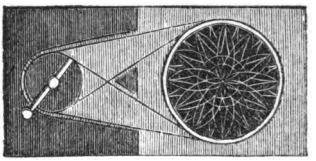


Fig. 745.

LANTERN SLIDES.

737. **Astronomical Diagrams,** (a series of ten) beautifully painted, with rack and pinion movement, by which they are made to revolve, so as to illustrate the theory of the tides, eclipses, the rotundity of the earth, etc.; in mahogany boxes, complete for the 3-inch lens phantasmagoria lantern *(fig.* 737) 4 5 0

738. Ditto for the 3½ and 4-inch 5 10 0

739. Astronomical Slides in boxes for

No. 1.	Magic Lantern . . .	with paper edges	0 6 0
" 2.	" " . . .	" " "	0 7 6
" 2.	" " . .	wood frames and book .	0 14 0
" 3.	" " . .	" " " .	1 0 0
" 4.	" " . .	" " " .	1 6 6
" 6 & 7.	" . .	" " " .	1 18 0

740. Comic Slides, in boxes, containing one dozen slides, with about 50 figures and views, for

No. 1.	Magic Lantern . .	with paper edges	0 3 6
" 2.	" " . .	" " "	0 3 6
" 2.	" " . .	" wood frames	0 7 6
" 3.	" " . . .	" "	0 10 6
" 4.	" " . . .	" "	0 13 6
" 5 & 6	" " . . .	" "	0 18 6
" 7.	" " . . .	" "	1 2 0

741. Slipping Comic Slides, for No. 3 and 4 Lanterns, at per dozen 0 15 6

" " " " 5 " " . . 0 18 6

" " " " 6 and 7 " . . 1 5 0

742. Lever Slides, *(fig.* 742) 3s., 4s. and 6s. each, according to quality.

743. Panoramic or Long Movement Slides, each one containing some interesting subject, as the Colossus at Rhodes, Mount Vesuvius, Bandit's Cave, etc., with ships, figures, etc. passing in front . . . each 0 5 6

744. **Natural History**—Superior Sets of Slides, including correct representations of mammalia, birds, fishes, reptiles and insects, (48 pictures on 12 slides in box) 12-inch for 2½-inch or 3-inch lenses, £1 8s.; 14-inch for 3 or 3½-inch lenses 2 2 0

*** Slides of Geological and other Scientific subjects, ancient and modern costumes, portraits of celebrated individuals, etc. painted to order.

745. **Chromatropes,** producing beautiful revolving circles, etc., of coloured light infinitely varied; as exhibited at the *Royal Polytechnic Institution, (fig.* 745, page 73), 2-inches diameter, 7s.; 2½-in., 9s. 6d.; 3-in. . 0 10 6

SELECT VIEWS—IN SETS.

suitable for the best lanterns and dissolving apparatus. These views embrace illustrations of popular tales and descriptions of interesting travels, etc., as well as selections of the most interesting scripture scenes. The views in the Holy Land, Natural Phenomena, etc. are executed in the first style of art, and are really beautiful transparent paintings, which may, however, where one price only is given, be had less highly finished at about 10 per cent. lower in cost if required.

746. **The Passage of the Israelites** from Suez to Jerusalem—consisting of 33 subjects—2½inch, £13 10s.; 3-in., £15; 3½-in. . 17 10 0

747. The Overland Route from Southampton to Calcutta, 31 subjects—2½-inch, £12; 3-inch, £14; 3½-inch 16 10 0

748. The 'Erebus' and 'Terror' expedition from Greenhithe to Baffin's Bay, 17 subjects—2½-inch, £6 10s.; 3-inch, £7 10s.; 3½-inch . 9 0 0

749 Mont Blanc from Geneva to the summit and down to Chamouni, 18 subjects—2½-inch, £3 3s. and £5 10s.; 3-inch, £4 10s. and £9: 3½-inch £7 15s. and 10 0 0

750. **The Seasons**—Spring, Summer, Autumn and Winter. Storm, with moving sky, and lightning. Rainbow in winter after a heavy fall of snow, and aurora borealis, 10 subjects—2½-inch £2 10s. and £3 10s.; 3-inch, £4 4s.; 3½-inch . . . . £7 15s. and 10 0 0

751. Wreck of an Emigrant Ship, 6 Subjects—2½-inch, £2 5s. 6d.; 3-inch, £4; 3½-inch 4 4 0

752. Mill of Llanrwst, summer and winter, rainbow, moving sky, clearing off of clouds, ripple in water, aurora borealis, etc. — 2½-inch, £2 8s.; 3-inch, £3 10s.; 3½-inch 5 5 0

753. **Mount Etna or Vesuvius**—4 subjects—day and night, eruption, etc.—2½-inch, £1 18s.; 3-inch, £2 2s.; 3½-inch . . . 3 10 0

754. Robinson Crusoe.—13 subjects—2½-inch, £2 4s.; 3-inch . . 3 17 6

755. Cinderella.—13 subjects—2½-inch, £2 4s.; 3-inch . . . 3 17 6

756. Tale of a Tub.—7 subjects—2½-inch, £1 5s.; 3-inch . . 2 5 0

757. Pussy's road to ruin.—13 subjects—2½-inch, £2; 3-inch . . 4 0 0

*** The views, etc., above, of 2½-inch size, are suitable for lanterns with 3-inch lenses, the 3-inch for 3½-inch lenses, and the 3½-inch for 4-inch lenses.

PICTURES,

illustrative of interesting localities, Ruins, Buildings, etc. of 2½ *and* 3 *inches in size, at about* 7*s. and* 10*s. each respectively.

St. Ruth's Priory,
Val St. Martin,
Melrose Abbey,
Horace's Fountain
Netley Abbey,
River Nile.
Abbotsford.
Lake of Albaro,
Holyrood Chapel,
Dryburgh Abbey,
Geneva,
Parthenon (Athens),
Temple of Jupiter,
Port of Venice, etc.
The Tower by Day.
The Tower by Night.
The Tower in flames.
Greek Church.

SACRED SUBJECTS.

VIEWS.

Jerusalem from the north east,
Pool of Hezekiah,
Birds-eye-view of Jerusalem,
The Red Sea,
The Plain of the Lawgiving,
Mount Sinai,
Mount Carmel,
The Land of Edom,
Entrance to the City of Petra,
Interior of the City of Petra,
Mount Hor, the burial place of Aaron,
The Dead Sea,
Wilderness of the Dead Sea,
The River Jordan,
Interior of the Convent of Mount Sinai,
Baths and City of Tiberias,
Vale of Nazareth.
The Village of Bethlehem,
Tyre—Beyrout,
The Cedars of Solomon,
The Ruins of Baalbec,
Damascus—the Lake of Tiberias
Mount Tabor—Nazareth,
Bethany—Jerusalem,
Garden of Gethsemane,
Tomb of Absolom,
Valley of Jehoshaphat,
Pool of Siloam—Mount Moriah,
The Jews' Place of Wailing,
Church of the Holy Sepulchre.

The passage of the Israelites from Suez to Jerusalem.

GROUPS.

Abraham's Sacrifice,
Rebekah at the Well,
Eli and Samuel,
Translation of Elijah,
The Holy Family,
The Prodigal Son,
Christ Tempted,
" Raising Lazarus,
Christ Bearing the Cross,
" Taken from the Cross
The Resurrection,
" Ascension,

NATURAL PHENOMENA.

Aurora Borealis,
Parhelion, or Mock Sun,
Ignis Fatuus,
Sand Storms,
Icebergs and Glaciers,
Waterfalls,
Falls of Niagara,
Halo,
Rainbow,
Water Spouts,
Coral Reef,
Ice floes breaking,
Geysers of Iceland,
Caverns,
Fingal's Cave,

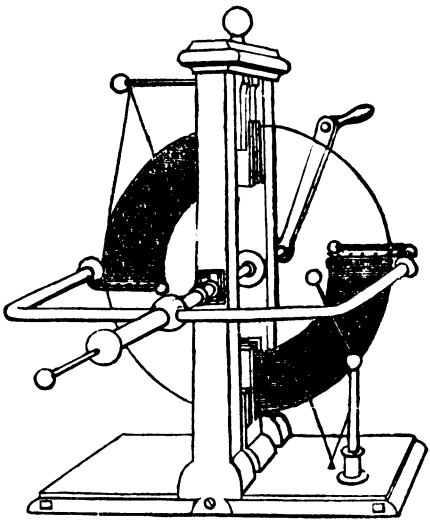


Fig. 764.

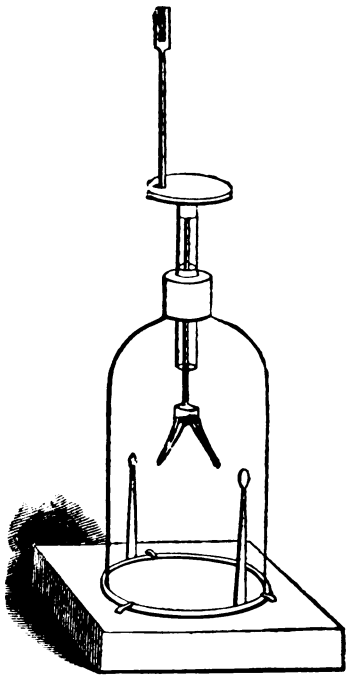


Fig. 786.

ELECTRICAL MACHINES

AND APPARATUS.

The growing interest attaching to Electricity, together with its extensive application under the various forms of Galvanic, Magnetic, etc., to a variety of purposes—among which may be specified the Electric Telegraph and the Medico-Galvanic Machine—render it imperative that apparatus intended to exhibit its varied and interesting phenomena, from the experiment of the Indian Children to the transmission of a message, should be of such superiority of quality that with ordinary precaution they may be pleasingly and instructively demonstrated.

Cylindrical Electrical Machines, with brass conductors and clamps, mounted on mahogany frames:

758.	Cylinder,	6	inches	long,	4	inches	diameter	. . .	£1	0	0
759.	"	7	"		5	"		. . .	1	5	0
760.	"	8	"		6	"		. . .	2	0	0
761.	"	10	"		8	"		. . .	3	10	0
762.	"	12	"		9	"		. . .	4	0	0
763.	"	15	"		10	"		. . .	4	15	0

Fig. 798.

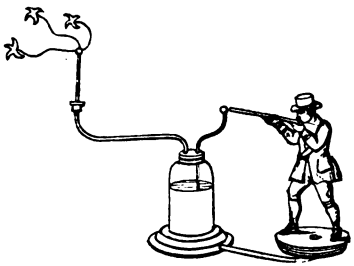


Fig. 796.

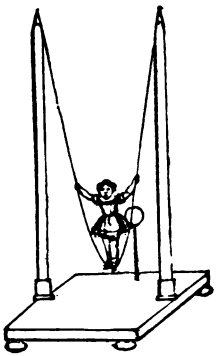


Fig. 802.

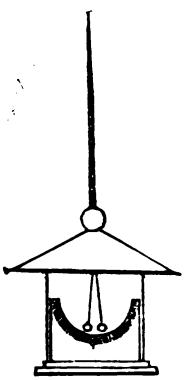


Fig. 784.

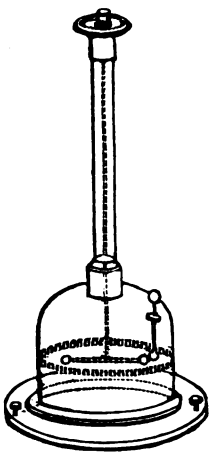


Fig. 790.

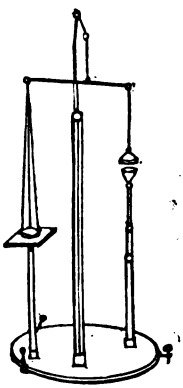


Fig. 792.

Plate Electrical Machines, of the most improved construction, with brass conductors, arranged so as to take the whole of the electricity from both sides of the excited plate, brass clamps and improved rubbers, mounted upon polished mahogany frames *(fig.* 764):

764.	Nine-inch plate machine	2	5	0
765.	Twelve-inch plate machine	3	15	0
766.	Fifteen-inch " "	4	10	0
767.	Eighteen-inch " "	6	10	0
768.	Twenty-four-inch plate machine.	9	9	0
769.	Thirty-inch " "	12	0	0
770.	Thirty-six inch " "	16	10	0

*** Larger sizes made to order.

771. **Electrical Machine,** cylinder 6 in. by 4 in., on mahogany frame, Leyden jar, brass discharger, hand spiral, glass cylinder for showing electrical excitation, brass chain, and box of amalgam - - 1 12 0

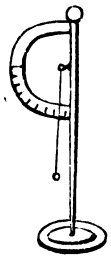


Fig. 785.

Fig. 800.

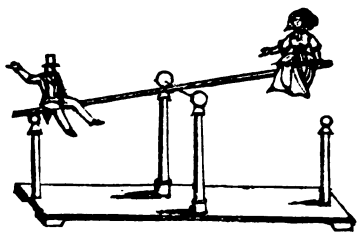


Fig. 804.

772. **Electrical Machine,** cylinder, 7 in. by 5 in. apparatus as above but of larger size, with pith ball stand on mahogany frame, and six pith balls extra 2 5 0

773. ELECTRICAL MACHINE, 10-inch plate, on polished mahogany frame, large and small Leyden jars, jointed discharger with insulating glass handle, electric fly or whirl, head of hair, luminous tubes, image plates with brass stand, pith figures, glass cylinder, brass chain, box of amalgam, and clamp. 6 6 0

774. ELECTRICAL MACHINE, 14-inch plate, on mahogany frame, with apparatus as above, and Bennett's gold leaf electrometer, Henley's quadrant electrometer, set of three bells on brass beams, and thunder house extra . . 7 15 0

775. **Electrical Machine,** 16-inch plate, with appliances as in No. 774, larger Leyden jar, and the following apparatus extra: luminous flask with brass cap valves, etc., exhausting syringe, Faraday's apparatus for passing a shock through eggs, etc., diamond spotted jar, luminous star improved with ball stand, balls of brass, ivory, boxwood and ebony, for showing the different lights produced by each, and a quantity of iron chain for illuminating a room by the electric light 11 0 0

776. ELECTRICAL MACHINE, 18-inch plate, with apparatus, as below, of the best construction, viz., Henley's electrometer, Bennett's electrometer, jointed discharger, Henley's discharger, hand spiral, aurora borealis tube, revolving spiral, electrical flask on stand, set of five spirals, head of hair, diamond jar, 6½ by 3; Leyden jar, 7 by 4; pith figure plates on stand with figures 19 0 0

*** In electrical experiments it is of the first importance that all parts of the apparatus should be slightly warmed at a distance from the fire, and all the old amalgam removed, the rubbers taken off, warmed and scraped, and fresh amalgam applied. The machine should be firmly clamped to the table, and carefully cleaned with a warm silk handkerchief. The room, also, should be both warm and dry, or should it be at all damp and without fire, two or three heated irons placed near the machine and renewed at intervals so as to radiate heat, and the free use of a warm silk handkerchief to dust and rub all the parts, will generally be found effective. The amalgam, if too dry, may be moistened by adding a very small portion of lard.

777. GLASS CYLINDER, for showing electrical excitation, when rubbed with a warm and dry piece of silk or fur 0 1 6

778. BRASS CYLINDER, mounted with insulating handle, for showing that metals become charged when excited by silk or fur, if properly insulated 0 4 6

LEYDEN JARS and BATTERIES, for accumulating Electricity:

	Height.	Diameter.					Height.	Diameter.			
No. 1.	5¼-inches,	2¾-inches	.	0	3	0	No. 4. 9 inches,	4½ inches	.	0	9	6
" 2.	6 "	3 "	.	0	4	6	" 5. 9½ "	5 "	.	0	13	6
" 3.	7 "	4 "	.	0	6	6	" 6. 10 "	5½ "	.	0	18	0

779. **Electrical Battery,** consisting of four No. 1 Leyden jars, with conducting rods, balls, etc., mounted in a mahogany stand . . . 2 0 0

780. Electrical Battery, consisting of four No. 2 Leyden jars, mounted as above. 3 16 0

781. Electrical Batteries, of large size, for using with large machines, or for brilliant effects of electricity, £6 to 18 0 0

782. Jointed Dischargers, with brass arms and insulating glass handles, 6s. 6d. and 0 11 6

783. Same, plain, without joint, for small size jars 0 3 0

ELECTROMETERS, for measuring electrical tension:

784. Cavallo's Pith Ball Electrometer *(fig.* 784, p. 77*)* . . 0 10 6

785. Henley's Quadrant Electrometer, with boxwood graduated arc, 3s. 6d.; with ivory arc *(fig.* 785, page 78) 0 6 0

786. Bennett's Gold Leaf Electrometer *(fig.* 786, p. 76), with an improved mode of insulation and stand, with half-pint, one pint, and one quart jars, 7s., 14s., and . . . . . 2 . . 0 15 0

787. Singer's Electroscope, with condensing plate and joint . . 1 17 6

788. Lane's Discharging Electrometer, 6s. to 0 8 0

789. Cuthbertson's Discharging Electrometer . . . 2 10 0

790. Coulomb's Torsion Electrometer, for measuring small quantities of electricity with precision *(fig.* 790, page 77*)* 2 5 0

791. Harris's Unit Jar Electrometer, with graduated slide for charging other jars or batteries with known proportions of electricity . . 1 10 6

792. Harris's Balance Beam Electrometer, for estimating in grains the attractive force exerted between two surfaces oppositely electrified, as the outer and inner coatings of a battery or Leyden jar *(fig.* 792, p. 77) . . 3 18 0

APPARATUS.

