SCIENTIFIC INSTRUMENTS
BY
L. CASELLA


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AN ILLUSTRATED

AND

DESCRIPTIVE CATALOGUE OF

SURVEYING,

PHILOSOPHICAL, MATHEMATICAL,

OPTICAL, PHOTOGRAPHIC,

AND

STANDARD METEOROLOGICAL

INSTRUMENTS,

MANUFACTURED BY

L. CASELLA,

SCIENTIFIC INSTRUMENT MAKER

To the Admiralty,

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

THE BRITISH METEOROLOGICAL AND THE ROYAL GEOGRAPHICAL SOCIETIES, THE ROYAL OBSERVATORIES AT KEW, CAPE OF GOOD HOPE, AND OF THE WAR DEPARTMENT;

THE UNIVERSITIES OF CAMBRIDGE, OXFORD, AND LONDON;

THE LEADING HOSPITALS AND INFIRMARIES; AND THE OBSERVATORIES OF ARMAGH, WASHINGTON, VICTORIA, TORONTO, CALCUTTA, THE MAURITIUS, ETC. ETC.

INTERNATIONAL EXHIBITION,

1862.

THE ONLY PRIZE MEDAL AWARDED

FOR

REGISTERING METEOROLOGICAL

INSTRUMENTS.

147, HOLBORN BARS, LONDON, E.C.,

Removed From 23, HATTON GARDEN.

1871

D. Lane, Steam Printer, 310, Strand, London, W.C.

CONTENTS.

ADDRESS.

The previous editions of this General Catalogue having been out of print for some time, I have now great pleasure in presenting this new and extended impression.

Had my object been the mere enumeration of the names and prices of instruments, etc., the present edition would have been completed long since; but my desire was to unite with these a brief description of many of them, including not only those of recent design, but also of others for which explanations are often required.

Amongst the new arrangements, I may mention the Deep Sea Thermometer, with which the real temperature of the sea at any depth has at length been determined; the Pocket Standard Barometer, by means of which the highest mountains or deepest shafts can be measured accurately; the extremely portable Traveller's Transit Theodolite, Pocket Altazimuth, Pocket Spirometer, and various important arrangements of Solar Radiation Apparatus, Anemometers, etc.

To self-registering instruments much of my attention is constantly given, and several of them are now described for which I was honoured with the only Prize Medal awarded to this class of instruments at the Great Exhibition of 1862, as well as the much extended patronage of the leading Governments and Observatories of the world, as shown on the title page.

For clinical, general medical and physical investigations of temperature, my arrangement of Self-registering Thermometers is now used exclusively, and many instruments of my design for these purposes are now also regarded as indispensable.

To Directors of Meteorological Observatories and other Institutions, the beginning of this Catalogue presents a practical selection of Standard Instruments, and in many, I believe, will be found a degree of excellence that is unequalled; in proof of this, I may state that the Standard Thermometers for most of the important investigations at the Kew Observatory, as well as those of the equally comprehensive researches of the most eminent Professors of Cambridge, Oxford, London, etc., have been made at my establishment. I may also mention the arrangements which I designed to meet the requirements of various Scientific Expeditions and Geographers of our own and other countries, including Livingstone, Burton, Speke, Grant, Hooker, Baker, etc., whilst the whole series of Portable Meteorological Instruments for Travellers, as now used, were expressly designed by me to meet the desires of the Alpine Club.

To amateurs and others, desirous of taking plain trustworthy meteorological observations, other instruments are described of a simpler kind, at a moderate cost, the indications of which will bear the strictest examination.

The numerous changes and additions to the Microscope, and at reduced cost, have also received my best care, as shown by the illustrations and descriptions; whilst Telescopes and Field Glasses have been so improved and simplified, as to enable me with much pleasure to refer to their respective lists in the Catalogue.

I have also great pleasure in referring to the improvements which I have made in Aneroid Barometers, whether for indicating changes of the weather, or for measuring great heights or low elevations, which they now do with a degree of precision hitherto unlooked for in these instruments, as described on pages 33, 34, and 35.

Though many instruments are enumerated in Optics, Mechanics, Surveying, etc., in which great changes are often being made, my attention is constantly given to such as are really practical and useful, whilst an extended intercourse with the leading authorities and scientific bodies enables me to introduce every novelty of interest as soon as it appears.

The greatest care is taken to adapt each instrument to the climate and conditions in which it is required to be used; and, as all are plainly and truthfully described, intending purchasers may at once know the real capabilities of any they may desire to select.

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

The utmost attention is given to shipping, packing, etc., so that even trivial loss from this cause is of the rarest occurrence.

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 either a reference or approximate remittance, or order for payment in London.

MERCHANTS, SHIPPERS, AGENTS, ETC., sending orders, will find the most liberal attention given to meet their interests and desires.

LOUIS P. CASELLA.

147, HOLBORN BARS, LONDON, E.C.

August, 1871.

REMOVED FROM 23, HATTON GARDEN.

N.B.—I regret to have to caution intending purchasers (particularly at a distance) against false imitations of many of my articles, not only by evasive descriptions, but even to the extent of affixing my name. To prevent this as far as possible, consecutive numbers are affixed to all my specialities and first-class instruments. Purchasers are therefore respectfully solicited to apply for them either direct, or to respectable agents only; see that the name is properly spelt, and give direct intimation of any such attempt which may come under their notice, that every care may be taken to meet such conduct as it deserves.

STANDARD
METEOROLOGICAL INSTRUMENTS,

MANUFACTURED BY

L. CASELLA.

BAROMETERS.

1. **Standard Barometer** (*figs.* 1 and 1*, p. 3). The construction of this barometer is that known as Fortin's, in which the mercury in the cistern is adjusted, at each observation, to a fixed ivory point, which is the zero of the scale. The mercury is boiled in the tube, which is 0·45 inch. internal diameter. The cistern is made partly of glass, to admit of the zero of the scale being visible, and the mercury is adjustable to the zero, or ivory point, by means of a thumb-screw acting upon a flexible base. The vernier reads to 1-500th part of an inch, or, by estimation, to ·001 inch, and is adjusted by a rack and pinion motion. In front of the barometer a thermometer is attached, in contact with the tube, with divisions etched on the stem. For facility of reading, a sheet of white note paper should be placed behind the scale. The barometer is mounted in a brass frame, and suspended from a bracket at the top of a mahogany board, so as to ensure perpendicularity. At the bottom of the board is a socket, with clamping screws for steadying the barometer in a vertical position, when an observation is made. The instrument is so mounted that it can be turned at pleasure to any source of light £10 0 0

2. STANDARD BAROMETER, precisely as above, but not so highly finished, inside diameter of tube, 0·40 inch. £8 10 0

(If with Millimetre Scale additional, £1 0 0 extra.)

3. **Standard Barometer of extra large size,** tube 0·7 inch. internal diameter, with a thermometer immersed in a tube of mercury (at the side) of the same diameter as the barometer tube; specially suited for public observatories £22 0 0

Barometers on Fortin's principle are the most reliable. The index error can suffer no change from lapse of time, because it is independent of the loss of mercury from oxidation, etc.; and, should any air find access into the tube, it can be easily known, and readily removed. To know if air has entered the tube, take down the barometer and incline it gently till the mercury reaches the top, when, if air be present, a soft dull tap will be heard; but if there is no air present, then a sharp clear click will be elicited. To remove air from the tube, incline the instrument gently as above, and invert it so as to allow the air to pass slowly into the cistern. If the quantity be very small, the head may be tapped slightly on the ground to facilitate its exit. It is best, however, to prevent the admission of air whenever possible.

Instructions.—When sent into the country or abroad, the barometer is packed apart from the mahogany board, in some soft elastic material, the mercury being screwed up so as to fill the tube and cistern. It should be unpacked carefully, but not handled until a position has been selected for it. The barometer may be placed in any convenient room, where it is not near a fire or exposed to the sun's rays. It should be in a good light, with the scale about five feet from the ground, so that the zero point in the cistern, and the vernier on the scale may

be easily seen. First, hang the board on the wall, then insert the lower part of the cistern through the bottom bracket, and suspend the instrument as in *fig.* 1, p. 3. When the barometer is thus suspended, unturn the thumb-screw till the mercury falls in the cistern to the level of the ivory point

To Set the Barometer.—First read the attached thermometer, then adjust the mercury, by means of the thumb-screw, so that it barely touches the ivory point in the cistern, which, with its reflection will then appear as a double cone; the height of the column is then taken by adjusting the lower edge of the vernier, so that it shall exactly form a tangent to the convex surface of the mercury in the tube, just excluding the light by keeping the eye in the same plane with the back and front lower edges of the vernier. Every care should also be used to avoid influencing the temperature whilst making the observation.

How to Read the Vernier (*fig.* 1**, p. 4).—By means of the annexed diagram, the use of the vernier in ensuring accurate measurement is readily understood. *c d* represents part of the fixed scale of the barometer, and *a b* is the sliding scale, or vernier. The scale *c d* is divided into inches, tenths and half-tenths of an inch, so that each division of the scale is ·05—*a b* is made equal to 24 divisions of the scale, and is divided into 25 equal parts. It follows, therefore, that each division of the vernier is smaller than each division of the scale, by the 25th part of ·05; which is ·002 inch. The lower edge of the vernier, *a*, is set to the top of the barometrical column, and hence we have to find the height of *a*. First, we read on the scale 29·15; next, we look along the vernier until we find one of its lines which lies evenly with a line of the scale. As shown in the figure, this line is the second above 3. Now, each of the figures engraved on the vernier count as hundredths, and each intermediate division as two thousandths (·002); hence the vernier shows ·034, and this added to the scale reading 29·15, gives the reading sought 29·184.

4. Standard Barometer, to revolve on cast-iron pedestal, as designed for the Committee of the Royal Kew Observatory, and most of the leading Foreign Observatories; size of tube ·08 in. internal diameter (*fig.* 4, p. 3) £24 0 0

5. **Standard Barometer** for observatories, with extra large column of mercury, in neat skeleton iron frame, arranged to revolve in brackets from the wall, or on pedestal, precisely as the Kew standard, for reading off by means of the cathetometer £18 10 0

6. Cathetometer, large size, precisely as used at the Kew Observatory (*fig.* 6, p. 4) . . . . £18 0 0 and £21 0 0

7. **Standard Barometer,** on the Kew principle, in which the graduations of the scale are arranged to compensate for the rise and fall of mercury in the cistern, by which the necessity of reading from a point in the cistern is obviated. The mounting, etc., the same in every respect as No. 1 standard barometer £8 10 0

8. Standard Barometer, as No. 7, in plainer mounting . . 6 0 0

9. The Student's Standard Barometer, on the Kew principle (as No. 7), with similar compensation, etc., but smaller in size, for those who do not at first desire a more expensive standard £4 15 0

10. Standard Barometer, on the Kew principle as No. 8, but with handsome bold ivory or metal scale, with plain and broad graduations for easy reading, revolving in brackets on oak or mahogany board . . £6 0 0

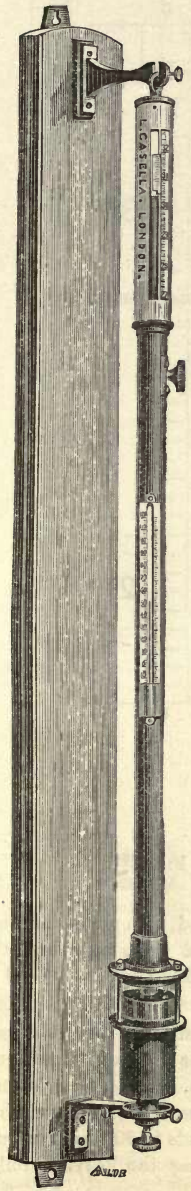

FIG. 1*.

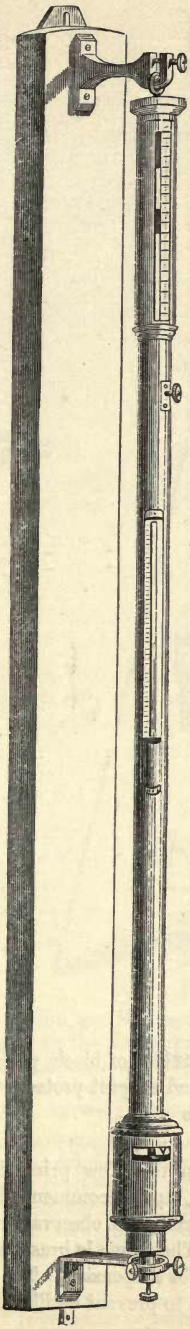

FIG. 1.

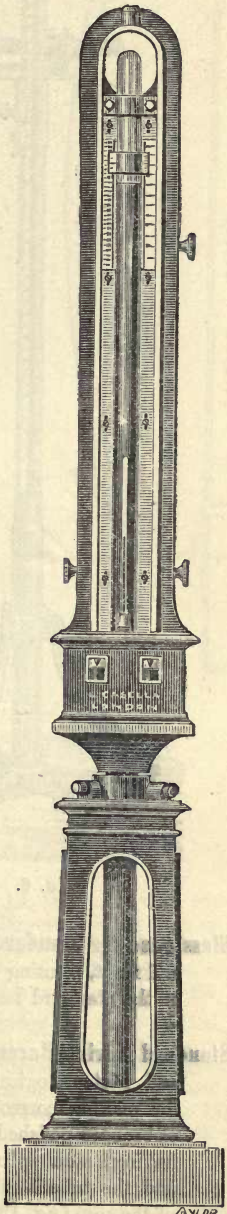

FIG. 4.

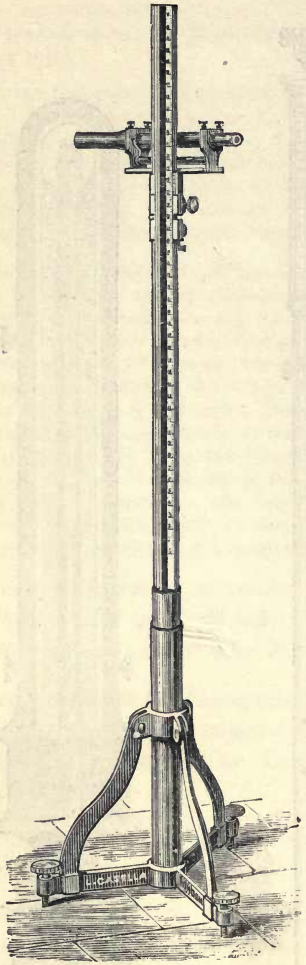

FIG. 6.

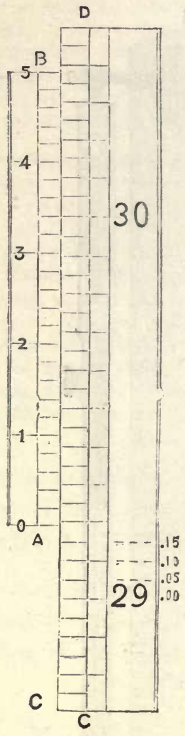

FIG. 1**.

12. **Glass Case for Standard Barometer,** of black polished wood, with plate-glass sides and front, forming a neat and elegant protection against dust, etc., for either of the Standard Barometers . . . £3 0 0 to £4 0 0

13. **Standard Marine Barometer** on the Kew principle, as used by the Admiralty and Meteorological Office, and recommended by the Brussels Conference, for making correct meteorological observations at sea. The cistern is made of bronzed polished iron. The frame is brass bronzed, and revolves in gimbals, having a stout spring arm for suspension. The scale reads to 500ths of an inch, and the tube is contracted to prevent oscillations during the heaviest rolling of the ship (*fig.* 13, p. 5) £4 5 0

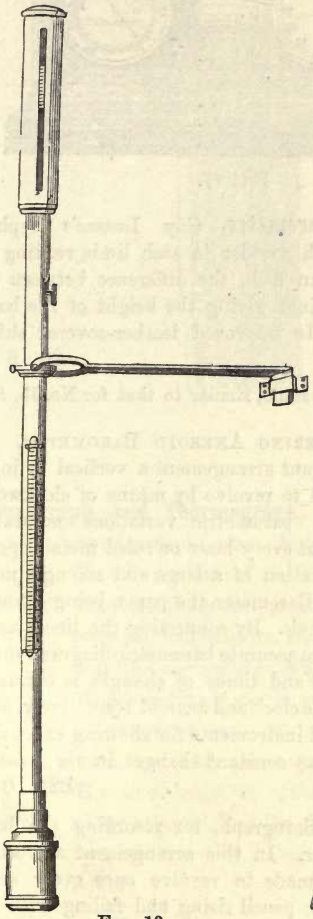

FIG. 13.