793. Insulating Stools, polished mahogany, with glass legs, 12 by 10 inches 10s.; 14 by 12 inches, 14s.; 16 by 14 inches . . . 0 18 0

794. Insulated Stand, with press, and Henley's universal discharger, forceps, etc., for frictional and voltaic electricity, £1 2s. to . . . 1 8 0

795. Electrical Cannon, 15s. 6d.; ditto, Brass Pistol . . . 0 6 0

796. Electrical Sportsman and birds *(fig.* 796, page 77) . . 1 2 6

797. Image Plates, with dancing figures, 7s. 6d. to . . . 0 11 6

798. Carved Head of Hair, mounted *(fig.* 798, page 77) . . 0 4 6

799. Fire House, 17s. 6d.; Thunder House 0 6 6

800. Electrical Figures, carved in cork, representing Neptune, mermaids, etc., *(fig.* 800, page 78) each 0 4 0

801. Bells, set of three 0 6 6

802. Electrical Swing, *(fig.* 802, page 77) 10s. 6d.; Ditto Bucket . 0 3 0

803. Electrical Spider and Whirl, each 0 1 6

804. Electrical See-Saw *(fig.* 804, page 78*)* 0 15 6

805. Box of Amalgam, or amalgam card 0 1 0
806. Electrical Planetarium 0 7 6
807. Magic Picture 0 6 6
808. Luminous Words and Devices, on glass 0 8 0
809. Diamond Spotted Jars, from 4s. to 0 15 0
810. Luminous Hand Spiral 0 4 6
811. Set of Five Spirals, with insulated revolving balls, on mahogany stand 1 5 0

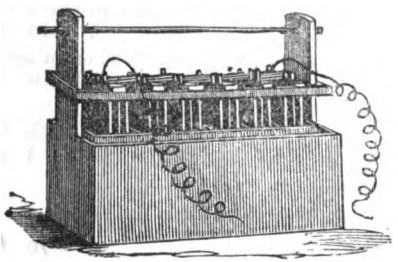


Fig. 819.

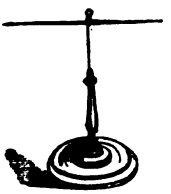


Fig. 871.

Fig. 872.

GALVANIC BATTERIES, ETC.

Daniell's Constant Battery.—This form of battery consists of a cylindrical copper vessel, in which is placed a porous earthen tube, containing a rod or slip of amalgamated zinc; dilute sulphuric acid is put in the porous tube and a saturated solution of sulphate of copper into the copper vessel. Where a long-continued and uniform current is required this battery stands pre-eminent.

811*Daniell's Batteries, copper cylinders, 6 by 3 inches, 5s. 0d.; 9 by 3½ in., 7s. 0d.; 12 by 4 in., 10s. 0d.

812. Set of Six Batteries, 6 by 3 inches, in mahogany tray with quantity and intensity connections 2 0 7
813. Set of Six Ditto, 9 by 3½ inches 2 10 0
814. Set of Six Ditto, 12 by 4 inches 3 5 0

Smee's Batteries, consisting of two amalgamated zinc plates, opposed to the surfaces of a platinized silver plate, in square porcelain cells, furnished with binding screws, conducting wire, etc., the exciting liquid being dilute sulphuric acid.

815. Pint size . . 0 7 6 | 817. Two Quart size . 0 18 6
816. Quart " . . 0 10 0 | 818. Gallon " . 1 17 0

819. Smee's Compound Battery, *(fig.* 819) consisting of six pint cells, the negative surface being 140 square inches, in mahogany frame with ratchet lifter for regulating intensity or quantity, by which the battery may be instantly set in action or stopped, and the zinc plates can also be renewed or re-amalgamated with perfect ease 3 10 0
820. Ditto, as above, quart size cells 4 15 0
821. **Grove's Nitric Acid Battery,** with double amalgamated zinc plates, platinum plate, porous pot, and porcelain trough, about 4 by 5 inches 0 10 0
822. Set of Four Batteries, as above, in mahogany tray, complete, capable of liberating about 8 cubic inches of the mixed gases per minute . 2 5 0
823. Apparatus for Decomposing Water, with single graduated tube 0 16 6
824. Ditto, with two graduated tubes for collecting the gases separately, 1 10 0
825. The Same, of larger size, with stop-cocks, etc. for using with a large battery 2 17 6
826. **V Tube,** for decomposing Neutral Salts, etc., with platinum plates and brass support on mahogany frame 0 7 0

827. GLASS GLOBE, for exhibiting brilliant voltaic light in vacuo . . 1 12 0

828. **Gassiot's Vacuum Tubes,** the various forms for showing the electrical stratifications in discharges, as especially manufactured by L. Casella, for the extended and interesting experiments of John P. Gassiot, Esq., V.P.R.S., and exhibited by him in illustration of his lectures at the Royal Society, and also at the meetings of the British Association, 1858 and '59 (see Royal Society's Reports, etc.), 17s. 6d. to 1 10 0

829. **Electro Magnets,** a current from a galvanic battery being passed through them, an intense magnetic power is immediately obtained—3-inches, 6s. 0d.; 4-inches, 10s. 0d.; 6-inches 1 0 0

The above, upon stands, 6s. and 8s. each extra.

830. PRIMARY AND SECONDARY COILS, with handles, etc., for multiplying the intensity of galvanic batteries, with regulating powers, from £1 1s. to 2 5 0

831. RHUMKORFF'S INDUCTION COIL to give 4-inch spark in air, with condenser and all the latest improvements 15 15 0

832. Ditto ditto to give 3-inch spark 12 12 0

833. Ditto capable of firing 50 charges simultaneously, for mining and other purposes 15 15 0

834. **Illustrative Forms of the Electric Telegraph,** from 1 10 0 to 5 0 0

835. TELEGRAPHIC ALARUM AND COMMUNICATOR, with book of signs 3 10 0

ELECTROTYPING APPARATUS, ETC.

836. ELECTROTYPE APPARATUS, consisting of an earthenware jar, porous pot, zinc rod, etc. . . . . from 1 6 to 0 4 6

837. SINGLE CELL APPARATUS, very convenient in form and simple in operation suitable for medals of two inches in diameter and under, 5s.; for medals, etc., three inches and under, 7s.; for medals, etc., five inches and under 0 10 0

838. BATTERY AND PRECIPITATING TROUGH, for making a large medal, about 7 by 4 inches, or a number of small ones at once . £1 4s. to 1 15 0

839. GILDING AND SILVERING APPARATUS of the most improved form, complete, for articles from about four to twelve inches square . £1 0 0 to 5 15 0

840. PLATINIZED SILVER, averaging about 4 oz. to the square foot, as required, per oz. 0 11 0

841. Gold wire and plate, per dwt. 5s. 6d.; Silver ditto, per oz. . . 0 8 0

842. Copper wire and plate of any thickness; amalgamated zinc plates of all sizes, per lb. 0 1 6

843. Sulphate of copper, per lb. 0 0 6 | 844. Sulphuric acid, per lb. 0 0 4

Gold and silver solution. per lb. 1s. 9d. and 0 3 0

845. Binding screws, of various forms and descriptions, each 6d., 8d., 10d. & 0 1 4

*** Porous cells, superior plaster of paris medallions, and all other apparatus for the above useful arts of any size or description, supplied to order.

MAGNETISM.

846. BAR MAGNETS, strongly magnetized, of the best steel, in boxes, pair six inches long, 2s. 6d.; pair seven inches long, 3s. 6d.; pair eight inches long 0 4 6

847. HORSE SHOE MAGNETS, with keepers, 6d. to . . . 0 3 6

Compound Magnets, horse-shoe form, with keeper, made of the best steel—

848. Composed of 3 Magnets, 2½-inches long, lifting 2lbs. . . 0 2 6

849. " 3 " 4 " " " 4 " . . 0 5 6

850. " 5 " 4½ " " " 8 " . . 0 9 6

851. " 5 " 5 " " " 10 " . . 0 10 6

852. " 5 " 6 " " " 12 " . . 0 13 0

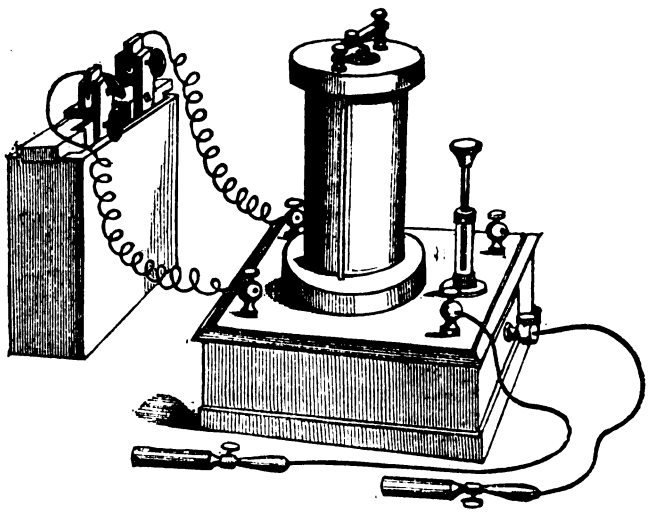


Fig. 880.

Magnetic Needles, blue steel with brass centres—

853.	Two inches	.	.	0	1	6	856.	Five inches	.	.	0 2 4
854.	Three inches	.	.	0	1	8	857.	Six inches	.	.	0 2 6
855.	Four inches	.	.	0	2	0	858.	Seven inches	.	.	0 3 0

*** The same, with agate cap, 1s. 3d. each extra.

859. MAGNETIC NEEDLES, for ship's and other compasses, 3½ inches to 7 inches long, per dozen 0 7 6

860. AGATE CAPS for ditto, per dozen, 13s. 6d.; Metal ditto . . 0 7 0

861. COMPASS CARDS, with magnetic needles and agate caps, from 3½ inches to 7 inches . . . . . per dozen 1 14 0

Talc Flies for Ship's Compasses.

862.	9 inches	0	6	0	865.	7½ inches	0	4	0	868.	6 inches	0	3	0
863.	8½ " .	0	5	0	866.	7 "	0	3	6	869.	5 "	0	2	0
864.	8 " .	0	4	3	867.	6½ "	0	3	3	870.	4 "	0	2	0

871. BRASS STAND *(fig.* 871, page 80), for suspending magnetic needles 0 3 6

872. DIPPING NEEDLE *(fig.* 872, page 80), with graduated arc for measuring the magnetic dip 1 10 0

873. MAGNETIC NEEDLE, with vertical and horizontal movements, graduated arc, etc., for showing terrestrial and local attraction . . . 1 5 0

874. MAGNETIC TOYS, consisting of floating swans, ducks, fishes, etc., showing magnetic attraction and repulsion . . each, 6d. to 0 5 0

875. PITH FIGURES of men and women as above . . each . 0 1 6

876. MAGNETIC SUN DIALS AND COMPASSES, see pages 46 and 48.

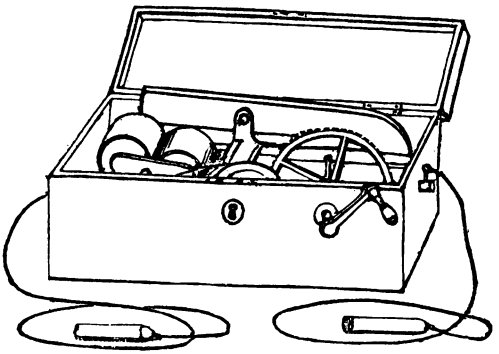


Fig. 877.

ELECTRO-GALVANIC AND MAGNETO-ELECTRIC MEDICAL MACHINES.

877. MAGNETO-ELECTRIC MACHINE, of improved construction, complete, in mahogany case, about 8 by 4 inches, with revolving armature, of the highest value as a curative agent for personal use or medical practice *(fig.* 877) 2 [redacted] 0

*** Amongst other authoritative enumerations of diseases in which the above and following machines are most effective are tooth-ache, tic-doloreaux, neuralgia, rheumatism, paralysis, spasms, ague, etc. etc. On this subject Abernethy has said in his lectures: "Electricity is a part of surgical practice that may be considered unique—all other means operate on the surface, but electricity will pervade the very centre of the body." E. W. Tuson, Esq., F.R.S., says, in *The Medical Times*, "Medical agents will do much in the treatment of disease, but magneto-electricity does more." Indeed, on consulting the published opinions of the highest medical authorities on this subject, it would seem that for most diseases afflicting humanity, a power of mitigation or removal is here given as startling as it is effective whenever it is tried.

878. **Electro-Galvanic Machines** of the most improved form, for administering medical galvanism; so arranged as to yield a current of the galvanic fluid of great quantity—flowing in one direction only—with the power of regulating it so that it may be applied alike to the strongest or most delicate person with any amount of strength required, without producing the least unpleasant sensation . . . . . .

879. ELECTRO-GALVANIC MACHINE, with a pint Smee's battery, galvanic coil, pair of each cylinder and sponge directors, and medical apparatus, packed in mahogany case 2 10 0

880. ELECTRO-GALVANIC MACHINE of larger size, with a quart Smee's battery, vaginal director and surgical discs, medical apparatus, etc., as above, complete *(fig.* 880) 3 5 0

881. ELECTRO-GALVANIC MACHINE of great power, arranged so that the galvanic current may be regulated to the greatest nicety, which allows it to be administered in its mildest form or greatest intensity, with two Smee's batteries, pair of each cylinder and sponge directors, vaginal director, directors for the mouth, ears, eyes, etc., foot plate, surgical discs, conducting wires, etc., in mahogany case 7 10 0

882. ELECTRO-GALVANIC APPARATUS, arranged especially for hospitals or foreign service, with all the necessary apparatus, directors, etc., very elegant and complete 14 0 0

THERMO-ELECTRICAL INSTRUMENTS.

These instruments are for demonstrating the evolution of electric currents by unequally heating dissimilar metals:

883. Bar of Bismuth and Antimony, for exhibiting the production of Thermo-electricity by heating its extremity, by which the needle of a delicate galvanometer is deflected 0 6 6

884. Ditto of larger size, on brass stand 0 13 6

885. Melloni's Thermo-Electric Battery (exceedingly sensitive) in mahogany frame on brass pedestal 1 18 0

886. Seebeck's Thermo-Electric Apparatus of Bismuth and Antimony, in which a magnetic needle is suspended; an electric current is manifested by the deflection of the needle on applying the flame of a spirit lamp to either corner 0 15 0

887. Thermo-Electric Rotation Apparatus, consisting of a horse-shoe magnet, fixed on a stand, having a spirit lamp between its poles, upon which are mounted two frames of silver and platinum; upon lighting the lamp the frames rotate in contrary directions 1 6 0

GALVANOMETERS, for measuring galvanic currents:

888. Galvanoscope, with upright spiral coils, for close approximation to a suspended magnet, by which the existence of a feeble current is beautifully exhibited, complete, with glass shade 1 8 0

889. Cumming's Galvanometer 1 8 0

*** This instrument is mounted between the poles of a powerful horse-shoe magnet, and consists of a strip of gold leaf, which forms part of a galvanic current when connected with a battery, the direction of the current being shown by its tendency towards either pole of the magnet.

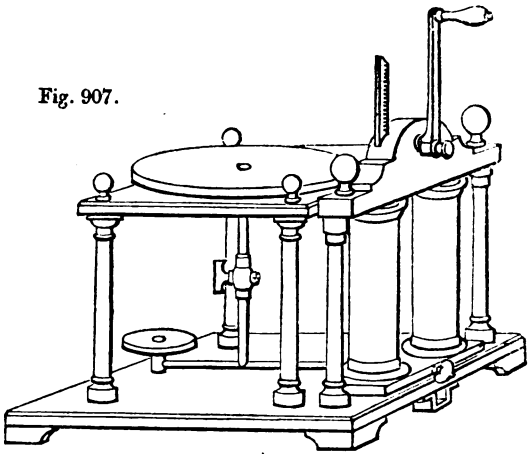
890. Gourjon's Improved Galvanometer, adapted for the lecture table. It consists of a firm mahogany base, furnished with levelling screws, on which is placed a graduated metallic circle and coil of fine insulated wire; in these a pair of astatic needles, about six inches long, supported on an agate cap, vibrate freely when connected with a battery . 3 10 0 to 6 10 0

891. Bachhoffner's Galvanometer, with astatic needles, on mahogany stand and glass shade, complete 0 18 0

892. Torsion Galvanometer, the astatic needles of which are delicately suspended in a glass tube, with a torsion circle and key very delicately balanced, with screw adjustment 2 18 0

893. Melloni's Galvanometer, improved by Prof. Wheatstone, with reading microscope for measuring very feeble currents of electricity . 5 10 0

Fig. 907.



PNEUMATIC APPARATUS.

For demonstrating the principles of elastic fluids, more especially the mechanical properties of air.

AIR PUMPS.

894. Air Pump, single barrel, $\frac{7}{8}$-inch diameter, 5 inches high, $3\frac{1}{2}$-inch ground plate, mounted on mahogany or iron stand 1 0 0

895. Receiver, for the above 0 3 0

896. Air Pump, single barrel, 1-inch diameter, 6 inches long, 5-inch ground brass plate, mounted on mahogany stand 1 8 0

897. Receiver, for the above 0 4 0

898. Air Pump, single barrel, sloping piston $1\frac{1}{2}$-inch diameter, 9 inches long, 5-inch ground brass plate with attached stopcock, allowing the vacuum to be retained when removed from the stand, answering as well for a transfer or fountain plate, and numerous pneumatic experiments (*fig.* 898, p. 86) 1 18 0

899. Receiver for the above, bell-shaped, 4s. 6d.; or tall, suitable for fountain experiments 0 6 6

900. Air Pump, single barrel, of large size, with metal valves, best ground stout glass, raised plate 9 inches diameter, on mahogany stand, very suitable for drying precipitates, in vacuo, transferring gases, and other chemical purposes (*fig.* 900, p. 86) 7 7 0

901. Receiver, bell-shaped, 15s. 0d.; dome-shaped . . 0 7 6

902. Dish, for sulphuric acid, etc. . . 0 7 6

903. Air Pump, improved, on Grove's principle, for accurate exhaustion, with 7-inch ground brass plate, mercurial gauge and clamps . 5 10 0

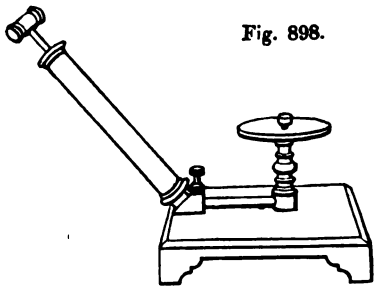


Fig. 898.