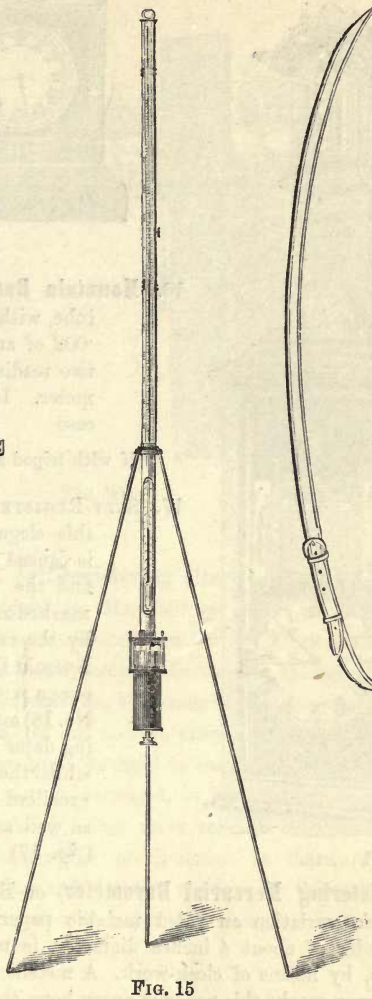

FIG. 15

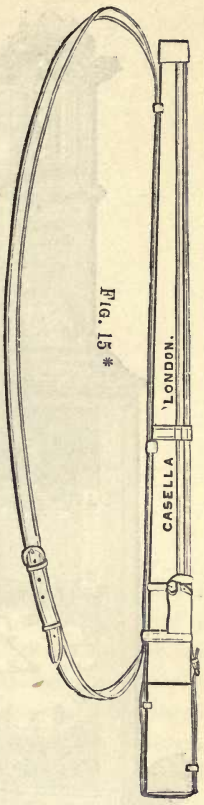

FIG. 15 *

14. **Gun Barometer,** being a special modification of No. 12, to enable it to withstand the concussion arising from the discharge of the largest modern guns on board ships of war at sea. This is really the *ne plus ultra* of marine barometers, possessing the utmost attainable accuracy combined with the best security against breakage. It is expressly made for H. M.'s service . £5 10 0

15. STANDARD MOUNTAIN BAROMETER, on the same principle as the Standard Barometer No. 1, but much reduced in size of frame, by which it is rendered so portable as to remove nearly every difficulty hitherto found by travellers in carrying a mercurial barometer. With English and millimetre scale and tripod stand, complete, in CASELLA'S improved leather-covered shield case (*figs.* 15 and 15*) £8 10 0

If without case 25s. less.

*** A verification from the Royal Kew Observatory is supplied with any of the preceding standard or marine barometers, if required, at an extra charge of 7s. 6d. to 12s. 6d.

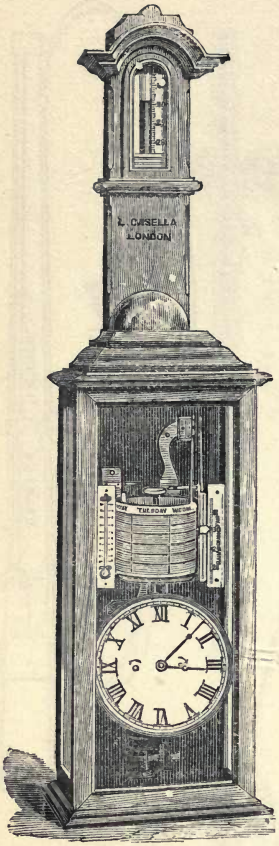

Fig. 18.

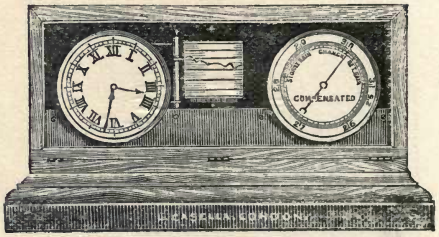

Fig. 17.

16. **Mountain Barometer,** Gay Lussac's syphon tube, with vernier to each limb, reading to ·002 of an inch, the difference between the two readings giving the height of the barometer. In improved leather-covered shield case . . . £6 6 0

(If with tripod stand, similar to that for No. 15, £8.)

17. Self-Registering Aneroid Barometer. In this elegant arrangement a vertical cylinder is caused to revolve by means of clockwork, and the barometric variations accurately marked at every hour on ruled metallic paper by the action of a large and strongly made Aneroid Barometer, the paper being changed once a week. By connecting the lines (as in No. 18) an accurate barometric diagram, showing dates and times of changes is obtained, whilst the clock and aneroid respectively, form excellent instruments for showing exact time as well as constant changes in the weather (*fig.* 17) . . £22 0 0

18. **Self-Registering Mercurial Barometer,** or Barograph, for recording the barometric variation on ruled metallic paper. In this arrangement a vertical cylinder of about 4 inches diameter, is made to revolve once every seven days, by means of clock-work. A metallic pencil rising and falling with the mercury marks this paper at every hour, the paper being changed once a week. The date, time, etc., of every change of pressure is thus correctly indicated, and being connected by lines drawn from point to point gives a correct continuous diagram of whatever changes may have occurred. The mercurial column and timepiece are also observable at any moment, the instrument thus forming an ordinary barometer as well as an excellent eight-day clock (*fig.* 18). The size being about 13 inch. wide × 8 inch. deep × 36 inch. high £18 10 0

19. **King's Barograph,** or Self-registering Barometer, as erected in the Liverpool Observatory. In this construction the barometric column may be caused to range from five to ten inches for each inch in the ordinary barometer, and to record continuously the smallest as well as the largest fluctuations which may occur in the pressure of the atmosphere. . . . £25 0 0

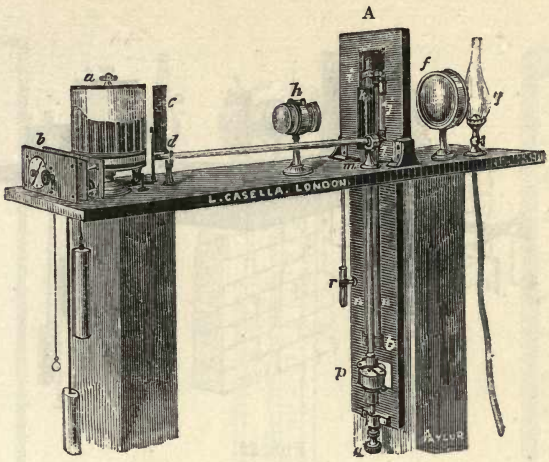

FIG. 20.

Barograph and Thermograph, Self-registering (BECKLEY'S). These interesting arrangements were designed by Mr. Beckley at the express desire of the Kew Committee of the British Association for the Advancement of Science. They faithfully and permanently record the varying changes in atmospheric pressure, temperature, and moisture, by means of photography. And together with the anemometer No. 82 are now in constant use at their observatory. Where ordinary gas is at hand its light is employed, but, when otherwise, a convenient form of lamp is arranged, in which colza or paraffine oil is used, and although requiring rather more care, is even preferable to gas. The knowledge of photographic manipulation in these arrangements is easily attained, and the time and attention required for this purpose is reduced to a minimum by using prepared paper and changing it every twenty-four hours . . . . . .

20. **Barograph.** The design of this instrument is to record the varying changes of barometric pressure by means of photography, as shown on *fig.* 20. £68 0 0

When in use the upper part is enclosed in a mahogany box or cover, which is here removed to show the various parts. Artificial light alone is employed, and is admitted only through the verticle slit in the shield *k*. *a* is the cylinder, or drum, on which the photographic paper is placed, and is turned round once in twenty-four hours by means of the clock *b*. Besides turning the cylinder the clock also liberates the small shutter *c*, which then turns sharply round once every two hours, thus stopping off the light for four minutes each time, leaving white lines on the photographic curve which represent intervals of two hours each. *g* is the burner or light; *f* a condensing lens through which the rays pass over the top of the mercurial column. On the light passing through the slit at *k*, from the lamp *g*, it passes through the photographic lens *h*, and thence on to the cylinder *a*; *p* is the barometer, the mercury of which rises and falls immediately behind the shield *k*; *q* is a screw by which the barometer is lowered

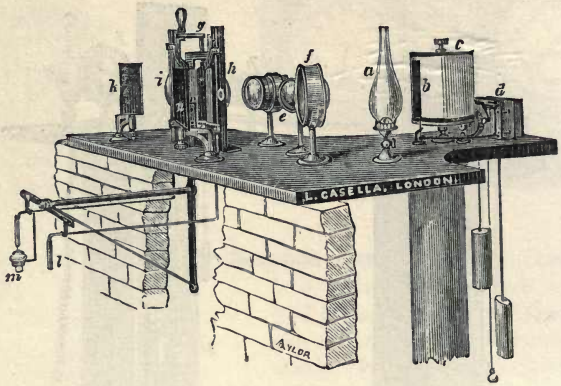

FIG. 22.

or raised when adjustment is required; *n n* are two zinc rods firmly screwed at their lower ends to the verticle slab *A*, and at their upper end a plate and socket are fixed which carries the short pendant glass rod *j*, together with small rollers by which its movements are kept free on the slab *A*; the lower point presses on the horizontal glass lever *d*, near the fulcrum *l*; by this arrangement the expansion and contraction of the zinc rods from varying temperature are so expanded as just to compensate for the thermometric changes in the mercurial column, an undulating line being thus formed which is always the zero line of the curve; *r* is a glass tube of the same internal diameter as that of the barometer, and is half filled with mercury in which the bulb of a standard thermometer is immersed.

22. **Thermograph.** This instrument is designed to show changes of atmospheric temperature and moisture, by means of photography; and when in use is enclosed in a mahogany box, for the exclusion of light in the same way as the barograph; in this case, however, the artificial light to the paper is only admitted through an air-speck in each thermometer, separating the mercury in the same manner as that arranged by L. CASELLA to detach the index in his maximum registering thermometer. An ingenious arrangement supports the thermometer bulbs in the open air, they project about one foot from the wall, upon the edge of which the slab rests. The general arrangement being as in *fig.* 22 . . . . . £82 0 0

m. Wet bulb thermometer. *l*. Atmospheric thermometer. *g*. The screw for adjusting the thermometers to the height required. *a a*. Artificial lights. *f i*. Condensers to throw the light on the mirrors *k n*. *k n*. The mirrors passing light through the air-speck in each thermometer. *o o*. The slits through which the light passes from the mirrors *k n*. *e e*. The lens throwing an image of the air-speck of each thermometer on to the cylinder *c* on which the photographic paper is placed. *d*. The clock which turns the cylinder *c* once round in forty-eight hours. *b*. The shutter which cuts off the light from the prepared paper for four minutes, every two hours, and thus leaves a white line in the photographic indication.

Fig. 24.

Fig. 26.

Fig. 25.

STANDARD THERMOMETERS.

Besides the precision with which thermometers may be graduated, where excellence is wanted, the greater part really depends on the care and skill employed in constructing the tube. In this respect L. CASELLA has much pleasure in referring to the guarantee afforded by his name, as well as that most critical test, viz., his well-known success in constructing thermometers for mountain measurement, as also his self-registering thermometers for clinical purposes; with which he believes he almost exclusively supplies the profession, and was alone identified with them full five years before they were adopted for general use. At the Exhibition of 1862, L. CASELLA obtained the only prize medal for registering meteorological instruments.

23. **Independent or Natural Standard Thermometer,** engine divided on the stem, the internal diameter of the bore being carefully calibrated, and the exact value of all its parts further determined by comparison at the freezing and boiling points of water £5 5 0

24. STANDARD THERMOMETER, COMPARATIVE, carefully tested in all its parts, tube 15 inches long, engine divided on the stem, and figured on raised metal or porcelain scale, 0° to 215° Fahrenheit, or 102° centigrade, in maroon case, with verification from the Royal Kew Observatory (*fig.* 24) . £2 5 0

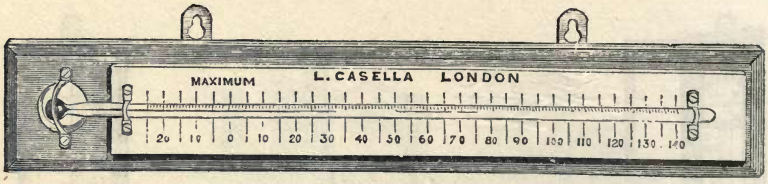

FIG. 28.

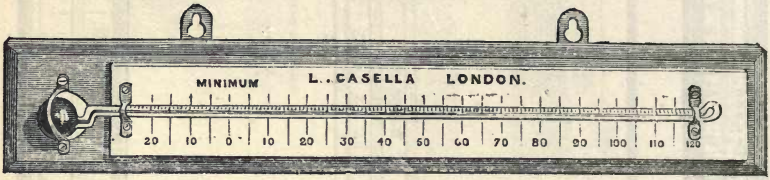

FIG. 39.

25. **Standard Thermometer, Comparative,** as No. 24, with porcelain scale on mahogany, for out-door use, range about 0° to 130°, as made by L. C. for various departments of the Government (*fig.* 25, p. 9) . £2 5 0

26. **Kew Observatory Thermometer** (*Meteorological Office and Admiralty pattern*), 12 inches long, with divisions etched on the stem, and the figures indelibly burned on the porcelain scale, range about 0° to 120°; with verification from the Kew Observatory, as arranged at the Brussels Conference, for taking reliable observations at sea. This is an excellent instrument, by which others may at any time be compared, within the range stated, and is, moreover, the only kind of thermometer which can be used at sea without deteriorating from the corrosive action of salt-water and damp, in copper case (*fig.* 26, p. 9) £0 15 0

N.B.—A set of six thermometers as No. 26, with two copper cases, in a neat box, as supplied by L. CASELLA to the Board of Trade and Admiralty . . £3 3 0

27. **Kew Observatory Thermometers,** a set of six, as above, with 1 each maximum and minimum thermometers, for use on board of ship . £4 10 0

CASELLA'S STANDARD MAXIMUM THERMOMETERS.

These registering instruments are made on the principle designed by Professor Phillips, F.R.S., of Oxford, and were first employed for meteorological purposes at the Royal Kew Observatory in 1851, by John Welsh, F.R.S., director of that establishment. Next to its ingenious inventor, L. CASELLA claims the exclusive merit of the introduction and arrangement of these most perfect maximum thermometers. In the report of the Kew Committee of the British Association for the Advancement of Science in 1856, they are described as "valuable for their extreme simplicity," "capable of greater accuracy than any others," "the most convenient form of all maximum thermometers." In 1862 they were amongst the chief causes of the decision of the

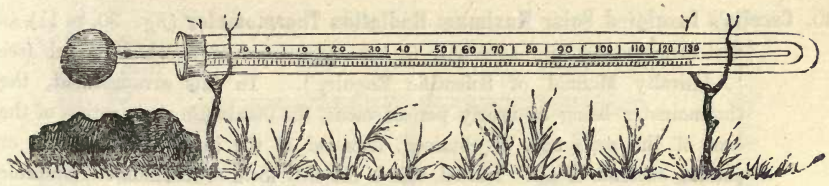

FIG. 29.

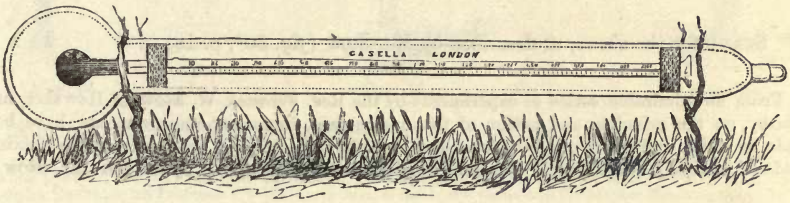

FIG. 30.

jury in awarding *the only prize medal* for registering meteorological instruments to L. CASELLA, and since then their adoption may be called universal. Thus, on this principle only, are those now made that are used by the faculty in the delicate investigations of the temperature of the body. It is exclusively used in registering thermometers for travellers, as well as for mines, deep wells, on ship-board, and indeed in any position in which portability and a true and reliable registration of temperature is required. The great advantage of this arrangement consists in the index, being formed of a small portion of the mercury itself, which is detached from the rest and made of any required length, according to the kind of thermometer to which it is applied; thus, for stationary instruments, it is kept sufficiently long to be set by merely lowering the bulb, whilst in others it is made short, so as to retain its indication in whatever position the thermometer may have to be used, whether erect or inverted. Thus, as a medical thermometer for clinical investigations, no other arrangement is of any service (see Nos. 127 to 130), whilst for safety of transit also, this principle leaves nothing to be desired.