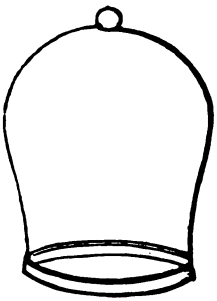
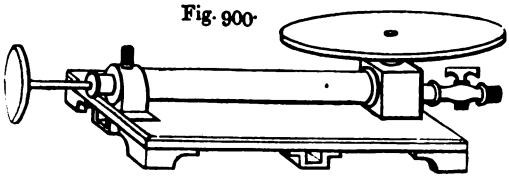


Fig. 918.

Fig. 919.

Fig. 900.



904. **Double Barrel Air Pump,** with 5¼ inch plate and clamp . 3 3 0

905. Ditto Ditto, 6-inch plate 4 4 0

906. Double Barrel Air Pump, with plate, on stand, 8 inches diameter, with gauge plate, syphon gauge and key 7 15 0

907. Double Barrel Air Pump, large size, on mahogany table stand, with raised plate 8 inches diameter, gauge plate and mercurial syphon gauge, key and clamps *(fig.* 907, p. 85) 9 9 0

908. Double Barrel Air Pump, as above, with raised plate 10 inches diameter 18 0 0

990. **Double Barrel Air Pump,** of the most improved construction, large size, on mahogany stool stand, barometer gauge and cistern, syphon gauge and metal key for tightening or unscrewing the various parts, 10-inch, ground brass plate 19 0 0

910. Double Barrel Air Pump as above, with 13-inch plate . 30 0 0

911. Double Barrel Air Pump, large size, with a Smeaton's single cylinder pump in addition, affording, by means of this combination, the best and most rapid means of exhaustion 56 0 0

912. **Set of Pneumatic Apparatus,** for performing a number of interesting experiments, consisting of air-pump with 6-inch sloping barrel, 4½-inch ground plate on mahogany stand, upright open receiver with glass plate to make it close when required, bladder and hand glass, skin balloon, fruit and taper stand and mercurial cup and saucer, in case complete . 2 5 0

913. Set of Pneumatic Apparatus (larger size), air-pump on mahogany stand, with sloping barrel 1½-inch diameter and 9 inches long, 5-inch ground brass plate with stopcock to retain the vacuum when separated from the stand, so as to answer for a transfer or fountain plate, brass table clamps, bell-shaped and open receiver with glass plate, brass fountain jet, glass jar, Madgeburg hemispheres with handles and stand, bladder glass, bladder frame with lead weights, mercurial cup and saucer, guinea and feather apparatus, fruit and taper stand, stand for egg experiment, bulb-tube and glass, glass balloon and car, in case, complete 5 15 0

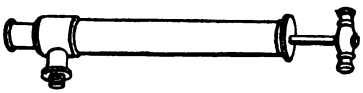


Fig. 917.

Condensing or Exhausting Syringes, very convenient for exhausting or condensing air from or into small vessels.

914. Six inches long, ¾-inches diameter 0 14 6

915. Eight „ 1 „ 0 18 6

916. Twelve „ 1½ „ 0 25 0

917. Exhausting and Condensing Syringe in one apparatus, for the purpose of exhausting from or condensing into vessels, with the additional power of transferring any gaseous fluid from one vessel to another, *(fig.* 917), 12s., 15s. 0d., and 1 0 0

918. **Closed Receivers,** of the best make, annealed glass and welted edges, carefully ground.

Diameter across the welt.	Bell Shaped (fig. 918).	Cylindrical Form.	
13 inches	1 5 0		
10 "	0 17 6		
8½ "	0 13 0		
6 "	0 7 0	12 inches high	0 6 6
5 "	0 5 0	" " "	0 5 0
4 "	0 3 0	8 " "	0 3 6

919. Open Receivers, with ground glass plate, to close the top opening:

Diameter across the welt.	Bell Shaped.	Cylindrical Form (fig. 919).	
13 inches	1 10 0		
10 "	1 1 0		
8½ "	0 15 6		
6 "	0 8 6	12 inches high	0 7 6
5 "	0 6 6	" " "	0 6 0
4 "	0 3 6	8 " "	0 3 6

920. Receiver for barometer guage or fountain experiment, 33 inches high, carefully ground welt 4½ inches diameter 1 10 0

*** Receivers of any pattern made to order.

921. **Hadgeburg Hemispheres,** consisting of two hollow half globes of brass, ground and fitted to each other so that their rims when touching are air-tight; the lower one has a stopcock attached. This apparatus demonstrates the pressure of the air which nearly equals 15lbs. for every square inch of surface, 13s. 6d., 15s. 6d., and 1 2 6

922. **Set of Two Mills,** consisting of two separate axles, with four thin vanes of equal length breadth, and weight. One set of vanes has its planes at right angles to its axle; the planes of the other set are parallel to it, £1 12s. 6d. to 2 0 0

923. Guinea and Feather Apparatus, for proving that the resistance of air diminishes the velocity of falling bodies, the diminution being greater or less according to their densities. This experiment shows that in a vacuum light and heavy bodies descend in equal times.

One fall, 9s.; two falls, 12s.; three falls 0 17 6

924. **Artificial Fountain,** produced by the elasticity of air. It consists of a vessel to be partly filled, with a tube reaching nearly to the bottom. When under the receiver, and the air exhausted, the spring of the confined air on the water forces it up in a pleasing jet, 3s. 6d., 5s. 6d., and . . . 0 10 6

925. SINGLE TRANSFER PLATE, with jet-pipe and stopcock; a tall receiver being placed upon the plate and the air removed from it, if the tube be immersed in water and the stopcock turned, the water will be forced up the pipe, thus forming a beautiful fountain within the receiver . . 0 8 6

926. DOUBLE TRANSFER PLATES, with connecting pipes and three stopcocks, for illustrating the expansion of air 2 2 0

*** If the air be exhausted from a receiver placed upon one of the plates, and another receiver is placed upon the other plate, a communication being made by means of a stopcock, each receiver will become fixed.

927. BACCHUS EXPERIMENT, illustrating the elasticity of air . 1 1 0

928. **Glass Model of the Diving Bell,** loaded at the bottom sufficiently to sink it. A condensing syringe is furnished for supplying fresh portions of air under the bell, likewise a stopcock as an outlet for impure air. Painted wooden figures are supplied, and a burning spirit-lamp may be placed under the bell 1 1 0

929. GLASS FLASKS, with brass cap and stopcock, illustrating the influence of diminished pressure in facilitating ebullition; they may also be employed for weighing air or any other gaseous fluid . . . 0 10 6

930. BLADDER AND WEIGHT in frame. If this apparatus be placed under a receiver, and the air removed, the air contained in the bladder will expand and raise the heavy leaden weight, thus illustrating the elasticity of the air, 7s. 6d. to 0 12 6

931. EXPANSION AND COMPRESSION BOTTLES, to illustrate the pressure and expansive power of air, each 0 1 3

932. VALVES for ditto, each 1s.; Cage, for ditto . . . 0 3 0

933. FRUIT AND TAPER STAND, each 0 2 0

934. FLINT AND STEEL APPARATUS, for proving that sparks cannot exist without air 0 18 6

935. BEAM AND STAND, with cork or globe 0 10 0

936. COPPER BOTTLE, beam and stand, for weighing air and gases . 2 2 0

937. FILTERING CUP, for mercurial shower, with receiver, 5s. 6d. to 0 10 6

938. PLATE, with wooden disc, for proving the porosity of vegetables . 0 5 6

939. RESPIRATION GLASS, illustrating the inspiration, etc., of the lungs 0 6 0

940. HAND AND BLADDER GLASSES, mounted for illustrating the pressure and percussion of the atmosphere, 2s. and 0 2 6

941. **Leslie's Apparatus,** for freezing water in a vacuum, with receiver 5 inches diameter, 8s. 6d.; 7½ inches, 12s. 6d.; 12 inches , . 1 12 6

942. BELL EXPERIMENT, for illustrating that air is essential to sound 0 6 6

943. SLIDING ROD, plate, and collar of leather, 9s. 6d. and . . 0 12 6

944. **Torricelli's** BAROMETRICAL EXPERIMENT, 12s. 6d. and . 1 1 0

945. SYRINGE AND LEAD WEIGHT 0 10 0

946. POCKET CONDENSER, for instantaneous light, with amadou . 0 3 6

947. MODEL OF WATER PUMP with glass barrel . . . 1 5 0

HYDROSTATICS AND HYDRAULICS.

Under this head are comprised such instruments as illustrate the properties of fluids and that part of mechanical science which relates to their forces and motions.

949. **Hydrostatic Equilibrium Apparatus,** showing that fluids will seek and maintain the same level, irrespective of the sizes of the channels through which they rise 1 15 0

950. DITTO in glass 0 4 6

951. HYDROSTATIC PARADOX, illustrating the principle, that the smallest column of water of a given altitude, will balance one of any size of the same height . . . . . 0 15 0 to 1 10 0

952. **Hydrostatic Bellows,** illustrative of the principle that fluids give equal pressures in all directions, the force being proportionable to the perpendicular height of the column of fluid . . 3 3 0 to 5 0 0

953. BRAMAH'S HYDROSTATIC PRESS (working model) highly finished to scale, with keys and breaking irons complete to 30 cwt. . . 14 14 0

954. DITTO DITTO, of larger size, to 60 cwt. . . . 19 0 0

955. **Hydrostatic Press** (working model) of smaller size, to raise 400 lbs. 6 6 0

956. MONTGOLFIER'S HYDRAULIC RAM, in which the velocity of water flowing through a long pipe is obstructed, and being connected with a smaller pipe, the column thus reduced is considerably raised . . 5 5 0

Hydraulic Pressure Gauge.—See Pressure Gauges, p. 93.

957. ARCHIMEDES SCREW, consisting of a tube wound round a cylinder revolving obliquely, an ingenious and primitive method of raising water, £1 15s. 6d. and 3 3 0

958. APPARATUS to illustrate that more water flows from a vessel through a short pipe than from an aperture of equal size . . . 0 10 6

959. APPARATUS for illustrating the laws by which fluids spout through various jets, £2 2s. and 3 3 0

960. TANTALUS'S CUP, with concealed syphon 0 7 6

961. CYLINDRICAL GLASS JAR containing water and a delicate hollow glass balloon or figure floating in it, with air-tight cover to the jar. This pleasing philosophical toy illustrates most of the laws of fluidity 7 0 to 0 14 0

962. **Centrifugal Pump,** for raising water by centrifugal and atmospheric pressure, in which a fan is made to revolve that gives rotation to the water, the centrifugal power of which drives it up the tube . . 5 5 0

963. FORCING PUMP (working model) with glass barrel, exhibiting also the operation of the fire-engine 2 10 0

964. LIFTING AND FORCING PUMPS, together, on high mahogany stand, with cisterns for supplying water 2 2 0

965. HOUSEHOLD LIFTING PUMP (working model) with glass barrel; the escape valve is here placed within the piston, so that the same barrel raises the water in a continued line, and the piston thus raised rests on the fixed valve when depressed, 17s. 6d and 1 10 0

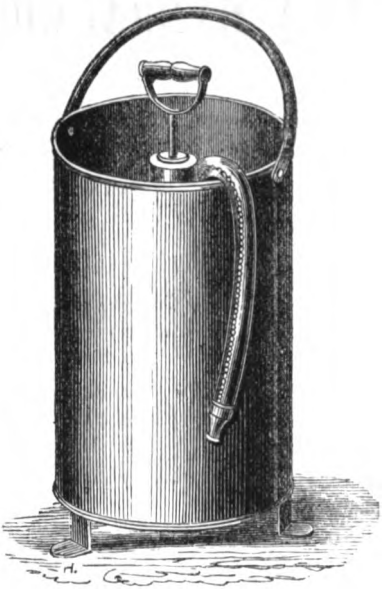


Fig. 970.

Fig. 971.

966. CAPILLARY ATTRACTION, shown by a set of tubes, with bores of different diameters, mounted 0 6 6

967. A SET OF FOUR TUBES, serving to illustrate the tensions of aqueous vapour, and of the vapours of alcohol and ether, which are respectively seen by the heights at which the mercury stands in three of the tubes as compared with that in which no vapour exists . 18s. 6d. to 1 5 0

968. MARIOTTE'S TUBE, on stand, illustrating the law of compression of elastic fluids . . . . . 10s. 6d. to 1 5 0

*** Hydrostatic Balances, Hydrometers, etc.—See Specific Gravity Instruments, p. 98.
Current Meter.—See p. 38.

GARDEN OR FIRE PUMPS, ETC.

969. **Garden Syringe,** best make, with three jets, £1; Ditto, plain, with two jets, 11s. 6d. and 0 15 0

970. PORTABLE FIRE OR GARDEN PUMP, an invaluable means of safety in dwellings, and applicable also for the garden, with galvanized iron pail. complete (*fig.* 970) 3 5 0

971. DITTO DITTO, without pail (*fig.* 971) 2 15 0

972. **Cabinet Fire Engine,** for private dwellings or ships, and the upper floors of galleries, mansions, hotels, etc., much used by the nobility, and usually kept charged for instant application by one or two domestics . 20 0 0

973. **The Farmer's Fire Engine** and **Agricultural Force Pump,** for liquid manures, adapted also for mansions, manufactories, plantations, etc . 27 0 0

*** These fire-engines obtained a prize medal at the Great Exhibition of 1851, as well as at the Paris Exposition of 1855, and are suited alike for all climates.

SODA WATER MACHINES.

Soda-water machines, with the latest patented improvements, for the continuous process of manufacturing soda water, lemonade and other effervescing beverages. For power and simplicity they are warranted superior to any other hitherto made; and are also admirably calculated for exportation, as they may be packed in one case ready for use, and set to work within an hour after their arrival.

974. No. 1. Capable of producing 150 dozen per day . . . 70 0 0
975. " 2. " " " 100 " " . . . 65 0 0
976. " 3. " " " 80 " " . . . 60 0 0

977. **Improved Bottling Machine,** for soda water, etc., of improved make, by which an inexperienced person can do more than the work of two, and the loss by the escape of gas, etc., is effectually prevented . . 10 0 0

978. GAZOGENE, an apparatus for making soda water or other aërated beverages, easily used, and an invaluable summer acquisition to every family, 2-pint size, £1; 3-pint 1 4 0

Fig. 980.

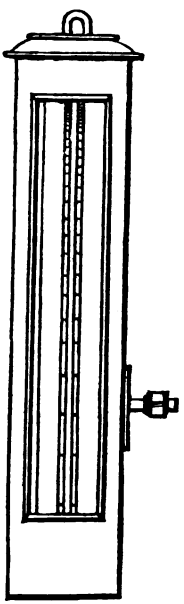


Fig. 979.

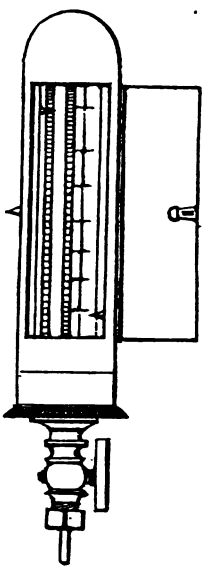


Fig. 984.

FIG. 1.

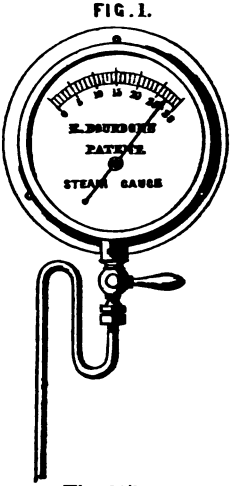


Fig. 987.

STEAM PRESSURE & VACUUM GAUGES.

MERCURIAL.

979. **Casella's Mercurial Pressure Gauge,** in mahogany frame, 25 inches long by 5 inches wide, with glass in front, and strong brass union joint. In this gauge, the pressure is shown by means of compressed air in the tube, and strict and permanent accuracy is obtained; the scale of graduations arranged to any required pressure within 300 lbs.; for low pressures the divisions are expanded to any required length without danger of over pressure disarranging the instrument *(fig.* 979) 2 0 0

980. **Casella's Paragon Mercurial Pressure Gauge**, in mahogany frame, 24½ inches long by 3 inches wide, upon the same principle as the above, and rather more portable *(fig.* 980, p. 91) 2 5 0

981. MERCURIAL PRESSURE GAUGE to any length, on painted board, for showing pressure by the height of the mercurial column, with CASELLA'S arrangement to prevent overflow of mercury, to 20 lbs., £2 5s.; to 30 lbs., £2 15s. upwards, according to pressure.

982. **Thermometric Pressure Gauge**, on which the pressure is shown by the temperature of the steam from 5 to 70 lbs., about 12 inches long, in round brass case for protection 1 15 0

983. **Mercurial Vacuum Gauge**, on mahogany frame, with scale, divided from 0 to 31 inches, glass cistern, brass tube and union joint . 1 16 0

984. MERCURIAL VACUUM GAUGE, with scale of 21 to 31 inches, in round brass case, with door, stopcock, etc. *(fig.* 984, p. 91) . . . 1 15 0

985. Ditto ditto ditto, with scale of 14 to 31 inches . 2 2 ~~1 18 0~~

986. SYPHON VACUUM GAUGE, with brass nut and screw, for air pumps, etc. 0 4 6

METALLIC.

The increasing demand for this description of gauge having given rise to various ingenious arrangements, the following list includes the most popular forms, all possessing certificates from important public bodies, who use them and speak of them with the highest praise.