28. **Maximum Thermometer,** for ordinary registration; engine divided on the stem and indelibly figured on CASELLA's improved porcelain scale, *which effectually resists frost and all effects of weather* (*fig.* 28, p. 10) . £1 0 0

29. SOLAR RADIATION THERMOMETER, maximum, with black bulb; tube divided and figured on the stem, and enclosed in glass shield for protection (*fig.* 29) £1 0 0

For other maximum thermometers, see Nos. 30, 46, 47, 48, 128, 176, and 204.

Directions for Using the Maximum Thermometer.—Suspend the instrument by means of the brass loops attached to the back, so as to keep it fairly horizontal, as shown in *fig.* 28, p. 10. To set the index, disengage and lower the bulb end to allow the detached portion of mercury to approach the rest, which it will do within about one-quarter of a degree. On an increase of temperature the mercury will rise as in an ordinary thermometer, and continue to do so as long as the heat increases, propelling the detached portion to whatever extreme the heat may attain. On a decrease of temperature the mercury will contract and recede in the usual manner, leaving the detached portion to indicate the highest temperature, which it does at the end furthest from the bulb.

30. **Casella's Insulated Solar Maximum Radiation Thermometer** (*fig.* 30, p. 11), as first arranged by him agreeably to the suggestions of Sir J. Herschel (see 'Admiralty Manual of Scientific Enquiry'). In this arrangement, the thermometer being in nearly perfect vacuo, the maximum registration of the heat of the sun's rays is obtained, divested of the influence of vapour or passing currents of air. Indeed, this is the only form of thermometer suitable for making comparable observations on solar heat . . £1 5 0

30* STAND for the above, as described by Mr. Stow (*fig.* 30*, p. 16) . 1 1 0

From an admirable series of experiments by the Rev. Fenwick W. Stow, of Hawsker, near Whitby, on the principle and action of this instrument, important improvements have been made, by which uniformity of action is secured, and the indications of temperature thus obtained rendered perfectly comparable. (See following interesting description by the Rev. Mr. Stow.)

The insulated solar maximum thermometer, usually called the black bulb in vacuo, is a sensitive maximum thermometer, having the bulb and a given portion of the stem covered with lamp-black, the whole being enclosed in a glass tube *fig.* 30, p. 11, from which all air and moisture have been removed, so that the heat of the sun's rays are thus obtained, divested of the influence of vapour or passing currents of air. In an extended series of experiments with a number of these thermometers as usually made, Mr. Stow found that when the stem within the large bulb was not properly blackened, the bulb lost much of its heat by induction, and that the indication of different thermometers so varied as not to be fairly comparable with each other. Mr. Stow also recommends that a stand like *fig.* 30*, p. 16, be adopted, and that the following rules should be observed :—

1.—Place the instrument four feet above the ground, in an open space, with its bulb directed towards the S.E. It is necessary that the globular part of the external glass should not be placed in contact with, or very near to, any substance, but that the air should circulate round it freely. Thus placed its readings will be affected only by direct sunshine and by the temperature of the air.

2.—One of the most convenient ways of fixing the instrument will be to allow its stem to fit into, and rest upon two little wooden collars fastened across the ends of a narrow slip of board, which is nailed in its centre upon a post steadied by lateral supports.

3.—The maximum temperature of the air in shade should be taken by a thermometer placed on a stand in an open situation. Any stand which thoroughly screens it from the sun and exposes it to a free circulation of air, will do for the purpose.

4.—The difference between the maxima in sun and shade thus taken is a measure of the amount of solar radiation.

The Rev. Mr. Stow will be glad to receive from time to time copies of observations made according to these rules.

32. **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

FIG. 35.

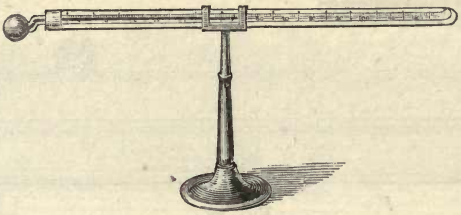

FIG. 42.

FIG. 36.

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 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. A small vessel has since been added, in which water boils violently in the box, with a piece of tube to carry off the steam."

Price, complete £2 5 0

33. **Solar Intensity Apparatus,** invented by Padre SECCHI, for measuring the comparative heat of the sun's rays. Two thermometers are here kept immersed in a fluid at any temperature, and a third surrounded by the same conditions, but not immersed, is exposed to the rays of the sun. The increase of temperature thus obtained is found to be the same irrespective of the temperature of the fluid which surrounds it. Cylindrical form, about 3 × 10 inches. Price, with the requisite three thermometers . . . £3 18 0

Tripod stand, with universal joint, by which the above may be kept in any position at any temperature £0 17 6

34. **Actinometer** (Sir JOHN HERSCHEL's), for ascertaining the absolute heating effect of the solar rays, time being considered one of the elements of observation. To take an observation, the Actinometer is placed in the shade for one minute and read off; it is then exposed for one minute to the sun's rays, and its indication taken; it is finally restored to the shade, and its reading also taken, the mean of the two readings in the shade subtracted from that in the sun, gives the actual amount of expansion of the liquid produced by the sun's rays in one minute of time. (See Report of the Royal Society on Physics and Meteorology). £5 18 0

35. POUILLETT'S PYRHELIOMETER (*fig.* 35), for ascertaining the effect of the sun's heat upon a given area by the number of degrees of heat imparted to mercury in five minutes, as described in Dr. Tyndal's 'Heat Considered as a Mode of Motion.' £4 4 0

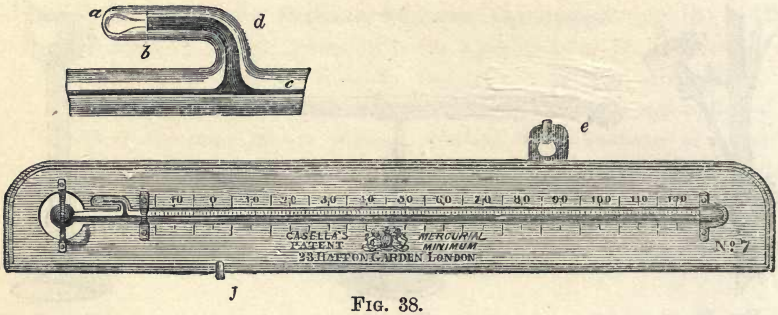

FIG. 38.

36. **Æthrioscope,** the invention of Sir JOHN LESLIE, for ascertaining the absolute intensity of terrestrial radiation, with which instrument time is an element of an observation (*fig.* 36, p. 13) £1 1 0

37. FLUCTUATION THERMOSCOPE, as designed by Dr. B. STEWART, of the Royal Observatory, Kew £1 10 0

In this arrangement two stems with unequal bores are united to one bulb, and the instrument used horizontally, the scale extending to one hundred divisions. On setting the mercury to the zero, every increase of temperature raises the mercury in the large stem, whilst every reduction in temperature abstracts it from the small one, illustrating a principle in the action of fluids well worthy of extended investigation.

38. **Casella's Mercurial Minimum Thermometer,** on porcelain scale, with hardwood back, and divided on the stem (*fig.* 38) . . . £2 10 0

This is the only practical mercurial minimum thermometer hitherto invented, and the result of quite ten years universal effort to achieve. Mercury is the only fluid employed in its make. The bulb and column are of the same size as in the standard maximum thermometers; and cold is thus registered under precisely the same conditions as heat; no steel or other index is employed; whilst the annoyance arising from vaporization, and breakage of the column in the spirit minimum, is entirely avoided. The general form is shown in *fig.* 38; *d* being a tube with large bore, at the upper end of which a flat glass diaphragm is formed by the abrupt junction of the small chamber *a b*, the inlet to which at *b* is larger than the bore of the indicating tube. The result of this is, that having set the thermometer, the contracting force of the mercury in cooling withdraws the fluid in the indicating stem only; whilst on its expanding with heat, the long column does not move, the increased bulk of mercury finding an easier passage through the larger bore into the small pear-shaped chamber attached. It is here most interesting to notice that the weakest natural force is thus capable of resisting the action of the heaviest fluid, as adhesion or capillary attraction seems to be the only force which holds the mercury, and prevents its recession from this point. Great care and a steady situation are essential in using this instrument.

Directions for Using the Mercurial Minimum Thermometer.—Place it in a horizontal position, with the back plate *e* suspended on a nail, and the lower part supported on a hook *f*. The bulb end may now be raised or lowered, causing the mercury to flow slowly until the bent part *d* is full, and the chamber *a b* QUITE EMPTY. At this point the flow of mercury in the long stem of the tube is arrested by adhesion to the diaphragm *b*, and indicates the exact temperature of the air at the time. On an increase of heat the mercury will expand into the small chamber *a b*; and on a return of cold will cause its recession from this chamber only, until it reaches the diaphragm *b* to which it adheres. Any further diminution of heat withdraws the mercury down the bore to whatever degree the cold may attain, where it remains until further withdrawn by increased cold, or till reset for future observation. When out of use, or after transit, it may be that raising the bulb may not, at first, cause the mercury to flow from the small chamber as above; in such a case a slight tap or jerk with the hand on the opposite end with the bulb up, or the application of the extreme tip of the chamber to the flame of a candle, will readily cause it to do so.

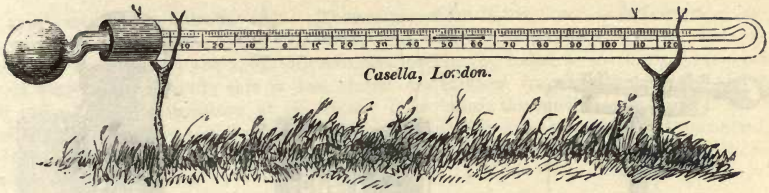

FIG. 40.

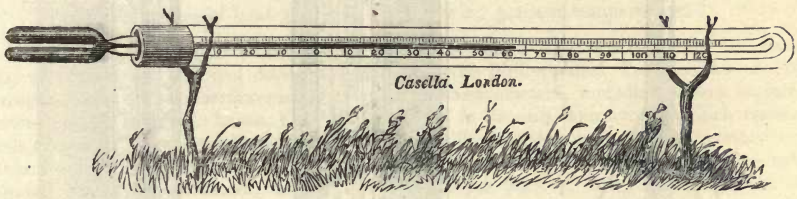

FIG. 43.

The Value of this Instrument is shown by the following Testimonials :—From SIR HENRY JAMES, R.E., F.R.S., Director of the Ordnance Survey and Topographical Depôt of the War Department, Author of 'Instructions for Taking Meteorological Observations,' with Tables, Notes, &c. :—

"I have great pleasure in stating that, after having had one of your Mercurial Minimum Thermometers carefully observed and registered at this office, and one at Southampton, during a period in which we have had a great range of temperature, I have found it to act perfectly, and never once to get out of order. I therefore think you have achieved a great success, and hope you will receive its reward."

B. STEWART, LL.D., F.R.S., Director of the Kew Observatory, in his Description of the instrument before the meeting of the British Association for 1862, said :—

"Before bringing this instrument to the notice of this association I have carefully tested its action at the Observatory, and find its indications in every way satisfactory."

From T. LAWRENCE, ESQ., Medical Staff, Mooltan, Punjaub :—

"Your Mercurial Minimum Thermometer works admirably. It seems to me the only instrument adapted for minimum registration in this climate."

39. **Minimum Thermometer,** filled with pure alcohol, for ordinary registration, engine divided on the stem, and mounted to correspond with the Standard Maximum, No. 28 (*fig.* 39, p. 10) £1 0 0

40. MINIMUM THERMOMETER, for terrestrial radiation, divided and figured on the stem, which is enclosed in a glass cylinder for protection (*fig.* 40) £1 0 0

42. MINIMUM THERMOMETER, on brass pedestal stand (*fig.* 42, p. 13) 1 4 0

43. **Casella's Extra Sensitive Minimum Thermometer** for terrestrial radiation. The unavoidably high price of CASELLA'S Mercurial Minimum Thermometer, as well as the care required in using it, has induced him to design the one shown in *fig.* 43, in which the bulb, being extended in the forked form therein shown, exposes a much increased surface to the air, and thus renders it little, if anything, less sensitive than the mercurial thermometer. It is really interesting to note the increased sensitiveness of this over standard instruments of the usual form £1 5 0

44. CASELLA'S EXTRA SENSITIVE MINIMUM THERMOMETER, forked as *fig.* 43, on porcelain scale, with hardwood back to correspond with standard maximum, No. 28 . . . . . £1 5 0

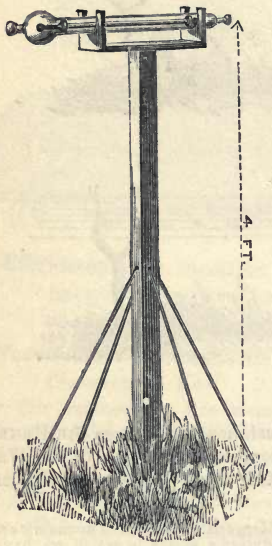

FIG. 30*.

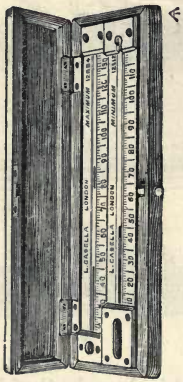

FIG. 47.

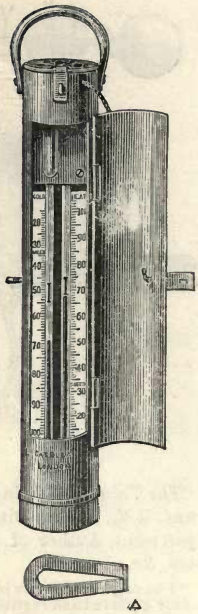

FIG. 48.

45. **Earth Thermometer,** for ascertaining the temperature below the soil, or the heat developed in hay-stacks, pine and melon pits, etc., with pointed copper tube, from (according to length) £0 18 6

46. MAXIMUM AND MINIMUM THERMOMETERS; the pair, in a neat pocket mahogany case for travellers, as arranged for Dr. Livingstone and Captains Burton and Speke. They are divided on the stem, and cannot be injured in travelling, unless by actual breakage £2 2 0

47. **Maximum and Minimum Thermometers,** of smaller size, as specially designed by L. CASELLA for the Alpine Club, and for use at sea; very portable, and admirably adapted for travelling invalids (*fig.* 47) . . £1 5 0

In these improved portable maximum thermometers, the index will not shift its position by disturbance, or in unsteady situations, as on shipboard, etc., whilst the instrument may be used either erect, inverted, or in any other position, and is certainly the most portable, and of more extended application than any other registering thermometer, whether it be in meteorological observations, or in physical or clinical researches.

Directions.—To set the index of Maximum Thermometers Nos. 46 and 47, bring it to its place with a moderate swing of the arm, keeping the bulb down at the time. This will bring it within about a degree of the rest of the mercury, at which point also it shows the existing temperature, the reading being taken from the end furthest from the bulb. To set the minimum index of Nos. 46 and 47, raise the bulb as No. 39. It may then be either laid down or suspended, as convenient, with the bulb kept a little lower than the opposite end.

Directions for Using the Spirit Minimum Thermometer, No. 39, etc.—Suspend it by the loops, or lay it down with the bulb a good half inch lower than the opposite end; and, to set the thermometer, disengage the bulb end, and raise it up until the index flows to its place in

the spirit, viz., to the extreme edge. Then suspend or lay it down as before; and, as the temperature decreases, the spirit will recede and take the index back with it; but, on an increase of temperature, the spirit will advance, leaving the index to mark whatever extreme of cold may have occurred; this it does at the end furthest from the bulb, whilst the spirit itself indicates the temperature at the time. If in transit the spirit is separated, it is easily united by a swing or two of the arm, holding the bulb downwards, and when thus united, let the thermometer hang with the bulb down for about ten minutes, to allow the fluid to settle from the sides of the tube.

Deep Sea Maximum and Minimum Thermometer on Six's principle. For registering past extremes of heat and cold, and showing present temperature.

This most ingenious and useful thermometer is named after the inventor, Mr. James Six, of Canterbury, and was described by him in the Philosophical Transactions of 1782. Excepting one or two arrangements of metallic thermometers, including a very ingenious instrument by Henry Jo hnson, Esq., F.R.A.S., this is the only thermometer which registers both extremes, in a vertical position. These metallic instruments, however, together with other forms tried, being found wholly inadequate for their purpose, and this alone being selected by the Government, as well as the Royal Society, for registering deep sea temperature, would seem to warrant its description here. As originally made, the Six's thermometer consisted of a long cylindrical bulb, united to a smaller tube of more than twice its length, bent up and down in the form of a syphon, with the cylinder in the centre, and terminated in a smaller oval-shaped bulb at the top. The lower portion of the syphon being filled with mercury, the long bulb, the other part of the tube, and about a third of the small bulb with rectified alcohol; the remaining part of the small bulb being filled with *highly compressed air*, which acts as a spring to depress the mercury and cause it to rise in the opposite tube on any contraction (from cold) of the spirit. A steel index enclosed in glass, moves in each limb of the syphon. The two indices are terminated at top and bottom wi th flattened projecting glass ends, to enable them to move with the least possible friction and prevent the mercury from passing them. They are supported in their position by means of a delicate hair spring. *On this principle strictly*, but in modified form, the deep sea thermometer has lately been made. Instead, however, of the long centre bulb, a short bulb filled with spirit is joined to the upper end of the syphon, about parallel with but rather lower than the opposite bulb (see form of the tube *fig.* 210, p. 49), thus keeping the instrument more strong and compact with but one bend, and adapting it better for the comparative rough usage to which it is subjected. The extent to which sea pressure at great depths might effect thermometric indications, however, was not yet known, and therefore the authorities at the Hydrographic Office having applied to the Royal Society on the subject, at their desire, towards the end of 1869, L. CASELLA constructed an hydraulic machine in which to make this interesting test. The result was startling, as, at a pressure equalling 2500 f athoms in depth equal 3 tons per square inch, the error equalled 12 to 13 degrees Fahrenheit in excess, whilst in other kinds of registering thermometers, it reached the extraordinary extent of 70 degrees. To remedy this, Dr. W. A. Miller, Vice-President of the Royal Society, suggested an effective remedy, which he thus describes in the 'Proceedings of the Royal Society,' No. 113, 1869:—

Self-registering Thermometers adapted to Deep Sea Soundings.—"Several of these thermometers have been prepared for the purpose with unusual care by Mr. CASELLA, who has determined the conditions of strength in the spring and diameter of tube most favourable to accuracy. He has also himself had an hydraulic press constructed expressly with the view of testing these instruments. By means of this press the experiments hereafter to be described were made.

"The expedien t adopted (as suggested by Dr. Miller) for protecting the thermometers from the effects of pressure, consisted simply in enclosing the bulb of such a Six's thermometer in a second or outer glass tube, which was fused upon the stem of the instrument in the manner shown in the accompanying figure 48, p. 16. This outer tube was nearly filled with alcohol, leaving a little space to allow of variation in bulk due to expansion. The spirit was heated to displace part of the air by means of its vapour, and the outer tube and its contents were sealed hermetically.

"In this way, variations in external pressure are prevented from affecting the bulb of the thermometer within, whilst changes of temperature in the surrounding medium are speedily transmitted through the thin stratum of interposed alcohol.

"Notwithstanding the great pressure to which these instruments had been subjected, all of them, without exception, recovered their original scale-readings as soon as the pressure was removed."

In sea-water of sp. gr. 1.027, the pressure in descending increases at the rate of 280 lbs. upon the square inch for every 100 fathoms, or exactly one ton for every 800 fathoms.

On completing this arrangement, a few of the instruments were immediately forwarded by Captain Richards from the Hydrographic Office to Dr. Carpenter and Dr. Wyvell Thompson then on board Her Majesty's Ship *Porcupine*, Captain Calver, at that time on a voyage of deep sea investigation in the North Atlantic, the results of which were shortly afterwards given to the Royal Society by Dr. Carpenter (see "Proceedings of the Royal Society," 1870), and this thermometer, under the name of the CASELLA-MILLER THERMOMETER was at once exclusively adopted by the Government for all investigations of deep sea temperature, with the guarantee of Mr. CASELLA to the authorities, that all should be subjected in his apparatus to an hydraulic pressure of not less than two and a half tons to the square inch=2000 fathoms depth in the sea.

Instructions.—The Six's thermometer is used vertically, and should always be kept upright or with the head well raised—especially in carriage. Before observation the indices should be set by applying the ends of the accompanying magnet close to the glass, and drawing them gently down to the surface of the mercury in each stem. On a rise of temperature, the spirit will expand and depress the mercury in the left-hand stem, while it raises it in the other, carrying up with it the index to whatever degree the heat may attain. A return of cold will contract the spirit in the bulb, allowing the elastic force of the compressed air in the opposite bulb to depress the mercury in the right-hand stem, which then rises on the opposite side, raising the index in like manner to register the extreme of cold; the indication in each case is at the end nearest the mercury, whilst the mercury at each end shows the temperature of the time being. The greatest heat is shown at the *top* of the right-hand stem, and at the *bottom* of that on the left.

48. **The Casella-Miller Deep Sea Self-Registering Thermometer,** as above, protected in vulcanite mounting, with black divisions, etc., on glass, very legible, in round copper case 7¼-inch. by 1¼-inch. outside (*fig.* 48) p. 16 £2 5 0

For other Six's Thermometers, see Nos. 203, 204, 204*, 210.

49. **Babinet's Apparatus,** with two thermometers, for taking the exact temperature of the air (*fig.* 49) p. 21 . . . . . £1 10 0

The slow and unequal transmission of heat by air and water is well known; the temperature of a body of the latter being only obtainable by its constant agitation. The above arrangement gives the same means of agitating the ambient air in order to ascertain its true temperature as well as the effect of its friction on the thermometer bulb.

HYGROMETERS.

50. **Mason's Hygrometer** (wet and dry bulb) with metal scales, mounted on mahogany board for suspension. The thermometers are divided on the stem, and the figures indelibly burnt in on porcelain slips at the side, as supplied by L. CASELLA to the various Government Departments and the Members of the British Meteorological Society (*fig.* 50) p. 19 . . £2 5 0

52. MASON'S HYGROMETER; like *fig.* 50, but mounted on porcelain scales 1 15 0

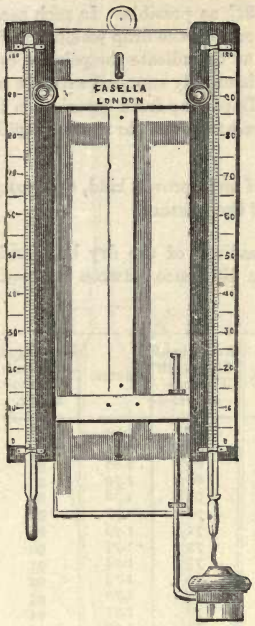

FIG. 50.

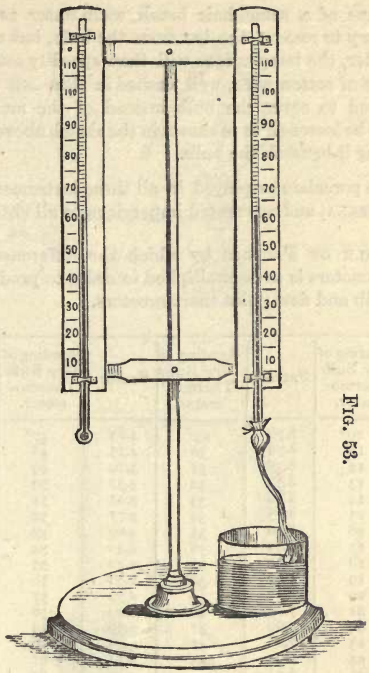

FIG. 53.

53. **Mason's Hygrometer,** exact as No. 50, but mounted on brass pedestal (*fig.* 53) £2 2 0

55. MASON'S HYGROMETER, as *fig.* 50, but of extra size, with expanded graduations, the tubes being fifteen inches long, and divided to 0.2° . £3 10 0

56. **Mason's Hygrometer,** with 18-inch. tubes, divided to 5ths for delicate investigations £5 5 0

57. PORTABLE POCKET WET AND DRY BULB HYGROMETER. A most convenient form of instrument for travellers, especially designed by L. CASELLA as a companion instrument to his Alpine, or pocket maximum and minimum registering thermometers, Nos. 46, 47, and pocket aneroid barometer, No. 118, and Livingstone's rain gauge, No. 62 . . . £2 2 0

The wet and dry bulb hygrometer or psychrometer may be fairly said to supplant the use of all others as an easy and practical means of indicating the humidity of the air. It consists of two thermometers placed parallel, about four inches apart, with their graduations as nearly as possible identical. The bulb of one is covered with thin muslin, from which trail a few threads of lamp cotton; these, being first wetted, are passed into a small attached vessel of water, two or three inches distant, and the bulb thus kept continually moist, causes this thermometer to indicate a *lower temperature in proportion to the rate* of evaporation, whilst the dry bulb thermometer shows the temperature of the air. From the readings of the dry and wet thermometers, the dew-point is obtained by means of the accompanying table. During frost, however, when the capillary action of the cotton is stopped, the bulb should be wetted

by means of a camel-hair brush, with water as near 32° as possible. In such cases it is not necessary to remove the ice from the bulb, but merely remove the drop which first forms from the water, the temperature will then speedily settle so as to indicate the point of evaporation. A piece of cotton-wick, well washed in clear soft water, is usually supplied with the instrument, and used to cover the bulb instead of the muslin. In placing fresh covering on the bulb, it should be loosened as is shown in the sketch above, and care taken not to restrict capillary action by tying it beneath the bulb.

The porcelain employed in all these instruments is of an improved kind, especially made for L. CASELLA, and warranted impervious to all changes of the weather.

TABLE OF FACTORS by which the difference of readings of the dry bulb and wet bulb thermometers is to be multiplied in order to produce the difference between the readings of the dry bulb and dew-point thermometers.

Reading of Dry Bulb Thermometer.	Factor.	Reading of Dry Bulb Thermometer.	Factor.	Reading of Dry Bulb Thermometer.	Factor.	Reading of Dry Bulb Thermometer.	Factor.	Reading of Dry Bulb Thermometer.	Factor.
10°	8.78	29°	4.63	47°	2.12	65°	1.82	83°	1.67
11	8.78	30	4.15	48	2.10	66	1.81	84	1.66
12	8.78	31	3.70	49	2.08	67	1.80	85	1.65
13	8.77	32	3.32	50	2.06	68	1.79	86	1.65
14	8.76	33	3.01	51	2.04	69	1.78	87	1.64
15	8.75	34	2.77	52	2.02	70	1.77	88	1.64
16	8.70	35	2.60	53	2.00	71	1.76	89	1.63
17	8.62	36	2.50	54	1.98	72	1.75	90	1.63
18	8.50	37	2.42	55	1.96	73	1.74	91	1.62
19	8.34	38	2.36	56	1.94	74	1.73	92	1.62
20	8.14	39	2.32	57	1.92	75	1.72	93	1.61
21	7.88	40	2.29	58	1.90	76	1.71	94	1.60
22	7.60	41	2.26	59	1.89	77	1.70	95	1.60
23	7.28	42	2.23	60	1.88	78	1.69	96	1.59
24	6.92	43	2.20	61	1.87	79	1.69	97	1.59
25	6.53	44	2.18	62	1.86	80	1.68	98	1.58
26	6.08	45	2.16	63	1.85	81	1.68	99	1.58
27	5.61	46	2.14	64	1.83	82	1.67	100	1.57
28	5.12								

In order to obtain all the data deducible from the wet and dry bulb thermometers, Glaisher's Hygrometrical Tables should be used.

58. **Daniel's Hygrometer;** the thermometers divided on the stems, with ether test, complete in mahogany case (*fig.* 58) p. 21 . . . £3 10 0

This elegant instrument consists chiefly of a bent glass tube, with two balls—a black one, about one-fourth filled with the highest rectified ether. The stem incloses a sensitive thermometer with the bulb placed rather below the centre of the ball, and a white one covered with thin muslin, the interior of the tube being thoroughly deprived of air and the greatest care observed not to over-boil or impoverish the ether.

Directions for Using Daniel's Hygrometer.—Turn the instrument up so that by applying the warm hand to the covered bulb all the ether goes into the black bulb, then place it upright as shown in the sketch, and pour ether upon the muslin enveloping the white ball, and when sufficient cold is produced by evaporation of the ether from the black ball to condense the moisture of the atmosphere upon its surface, in the form of a ring just below the centre, the internal thermometer will show the exact temperature at which the deposition of dew takes place, which is called the dew-point.

59. **Regnault's Condensing Dew-Point Hygrometer (Casella's Improved,)** with ether bottle, etc., complete in mahogany case (*fig.* 59) p. 21 . £4 4 0

*** Agreeable to the suggestions of Colonel Sykes, F.R.S., and Dr. Miller, F.R.S., L. CASELLA has adapted to this instrument 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 20s.

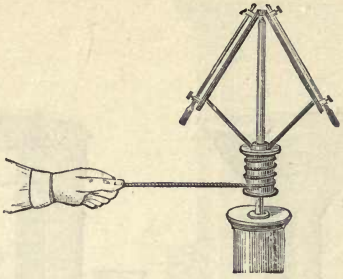

FIG. 49.

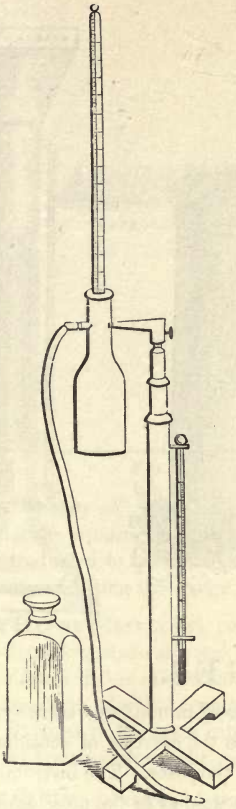

FIG. 59.

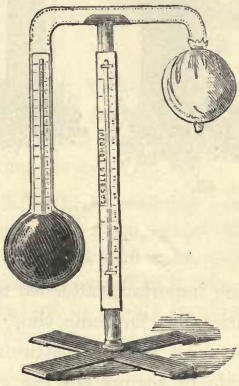

FIG. 58.

Although Mason's Hygrometer has for some time been in general use, yet Regnault's is still much employed for taking direct observations of the dew-point. It consists chiefly of two sensitive thermometers, one exposed to the action of the atmosphere and the other to the influence of a current of air passing through ether. An important part of this instrument is the small polished silver bottle into which, through a stopper, one of the thermometers is inserted. On one side, within the bottle a small silver tube descends nearly to the bottom; the other end passing outwards is connected with a small flexible aspirating tube. Supporting the bottle is a hollow bent neck connecting it with a telescopic stand that is also hollow, by which the air freely escapes at the base.

Directions for Using Regnault's Hygrometer.—Pour just as much ether into the silver cup as will cover the thermometer bulb, and insert the thermometer as shown in the drawing. On causing the air to bubble slowly through the ether, by breathing through the tube, the immersed thermometer will show a decline in the temperature; and when a film of moisture forms on the larger part or shoulder of the silver bottle, the temperature at that instant indicates the dew-point. The observer should stand so as not to allow the breath or heat of the person to affect the instrument.

60. **Atmidometer** (Dr. BABINGTON's), 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 from Various Fluids," November 24, 1859.

£2 0 0 to £3 10 0

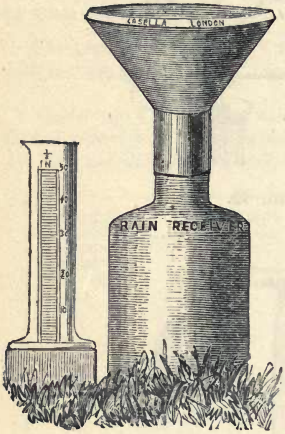

FIG. 63.