987. **Bourdon's Circular Patent Pressure Gauge**, seven inches diameter, in brass case, for stationary engines, to indicate pressures of 10, 25, 35, 60, 80, or 100 lbs. per square inch above the atmospheric pressure *(fig.* 987, p. 91) 4 10 0

988. DITTO, ditto, to 200 or 300 lbs. by five pound indications . . 4 15 0

989. **Bourdon's Pressure Gauge**, as above, in japanned iron case, for pressures to 80 or 100 lbs. for blast furnaces and forges . . . 4 2 0

990. BOURDON'S PATENT PRESSURE GAUGE, size of No. 987, with eccentric hand for locomotives or positions of unusual vibration, to 100 or 150 lbs., £4 6s. 0d; to 200 lbs. 4 18 0

991. BOURDON'S PRESSURE GAUGE, (PLAIN), japanned iron frame and eccentric hand for collieries and mines, to 30, 60, 80 or 100 lbs. . 3 8 0

992. BOURDON'S PRESSURE GAUGE, 4-inch; in polished brass, for agricultural engines or as an inspector's portable gauge, with reverse dial to form its own syphon, to 35, 60, 80 and 100 lbs. . . . 3 8 0

993. BOURDON'S VACUUM GAUGE, 7-inch, with centre hand in brass frame, to indicate by units to 30-inches of mercury 4 10 0

*** An ornamental syphon pillar, 17s. 6d.; or plain iron syphon, should be used to connect these gauges with the boiler.

Schaffer and Budenberg's PATENT PRESSURE GAUGES:

		Diameter of Dial.		
994.	SMALL GAUGE, for portable engines or inspectors,	3 inches	.	2 15 0
995.	PRESSURE GAUGE, in metal case, with brass ring,	6 "	.	3 0 0
996.	DITTO DITTO, in brass case,	6 "	.	3 15 0
997.	DITTO DITTO, highly finished,	6 "	.	4 10 0

*** If a maximum or minimum pointer, or both, be applied for registration, 10s. extra are charged for each gauge.

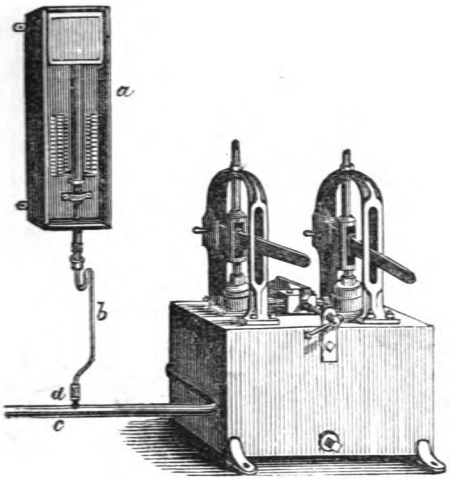


Fig. 1002.

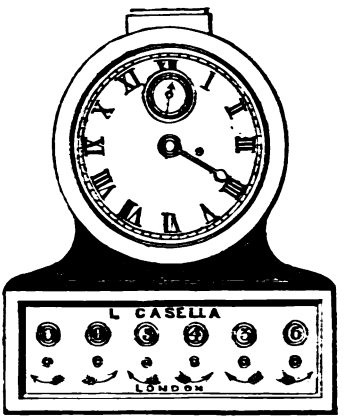


Fig. 1004.

998. HYDRAULIC GAUGES, with maximum pointer, up to 4 tons pressure per square inch; diameter of dial 6 inches . 6 0 0

For each additional ton, 5s. extra.

999. **Smith's Patent Circular Pressure Gauge,** in brass frame, 7 inches diameter, with syphon, in case 4 4 0

1000. VACUUM, ditto, same pattern 4 4 0

1001. SMITH'S PATENT WATER PRESSURE INDICATOR, for any pressure up to a 600-feet column, much used for testing the strength of mains, and for showing the constant actual pressure of water . . 5 5 0

1002. **Hawkins's Hydraulic Pressure Gauge,** for showing the exact pressure on Hydraulic Presses whilst in operation. The testimonials in favour of this gauge are of the highest order and are from the leading Metropolitan and Provincial firms employing hydraulic pressure *(fig.* 1002) 6 0 0

*** Any of the above gauges repaired, adjusted, or any part renewed.

1003. **Improved Steam Engine Indicator,** for high and low pressures, for registering with precision the rate of speed on the engine, in mahogany case, with steel tap and ivory scale *(fig.* 1003, p. 94) 5 10 0

1004. **Improved Steam Engine Counter,** for registering the number of revolutions or strokes made by an engine, whether stationary, marine, or locomotive, up to 1,000,000 *(fig.* 1004) 10 10 0

1005. DITTO ditto, the same, with clock, in brass frame, for the engine room 20 0 0

1006. **Schaffer's Engine Counter,** in metal frame, for same purposes as the above, an also for counting or tally machines at entrances of docks, bridges, warehouses etc., with 4 dials or figures to count up to ten thousand . 2 13 6

1007. DITTO 5 do. do. one hundred thousand 3 0 0

1008. " 6 do. do. one million . 3 7 6

1009. " 7 do. do. ten millions . 3 15 0

1010. **Transmission Instrument,** for transferring the figures of the above, either to tens or hundreds, for counting very high speeds, revolutions of spindles in cotton mills, etc., running up to 10,000 per minute, for transferring the revolutions, so that the first figure indicates either tens or hundreds . 0 12 6

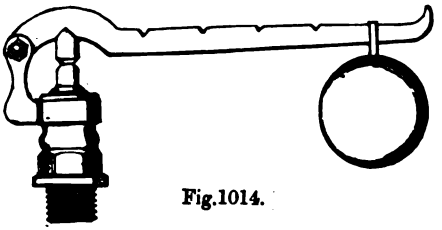


Fig.1014.

Fig. 1003.

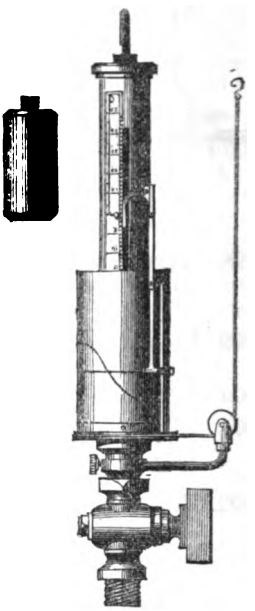
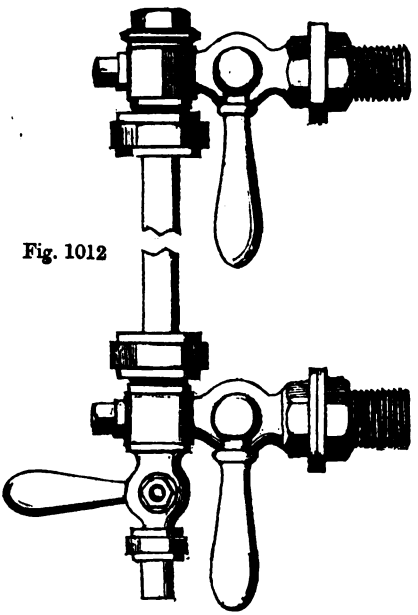


Fig. 1012



1011. Trocheameter, for registering the revolutions of machinery, etc. (see p. 38) 2 18 0

1012. **Water Gauge,** ¾-inch, of best gun metal, with screw-bottom taps, and centre guard *(fig* 1012) 1 15 0

1013. Ditto ditto, ½-inch 1 12 0

1014. Improved Small Safety Valve, with wrought-iron lever and weight, by which it may be adjusted to 10 lbs., 20 lbs., 30 lbs., 40 lbs., or 50 lbs. on the inch *(fig.* 1014), with ½-inch way, 9s. 6d.; ¾-inch, 11s.; 1-inch, 13s.; 1¼-inch, 15s.; 1½-inch 1 0 0

1015. **Railway or Engine Whistles,** of best make, 1¼-inch, brass, 12s. 6d.; 1½-inch *(fig.* 1015) 0 14 0

1016. Ditto ditto, gun metal, 2-inch 0 18 6

1017. Break Whistles, gun metal 1 12 0

1018. Ditto, extra large 2 8 0

1019. Lubricators, *(fig.* 1019, p. 96), with caps, 3s. 6d.; 5s. 6d.; and 0 6 0

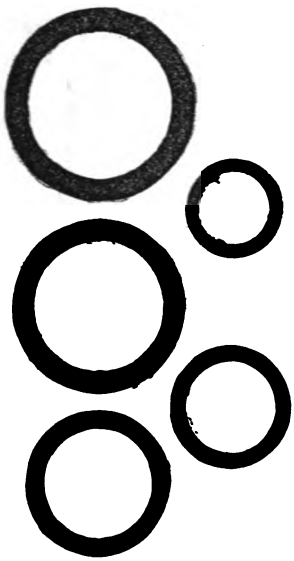


Fig. 1012.

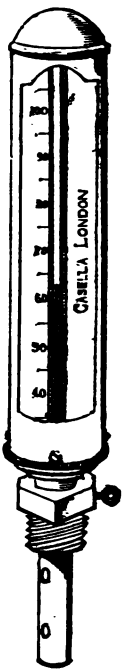


Fig. 1026.

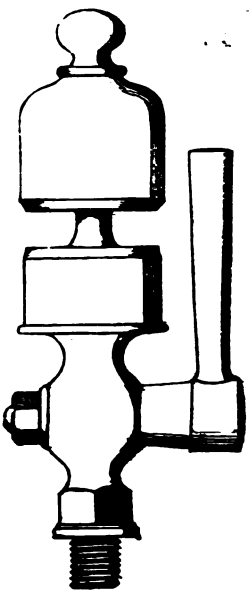


Fig. 1015.

1020. **Gun Metal Gauge Taps**, Homersham's much improved, which admit of being cleaned out without removal from the boiler, 9s. 6d.; 10s. 6d., and 0 12 6

*** Gauge taps, steam-taps, full-way taps, etc. etc.

1021. **Water Gauge Tubing**, of the best quality, of stout annealed flint or green glass

Outside diameter.	Length.	Flint glass.	Green glass.
½ inch,	14 inches, per doz.	9s. 6d. . . .	10s. 6d.
⅝ "	" "	10 6 . . .	11 0
¾ "	" "	12 0 . . .	13 0
⅞ "	" "	14 0 . . .	15 0

*** For diameters and approximate thicknesses, see fig. 1012. Other lengths and diameters in proportion.

GAS GAUGES AND APPARATUS.

1022. **Gas Pressure Gauges**, with brass mountings and stopcock:

Ivory Scales.		Boxwood Scales.	
4-inch scales . .	0 7 6	6-inch scales . .	0 8 6
5 " " . .	0 8 6	8 " " . .	0 9 6
6 " " . .	0 10 6	10 " " . .	0 11 6
7 " " . .	0 11 6	12 " " . .	0 13 6

Larger sizes to order.

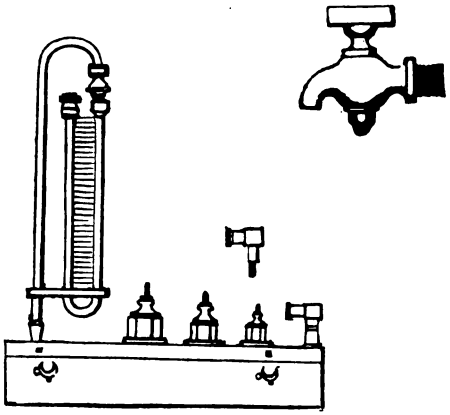


Fig. 1024.

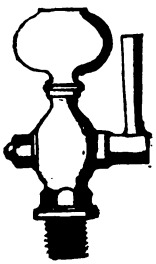


Fig. 1019.

1023. INSPECTORS POCKET GAUGE, 3-in. scale, with two adapters, elbow, and pliers in maroon or tin case, as used by most of the London companies . 1 6 0

1024. Large size ditto, 5-in. scale, bent brass work and ground socket (*fig.* 1024) 1 14 0

1025. REGISTERING PRESSURE GAUGE (A. Wright's), for registering the pressure during the successive hours of the night, size about one foot square, with 5-inch scale, £8 10s.; or with glass shade, 10s. extra.

*** Bent or straight glass tubes, of any size, for gas gauges to order.

1026. **Gas Thermometer,** 8-inch scale, in brass case, straight for horizontal pipes, with socket and plug (*fig.* 1026, p. 95) 1 1 0

1027. DITTO, ditto, bent, for perpendicular pipe, with socket and plug 1 2 0

1028. Extra sockets and plugs, each 0 2 0

1029. TEST GAS HOLDER, capacity of ten cubic feet with cycloid compensation, pressure gauge, two brass cocks, engraved brass scale, gun metal wheels, etc., best make 25 0 0

1030. DITTO, ditto, capacity of twelve cubic feet 30 0 0

1031. BROMINE TEST APPARATUS (Thompson's), arranged by A. Wright, with graduated tube and equalising cylinder 1 1 0

1032. WRIGHT'S SPECIFIC GRAVITY APPARATUS, by means of which the difficulties of taking the specific gravity of coal gas are entirely removed and reduced to a simple operation of a few minutes 2 2 0

1033. **Bunsen's Gas Photometer,** improved by King, Wright and others, divided to save calculation, it comprises the latest improvements of the best experimentalists 3 3 0

1034. EXPERIMENTAL METER AND PILLAR, the pillar having micrometer adjustment and pressure gauges affixed 5 10 0

1035. EXPERIMENTAL GOVERNOR, for maintaining perfect uniformity of pressure during experiments 2 2 0

1036. ALKALIMETER (Wright's), for determining the strength of ammoniacal liquor 0 10 6

1037. WRIGHT'S Work on Gas Analysis, for practical men . 0 1 0

MECHANICAL AND DYNAMICAL APPARATUS.

1038. **Mechanical Apparatus,** in one set, for educational purposes, illustrating the mechanical powers, viz., gravity, friction, motion, etc., in mahogany frame, very complete 5 0 0

1039. SMALL SET, ditto, ditto 3 0 0

1040. SET OF LEVERS (mahogany), of the first, second, and third orders, on stand, with friction rollers and graduated scales . . . 1 18 0

1041. DITTO, ditto, in brass 4 10 0

1042. A Set of three toothed wheels and pinions, for showing the relation of power to weight 1 16 0

1043. SET OF COMPOUND LEVERS, in wood, with stand, £1; Ditto, in brass 4 10 0

1044. SEPARATE PULLEYS, for making different combinations, 3s. to . 0 10 0

1045. **Inclined Plane,** 24-inch, with locomotive, and graduated arc of ninety degrees, to explain the law of gradients, and showing that an angle of ten degrees increases the resistance of the load nine times . . . 3 15 0

1046. INCLINED PLANE, mahogany, with graduated arc and roller, for increasing or reducing the angle, 10s. 6d. to. 1 10 0

1047. A SET OF THREE BRASS PULLEYS, in frame, of the first, second, and third orders 1 18 0

1048. A PAIR OF THREE-INCH WHITE'S PULLEYS, £1 16s.; Ditto, of 6-inch 2 12 6

1049. MODEL, showing the action of the endless screw, 15s., and . 1 1 0

1050. FERGUSON'S COMPOUND ENGINE, in which all the simple mechanical powers move together 5 5 0

1051. A SET OF SIX BRASS VALVES, highly-finished, on four-inch mahogany blocks, showing the flat, clack, conic, ball, throttle, and side valves . 2 8 0

1052. **Whirling Table,** improved form, as adopted in the military schools, for demonstrating the laws of planetary motion and central forces, including the Keplerian law of the squares of the periodic times being proportional to the cubes of the distances of the planets 15 10 0

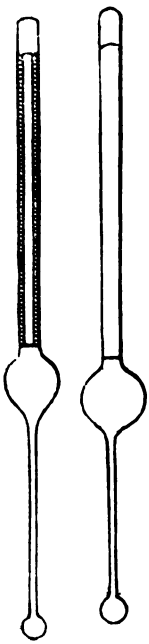
1053. WHIRLING RINGS, for proving the oblate figure of the earth . 1 1 0

1054. **Gyroscopes,** compound and simple, for illustrating the inertia of matter, the laws of rotation, the earth's diurnal motion and the precession of the equinoxes, £1 12s. 6d. and 4 4 0

1055. COMETARIUM, for showing the elliptical orbit of a comet, laid off to explain the law of equal areas in equal times 2 15 0

1056. GEOMETRICAL SOLIDS, in case, with book and illustrated text for stereometry and stereography 0 8 6

1057. TRINOMIAL CUBE DISSECTED, for showing the relation between geometry and algebra: large, 7s. 6d.; small 0 5 0



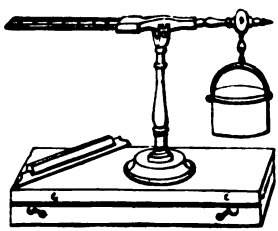


Fig. 1106.

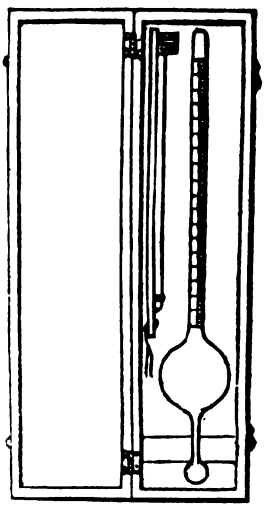


Fig. 1069.

SPECIFIC GRAVITY INSTRUMENTS.

In this department the utmost attention is given to adapt the various articles to the special uses for which they are designed, whether it be for manufacturing purposes, for high excellence in the most refined investigations. L. CASELLA having manufactured about one thousand Hydrometers for the English and American Governments, the following official reports were made respecting them: "Those made by CASELLA are, on the whole, the best adapted for practical work. In shape and strength they are by far the best. In respect to accuracy, CASELLA's are incomparably the best, and he deserves credit for the care with which they have been made."—*Report of the Kew Observatory Committee to the British Association*, 1854-5.

HYDROMETERS, SACCHAROMETERS, ETC.

1058. **Sykes's Hydrometer**, best gilt, excise pattern, with slide rules, tables and thermometer, in mahogany case with jar, complete . . 4 4 0

Ditto, with ivory rule, 12s. 6d. extra.

1059. SYKES'S HYDROMETER, glass, with ivory or paper scales expressly arranged to suit the tables used by her Majesty's Excise, with thermometer, trial jar, and book of tables, in case, complete 1 10 0

*** This instrument being anti-corrosive and invariable in its adjustment, is much used as a standard of comparison with which to test brass instruments.