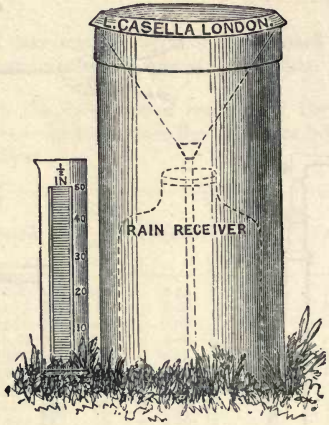

FIG. 68.

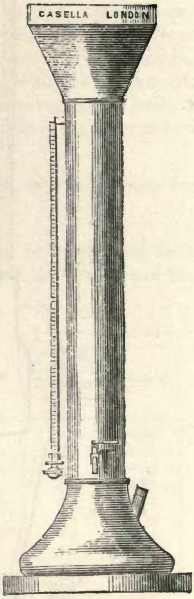

FIG. 65.

RAIN GAUGES.

The increasing importance attached to a knowledge of rainfall, as well as evaporation, in various localities, has for some time contributed to the exercise of considerable skill in arranging the most suitable instruments for these purposes. The instruments, however, being simple in themselves, the great question was, as to the most desirable size, as well as height from the ground on which they should be placed, large areas as a rule obtaining the preference. In an extended series of careful experiments, however, liberally conducted by Colonel Ward, at his own expense, and assisted by that eminent authority on rainfall, Mr. Symons, it was found that the best sizes were between five and eight inches of circular area; Mr. Glashier, F.R.S., then President of the Meteorological Society, also preferring the latter size, the following are made according to this result. The height again is fixed at ten to fourteen inches above the surface of the ground, the rain caught decreasing in quantity in proportion as gauges are raised above that height.

62. **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 Philosophical Journal,") the greatest accuracy is obtained, with graduated jar, in maroon case for the pocket £0 16 6

63. RAIN GAUGE, as described by Howard in his "Climate of London" (*fig.* 63), 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

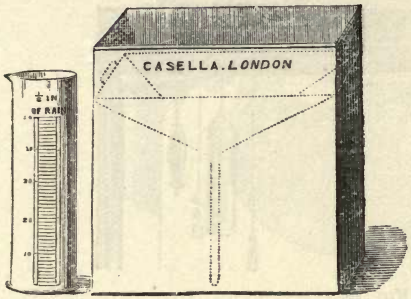

FIG. 64.

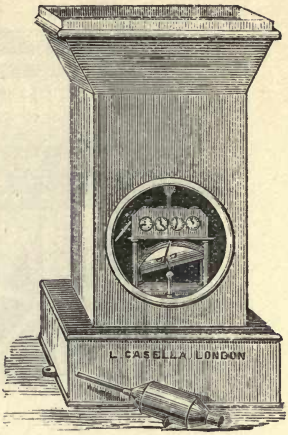

FIG. 73.

64. **Rain Gauge,** of stout copper, height twelve inches, receiving surface ten inches square, and funnel formed inside to prevent evaporation, with jar graduated to hundredths of an inch, and small receiver to prevent the necessity of lifting the gauge when measuring the rain (*fig.* 64) . £2 10 0

65. RAIN GAUGE (CASELLA'S), pedestal form, 3 feet high, receiving surface 8 inches in diameter, made of stout copper japanned, with strong glass tube graduated to show 3 inches of rain in tenths and hundredths, with extra stop-cock for frosty weather. In this arrangement the rain is measured as it falls, being visible at all times in the glass tube, and is poured off by simply turning the stop-cock, without removing the gauge from its place (*fig.* 65) p. 22 . £3 10 0

66. **Rain Gauge,** cylindrical form, of stout copper, 8-inch. diameter, with deep brass rim, and inside receiving-can or bottle, by which large or small quantities are measured without disturbing the gauge, and efficient protection secured against evaporation or frost or of overflow during the heaviest rains of the tropics £3 15 0

67. RAIN GAUGE (CASELLA'S TROPICAL), to measure up to 40 inches of rain, in 100ths of inches, in japanned tin, with brass rim . . . £1 10 0

68. **Rain Gauge** (SYMON'S), 5-inch. diameter, japanned tin, with receiving-bottle etc. (*fig.* 68) p. 22 . . . . . £0 15 6

69. RAIN GAUGE (SYMON'S), of copper, for durability . . 1 1 0

Instructions for Use.—The funnels of this rain gauge and the five preceding ones are made to lift on and off the cylinder, and a can or bottle for receiving the rain from the funnel is placed inside. When rain is to be measured, remove the funnel, take out the can, and pour the rain collected into the glass measure, which is graduated to represent hundredths of an inch, up to 0.50, or half an inch. Place the glass upon a table or other horizontal surface for support and steadiness, bring the eye on a level with the surface of the water and read off. Should *more* than half an inch of rain have been collected, successive measurements will be necessary. For instance, having measured half an inch, or 0.50, empty the glass, fill up again from the collecting-can, and add the result of this second measurement, to the half-inch measured previously. For example, should the second reading be 0.07, the two readings added together will give the total rainfall or 0.57 of an inch.

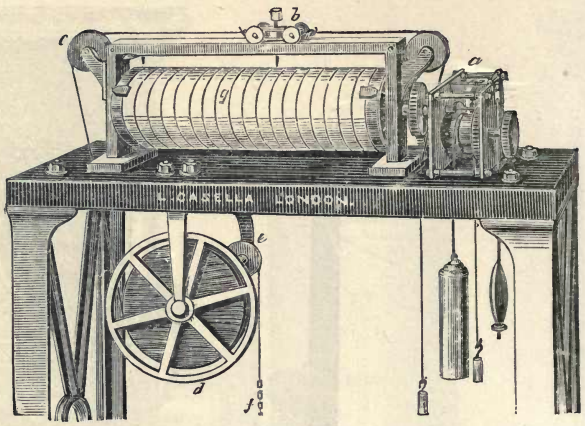

FIG. 72.

70. **Evaporating Dish or Gauge,** of copper, with wirework edge for protection from birds, etc. The receiving surface of same diameter as the gauge with which it is used, say five inches, with graduated glass measure . £0 15 6

71. EVAPORATING GAUGE, as above, eight inches diameter inside . 1 4 0

Instructions for Evaporating Gauge.—Nearly fill it with water, measured by the graduated glass measure, and place it out-of-doors freely exposed to the air. After exposure, again measure the water, and the difference between the first and second measurement shows the amount that has evaporated. Should rain have fallen, however, during the interval, the quantity equal to that collected in the adjoining rain gauge must first be deducted from the evaporator, the remainder, compared with the measured quantity put in, shows the amount that has evaporated. For districts which are subject to very heavy rainfall, an evaporating gauge, with overflow pipe to meet any exigency, may be had at a slight increase in the price.

72. SELF-RECORDING EVAPORIMETER OR TIDE GAUGE (*fig.* 72) shows the general design of this new and interesting instrument. It answers equally well for a rain gauge as for either of the above-named purposes, or for the rise and fall of water in a river, canal, lock, or any other body of water, the rate of evaporation, etc., showing the exact time at which any increase or reduction may have occurred £32 0 0

DESCRIPTION—*a* is a 30-hour timepiece of best English make; *b* the carriage carrying the pencil which marks the paper on the cylinder *g*; *c* pulley over which the cord runs to communicate with the float-wheel *d*; *e* small wheel communicating with *d*, from which the line is connected with the float resting on the water. The paper is changed every 24 hours. The angles of pulleys, etc., may be altered to adapt it for almost any position.

73. **Rain Gauge,** improved self-registering, receiving surface 100 inches diameter, 10 inches square. In this arrangement the rain is measured to tenths and hundredths of inches, and a continuous record is kept to the depth of 100 inches of the quantity of rain fallen (*fig.* 73) p. 23 . £4 10 0

The registering parts are all of copper, carefully tinned, and the arrangement so simple that any one can clean the works when needed, or adjust the gauge to the greatest nicety; indeed, this adjustment is so simple that it may be as well for the purchaser to test it on receiving it, or at any time after its removal; thus the small measure, when quite full, holds five cubic inches of water; this quantity passed through the instrument should move the hand of the hundredth circle five divisions, or half-way round, and is equivalent to half a tenth of an inch in depth of rain; and the receiving trough being ten inches square at the top or=100 superficial inches, five cubic inches equals one-twentieth, or half a tenth of an inch=0.05.

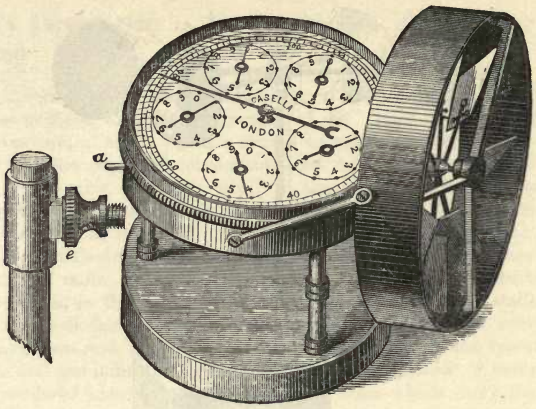

FIG. 75.

ANEMOMETERS.

The anemometers and air meters in the following list include only such as are approved of by the highest authorities, and in constant use at the present time. The table for converting velocity into force is introduced on account of the little confidence usually felt in reports of the wind's force; the authoritative course now followed being almost exclusively confided to reports of velocity, from which the comparative force is thus easily obtained.

74. ANEMOMETER (LIND'S), in which the pressure or force of the wind is shown by the depression and elevation of a column of water below and above the zero of the scale (*fig.* 74) p. 31 . . . . £2 2 0

75. **Casella's Air Meter,** for Mines, Hospitals, and other public buildings. The object of this little instrument is to give correct means of measuring the velocity of currents of air passing through coal and other mines, and the ventilating spaces of hospitals and other public buildings. It was first constructed for Dr. Parkes, F.R.S., of the Royal Victoria Hospital, Netley, for measuring the state of ventilation in that large military establishment, and declared to be the most perfect instrument of the kind in use. Since then it has been adopted in our Houses of Parliament, the United States Senate, most of our northern mines, and many of the leading prisons and hospitals throughout the country. The graduations for each instrument are obtained by actual experiment by means of machinery made for the purpose, so that the indications of all are as comparable with each other as the weight or measure of ordinary substances. The indications are shown by means of the large dial and hand, and five smaller ones, as shown in the annexed plate. The whole circumference of the large dial is divided into 100 parts, and represents the number of feet up to 100 traversed by the current of air. The five smaller dials are each divided into ten parts only, one revolution of each being equal to ten of the preceding dial, and representing 1000, 10,000, 100,000, 1,000,000, and 10,000,000 respectively. By means

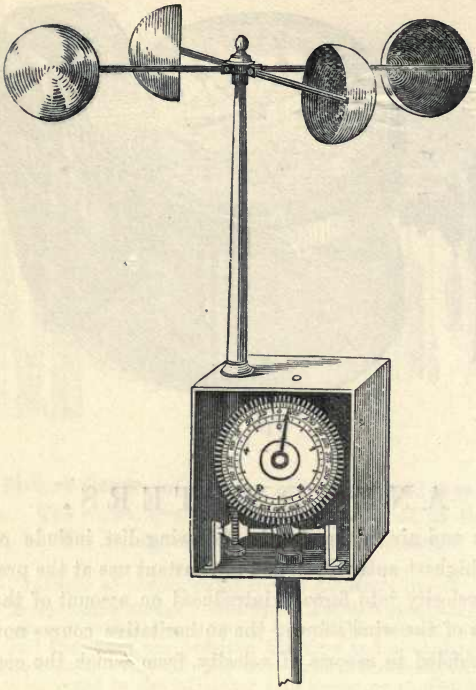

FIG. 78.

of the large dial the low velocity of fifty feet per minute may be measured, and by the smaller ones continuous registration is extended up to 10,000,000 feet, or 1893 miles, being practically beyond what the most extended observations can require, whilst jewelling in the most sensitive parts, ensures the utmost delicacy of action, FORMING ALSO AN ADMIRABLE POCKET ANEMOMETER FOR TRAVELLING, (*fig.* 75) p. 25 . . £4 4 0

76. **Air Meter,** as above, with large dial to 100, and only one smaller dial to 1000 . . . . . £3 10 0

77. **Anemometer** (ROBINSON'S), plain, with four index wheels, registering successively 100, 1000, 10,000, and 100,000 revolutions. In this arrangement the cups travel at the rate of one-third the wind's velocity, and each revolution represents 3.14 feet; thus, 3.14×3=9.42 feet, being the distance travelled by the wind for each revolution. This, multiplied by the number of revolutions indicated on the dial, shows the distance the wind has travelled between one observation and another. The dials are read from right to left, and the amount indicated at the last observation is to be deducted from that shown on the dials at the time of the current observation £3 3 0

78. ANEMOMETER (ROBINSON'S IMPROVED), for registering the velocity of the wind in miles and tenths, up to 505 miles, and described by Sir Henry James, R.E., F.R.S., in his 'Instructions for taking Meteorological Observations' (*fig.* 78) £4 4 0

79. **Robinson's Anemometer,** as No. 78, with extra dial extending the registration to 5050 . . . . . £5 5 0

Robinson's Anemometer consists essentially of four hemispherical cups, having their diametrical planes exposed to a passing current of air. They are carried by four horizontal arms attached to a vertical shaft, 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 with one-third of the wind's velocity, which is here measured by a simple arrangement of two wheels, working in endless screws, and, by means of two indices, shows, on inspection of the dial, the velocity of the wind. The outer, or front wheel, which revolves once for every five miles, is furnished with two graduated circles, the interior circle being sub-divided to miles and tenths of miles, whilst the outer circle is divided into 101 parts, each part being equivalent to five miles, so that it measures 505 miles of wind. The stationary index at the top of the dial marks on the *inner* circle the number of miles (UNDER FIVE) and tenths, that the wind may have traversed, in addition to the miles shown by the traversing index, which revolves with the dial and indicates on the *outer* circle the transit of every five miles. This anemometer is rendered extremely portable by the arms which carry the cups being made to take off. When in use it may be screwed on a shaft or ordinary piece of iron pipe which accompanies it, and may be fixed in any desirable position, their construction being such as to adapt them to withstand the most violent storms, and the simplicity of their make enables the observer to clean and lubricate them at pleasure, twice a year being sufficient.

To Place the Anemometer, No. 78, and take the first reading.—If after placing the instrument the hands are at 0, the next observation will show the distance travelled by the wind during the interval; but if the hands stand otherwise, then read them as they are, by noting down the divisions and figures indicated by the traversing hand and stationary index at the top. Thus, say that the former points to 125, and the latter to 2.6, making together 127.6, this will now be the starting-point of the gauge.

I. *Example.*—Let the traversing hand point to any increased number on the outer circle, say 375, and the stationary index to 3.6; these two numbers added together give the true reading, *i. e.* (378.6) miles. From this reading 378.6 must now be subtracted the first reading of the instrument, viz., 127.6, giving 251 miles as the distance traversed by the wind during the interval.

II. *Example.*—Let the traversing hand now point to 425, and the stationary index to 4.7, adding these two together we have 429.7, from which take the last reading, viz., 378.6, and the remainder, 51.1, will be the velocity of the wind for the interval between the two readings.

III. *Example.*—Lastly, let the traversing hand be at 175, and the stationary index at 2.8; here it is evident that the traversing hand, which at the last reading was at 429.7, must have passed the highest number marked on the dial, viz., 505. Hence, to obtain the true reading in this case, we must add together the three numbers, viz., 505, 175, and 2.8, together making 682.8; from this, taking the last reading 429.7, we have 253.1 miles as the distance travelled by the wind in the interval.

To save time and dispense with figures, it is usual, when the traversing hand has passed the 505, to place an asterisk at this point in the register, to denote that 505 must be added to the next reading.

To read the Anemometer, No. 79.—The divisions and figures on the left-hand dial are precisely the same as those in No. 78, and are read off in the same way. Each division on the dial to the right represents 505 miles, the subdivision of which are shown on the left-hand dial.

Example.—Take the reading of both dials as they are found to be at the time, say the left-hand dial showing 275.4 and the one to the right 505, and a little over a half; these figures added give 780.4 as the true reading, from which must be deducted the former reading, if any, to show the distance traversed by the wind in the interval.