1060. **Hydrometer** *(glass)*, for spirit, showing the per centage of proof spirit from 70 above to 40 per cent under proof, in tin case, with tables . 0 5 6

1061. DITTO, the same, with tables of heat up to 100° for hot climates 0 6 0

1062. **Alcoholmeter,** for brewers, Field's patent improved, with Crockford's condenser indicating by the boiling point the amount of alcohol contained in any sample of beer or ale, together with its specific gravity and pounds weight per barrel 5 15 0

1063. ACIDOMETER, for use with the above where the amount of acid in old beer, or in other acetous fermentations, is required to be known . . 1 5 0

1064. SPIRIT ANALYZER *(patent)* for showing the amount of alcohol contained in wines, cordials, etc., agreeably to the Treasury order of July, '53, fixing the maximum of spirit allowed (without increase of duty) in wines at 33 per cent. 4 4 0

1065. **Improved Saccharometer,** best gilt, with weights, table, slide rule and thermometer, in case, with trial jar 4 10 0

1066. DITTO, as above, without slide rule 4 5 0

1067. ALLEN'S SACCHAROMETER, best gilt, chiefly used in scotch breweries, with slide rule, trial jar, etc., in case complete 4 10 0

1068. **Richardson's Saccharometer,** best gilt, with weights, etc. . 4 10 0

1069. SACCHAROMETER, (*glass*), for brewers, with thermometer, in mahogany case, also glass jar, improved tables of gravity, and temperature, etc. *(fig.* 1069) 1 1 0

1070. SACCHAROMETER, (*glass*), in round case, with tables of heat, as above 0 5 6

1071. SACCHAROMETER, (*glass*), for British wine making, as described in Roberts' "Wine Makers' Guide" 0 5 0

1072. LACTOMETER, for ascertaining the value of milk by its gravity, with comparative scale attached 0 5 0

1073. LACTOMETER JAR, for showing the per centage of cream from 0 to 25 per cent., and the comparative value of milk from different cows . 0 4 0

1074. ACETOMETER, for vinegar and other light acids . . . 0 5 0

1075. BARKEOMETER, with open graduations, for tanning . . 0 6 0

1076. OLEOMETER, for testing the quality of oils, in round case. . 0 4 6

1077. DITTO, with thermometer and glass jar, in mahogany case . 0 16 0

1078. **Salinometer,** of strong brass, best gilt, adjusted to 200° fahr. (or Centigrade or Reaumur if required), for showing the quantity of salt in the boilers of steam-engines, and the proper time for blowing it off, in tin case, £1 6s.; or in mahogany case, with thermometer 1 18 0

1079. SALINOMETER, of stout glass, for same purpose as above, in tin case 0 4 6

1080. HYDROMETER, for showing the specific gravity of salt water, from 0 to 40 as designed for and supplied to the Admiralty and United States Government by L. Casella 0 4 6

1081. DITTO, ditto, a pair, in mahogany case, the scales ranging from 0 to 20, and from 20 to 40 . . . . . 0 12 6

1082. **Twaddle's Hydrometers** (*glass*), with ivory scales, as used by dyers, bleachers, etc., each 0 3 6

No. 1 . .	Range 0 to 24		No. 4 .	Range 74 to 102	
2 . .	„ 24 to 48		5 .	„ 102 to 138	
3 . .	„ 48 to 74		6 .	„ 138 to 170	

The set of six, in case, complete, £1 5s.; or, with paper scales, 2s. per set less.

1083. HYDROMETER, for heavy fluids, with specific gravity scale, 1000 to 1900, and Beaumes' scale, 0 to 70 . . . . . 0 7 6

1084. HYDROMETER, for light fluids, with specific gravity scale, 1000 to 800; and Beaumes' scale, 10 to 45 . . . . . 0 7 6

1085. BEAUMES' HYDROMETER, 0 to 45 for syrups, soap, leys, etc. . 0 5 6

1086. SACCHAROMETER, for sugar-boiling, Beaumes' scale 0 to 40, of stout brass gilt, in tin case. 1 8 0

1087. **Three Hydrometers** in one set, for testing the gravity of spirits, ether, etc., from water to 700—viz.: No. 1, from 700 to 800. No. 2, 800 to 900. No. 3, 900 to 1000, arranged by L. CASELLA with extreme care as instruments of standard excellence, £1 5s. 0d., or in one case . 1 11 6

1088. A SET OF THREE HYDROMETERS for heavy fluids, by L. CASELLA, of standard excellence, as above: No. 1, 1000 to 1300. No. 2, 1300 to 1600. No. 3, 1600 to 1900, £1 4s., or in one case 1 10 0

1089. SHEEFER'S HYDROMETERS, with solution tube, two spindles, 700 to 1·900, per pair 0 12 0

1090. HYDROMETER for spirits, with Cartier's and specific gravity scales 0 5 0

1091. BEADS for showing specific gravity, of 1000 to 1500 every five degrees, in sets of any number, in round case, per dozen . , . 0 6 0

1092. **Spirit Bubbles** or Beads, for showing approximately the strength of spirits, much used abroad in the manufacture of rum, etc., being very strong, and unlikely to break, in round case, with instructions, a set of twelve, 5s. 6d.; of eighteen, 8s., of twenty-four . . . 0 10 6

1093. SALT WATER BEADS or Bubbles, for aquariums, in pairs (Lloyd's arrangement) with instructions 0 2 0

1094. AQUARIUM HYDROMETER (Lloyd's) for adjusting the salt water to its proper density 0 3 6

1095. ARGENTOMETER, for ascertaining the proportion of nitrate of silver, in solution by chloride of sodium, for photographic purposes, 7s. 6d., or in morocco case 0 12 6

1096 PHOTOGRAPHIC HYDROMETER, for showing grains per ounce of nitrate of silver in solution . . . . . , 0 4 6

1097. SPECIFIC GRAVITY BOTTLES, of 1000 grains capacity, with counterpoise, in tin case, japanned, 8s. 6d.; ditto to 500 grains, 6s. 6 ditto to 250 grains, 5s. 6d.; ditto to one cubic inch 0 5 6

1098. **Urinometer** (Prout's) for ascertaining the specific gravity of urine, in sheath case 0 4 0

1099, Ditto ditto, in round case, with 2 oz. graduated glass jar . . 0 6 6

1100. URINOMETER, with graduated jar, delicate thermometer and test papers, in maroon case 0 12 6

1101. Ditto ditto, very handsome, with thermometer, 2 oz. graduated jar, spirit lamp, acid bottles, nine test tubes, test papers, and dropping tube . 1 8 0

1102. Ditto ditto, in mahogany case, with large bottles and lamp; large dropping and test tubes, thermometer, test papers, evaporating dishes, forceps, etc., very complete . . , ... 2 0 0

1103. **Metal Urinometer,** gilt or electro-plate, in round sheath case . 0 17 6

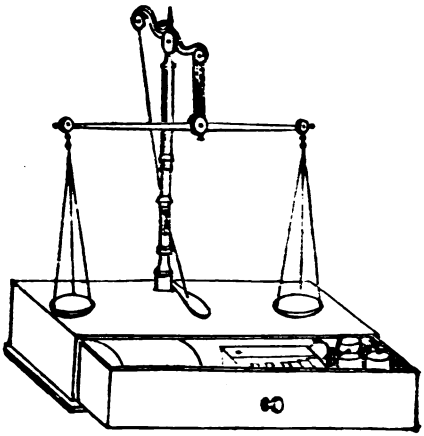


Fig. 1111.

1104. **Nicholson's Gravimeter,** in japanned tin, for showing the specific gravity, of gold, minerals, etc., with marked stem and directions for use 0 7 6

1105. NICHOLSON'S GRAVIMETER, very accurate, in glass or gilt brass, for showing the specific gravity of gold, metals, minerals, or other solid substances with silver cup and weights, ranging from $\frac{1}{10}$ of a grain to 1000 grains in case, complete 2 2 0

1106. **Corndrometer,** for ascertaining the weight, per bushel, of wheat, oats, barley, etc., from the weight of a small quantity, with tables, in mahogany case, with instructions: $\frac{1}{4}$-pint, £2; $\frac{1}{2}$-pint, £2 5s.; 1 pint . . 2 10 0

1106.* PARTING GLASSES OR SINKING PHIALS, for East India, per doz. 0 7 0

CHEMICAL AND ASSAY BALANCES.

Those at four guineas and upwards, are of the very finest make, and, as well as the separate sets of weights, are warranted of the highest degree of precision.

1107. PLAIN BALANCE, with 6-inch steel beam, brass pans and weights, from $\frac{1}{2}$ grain to $\frac{1}{4}$ ounce, in oak case, 3s. 6d. and 0 4 6

1108. DITTO, with glass pans, to one ounce 0 6 6

1109. DITTO, with glass pans and box-end beam, in mahogany case, 10s. 6d. to 0 18 6

1110. **Chemical Balance,** with 12-inch beam, to carry 800 grains, and turn with $\frac{1}{50}$ of a grain, with divided beam, for slide weight . 4 10 0

1111. CHEMICAL BALANCE, superior, with 8-inch beam, on mahogany box with drawer to carry 300 grains in each pan, and turn with $\frac{1}{50}$ of a grain (*fig.* 1111), £3 3s., or with glass case 4 4 0

1112. DITTO, the same, in glass case, with adjusting screws . . 6 6 0

1113. CHEMICAL BALANCE, with 12-inch beam, to carry 1000 grains in each pan, and turn with $\frac{1}{100}$ of a grain, divided beam with straight knife edges at the ends on which the pans are suspended by steel planes, fixed apparatus to move slide weight, with short pan for specific gravities, etc., in glass case with adjusting screws 8 10 0

1114. THE SAME, in glass case, on three feet, without draw or apparatus to move slide weight, particularly suitable for pupils in the laboratory . 6 6 0

1115. **Chemical Balance,** with 14-inch beam for 1500 grains, turning with $\frac{1}{1000}$ grain, knife edges, agate centre and planes, divided beam, slide moving and potash apparatus, in glass case, with screws 15 15 0

1116. DITTO, the same, more effectually protected against the fumes of the laboratory, or effects of damp climate 18 18 0

1117. CHEMICAL BALANCE, 16-inch divided beam, to weigh to 1½ lbs. to 2 lbs., turning with $\frac{1}{100}$ of a grain, slide moving apparatus, in glass case, with adjusting screws, £14 14s., or with agate edges 16 0 0

1118. THE SAME, for general use in the laboratory, weighing to 2 lbs., and turning to $\frac{1}{10}$ grain, in glass case 8 10 0

1119, **Assay Balance,** with 8-inch beam, to carry 50 grains in each pan, and turn to $\frac{1}{500}$ of a grain 5 15 0

1120. OTHER ASSAY BALANCES, turning to $\frac{1}{500}$ and $\frac{1}{1000}$ of a grain, with agate planes, etc., at £12, £15, £18, and 25 guineas each.

1121. **Bullion Balances,** to weigh 300, 1000, to 2000 ozs. at £40, £60, and 90 0 0

1122. SET OF GRAIN WEIGHTS, in mahogany boxes, containing the following weights: 10,000, 6000, 3000, 2000, 1000, 600, 300, 200, 100, 60, 30, 20, 10, 6, 3, 2, 1, ·6, ·3, ·2, ·1, ·06, ·03, ·02, ·01 . . . . 3 12 0

1123. Set of 6000 grains to $\frac{1}{100}$ grain £3 3s.; set of 1000 grains to $\frac{1}{100}$ grain £1 15s.; set of 600 grains to $\frac{1}{100}$ grain, £1 10s.; Set of 10,000 grains to 1000 grains 2 5 0

*** Gramme weights, as above, of proportional subdivisions, at about the same prices.

1124. **Set of Troy Weights,** from 10 ounces down to $\frac{1}{100}$ of an ounce in box 3 3 0

1125. SET OF WEIGHTS of 100, 50, 40, 30, 20 ounces . . 5 5 0

1126. Single weight of 200 ozs. 2 2 0 | 1128. Single weight of 400 ozs. 4 4 0
1127. " " 300 ozs. 3 3 0 | 1129. " " 500 ozs. 5 5 0

CHEMICAL APPARATUS.

AIR OR TRANSFER JARS, ETC.

1130. **Air Jars,** cylindrical, with ground ends, so that they may be closed with a plate of glass, for collecting and preserving gases, a set of seven, size from 6 to 50 oz. 10s. 6d.; or separately from 9d. to 2s. 6d. each.

AIR OR DEFLAGRATING JARS, bell-shaped, stoppered, with ground base, for collecting and preserving gases:

1131. 1½-pint size . . 0 2 6 | 1133. 6-pint size . . 0 6 0
1132. 3 " " . . 0 3 6 | 1134. 10 " " . . 0 8 6

Air or Transfer Jars, with brass caps;

Cubical Contents	Without Stopcock, plain,	Without Stopcock, Graduated.	With two Stopcocks. Union Ferule bladder, etc. (Fig. 1135). Plain.	With two Stopcocks. Union Ferule bladder, etc. (Fig. 1135). Graduated.
1135. 70 inches	5s. 0d.	9s. 6d.	13s. 6d.	18s. 0d.
1136. 130 "	6 0	11 0	15 6	19 0
1137. 170 "	7 0	12 0	16 6	1 2 0
1138. 248 "	9 6	15 6	18 6	1 4 0

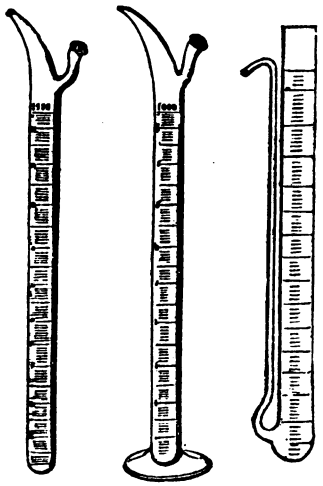


Fig. 1158. Fig. 1158.* Fig. 1159.

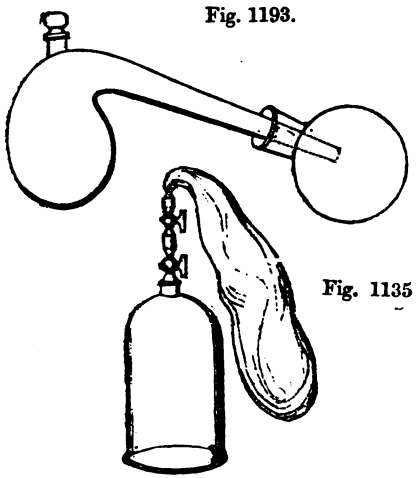


Fig. 1193.

Fig. 1135

1139. **Beaker Glasses,** (best german), of uniform substance and annealed, sold only in sets:

No.	Contents.	Height.	Diameter.	No.	Contents.	Height.	Diameter.
1	2½ ounces	2½ inches	1½ inches	7	36 ounces	6½ inches	3½ inches
2	4 "	3 "	1¾ "	8	46 "	7¼ "	3¾ "
3	6 "	3½ "	2 "	9	78 "	8½ "	4½ "
4	9 "	4 "	2¼ "	10	110 "	9 "	5 "
5	14 "	4½ "	2½ "	11	145 "	9¾ "	5 "
6	21 "	5¼ "	3 "	12	180 "	10 "	6¼ "

1140. Nests of the above, No. 1 to 12, 10s. 6d.; No. 1 to 8, 7s. 0d.; No. 1 to 5, 2s. 6d.; No. 1 to 3, 1s. 6d.

1141. **Best Bottles, London Flint Glass,** stoppered, price per dozen, as below; or singly at a slight increase of price.

	Narrow Mouth.	Wide Mouth		Narrow Mouth.	Wide Mouth.
½ and 1 ounce	5s. 0d.	5s. 0d.	8 ounce	10s. 6d	12s. 0d.
2 "	7 0	8 0	16 "	15 0	16 0
3 "	8 0	9 0	1 quart	1 1 0	1 4 0
4 "	8 6	9 6	3 pint	1 8 0	1 13 0
6 "	9 6	10 6			

1142. Bottles, capped and stoppered, for acids and volatile fluids, 1 oz., 1s. 6d.; 2 oz. 2s.; 4 ozs., 3s.; 8oz., 4s.

1143. Bottles of gutta percha, for containing flouric acid, 1 oz., 6d.; 2 ozs., 7d.; 4 ozs., 9d.; 6 ozs., 1s. 4d.

1144. Glass Plates for covering air jars, funnels, etc., 2d. to 9d. each.

1145. Trays for air jars, for removing jars filled with gas from the pneumatic trough and preventing the access of air, 4 inches diameter, 1s.; 6-inch, 1s. 3d.; 8-inch 0 1 6

1146. **Mercurial Pneumatic Trough,** porcelain, 2s. 6d. to . . 0 3 6

1147. PNEUMATIC TROUGH, japanned tin, with moveable shelf and tray, 3s.6d. to 0 12 6

1148. BLADDERS, prepared for containing gases, with brass ferule and stopcock 0 5 0

1149. Alembics of hard german glass, 2-oz. size, with moveable heads 0 2 0

1150. Alembics of glass, large size, *(fig.* 1150, p. 105) 5s., 6s. 6d., 7s. 6d., and 0 10 0

1151. Arsenic tubes, of hard german glass, for the reduction of compounds containing arsenic, Berzelius's, Rose's, Clarke's or Liebig's pattern, 1s. 6d. per dozen

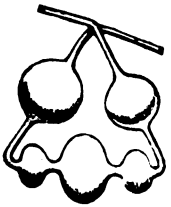


Fig. 1209.

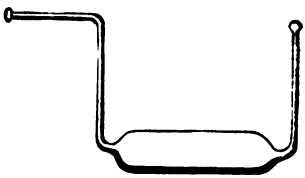


Fig. 1170.

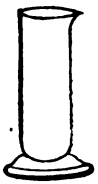


Fig. 1175.

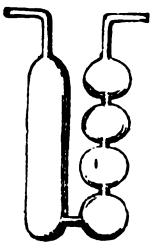


Fig. 1208.

Fig. 1174

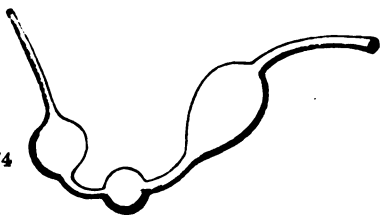


Fig. 1207.

1152. **Evaporating Capsules,** of thin glazed porcelain, with spout, from 2 ozs. to 10 ozs., pint size, each, 6d. to 0 12 0

1153. Evaporating Capsules of glazed porcelain with handles, without spout, 1½ ozs. to 18 ozs., each, 6d. to 0 2 0

1154. Capsules, small and extra thin, for weighing the results of analysis ⅛ to 1½ oz., 4d. to 0 1 0

1155. Platinum Capsules, for blowpipe experiments, ¼-inch diameter, 1s. 3d.; ⅜-inch, 1s. 9d.; ½-inch, 2s. 6d., ¾-inch 4s.; 1-inch 0 4 0

1156. **Carbonic Acid Apparatus,** (Frezenius and Wills), for analysing carbonates of potash, soda, lime, etc. *(fig.* 1156*)* 0 2 6

1157. Carbonates (Parnell's) Testing Apparatus *(fig.* 1157) . . 0 1 6

1158. **Bink's Alkalimeter,** for centigrade testing *(fig.* 1158, p. 103), graduated into 100 divisions, equal to 100 decimillems, 700 or 1000 grains of water, or 50 cubic centimeters, 6s.; or upon glass stand *(fig.* 1158,* p. 103) . 0 6 6

1159. Gay Lussac's Alkalimeter, divided as above *(fig.* 1159) . 0 6 0

1159.* Mohr's Alkalimeter, with support, divided as above . . 0 14 0

1160. Schuster's Alkalimeter, 1s. 6d.; Clarke's Tube Retort and Receiver 0 1 6

1161. **Chlorimeter,** with improved graduations . . . 0 8 6

1162. Decem Bottle, containing $\frac{1}{10}$ gall. when filled to a mark on the neck 0 3 6

1163. Decimillem, Millem, or Centem Pipette, graduated, each . 0 3 6

1164. Reciprocal Pipette, 5s.; Sulphuric Acid Pipette . . 0 4 0

1165. Chloride of Calcium Tubes, for drying gases, from 6d. to . 0 1 3

1166. Crucibles and Covers, best glazed porcelain, 4d. to . . 0 1 6

1167. Ditto, Hessian Triangular, in nests of three to eight, per nest, 5d. to 0 2 6

1168. Ditto, Fire Clay, best London make, 3 to 9-inch, per dozen, 1s. 6d to 0 13 6

Covers for the above at same prices as the crucibles.

1169. Crucibles, black lead, 20 sizes, 2½d. to 21s.; covers about two thirds extra.

1170. Drying Tube *(fig.* 1170) 0 2 0

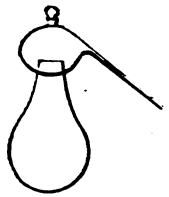


Fig. 1150.

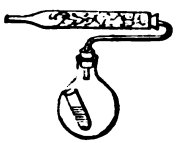


Fig. 1157.

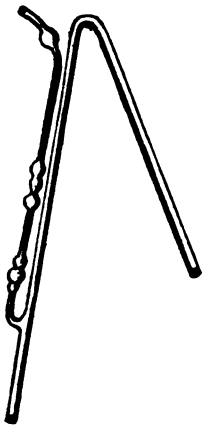


Fig. 1206.

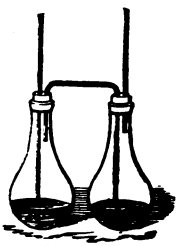


Fig. 1156.

1170.* Cuff's Scale of Chemical Equivalents, with slide rule . . 0 6 6

1171. Glazier's Diamonds, very superior, 15s. 6d. and . . 0 18 6

1172. Diamonds, mounted, for writing on glass, 5s. and . . 0 8 0

1173. Files for cutting glass, 9d.; Rasps for corks, 9d. and . . 0 1 0

1174. **Graduated Glass Measures,** cylindrical or conical form *(fig.* 1174*)*:

Containing 1 dram .	0	0	10	Containing 8 ounces . .	0	2	4
„ 2 „ .	0	0	10	" 16 „ . ,	0	3	4
„ 1 ounce .	0	1	2	„ 20 „ . .	0	4	6
„ 2 „ .	0	1	4	„ 32 „ . .	0	5	6
„ 4 „ .	0	1	9	„ 40 „ . .	0	7	0

**** The above, not graduated, about one-third less.

1175. **Glass Jars, on foot,** for hydrometers, cold solutions, etc. *(fig,* 1175):

Height.	Diameter.				Height.	Diameter.			
8 inches	1½ inches . .	0	1	4	12 inches	1⅝ inches . .	0	2	6
9 "	1¾ " . .	0	1	8	13 "	2 " . .	0	3	0
0 "	1¾ " . .	0	2	2	12 "	3 " , .	0	4	6

1176. **Test Tubes,** of the best hard german glass:

Diameter.	Length.	Per Dozen.			Diameter.	Length.	Per Dozen.		
¼-inch	2 to 2½ inches .	0	1	0	¾-inch	4 to 6 inches . .	0	2	4
½ "	3 " 6 " . .	0	1	4	1 "	5 and 6 " . .	0	2	9
⅝ "	4½ " 6 " . .	0	2	0	1 "	7 " 9 " . .	0	4	3

1177. Test Tube Stand, to hold 6 test tubes, 8d.; ditto, 12 ditto . 0 1 6

1178. Ditto, ditto, with 8 holes and pegs for drainage, 1s. 6d.; Ditto, with 12 ditto 0 3 6

1179. Test Tube Stand, of polished mahogany, for 24, 5s.; for 36. 0 6 0

1180. Test Glasses, for the lecture table, 9d., 1s., and . . 0 1 6

1181. Flasks, of hard german glass, for resisting, varying and extreme temperatures, flat or round bottoms:

Sizes:	2-oz.	4-oz.	6-oz.	8-oz.	12-oz.	16-oz.	24-oz.	36-oz.
	0 4	0 5	0 6	0 8	1 0	1 2	1 8	2 4

1182. Florence Flasks 0 0 3

1183. Washing Bottle, with double tubes, by which a continuous stream of water can be directed upon precipitates, etc. 0 2 0

1184. Woulff's Bottles, best make, the necks carefully rounded for the cork:

With two necks, ½-pint, 1s. 6d.; 1-pint, 2s. 0d.; 1-quart, 2s. 3d.; 3-pint 0 3 0

With three necks. ½-pint, 2s. 0d.; 1-pint, 2s. 6d.; 1-quart, 3s. 6d.; 3-pint 0 4 0

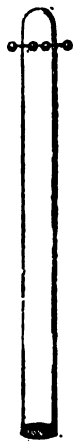


Fig. 1191

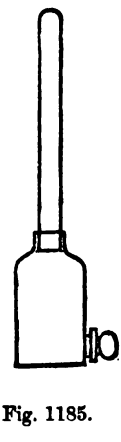


Fig. 1185.

Fig. 1186. Fig. 1187.

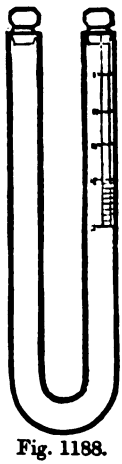


Fig. 1188.

Fig.1190

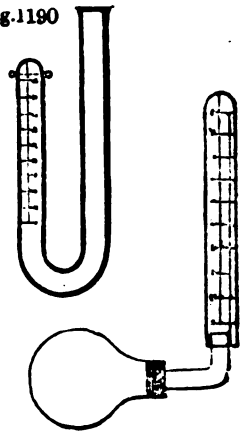


Fig. 1189.

Eudiometers, for the analysis of gases,

1185. **Eudiometer,** Hope's, graduated to $\frac{1}{100}$ of a cubic inch *(fig.* 1185) 0 11 6

1186. Ditto, Marcet's, graduated to $\frac{1}{60}$ of a cubic inch *(fig.* 1186) 0 7 0

1187. Ditto, Metscherlich's, graduated to $\frac{1}{100}$ of a cubic inch . 1 10 0

1188. Ditto, Davy's, *(fig.* 1188) 0 8 6

1189. Ditto, Pepy's *(fig.* 1189) 0 8 6

1190. Ditto, Ure's, *(fig.* 1190) 0 8 6

1191. Ditto, Volta's *(fig.* 1191), 9s. 6d. and . . . 0 15 6

1191.* Ditto, Bunsen's, 30 inches long, divided to millimeters . 1 1 0

1192. Ditto, Bunsen's, transfer, 12 inches long, divided as above 0 10 6

1192*. WATER HAMMER, illustrating the principle that water falls in vacuo with the weight of lead, producing sound like solid metal . . 0 4 6

1193. **Retorts** of thin hard german glass *(fig.* 1193, *p.* 103):

Size:	2-oz.	4-oz.	6-oz.	8-oz.	12-oz.	16-oz.	24-oz.	36-oz.
Plain	0 5	0 6	0 8	0 9	0 11	1 1	1 4	0 1 8
Tubulated	0 7	0 8	0 10	0 11	1 1	1 4	1 6	0 2 0
Stoppered	1 0	1 2	1 4	1 6	1 8	2 0	2 2	0 2 6

1194. RECEIVERS, plain, tubulated and stoppered, about same capacity and price as retorts.

1195. RETORT STANDS, small, on iron foot, with two rings, 1s. 9d. and. 0 2 6

1196. RETORT STANDS, 13 inches high, with three rings . . 0 3 4

1197. DITTO, ditto, more massive, 16 inches, 5s. 6d.; 20 inches, 9s. 6d.; and 24 inches high, with larger rings 0 18 6

1198. **Pestals and Mortars,** of best Berlin porcelain, biscuit or glazed, of 2-inch (inside) diameter, 9d.; 3½-inch, 2s.; 4½-inch, 3s.; 5-inch . . 0 4 0

1199. Pestals and Mortars, best quality, to resist acids:

Diameter,	2½-in.	2½-in.	3-in.	3½-in.	3¾-in.	4¼-in.	6½-in.
In Wedgewood	0 10	1 0	1 0	1 2	1 4	1 10	4 3
In Stout Glass	1 9	2 3	3 4	3 8	6 0		

1200. PESTALS AND MORTARS, AGATE, the prices of which are approximate, and vary according to size and soundness of material employed:

Diameter 1½-in.	1¾-in.	1¾-in.	2-in.	2½-in.	2¾-in.	2¾-in.	3-in.	3½-in.	4-in.
7 6	9 0	10 0	10 6	12 6	14 6	18 0	19 0	1 8 0	2 12 0

1201. DIGESTERS, best porcelain, with handle and ground lid, 8-oz. 2s.; 16-oz. 2s. 6d.; 20-oz. 0 3 0

1202. **Funnels,** of best form, to prevent injuring or straining the paper:

Diameter.	2½-in.	3-in.	3½-in.	4-in.	4½-in.	5-in.	6-in.	8-in.
Glass	0 6	0 7		0 8		0 10	1 1	1 6
Wedgewood	0 5	0 7	0 8	0 10	1 0	1 3	1 9	

1203. Funnels, glass, small size, with long necks for filling retorts, etc. 4d. to 0 1 6

1204. Funnel, separating, with stopcock, 8s. 6d.; ditto, with cover . 0 11 6

1205. Safety Funnels, for gas bottles, with round or long bulbs, each, . 0 1 9

1206. Syphon, plain, 1s. to 1s. 6d.; ditto, with improved suction tube *(fig.* 1206, p. 105) 0 2 6

1207. Nitrogen Bulb, Horseford's, improved *(fig.* 1207). . . 0 1 6

1208. Potash Apparatus, Mitscherlich's *(fig.* 1208, p. 105) . . 0 2 6

1209. Ditto, ditto, Liebig's *(fig.* 1209, p. 105) 0 2 6

1210. Cork Borers, of polished brass, set of 6, 3s. 6d.; set of 12 . 0 5 6

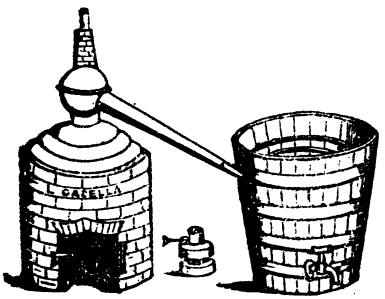


Fig. 1211.

Fig. 1219.

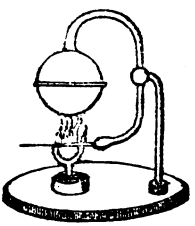


Fig. 1225.

DISTILLING APPARATUS.

1211. **Still,** working model, suitable for the student or lecture table *(fig.* 1211), ½-pint size, £1 10s.; 1-pint, £1 18s.; 1-quart . . 2 10 0

1212. Stills, of stout copper, tinned inside, with tub and pewter worm, complete for use on common fire, 1 gallon size, £1 18s.; 2 gallon ditto . 2 15 0

1213. Stills, of stout tin, 1 gallon size, £1; 2 gallon ditto . . 1 8 0

1214. Stills, portable, of stout copper, tinned inside, best make, galvanized iron tub, pewter worm, strong iron furnace and frame, 2-gallon size, £5; 3-gallon, £5 10s.; 4-gallon, £6 6s.; 5-gallon 8 0 0

BLOW PIPES AND LAMPS.

1215. Blow-pipe, plain brass, 6d.; Black's, japanned body . . 0 1 0

1216. Black's japanned, with ivory mouth-piece, 1s. 9d.; ditto ditto brass . 0 2 3

1217. Cronsted's, with condensing bulb, 3s. 6d.; ditto with ivory mouth-piece and two jets, 5s. 6d.; Wollaston's pocket portable blow-pipe . . 0 6 6

1218. Pepy's, with ivory mouth-piece and two jets . . . 0 6 0

1219. **Spirit Lamps,** with brass wick holders and ground glass caps *(fig.* 1219): 2-oz. size, 1s. 6d.; 3-oz., 2s. 6d.; 4-oz., 3s. 6d.; 7-oz. . . . 0 5 6

1220. **Argand Lamp, Chemical,** with supports, cotton and adapter complete 0 7 0

1221. Ditto, larger size, 5s. 6d.; ditto, with double concentric wick . 0 14 6

1222. **Spirit Lamp,** on stand, with concentric wick and double current of air, embracing the improvements of Faraday, Rose, Liebig, etc. . 0 18 0

Fig. 1228.

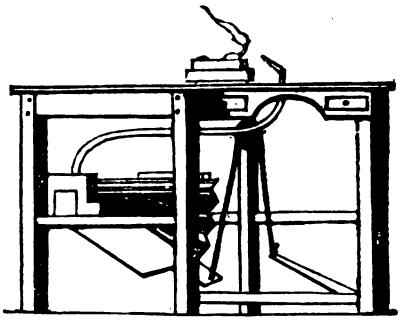


Fig. 1232.

1223. **Gas Lamp or Burner,** for burning common gas mixed with air, giving intense heat without smoke, very useful in laboratories, for boiling, distilling, etc. 0 7 6

1224. HOFFMAN'S GAS LAMP, with Argand burner, jet for blow-pipe, wire gauze and stop-cock; by turning which it is adapted for a large flame or the blow-pipe 0 14 0

1225. SPIRIT LAMP OR BLOW-PIPE, SELF-ACTING, on the Russian principle, with copper ball *(fig.* 1225, p. 107) 0 7 6

1226. DAVY'S SAFETY LAMP, for coal-mines, etc. 0 10 6

1227. DAVY'S LAMP (Dr. Clanny's improved) with glass cover to show the flame, without disturbing the gauze cover 2 0 0

1228. **Hot Air Bath** (TAYLOR'S) the body 9-inches diameter and 5-inches high, japanned iron, with moveable tray *(fig.* 1228) . . . 0 17 6

1229. DITTO with copper body, tinned inside 1 10 0

*** This bath being heated by a gas-lamp, and so arranged that a thorough draft carries all moisture up the chimney, would seem to supersede the use of any other bath of its size, either as a drying medium or as a means of retaining with precision any temperature required.

1230. HOT OIL OVEN, of stout copper, rivetted, 7-in. square by 6-in. high 2 5 0

1231. DITTO DITTO, 9-in. square by 8-in. high . . . 2 12 6

1232. **Glass Blowers' Bellows,** best double action, (full size) with table, brass mountings, lamp, improved jet holder, three jets and scissors *(fig.* 1232) 2 18 6

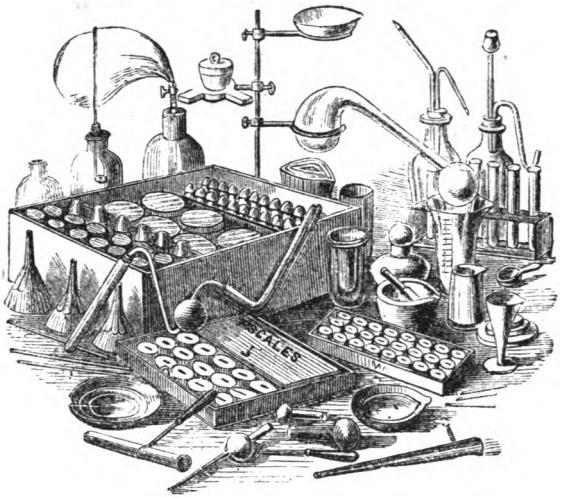
*** The above bellows, with screw-joints for exportation, 10s. 6d. extra.

1233. GLASS BLOWERS' BELLOWS, circular, in round pedestal, with square table top, lamp, jets, etc., as above, much used in laboratories . . 5 0 0

1234, **Flint Glass Tubing,** soft and easily worked, 18 to 36 inches, or longer, ¼ inch and under, 2s. 3d.; ⅓ to ½ inch, 1s. 8d.; 1 to ⅓ inch longer, 1s. 4d. per lb.