80. **Casella's Embossing Self-recording Anemometer,** *for registering the velocity and direction of the wind and the time of its various changes.*

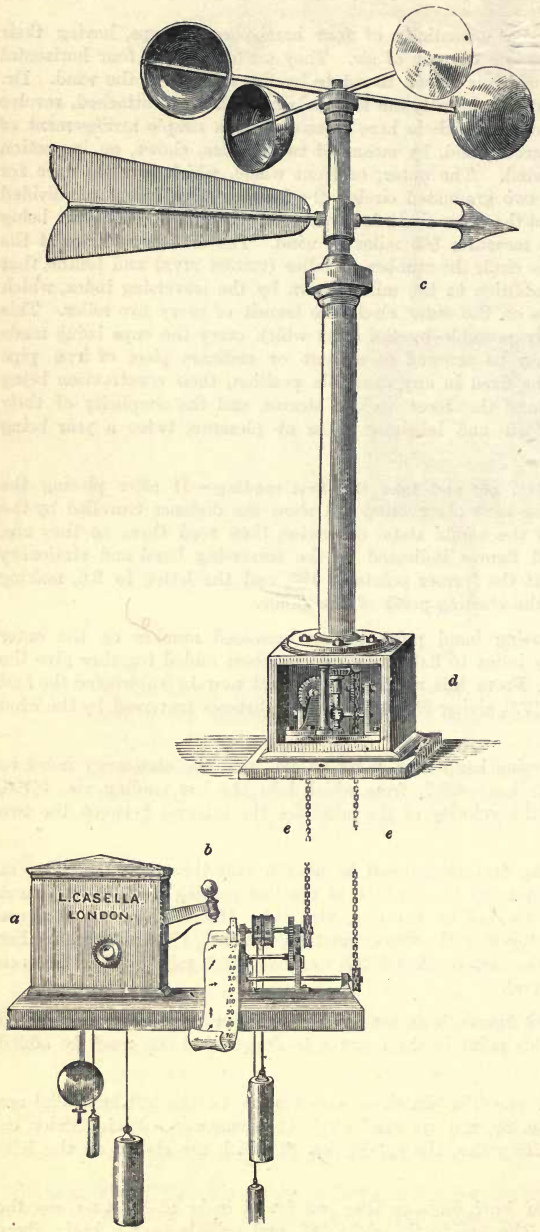

FIG. 80.

The general principle of this instrument is that of Dr. Robinson, of Armagh, in which four hemispherical cups revolve with the pressure of the wind, and give action to most of the other parts. The registering parts of the instrument, however, as well as the vane *are entirely new*, and the result of the joint efforts of myself together with those of Mr. Beckley, the ingenious engineer of the Royal Kew Observatory. The Force-and-Die principle of embossing is the means of registration herein adopted. The paper employed is a narrow strip, wrapped round a small attached roller, from which it is drawn, and embossed on one edge by the action of the rollers, as shown in the sketch. The rollers are divided to represent miles; they are figured at every ten, and one revolution shows the wind to have travelled fifty miles. The clock (*a*) raises the small hammer (*b*) which falls once in every hour, impressing the other edge of the paper with a small arrow whose movements are identical with the larger one at the top, and thus shows the exact direction of the wind at the time, as well as its rate of speed during each preceding hour. The paper is of sufficient length to last from four to six weeks without being changed, and the clock may be wound up daily or weekly, as may be desired. The projection (*c*) contains metal balls, which firmly support the top, and aid in giving freedom of action. The square box (*d*) is of cast iron, and contains the

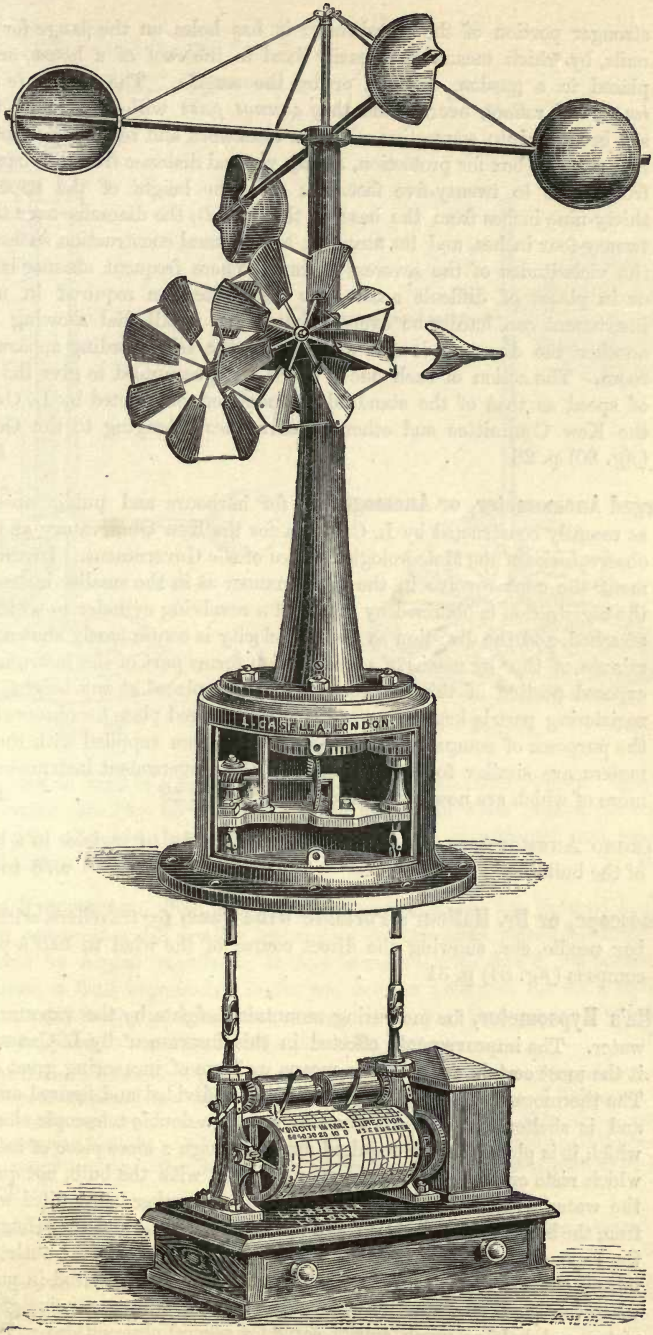

FIG. 82.

stronger portion of the wheelwork; it has holes on the flange for screws or nails, by which means it is easily fixed to the roof of a house, or to a pole placed in a garden, or field, or by the seaside. The chains (*e e*) act on *improved* rollers, over which they *cannot pass* without turning them, and are brought into connection with the clockwork and registering parts, placed in a room or box for protection, at any vertical distance from the base (*d*), say from three to twenty-five feet. In size, the height of the upper part is thirty-nine inches from the base of the box (*d*), the diameter over the cups is twenty-four inches, and its strength and general construction such as to bear the vicissitudes of the severest storm. Where frequent absence is requisite, or in places of difficult access, the little attention required in using this instrument can hardly be over-estimated. A small dial showing time, and another the direction, is also attached to the self-recording apparatus in the room. The action of each one is tested and guaranteed to give the same rate of speed as that of the standard anemometer constructed by L. CASELLA for the Kew Committee and other Observatories belonging to the Government (*fig.* 80) p. 28 . . . . . £38 0 0

82. **Enlarged Anemometer, or Anemograph,** for harbours and public observatories, as recently constructed by L. CASELLA for the Kew Observatory and the other observatories of the Meteorological Office of the Government. In this arrangement the cups revolve in the same manner as in the smaller instrument, but the registration is obtained by means of a revolving cylinder to which paper is attached, and the direction as well as velocity is continuously shown for every minute of time by means of a clock which forms part of the instrument. The exposed portion of this anemometer may be placed at any height, whilst the registering part is kept in a room or other covered place for observation. For the purposes of comparison, the registering papers supplied with these anemometers are similar to those used with the Government instruments, several more of which are now being erected (*fig.* 82) p. 29 . £70 0 0

83. ENLARGED ANEMOMETER, or ANEMOGRAPH, if made to register in a lower room of the building . . . . . £75 to 80 0 0

84. **Anemoscope, or Dr. Halleur's Portable Wind Vane,** for travellers, with compass, bar needle, etc., showing the direct course of the wind to half a point of the compass (*fig.* 84) p. 31 . . . . . £2 2 0

85. **Casella's Hypsometer,** for measuring mountain heights by the vapour of boiling water. The improvements effected in this instrument by L. CASELLA render it the most certain and portable means we have of measuring great elevations. The thermometer, strong, with small bulb, is divided and figured on the stem, and is sheltered from cold when in use by a double telescopic chamber, into which it is placed to any required depth through a loose piece of india rubber, which rests on the top. The proper depth is, with the bulb, not quite so near the water as is shown in the sketch. The chamber being filled with vapour from the boiling water beneath, and the inner chamber and tube thus enveloped, the vapour descends in the outer chamber, and escapes by the outlet. By this means the mercury, both in the bulb and stem, is immersed in pure vapour, whatever kind of water may be employed; less than a wine-glass full of water and half as much spirits serve for several observations. The thermo-

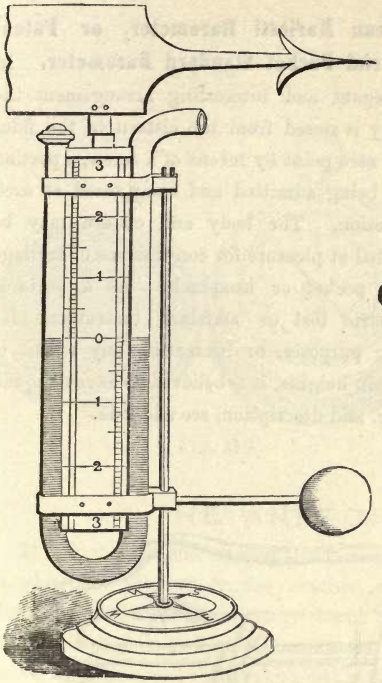

FIG. 74.

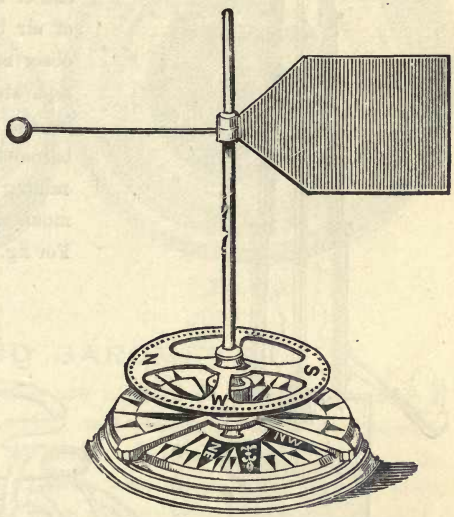

FIG. 84.

meter is kept in a light metallic case, lined with india rubber. The portable leather case (*fig.* 85*) p. 32, contains the whole when packed for travelling. Price, with one thermometer, divided to 0°1, as arranged and made by L. CASELLA for the Government (*fig.* 85) p. 32 . . £4 15 0

86. **Pocket Hypsometer.** The success attending the above has induced L. CASELLA to construct a still smaller instrument on the same principle, which is much used by Alpine travellers. It may be carried with ease in the pocket, and by those a little experienced in its use, is often preferred for its simplicity and certainty to the mountain barometer. With one thermometer divided to 0° 2, as supplied to the Royal Geographical Society . . £2 10 0

Wherever the measurement of mountain heights is required to be taken by other means than the theodolite, or standard barometer, or where there may be danger of damage or breakage of either, without an easy means of comparing or replacing them, this cheap and simple means of measuring heights will be found as efficient as it is handy, and at all times a reliable test of the aneroid or any other instrument, which from time to time require to be compared and adjusted.

87. **Casella's Tables,** with instructions for using the hypsometer, second edition £0 1 0

"For the elevation of great mountain masses and continuously elevated areas I conceive that hypsometrical results are as good as barometrica' ones; for the general purposes of botanical geography, the boiling-point thermometer supersedes the barometer in point of practical utility, for under every advantage the transport of a glass tube full of mercury, nearly three feet long, and cased in metal, is a great drawback to the unrestrained motion of the traveller."—Dr. J. D. HOOKER'S "Himalayan Journals" Vol. II.

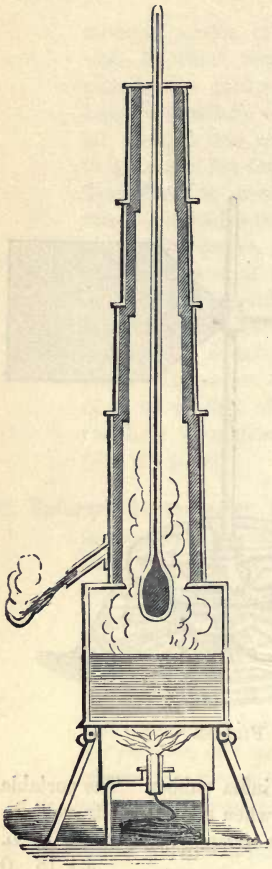

FIG. 85.

88. **The Boylean Mariotti Barometer, or Patent Mercurial Pocket Standard Barometer.** In this elegant and interesting arrangement the mercury is raised from the cistern to the fiducial or zero point by means of a screw, a portion of air being admitted and compressed at each observation. The body and cistern may be separated at pleasure for convenience of carriage in the pocket or knapsack. As a portable barometric test or standard instrument for mining purposes, or measuring any extent of mountain heights, it is believed to have no equal. For fig. and description, see addenda.

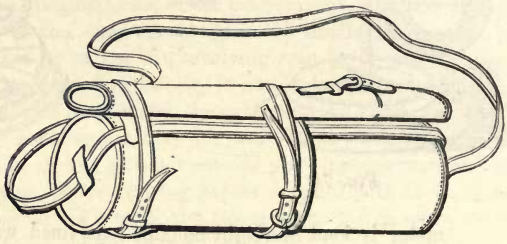

FIG. 85*

89. **Ozonometer** (DR. SCHONBEIN'S), consisting of strips of paper prepared with iodide of potassium and starch. The papers are to be 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, they become tinged, the intensity of which is measured by a graduated scale of twelve tints, which accompanies the ozonometer. L. CASELLA is the sole agent for Dr. Schonbein's ozone test papers. In case to last one year. £0 6 6

90. Dr. MOFFATT'S OZONOMETER 0 8 6

91. **Sedan's Ozonometer** 0 8 6

92. OZONE CAGE of fine wire gauze, as recommended by Sir Jas. Clark . 0 12 6

93. Smaller Size, ditto, for travellers 0 12 6

94. **Casella's Forms for Registering Ozonometer Indications** . 0 1 6

95. CASELLA'S FORMS FOR REGISTERING METEOROLOGICAL OBSERVATIONS, with concise remarks and instructions, in twelve monthly forms for one year £0 4 0

96. **Portable Meteorological Register and Note Book** (STRACHAN'S), with weather diagrams, tables, and instructions, second edition . . £0 2 6

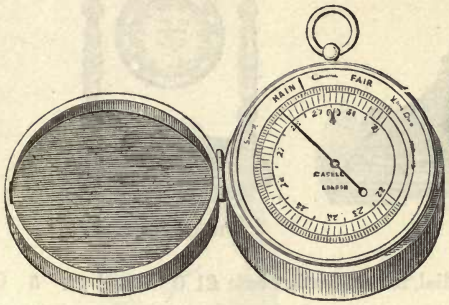

FIG. 119.

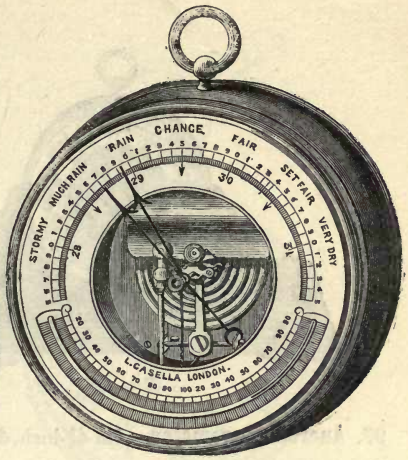

FIG. 100.

THE ANEROID BAROMETER.