1235. FLINT GLASS TUBING, best, assorted bore for thermometers, sealed when drawn, 4s. 6d. per lb.; enamelled ditto, 7s. per lb.

1236. German Glass Tubing, without lead, ¼-in. and under, 2s. 6d.; ⅓ to ½-in., 2s. 3d.; ¾ to ⅓-in. 2s. per lb.



CHEMICAL CABINETS.

The daily increasing importance of the study of chemistry and the alacrity with which it is followed by youth, has led to the following simple combinations of apparatus. Each small cabinet contains every requisite properly labelled, to enable the youthful student to perform with pleasure and ease such experiments as with moderate care are calculated to lead to the higher attainments in the science, whilst the larger sets include such apparatus and materials as amply meet the wants of the lecturer, farmer, agricultural gentleman, and occasional experimentalist. As an article for exportation they present the most practical arrangement and compact form in which chemical apparatus have yet been offered.

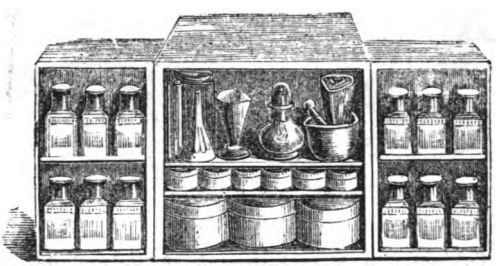


Fig. 1237.

1237. **Youth's Chemical Cabinet,** *(fig.* 1237), containing upwards of sixty chemicals, tests, and apparatus, without strong acids or other deleterious, or dangerous articles, No. 1, in fancy paper case, 5s. 6d.; No. 2, in cedar case, 7s. 6d.; No. 3, in stout mahogany case, with lock and key . . 0 10 6

1238. STUDENTS' CHEMICAL CABINET, No. 1, fitted up with 48 boxes and 12 bottles filled with chemicals, and re-agents, also a large assortment of apparatus of a practically useful size, containing in all upwards of 100 articles, carefully arranged, with labels, in mahogany cabinet, with lock and key *(fig.* 1238, p. 110) 1 1 0

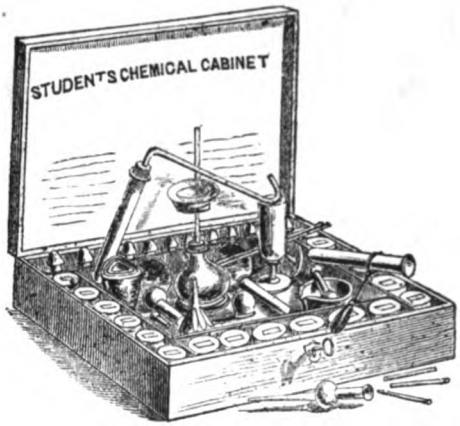


Fig 1238.

1239. **Student's Chemical Cabinet** (No. 2) in neat mahogany case, with same chemicals, apparatus, etc. as No. 1, but with stoppered instead of corked bottles and turned wood instead of card boxes 1 11 6

1240. STUDENT'S CABINET (No. 3) as above, with 70 chemicals, etc. . 2 2 0

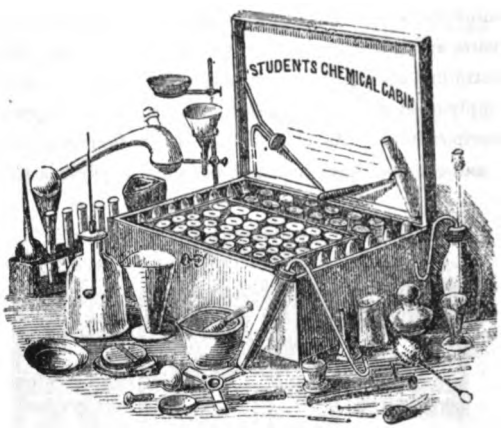


Fig. 1241.

1241. **Student's Cabinet** (No. 4) with upwards of 70 chemicals, etc., in round boxes, with large size bottles, stoppered and plain, comprising requisite articles for manipulating with gases, in handsome case, with lock and key (*fig.* 1241) 3 3 0

1242. STUDENT'S CHEMICAL CABINET (No. 5) more elaborate and extended than the foregoing, especially arranged for qualitative analysis, including apparatus for testing in the humid way; also blow-pipe apparatus, fluxes, and tests for ores and minerals, the whole arranged according to the works of Rose, Frezenius, Liebig, Galloway, etc., a great acquisition to naval or military officers, carefully packed for abroad 8 8 0

*** Galloway's "First Steps in Chemistry", 5s.; and Galloway's "Manual of Qualitative Analysis," 4s. 6d.; are strongly recommended with the above chests.

1243. **Agricultural Test Chest,** (No. 1) includes about 100 re-agents and apparatus for qualitative analysis of soils, manures, etc., the tests are pure, in best stoppered bottles, and the solutions are of the proper testing strength, the apparatus of convenient size and superior make, with bottle racks, trays, scales weights, etc. etc., in strong case, with handles, lock and key . 3 3 0

1244. AGRICULTURAL TEST CHEST (No. 2) with larger and more extended apparatus, £5 5s.; No. 3, ditto 8 8 0

*** Johnson's "Catechism of Agricultural Chemistry" is recommended with the above chests.

1245. **Toxicological Test Chests,** containing all such re-agents and apparatus as are requisite for the accurate analysis of any substance suspected to contain poison, arranged in strict accordance with the present advanced state of this branch of chemical science, No. 1, £2 2s.; No. 2, £3 3s.; No. 3, 5 5 0

MINERALOGY, GEOLOGY AND CONCHOLOGY.

To assist beginners in the study of these interesting and useful sciences, the following educational collections are arranged in neat cabinet cases, with glass covers, carefully labelled, and accompanied with brief descriptions of their uses in the manufactures and arts.

1246. **Minerals,** small collection, 24 specimens, 2s.; Ditto, larger specimens 0 5 0

1247. MINERALS ditto 40 do. 5s.; Ditto, do. 0 10 0

1248. MINERALS, collection of, containing 40 specimens . . 0 7 6

1249. DITTO, in mahogany cabinet 0 10 0

1250. MINERALS, collection of 74 specimens, in mahogany cabinet . . 1 0 0

1251. **Rocks,** collection of, showing the different strata. . . 0 5 0

1252. ROCKS ditto in mahogany cabinet, 40 specimens. . 0 10 0

1253. FOSSILS ditto stratigraphically arranged in mahogany cabinets 1 0 0

1254. ROCK AND FOSSILS, 74 specimens, stratigraphically arranged . 1 0 0

1255. COLLECTIONS OF MINERALS, arranged according to Phillips, in mahogany cabinet covered with glass, 100 specimens 1 10 0

1256. DITTO, with two trays and 100 specimens . . . 2 0 0

1257. DITTO, three trays, 150 specimens 4 0 0

1258. COLLECTION OF ROCKS, stratigraphically arranged according to Lyall, with the characteristic fossils, in mahogany cabinet, with two trays and glass covers, 100 specimens 2 0 0

1259. DITTO, ditto, larger and more select, with three trays, 150 specimens 5 0 0

1260. **Shells,** a collection arranged according to S. T. Woodward, in mahogany cabinet, 50 specimens 1 0 0

1261. DITTO, more select, illustrative of the different genera, in mahogany, with three trays, covered with glass, 100 specimens . . . 3 0

*** Larger collections for museums, institutions, etc. etc., arranged to any extent. Single specimens of minerals, rocks and shells for the cabinet.

1262. Transparent glass-capped boxes, the same as used in the York, Liverpool, and other museums, for preserving minerals, fossils, shells, eggs, etc., from 1s. per dozen.

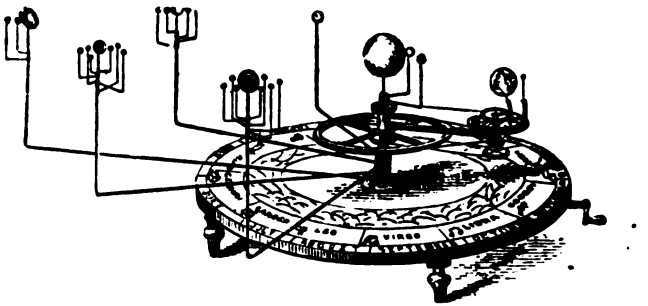


Fig. 1281.

GLOBES, ORRERIES, ETC.

The globes enumerated in this list are carefully revised, and embrace every recent discovery of consequence up to the present time. They are also of the best style of workmanship, and adapted for all climates.

1263. **Pocket Globes,** in round cases *(fig.* 1263) 3-inch, 3s. 6d.; 2-inch, 2s. 6d.; 1½-inch, 2s. 0d.; 1-inch. 0 1 0

1264. POCKET GLOBES, EDUCATIONAL, in cases, 3½-inch, 4s. 6d.; 2½-inch, 3s. 6d.; 1¾-inch. 0 1 9

1265. DITTO, DITTO, 6-inch, in mahogany case, lock, *etc. (fig.* 1265) 0 15 6

Fig. 1269.

Fig 1270.

Fig. 1272*.

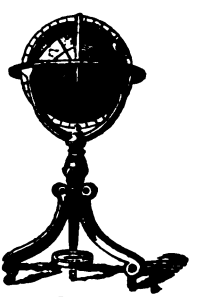


Fig. 1272.

1266. GLOBES, on mahogany pedestals, with brass semi-circular meridians, (*fig.* 1266) 2-inch; 2s. 6d.; 3-inch, 3s. 6d.; 4½-inch, 5s. 0d.; 6-inch . 0 7 6

1267. GLOBES, on mahogany pedestals and triangular base, with semi-circular brass meridians, *(fig.* 1267) 6-inch, 10s. 6d.; 10-inch, £1 4s.; 12-inch 1 10 0

Fig. 1263.

Fig. 1267.

Fig. 1265.

Fig. 1266.

1268. **Globes,** on tripod stands, with gilt or bronzed metallic meridians, very suitable for schools, per pair 12-in., £3 3s.; 16-in., £4 15s.; 18-in . £6 6 0

1269. Globes, on neat mahogany stands, for the table, with brass meridians and quadrant of altitude *(fig.* 1269); per pair, 6-inch, £2 5s.; 10-inch, £3 10s. 12-inch, £4 10.; 16-inch, £6 15s.; 20-inch . . . 10 10 0

1270. Globes, chair high, on mahogany pillar-and-claw frames, *(fig.* 1270); or tripod frame with compasses, double hour circles, etc., very elegant 12-inch, £5 15s.; 16-inch, £8 12s. 6d.; 18-inch, £12 12s.; 20-inch, £13 15s.; 25-inch 25 0 0

1271. Ditto, ditto, without compasses, 12-inch, £4 12s. 6d.; 15-inch, £6 15s.; 20-inch, £10 10s.; 25-inch . . . 21 10 0

1272. **Globes,** mounted on carved mahogany pillar-and-claw frames, chair high, with compasses, double hour circles and quadrants of altitude, *(figs.* 1272 and 1272*)), per pair 12-inch, £6 18s.; 15-inch, £10 15s.; 20-inch, £16; 25-inch. 32 0 0

1273. Globes, on tripod mahogany stands, chair high, very handsomely carved, with compasses, etc. *(fig.* 1273, p. 114); per pair, 12-inch, £8.; 15-inch, £12 18s.; 20-inch, £19; 25-inch 36 0 0

1274. Globes on richly carved rosewood or walnut pillar-and-claw frames, with compasses, quadrants, etc. (Queen's pattern), very handsome, per pair, 12-inch, £8 15s.; 15-inch, £13; 16-inch, £15; 20-inch, £19; 25-inch 42 0 0

1275 **Captains' Globes,** on best mahogany frame, with compasses, etc., each globe. 12-inch, £2 10s.; 16-inch, £4 10s.; 18-inch *(fig.* 1275., p. 114) 5 10 0

Fig. 1273.

Fig. 1275.

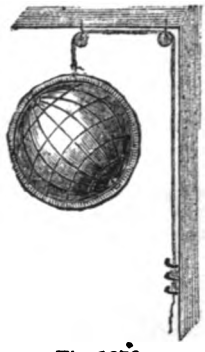


Fig. 1276.

1276. GLOBES mounted to suspend from the ceiling, very suitable for schools and lectures, with quadrants of altitude *(fig.* 1276); 12-inch, £1 1s.; 16-inch, £1 16s.; 20-inch, £3 10s.; 25-inch 7 10 0

*** Globes, mounted in rosewood, walnut, or other fancy woods at an increase of 10 to 20 per cent. on the prices given. Any particular style of mounting to order.

1277. **Quadrants of Altitude,** for globes:

3-inch . . .	0	1	6	15-inch . . .	0	4	6
6-inch . . .	0	2	0	18-inch . . .	0	6	6
9-inch . . .	0	3	0	20-inch . . .	0	6	6
12-inch . . .	0	3	6	25-inch . . .	0	10	6

1278. **Covers for Globes,** of American cloth,

FOR TABLE GLOBES.				FOR HIGH FRAMES.			
20-inch, per pair . .	1	6	0	25-inch, per pair . .	2	0	0
16 „ „ „ . .	0	16	0	20 „ „ „ . .	1	10	0
12 „ „ „ . .	0	11	6	16 „ „ „ . .	1	1	0
10 „ „ „ . .	0	7	0	12 „ „ „ . .	0	14	0

1279. **Armillary Sphere,** on handsome mahogany stand, chair high, with compass, consisting of a terrestrial globe, in the centre of a series of metallic rings, representing the horizon, equator, ecliptic, meridian, the tropics, etc.

10-inch diameter .	3	10	0	15-inch diameter .	6	10	0
12 " " . .	5	5	0	20 " " . .	10	10	0

1280. **Tellurium,** on 13½-inch zodiac, showing the movements of the earth and moon round the sun, intended to illustrate the phenomena of the seasons, tides, day and night, etc., in case 1 11 6

1281. **Orrery,** complete, on 17½-inch zodiac, showing the planets and their satellites, the diurnal and annual motions of the Earth, revolutions of the Moon, Mercury, Venus, and all the planets, with rack motion, in case, complete *(fig.* 1281, p 112.) 10 10 0

1282. PLANETARIUM on 17½-inch, the earth, moon, and two planets only having rack motion 5 5 0

1283. DITTO, ditto, as above, the movements being without rack . 3 13 6

1284. ORRERY, on 13½-inch zodiac, showing the Earth, Sun, the Moon with its phases; Mercury and Venus, a lamp and gilt ball are used to represent the sun (one by night the other by day), it has rack and winch movement, carefully calculated to time; the earth revolving in the proportion of 1160 miles per minute; in case, complete . . . 5/5/- 4 10 6

TRACING AND DRAWING PAPERS,

COLOURS, ETC.

Under this head are included papers, etc., that are mostly used by architects, engineers and surveyors, and such varieties only as they usually prefer.

TRACING PAPERS.

		Inches.	Per Quire.
1285.	No. 1. TRANSPARENT TRACING PAPER, double crown	30 by 20	0 3 0
1286.	Ditto, double double crown . .	40 " 30	0 6 0
1287.	No. 2. Best Ditto, double crown . . .	30 " 20	0 4 0
1288.	Ditto, ditto, double double crown . .	40 " 30	0 8 0
1289.	Ditto, ditto, triple double crown . .	60 " 40	0 15 0
1290.	GLAZED TRACING PAPER . . .	30 " 20	0 6 0
1291.	GELATINE " " . . .	20 " 13	1 0 0
1292.	IMPERIAL THICK PARCHMENT TRACING PAPER	30 " 20	0 8 0

HARDING'S TRACING PAPER, BEST QUALITY.

1293.	No. 1, 30-in. by 40-in.	0	7	0	1296. No. 1, 60-in. by 40-in.	0	14	0
1294.	3, " " .	0	8	0	1297. 3, " "	0	16	6

1295. CONTINUOUS, ditto, quality No. 1, 20 yards long by 44 inches wide 0 12 6

BEST VEGETABLE FRENCH TRACING PAPER.

1298. Royal size, 24 inches by 18 . . . . per quire 0 6 6
1299. Double elephant ditto, 40 by 27 . . . " 1 8 0
1300. **Carbonic** or **Transfer Paper,** black one side, 4s. 6d.; black both sides 0 6 6
1301. Ditto ditto, blue, red or white one side, 5s. 6d.; black-lead, 4s. 6d. per quire.
1302. OILED ROYAL, for copying machines, 6s. 6d. per quire.

Patent Tracing Vellum Cloth.

		Width.	Yds. in piece.					Width.	Yds. in piece.			
1303.	No. 1.	18 inches	40	.	0	15	0	1308. No. 5. 28 inches	24	.	1	3	0
1304.	"	36 "	"	.	1	9	0	1309. " 6. 36 "	"	.	1	8	0
1305.	No. 2.	19 "	"	.	0	18	6	1310. " 7. 19 "	"	.	0	17	6
1306.	" 3.	26 "	29	.	1	2	0	1311. " 8. 38 "	"	.	1	15	0
1307.	" 4.	18 "	24	.	0	14	0	1312. " 9. 32 "	52	.	2	15	0

*** The pieces vary a little in length, and if cut are charged about 15 per cent extra.

DRAWING PAPERS.

1313. WHATMAN'S TURKEY MILL, plain or hot-pressed:—

	Size.	Best.	Retrée or second quality.
Imperial . .	30 by 21 inches, per quire	0 9 0	0 7 6
Rough Imperial .	30 " 21 " "	0 9 0	
Thick ditto .	30 " 21 " "	0 12 0	
Extra Thick ditto .	30 " 21 " "	0 16 6	
Elephant . .	28 " 23 " "	0 9 6	0 8 6
Columbia . .	34 " 23½ " "	0 13 6	0 9 6
Atlas . .	33 " 26 " "	0 13 6	0 9 6
Double Elephant .	40 " 27 " "	0 16 6	0 13 0
Antiquarian . .	53 " 31 " "	4 0 0	1 17 6

1314. WHATMAN'S DOUBLE ELEPHANT (best), drawing paper, on brown holland cloth, 4½d.; or white union cloth, 4d. per square foot.
Retree or second quality one half-penny per square foot less.

1315. Cartoon, or continuous Drawing Paper, 54-inches wide, 1s. per yard.

1316. **Drawing Cartridge,** imperial for engineers, etc.

1317. **Tinted Crayon or Drawing Paper,** buffs, greys, and drabs, imperial, 30-in. by 21-in., per quire 0 8 0

1318. London and Bristol Boards, in every variety.

COLOURS.

1319. **Superfine Water Colours,** in cakes, 10s. to 30s. per doz.

1320. CARMINE, Burnt Carmine, Gall Stone, etc., 5s. per cake.

1321. **Best Water Colours,** in mahogany boxes, with brushes and slide tops:—

6 Cakes	.	0	6	6	18 Cakes .	0	18	0
12 "	. .	0	12	0	24 " . .	1	4	0

1322. TWELVE CAKES, in neat box, with lock and drawer, brushes, pencils, and saucers 0 16 0

1323. DITTO, with 18 cakes, £1 1s. 0d.; Ditto, with 24 cakes . . 1 7 0

1324. **Superior Boxes,** with ink slab, water glass, indian ink, indian rubber, chalk stumps, porte crayon, brush rests, brushes, pencils, and slope tiles, twelve cakes, £1 1s.; eighteen cakes, £1 10s.

1325. DITTO ditto, with twenty-four cakes, extra price colours, sable hair brushes, etc., in superior case 3 3 0

*** Very elegant boxes of colours, inlaid or brass-bound for abroad, fitted with every requisite to order.

1326. PORTABLE JAPANNED BOXES OF OIL COLOURS, £1 10s. to . 2 2 0

*** Finest sable and camel-hair pencils, brushes for oil colours, etc.

VULCANIZED INDIA RUBBER TUBING, ETC.

Best Elastic Tubing, of pure India rubber, the most flexible that is made.

Internal diameter.	⅛-in.	¼-in.	⅜-in.	½-in.	¾-in.	¾-in.	1-in.	1¼-in.
1327. Price, per foot .	5d.	6d.	8d.	11d.	1s. 4d.	1s. 6d.	2s. 0d.	2s. 6d.

1328. DRAB TUBING, firmer and less elastic than the above, about 10 per cent. less in price. Either kinds of the above, with spiral wire, up to 1-inch diameter, about the same as without.

1329. **Glazed Tubing,** for Portable Gas Lamps, etc.

External diameter.	¼-in.	⅜-in.	½-in.	¾-in.	¾-in.	¼-in.	1-in.
1330. Price per ft.	8d.	8d.	10d.	1s.	1s. 4d.	2s. 0d.	2s. 4d.

1331. **Washers,** best quality, for glass gauges, steam boilers, etc., flat form, 10s.; round ditto, 17s. per pound.

1332. **Vulcanized India Rubber,** in sheet, 2s. to 8s. 6d. per pound, according to thickness and quality.

1333. WASHERS, BUFFER'S, BEARING AND CHECK SPRINGS, VALVES, etc., in any size or quantity, on the best terms.

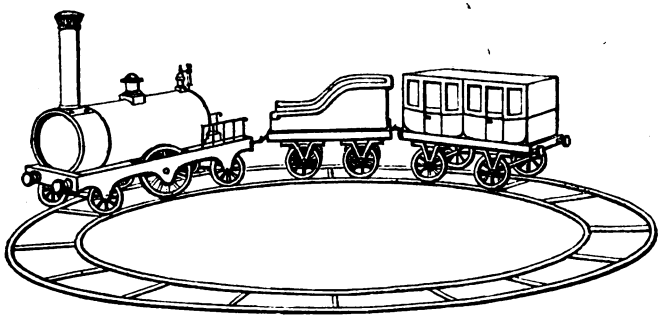


Fig. 1342.

WORKING MODELS OF STEAM ENGINES, STEAM BOATS, ETC.

1334.* **Marcet's Steam Apparatus,** with barometer, thermometer, stopcock, etc., for illustrating the principal experiments connected with high or low pressure steam and latent heat (*fig.* 1334*), £4 and . . 4 10 0 - - 5/10/-

1335. Woolaston's Apparatus, showing the action of the atmosphere, or condensing engine, 7s. 6d. and . . . 0 10 0

1336. **Oscillating Engine,** *working model,* with brass boiler and stand . 1 16 0

1337. Oscillating Engine, with detached boiler, steamcock, etc., on french polished mahogany stand, 7 by 5 inches . . 1 18 0

1338. Ditto Ditto, of larger size, on mahogany stand, 7 by 10 inches . 2 12 6

1339. Oscillating Engine, on brass boiler, with fly wheel 5 inches diameter, supported by four brass pillars, on mahogany stand 2 12 6

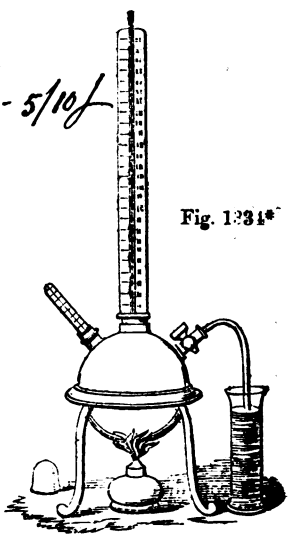


Fig. 1334*

1340. **Steam Saw Oscillating Engine,** with 3-inch fly wheel, circular saw in bed plate, and separate boiler, supported by four brass pillars, on mahogany stand 3 15 0

1341. **Locomotive Engine,** *working model,* with four wheels . . 4 4 0

1342. Ditto Ditto, with tender, two carriages, and circular railroad 3½ feet diameter (*fig.* 1342) 10 0 0

1343. Locomotive Engine, of larger size, with six wheels, tender, two carriages, and circular railroad 3½ feet diameter 14 10 0

1344. **Locomotive Engine,** *working model,* made to scale, of similar construction to those generally employed on railroads, 15 inches long, with fixed cylinders, slide valves, double motion, etc. 36 0 0

1345. Tender for the above, £5 10s.; Carriages for ditto, each, 17s. 6d.; Railroad suitable for the above locomotive, 2s. 9d. per foot.

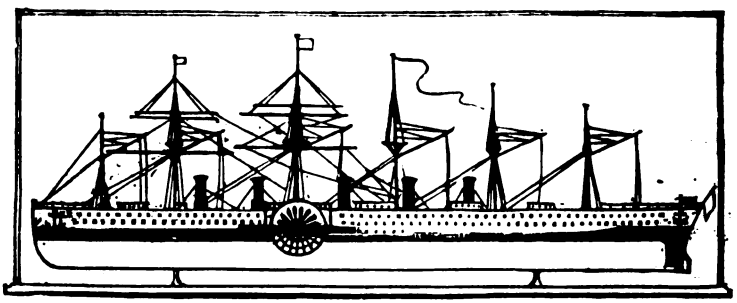
1346. Turn Tables, models of, for turning and shifting locomotives and carriages on railroads 6 6 0

1347. **High Pressure Beam Engine,** with slide valve, fly wheel 5¼ inches diameter, and brass boiler 9 10 0

1348. MARINE ENGINE, with green japanned brass boiler, and paddle wheels 3½ inches diameter, or screw propeller, suitable for working a steam boat from 3 to 4 feet long 5 10 0

*** Models of engines of any description made to drawings in wood or brass.

Fig. 1354.



MODELS OF STEAM BOATS.

1349. **Paddle Wheel Steam Boats,** suitable for marine engine No. 1348, with rigging, etc., complete, 4 feet long, £8 10s.; 3 feet 6 inches long 7 0 0

1350. DITTO DITTO, extra finished, 4 feet long, £11; 3 feet 6 inches . 9 10 0

1351. SCREW STEAM BOATS, suitable for marine engine, No. 1348, rigged, etc., complete, 4 feet long, £7 15s.; 3 feet 6 inches long . . . 5 10 0

1352. DITTO DITTO, extra finished, 4 feet, £10 10s.; 3 feet 6 inches long 9 0 0

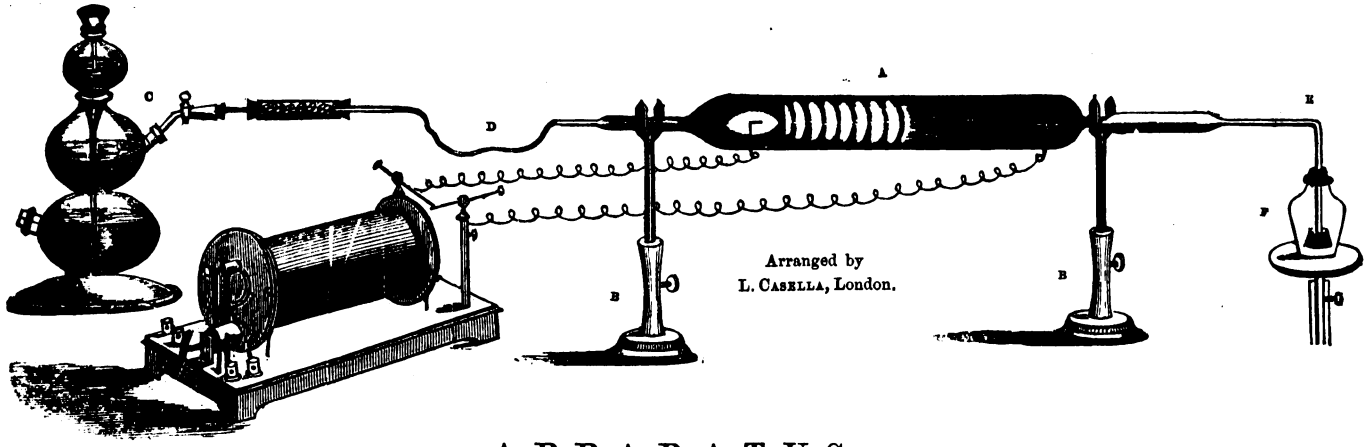
1353. **Models of Paddle and Screw Steamers** (not working), including the Irena, Trinity Yacht, Cosmopolitan, etc., 2 feet long, each . . 3 10 0

1354. **Model of the Great Eastern,** rigged, etc., complete, made to scale, very accurate, 32 feet to the inch, length of model 21⅜ inches, under glass case, (*fig.* 1354), £3 10s.; or extra finished . . . 6 0 0

*** Sections, models, or working models of ships of any description made to order, on scale from draughts or drawings.

GASSIOT'S VACUUM TUBES
AND APPARATUS.

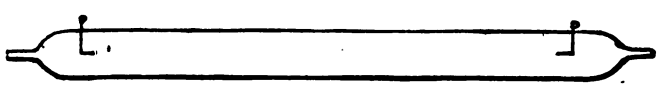
These tubes show the stratifications in electrical discharges as obtained by John P. Gassiot, Esq., V.P.R.S., in torricellian and other vacua. The prices quoted are all for tubes that are finished, with vacuums complete, excepting No. 11, which must be charged with mercury at the time of using it. Annexed, a few articles of apparatus are described, by means of which, with an ordinary knowledge of chemistry, the experimentalist may charge the tubes for himself, and thus obtain an almost endless variety. The prices of tubes, not charged, complete, are about one half the prices here quoted; and, when so supplied, sufficient glass is left on the ends for filling and exhausting the tubes. In ordering any particular tube from the list, the number only is required.



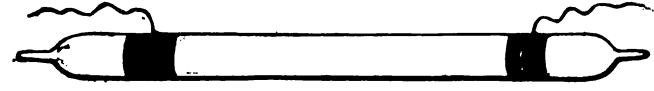
APPARATUS.

A Vacuum Tube, showing stratifications as obtained an hour or so after completion.
B Stands, for the above, each 0 2 6
C Carbonic Gas Apparatus, with chloride of calcium tube 1 10 0
D Flexible Tubing (a few feet), per foot . 0 0 6
E Glass Tubing, one or two pounds, per lb. . 0 2 3

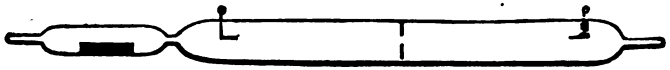
F Receiver and Mercury Glass . . 0 6 0
Air Pump, No. 906, £7 15s.; or a 16-inch single barrel with gauge, 17½-inch plate and clamp . 4 10 0
Induction Coil.—See Nos. 831 and 832.
Electro Magnets.—No. 829.
Hand Blow Pipe 0 2 0
Spirit Lamp 0 2 6



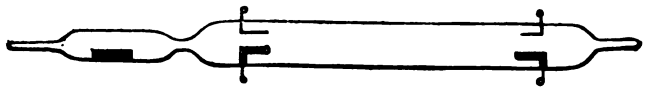
No. 1. Long Mercurial . . . 1 10 0
" 1. As above, with potash vacuum . 1 0 0



No. 2. The Same, with coatings, to show reciprocating discharges 0 18 6



No. 3. CAUSTIC POTASH with GLASS DIAPHRAGM . . . 1 6 0



No. 4. FOUR WIRES, two guarded 1 6 0

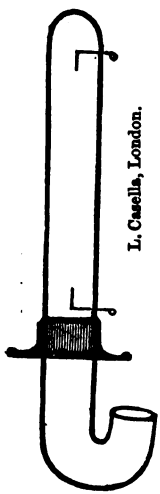
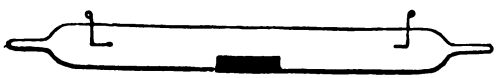
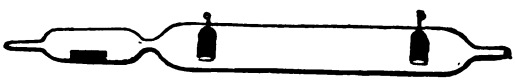


Fig. 11.

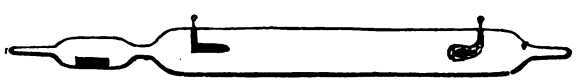


No. 5. With caustic potash in the tube . . 0 18 6



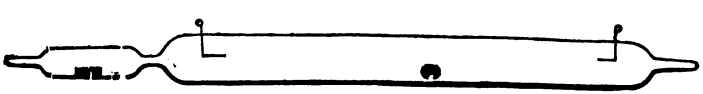
No. 6. CARBON, terminals protected, to shew the direction of negative discharges . . . 1 5 0

No. 7. WIRES INSERTED IN GLOBES, to shew Plücker's experiment of the negative discharge in direction of the lines of the magnetic force when placed between the poles of an electro-magnet 1 5 0



No. 8. CARBON TERMINALS 1 4 0

No. 9. To show the difference of the stratifications when the caustic potash is heated 1 6 0



No. 10. With Uranium Bead 1 2 0
No. 11. For Torricellian vacuum *(fig.* 11) 0 16 6

*** Several of these tubes are occasionally required to be made of Uranium glass, which is rarely to be had, and is nearly double the cost. However, where such are wanted, the earliest notice should be given. In addition to the above tubes every new arrangement of Mr. Gassiot's will be supplied as soon as produced. Since the above was written Mr. Gassiot has found that aluminium wire appears to give no deposit on the glass, consequently, in many cases, this wire will now be used for the tubes.

ADDENDA.

1356. **Anorthoscope,** or magic pictures, with twelve diagrams, by which masses of colours and apparent distortions are made to revolve and represent interesting and beautiful figures and pictures 1 2 0

1357. **Phantoscope,** for projecting figures in air, being one of the illusions of the concave mirror 2 10 0

1358. Polemiscope, by which an object is seen, though an opaque body be placed before it, 12s. to 1 10 0

1359. **Cylindrical or Distorting Mirrors,** in rosewood frames, 8 in. by 6 in., £1 10s.; 9 in. by 7 in. 2 0 0

1360. **Microscopic Argand Lamp (Improved),** japanned, 18s. 6d.; Ditto, brass 1 2 0

1361. Microscopic Gas Lamp, with shade, etc. . . . 1 2 0

1362. Microscopic Gas Lamp, Highley's, with water bath, hot plate, shade, etc. 1 18 0

1363. **Dissecting Knives,** 0 3 3

1364. " " Valentine's 0 16 0

1365. Dissecting Scissors, straight, 3s. 3d.; elbow, 5s. 0d.; curved . 0 6 0

1366. Ditto Needles 0 1 0

1367. Microtome, ... 0 6 0

1368. Cases of Dissecting Instruments, £1 18s.; £2 15s.; and . 4 8 0

1369. Damp Detector or Oat Beard Hygrometer, in form of watch, for the pocket, for detecting the comparative moisture in apartments or beds 0 6 0

1370. **Goniometer,** Pepy's, for measuring the angles of crystals, in case, for the pocket 1 1 0

1371. Goniometer, Woolaston's, reflecting 5 5 0

1372 **Volutor,** for describing spirals and volutes, invented by H. Johnson, Esq., and described by Dr. Booth, F.R.S., at the meeting of the British Association, at Leeds, 1858. . . . . 5 0 0

1372* Opiesometer or Pocket Perambulator, for measuring curved lines on maps, etc., 3s. 6d. and 0 4 6

1373. Pedometer, patent, form of a watch, for measuring any distance walked by the wearer, gilt, £4 4s.; silver, £5 5s.; gold . . . 8 8 0

1374. **Spirometer,** Dr. Hutchinson's, for measuring the vital capacity of the lungs, with tables and instructions, complete 4 4 0

1375. Weighing and Measuring Machine, to be used in conjunction with the above 7 10 0

1376. Stethometer, Dr. Quain's, for determining the expansion of the chest, in watch case, for the pocket 1 8 0

1377. Covered Copper Wire, for galvanic instruments, per lb., from . 0 3 0

1378. Lime Cylinders, for the oxy-calcium light, in bottles containing one dozen, 3s. to 0 4 0

1379. Lime Balls, for ditto ditto 0 2 0

1380. **Ship's Lamps**, starboard and port, constructed agreeably to the regulations of the Board of Trade, £1 8s. to 1 16 0

1381. DITTO DITTO, anchor and mast-head, 17s. 6d. to . . . 1 4 0

1382. SPEAKING TRUMPETS, 5s. to 14s.; FOG HORNS, 7s. to 10s.; FOG ALARM BELLS

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