This ingenious and elegant instrument is now regarded as almost indispensable to all who take interest in the weather, whilst, to travellers in particular, it presents advantages which hitherto they could not obtain. Before the introduction of the aneroid, limited indeed were the means of those, who, moving from place to place, desired in their progress to take reliable notice of meteorological phenomena, whilst the measurement of heights by any convenient or simple and portable arrangement was quite out of the question. Not only are all these difficulties entirely overcome by this instrument, but the older fragile form of barometer used at sea is almost entirely superseded. The action is obtained by the compression by the atmosphere of a thin, flat, circular metallic box, which is deeply corrugated to increase its elasticity, and from the interior of which the air has been carefully removed; the upper and lower surfaces are held in a state of tension or separation from each other by means of strong springs; the atmosphere pressing with varying force on these surfaces, conveys action to smaller springs, and thus show by hands on the dial the variation of heights, as well as changes of the weather.

No. 100 shows the general interior arrangement. In the measurement of small differences of height, as well as great elevations, the improved aneroid is alike interesting and valuable; not only does it show with precision the differences in height between one room and another, or the varying gradients in travelling on a railway, but it is now so improved as to show with much precision elevations up to fifteen to sixteen thousand feet.

The sizes vary from those of a small watch, to those of the largest dials; the form being usually circular, though that is also varied according to the position or place, such as large halls, public buildings, etc., for which it may be required.

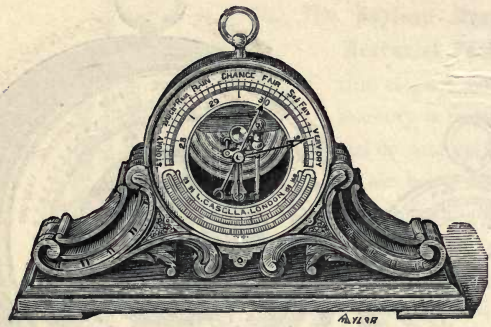

FIG. 100*.

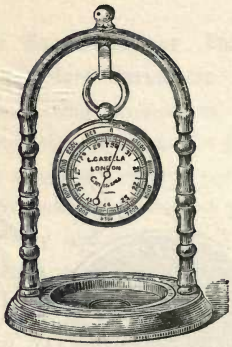

FIG. 120 and 120*.

97. **Aneroid Barometer,** with 4½-inch. dial, in neat leather case £1 0 0 and £1 5 0

98. ANEROID BAROMETER, with silvered metal dial . 1 10 0 and 1 15 0

99. ANEROID BAROMETER, with thermometer 2 5 0

100. **Aneroid Barometer,** with 4½-inch. open dial, showing the interior mechanism, with thermometer (*fig.* 100, p. 33) £3 0 0

If with stand as *fig.* 100*, 15s. 6d. extra.

102. ANEROID BAROMETER, cylindrical form, more finely divided and engraved, with extra compensation for temperature, with or without thermometer, as supplied to Her Majesty's Navy (*fig.* 102, p. 35) . . . £4 4 0

103. ANEROID BAROMETER, extra sensitive, with greatly extended graduations, divided to ·001-inch. each barometric inch being equal to nearly four inches, with circular thermometer and richly engraved 4½-inch. dial . £5 10 0

The extreme sensitiveness of this instrument is very remarkable.

104. **Aneroid Barometer,** in bronze metallic frame with 8-inch. dial, for use at sea £2 10 0

105. ANEROID BAROMETER, as above, with thermometer . . 2 15 0

106. ANEROID BAROMETER, with handsome turned wood frame, oak or imitation of ebony, 10-inch. dial £4 4 0

107. **Aneroid Barometer,** with 18-inch. dial, very bold and handsome, for large halls or public institutions . . . £15 0 0 to £25 0 0

108. ANEROID BAROMETER of superior finish, with richly engraved 4½-inch. dial, raised circle, and revolving index, with or without thermometer . £5 0 0

109. **Pedestals** of various designs, for aneroid barometers for the mantel-piece £0 7 6 to £1 1 0

110. ANEROID BAROMETER, for the pocket, in maroon case, 2¾-inch. by 1½-inch., finely divided and compensated, very sensitive, for indicating changes in the weather, or measuring heights up to 1000 feet, with revolving index £4 4 0

112. **Aneroid Barometer** (plain), for the pocket, in neat leather case 2¾ inches by 1¼, for indicating changes of the weather or measuring heights up to about 7000 feet £2 10 0

FIG. 102.

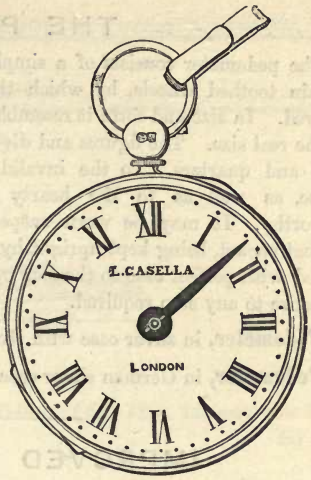

FIG. 124.

113. ANEROID BAROMETER, with revolving index to about 8000 feet. £3 0 0

114. **Aneroid Barometer,** rather smaller in size, and carefully compensated 3 10 0

115. ANEROID BAROMETER, with scale of heights . . . 4 10 0

116. **Aneroid Barometer,** with circular thermometer and raised barometric circle, carefully compensated for measuring up to 10,000 to 12,000 feet £4 10 0

117. ANEROID BAROMETER, pocket size, in neat case, about $2\frac{3}{4}$ inches by $1\frac{1}{4}$, carefully compensated for temperature, with superior compass and thermometer; an excellent traveller's companion £4 10 0

118. **Alpine Aneroid Barometer,** very carefully compensated and tested for measuring heights up to 15,000 feet (small pocket size) . . £5 10 0
If in silver 6 6 0

119. **Aneroid Barometer,** with extra small dial, about the size of a small Geneva watch, carefully tested and compensated, with every improvement, graduated from about 23 to 31 inches, or more if desired (*fig.* 119, p. 33) £5 0 0

120. ANEROID BAROMETER, same size, in silver, with double back to open with spring (*fig.* 120, p. 34) £6 6 0

If on neat gilt watch stand (*fig.* 120*, p. 34), 10s. 6d. extra.

122. **Aneroid Barometer,** in best gold, 18 carat . . . 12 0 0

N.B.—A scale of altitudes accompanies any of the above instruments *gratis*, or may be engraved on the dial of either, from No. 108, at an extra charge of 7s. 6d.

*** The larger sized aneroids, as 4½ inch., can have self-registering indices added, by which the highest and lowest point during absence may be registered at, extra . . £1 1 0

123. **Sympiesometer** (CASELLA'S IMPROVED) for measuring mountain heights up to 15 to 21,000 feet, as adopted by some of the leading members of the Alpine Club, in neat mahogany case with straps £4 0 0

For other Simpiesometers, see Nos. 142, 143, and 144.

REGISTERING ANEROIDS, BAROMETERS, ETC., see Nos. 17 to 22 inclusive.

THE PEDOMETER.

The pedometer consists of a simple arrangement of weight and pendulum acting on plain toothed wheels, by which the distance walked by the wearer is accurately measured. In size and form it resembles a small watch, the annexed plate being rather over the real size. The figures and divisions represent one to twelve miles, divided into halves and quarters. To the invalid lady or gentleman requiring limited walking exercise, as well as to the hearty active pedestrian, it is equally valuable and trustworthy. It may be worn suspended from the neck, or placed in a front or waistcoat pocket, being kept upright by means of the small hook (*a*). The pedometer is adjusted with perfect ease to the step of the wearer, however long or short, and altered at pleasure to any step required.

124. **Pedometer,** in silver case with strong crystal glass (*Fig.* 124, p. 35) £2 15 0

125. **Pedometer,** in German silver case 2 5 0

IMPROVED CHRONOGRAPH,

For the correct registration of any number of rapidly passing objects, as at regattas and races, as well as eclipses and occultation of stars, the exact speed of machinery, etc., by merely touching a spring without removing the eye from the objects. In size and form the chronograph precisely resembles a watch; it is made of silver, and consists of an ordinary quick train lever movement, with the addition of a centre seconds-hand, which traverses the dial as in a stop seconds watch. By this means time is taken to the tenth of a second, in either scientific or sporting pursuits, without the confusion and anxiety of taking the eye from the object.

126. **Chronograph,** as above £9 9 0

CLINICAL THERMOMETERS.

CASELLA'S Clinical Thermometers, as expressly arranged by Dr. Aitkin of the Royal Hospital, Netley, for use at that great military establishment. In Aitkin's arrangement two thermometers are used, the one bent for reading *in situ*, the other straight for reading by registration where the danger of fever, defective sight, and other causes might render direct observation difficult, or even dangerous. Of the many uses to which CASELLA'S Maximum Thermometers are now applied, perhaps none are equal in importance to their application for clinical purposes, and though many desultory efforts were made at various times, none certainly assumed the distinct form of applying this principle until taken up by Dr. Aitkin. See Aitkin's "Science and Practice of Medicine," 1st, 2nd, and 3rd Editions which show that his description of clinical temperature by registration, considerably precedes all other names associated with it. This thermometer registers the greatest heat of the body in any position. It may be inserted in the mouth, the axilla, or between the thighs, so as to be well covered, and in two and a half to three minutes removed to the light and read off at leisure. Length 9 inches, divided and figured on the stem from 80° to 115° or 120° in 5ths of degrees.

127. The two in neat pocket case, as above £1 5 0

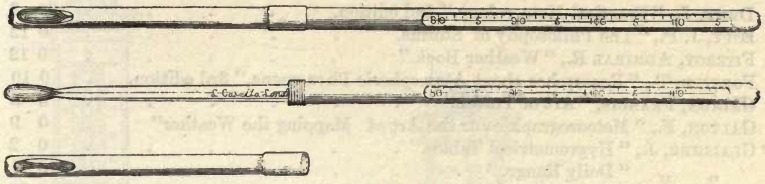

FIG. 134*.

FIG. 128.

128. **Clinical Thermometer** (self-registering), 10-inch. (*fig.* 128), in neat case for the pocket £0 12 6

129. CLINICAL THERMOMETER, 6 or 7 inch. 0 12 6

130. **Clinical Thermometer,** 4 or 5 inch. 0 12 6

132. CLINICAL THERMOMETER (non-registering), 10 inch. . . 0 7 6
No shorter Non-Registering Clinical Thermometer than this should be used.

If silver case for the 4 or 5-inch. size . . . . extra £0 5 0

If ivory case for the 5 or 6-inch. size . . . . „ 0 3 0

133. **Dr. Aitkin's Clinical Chart of Temperature, Pulse, Respiration, and Excreta,** arranged for thirty-one days, with comparative scale of Fahrenheit and centigrade degrees, per dozen. £0 1 8

134. GUY'S HOSPITAL CHART, per dozen . . . 0 1 6

N.B.—The 7-inch. Clinical Thermometer is also now much used by veterinary surgeons, for the treatment of animals in cases of fever, etc., during the cattle plague especially, when applied in the rectum, no other first symptom was found so distinctive and positive as the indication thus obtained.

134* The above-named thermometer, especially arranged for the treatment of cattle, with instructions, and shield for protection 10-in. (*fig.* 134*) £0 14 0

BOOKS ON METEOROLOGY, ETC.

1. "A Manual of Scientific Enquiry," by SIR JOHN HERSCHEL and ROBERT MAIN. £0 10 6
2. ARAGO, F., "Meteorological Essays," translated by SABINE. . . . 0 10 0
3. BEARDMORE, N., "Manual of Hydrology." 1 15 0
4. BLODGET, L., "Climatology of the United States." 1 0 0*
5. BUCHAN, A., "Handy Book of Meteorology," 2nd edition. . . . 0 8 6
6. CASELLA, L. P., new edition of "WELLS on Dew," with notes and appendix by R. STRACHAN, F.M.S. 0 5 0
7. CLARK, Sir J., Bt., M.D., "On Climate," 4th edition. 0 7 6*
8. CLOUSTON, Rev. Dr., "Explanation of Popular Weather Prognostics. . 0 1 6
9. DALTON, J., "Meteorological Observations," 2nd edition. . . . 0 10 0*
10. DANIELL, PROFESSOR J. F., "Elements of Meteorology," 3rd edition, 2 vols. 0 16 0
11. DOVE, PROFESSOR, "The Law of Storms," translated by SCOTT . . 0 10 6

12.	DREW, J., "Practical Meteorology," 2nd edition.	£0	5	0
13.	ESPY, J. P., "The Philosophy of Storms."	0	12	6*
14.	FITZROY, ADMIRAL R., "Weather Book."	0	12	6
15.	FORSTER, T., "Researches about Atmospheric Phenomena," 3rd edition.	0	10	6*
16.	GALTON, FRANCIS, "Art of Travel."	0	5	0*
17.	GALTON, F., "Meteorographica or the Art of Mapping the Weather"	0	9	0*
18.	GLAISHER, J., "Hygrometrical Tables."	0	2	6
19.	„ „ "Daily Range."	0	1	6
20.	GUYOT, A., "Meteorological and Physical Tables."	0	16	0*
21.	HARRIS, Sir W. SNOW, "On Thunder Storms."	0	7	6*
22.	HERSCHEL, SIR J., "Meteorology."	0	5	0*
23.	HOWARD, LUKE, "On the Modification of Clouds," new edition.	0	10	6*
24.	HOWARD, L., "Climate of London," 2nd edition, 3 vols.	0	15	0*
25.	JAMES, COLONEL SIR H., "Instructions for taking Meteorological Observations."	0	7	6
26.	JENYNS, REV. L., "Observations in Meteorology."	0	10	6*
27.	KAEMTZ, PROFESSOR, "Meteorology," translated by WALKER	0	12	6*
28.	LAUGHTON, J. K., "Winds and Currents."	0	14	0
29.	LOOMIS, ELIAS, "Treatise on Meteorology."	0	12	0
30.	LYELL, SIR CHARLES, "Elements of Geology."	0	9	0
31.	LYELL, SIR CHARLES, "Principles of Geology," 2 vols. each	0	16	0
32.	MAURY, M. F., "Physical Geography of the Sea and its Meteorology."	0	5	0*
33.	METEOROLOGICAL OFFICE.—Publications, consisting of Parliamentary Reports, Quarterly Weather Report, Charts, and Papers. Prices varying, but low.			
34.	METEOROLOGICAL SOCIETY, PROCEEDINGS, per vol.	1	0	0
35.	MORRIS, A. J. T., "Treatise on Meteorology."	0	4	6
36.	MULLER, PROFESSOR, "Physics and Meteorology," in German.	0	12	0
37.	MULLER, PROFESSOR, "Physics and Meteorology," English edition.	0	10	6
38.	ODLING, DR., "Chemistry," by SIMMONS.	0	7	6
39.	PETERMAN'S, Hydrographical Map of the British Isles, folded in case.	0	15	0
40.	PIDDINGTON, H., "Horn Book of Law of Storms."	0	7	6*
41.	REID, COLONEL, "Law of Storms."	0	14	0*
42.	REID, COLONEL, "Variable Winds."	0	10	0*
43.	ROWELL, G. A., "On the Cause of Rain."	0	5	0
44.	SCOTTISH METEOROLOGICAL SOCIETY, Quarterly Journal, per year	0	10	0
45.	SIMMONDS, G. H., "Meteorological Tables."	0	2	6
46.	SMYTH, C. P., "Teneriffe, or an Astronomer's Experiment," with photographs.	0	7	6*
47.	SOMERVILLE, Mrs., "Connection of the Physical Sciences," portrait, post 8vo.	0	5	0
48.	STEINMETZ. A., "Sunshine and Showers."	0	7	6
49.	STRACHAN, R., "Weather-casts and Storm Prevision."	0	2	0
49*	STEWART, BALFOUR, "Elementary Treatise on Heat."	0	7	6
50.	SYMONS, G. J., "British Rainfall," 1865, and subsequent years, per year.	0	5	0
51.	„ „ "Monthly Meteorological Magazine," per year.	0	5	0
52.	„ „ "Rain, how, when, where, and why it is measured."	0	2	0
53.	„ „ "Meteorological Register with Instructions," paper cover, per year	0	2	0
54.	„ „ „ „ „ half bound, for five years	0	7	6
55.	„ „ "Barometer and Thermometer Diagrams." per year	0	1	0
56.	„ „ "Rainfall Register," single sheet folio „ „	0	0	3
57.	THOM. A., "Nature and course of Storms."	0	7	6*
58.	TYNDAL, JOHN, "Glaciers of the Alps, with three years Observations and Experiments on the General Phenomena."	0	14	0
59.	TYNDAL, "On Heat, considered as a Mode of Motion."	0	10	6
60.	WEBSTER, W. H. B., "Recurring Atmospheric Periods."	0	7	6*

NOTE.—As many of the above works are out of print and several are very scarce, L. CASELLA cannot bind himself to supply at the prices to which an asterisk (*) is affixed, but he will use his best efforts to accommodate purchasers.

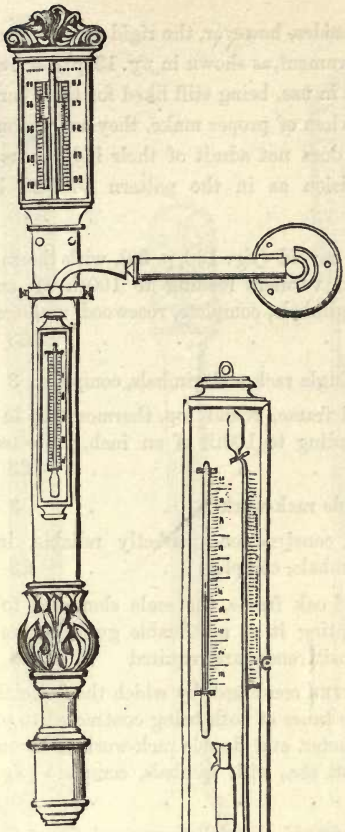

FIG. 136.

FIG. 144.

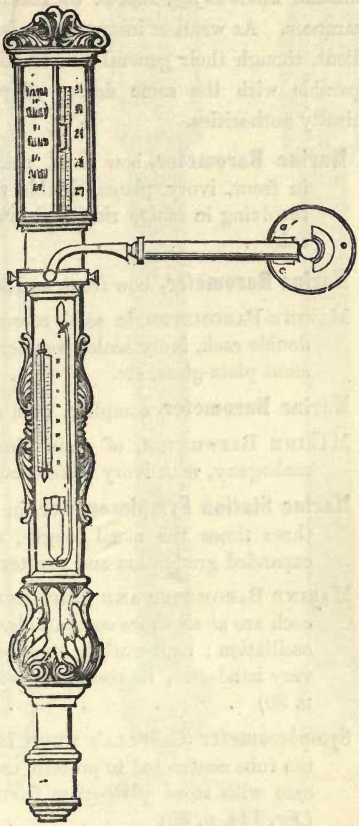

FIG. 143.

BAROMETERS.

Besides the standard instruments as most of those described in the preceding pages, the following are those most employed by the farmer, mariner, etc., as well as for *weather glasses* for ornamental and general use, a few forms and arrangements only are given, but they may be had of any design to correspond with the architecture of halls, libraries, and public buildings, perfect efficiency in the cheapest as well as the most costly being the first consideration, few things keeping nature's laws better before us than such efficient means of seeing and estimating the varying condition of the pressure and heat of the atmosphere.

MARINE BAROMETERS AND SYMPIESOMETERS.

The great change effected in the use of these instruments since the time of the Brussels Conference, as well as the introduction of the aneroid and Bourdon's barometers

must greatly curtail the length of this list. Besides, however, the rigid form suggested at the above conference and adopted by our Government, as shown in *fig.* 13, p. 5, a few other ornamental kinds as *fig.* 136, p. 59, continue in use, being still liked for their handsome appearances. As weather instruments also, when of proper make, they are undoubtedly excellent, though their general construction does not admit of their indications being comparable with the same decree of precision as in the pattern adopted by our Admiralty authorities.

136. **Marine Barometer,** bow front, neatly carved (*fig.* 136, p. 39), 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

137. **Marine Barometer,** bow front, as 136, single rack and gimbals, complete 3 5 0

138. 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

139. **Marine Barometer,** complete, with single rack-work . . 3 3 0

140. MARINE BAROMETER, of plain simple construction, perfectly reliable, in solid mahogany, with ivory plates and gimbals, complete . . £2 2 0

142. **Marine Station Sympiesometer,** in bold oak frame, 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 . £4 10 0

143. 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.* 143, p. 39) £6 10 0

144. **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.* 144, p. 39) £3 3 0

For Mountain Sympiesometer, see No. 123.

145. **The Fisherman's or Storm Barometer,** as expressly approved by Admiral Fitzroy, Board of Trade, etc., for Lifeboat Stations . . £5 5 0

This instrument consists of a strong tube with large bore, and very correct and bold thermometer mounted in a solid oak frame, firmly screwed together. The scales are of porcelain, boldly engraved, and impervious to any injury from the weather; the vernier reading is to 1·100ths of an inch. It is strongly recommended as a sound and excellent instrument, admirably adapted for the sea coast and public institutions.

146. MINER'S BAROMETER.—The numerous accidents occurring in coal mines in particular, and the close connection of these with diminished atmospheric pressure, as shown by a low state of the barometer, has induced L. CASELLA to arrange an economic and highly portable form of instrument for this purpose; it is plain, hardy, sensitive, and adapted alike for all climates. No manager of mines should be without it . . . £1 10 0

147. **Miner's Barometer,** more elaborately finished . . 2 2 0

FIG. 156.

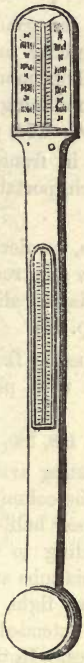

FIG. 155.

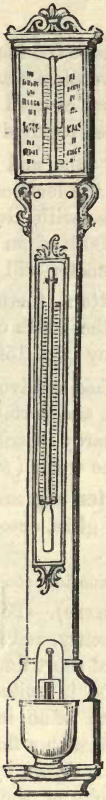

FIG. 153.

FIG. 154.

FIG. 149.

148. THE ANEROID BAROMETER, of plainest form; when well made is also perfectly adapted for this purpose (see also page 34) . . £1 10 0 to £2 10 0

149. **Plantation Barometer** (*fig.* 149) (see also Nos. 180 and 182) 1 10 0 to 2 0 0

PORTABLE OR PEDIMENT BAROMETER.

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 barometer scale, the nearest approach to a standard barometer is attained.

150. **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 . £7 7 0 £8 8 0 and £10 10 0

152. 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

153. **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, for plain standard adjustment when required (*fig.* 153, p. 41) . £8 10 0

154. **Portable Barometer,** with 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 (*fig.* 154, p. 41) £4 10 0

155. 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.* 155, p. 41) . . £2 10 0

156. **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 good and hardy instrument, adapted alike for home use or transmission to all parts of the world (*fig.* 156, p. 41) . £1 5 0

157. **Agricultural or Cottage Barometer,** expressly designed by L. CASELLA as a cheap, portable, and popular weather glass, accompanied with plain description and instructions (*fig.* 188, p. 47) £0 12 6

For barometers of this construction, see also Nos. 188, 189, and 190.

158. **Long Range Barometer** (DESCARTES).—This interesting arrangement consists of a syphon tube filled with mercury, and having the column of ordinary length, the upper part of the tube and short limb being say half an inch in diameter; to the latter a length of tube is united, extending to the top, the interior diameter being, say one-eighth of an inch. This tube and lower limb of the instrument being partly filled with a fluid of very light specific gravity, the rise and fall of the mercury is shown by it, but extended in length in proportion to the difference in capacity of the two tubes. In this way the ordinary barometric inch may be extended to from seven to ten inches, which being moderately subdivided, the barometric action or changes during a storm are often visible. This instrument, however, is not very portable, and should only be carried by hand from place to place . . . £2 10 0

CIRCULAR OR DIAL BAROMETERS.

This popular and interesting arrangement of household instrument was first designed by that able philosopher Doctor Hook, who took great pains to make it perfect, so much so, that had his plans been carried out with fair progressive improvement, and the instrument been of a slightly more portable character, any other arrangement of weather indicator for general use might almost be considered superfluous; the clear and expanded graduations on the dial, as well as its well-known response to the simple tap so frequently given "to see which way the mercury is going," is familiar to all.

Not only did the Doctor attach a thermometer to it, but a hygrometer also, and even a level for the purpose of carrying out his arrangement with greater delicacy;

FIG. 167.

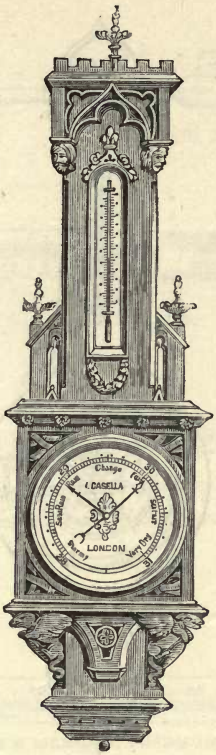

FIG. 159.

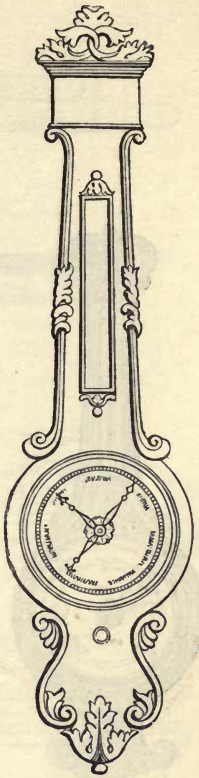

FIG. 162.

the ultimate rude combination, however, of these, from commercial competition has brought an unmerited distrust on the design, and hence its recent unpopularity. As regards the hygrometer, however, the simplicity and efficiency of the wet and dry bulb has subsequently caused it to supplant almost every other form. The following brief list, therefore, combines only instruments in which the desire of the Doctor is fully carried out, excepting that the above-named hygrometer (wet and dry bulb) is advised and its use recommended as a separate instrument.

159. **Circular or Dial Barometer,** in rosewood, walnut, oak, and mahogany, either plain or elegantly carved to any style of furniture or architecture, for halls, libraries. etc. (*fig.* 159) . . . £5 5 0 to £21 0 0

160. **Ten-inch Dial Barometer,** handsomely inlaid with buhl work, plate-glass over dial, and attached thermometer (*fig.* 160, p. 44) . . £5 5 0

162. TEN-INCH DIAL BAROMETER, Egyptian pattern as (*fig.* 162), very chaste, in rosewood, walnut, oak, etc., with plate-glass over dial and bold thermometer £4 4 0

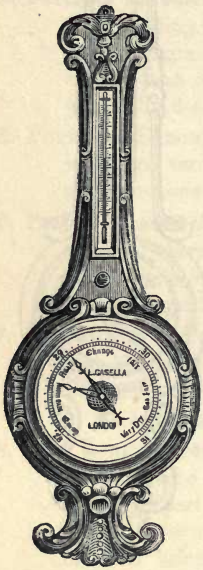

FIG. 164.

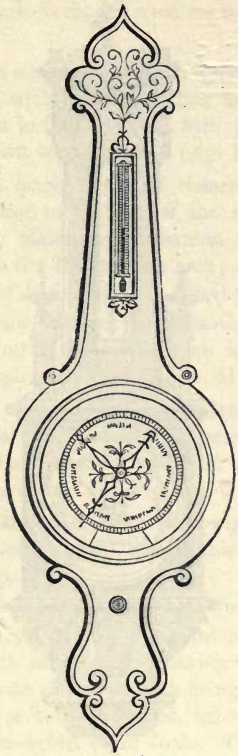

FIG. 160.

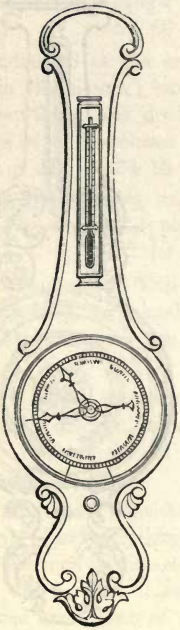

FIG. 166.

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

164. TEN-INCH DIAL BAROMETER, richly carved in rosewood, oak, or mahogany, with bevelled plate-glass in front, very handsome (*fig.* 164) . £7 10 0

165. **Eight-inch Dial Barometer,** same pattern as No. 160 (*fig.* 160) 4 10 0

166. EIGHT-INCH DIAL BAROMETER, same pattern as No. 162, or (*fig.* 166) £3 3 0

167. **Ten-inch Dial Barometer** (CASELLA'S), richly carved in walnut, oak, or rosewood (*fig.* 167, p. 43), with bevelled plate-glass, and best double ring and thermometer, very chaste and handsome . . £5 10 0

169. 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 10 0

170. **Eight-inch Dial Barometer,** same pattern as No. 160 . . 2 10 0

FIG. 179.

FIG. 178.

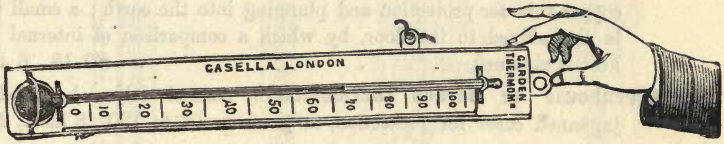

FIG. 175.

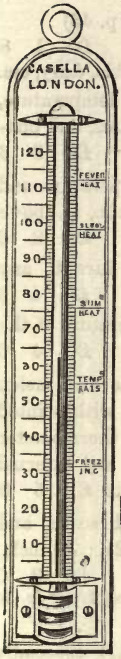

FIG. 174.

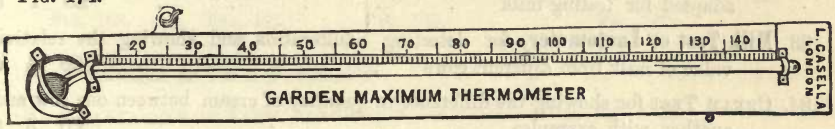

FIG. 176.

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

173. EIGHT-INCH DIAL BAROMETER, same pattern as No. 172 . 1 5 0

When the better sorts of dial barometers are required for transmission abroad, they are supplied with steel stop cocks to render them portable, so that on reaching their destination they merely require to be suspended and the stop cocks turned to put them in action, the extra charge being 7s. 6d. to 12s.

HORTICULTURAL AND GARDENING BAROMETERS, THERMOMETERS, ETC.,

Embracing several simple weather instruments and appliances; the prices of some are purposely very low with the view of extending their use even to the cottage; the name being affixed to all, however, the fullest confidence may be placed in their precision. The barometers especially are equally available for use along the coast.

174. **Garden Thermometer,** good plain, 8-inch, on boxwood scale (*fig.* 174, p. 45) £0 1 8
or per doz., 17s.; half doz., 9s.; perfectly adapted for the greenhouse, stable, dairy, etc.

175. GARDEN REGISTERING MINIMUM THERMOMETER, to show present temperature, and register the extreme of cold during absence, for pits, greenhouses, and out-door use (*fig* 175, p. 45) £0 3 6

176. **Garden Registering Maximum Thermometer,** to show present temperature and register the extreme of heat during absence, for greenhouses, etc., as above (*fig.* 176, p. 45) £0 8 6

177. THE GARDENER'S WINDOW THERMOMETER, in revolving frame, to turn to any angle (*fig.* 177, p. 47) £0 4 6

178. THE GARDENER'S GROUND THERMOMETER, with brass end for temperature of the ground when sowing seeds (*fig.* 178, p. 45) . . . £0 4 6

179. **Hot-bed Thermometer** (*fig.* 179, p. 45), especially adapted for pine and melon pits, as well as ground temperature to 18 inches 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 . . . . . £0 18 6 to £1 5 0

180. **Greenhouse or Garden Thermometers,** enamel tubes, boxwood scales and japanned cases for protection, range from 0° to 120°, 8 inch., 2s.; 10 inch., £0 3 0

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

182. DAIRY THERMOMETER (insulated) in glass tube (*fig.* 182, p. 47) especially adapted for testing milk £0 1 8

183. **Milk Test or Lactometer,** for detecting adulteration and showing the relative value of milk from different cows £0 4 6

184. CREAM TEST for showing the difference in quantity of cream between one cow and another, with examples £0 3 6

185. **The Gardener's Wet and Dry Bulb Hygrometer,** for showing the exact state of moisture in the greenhouse or open air, with improved porcelain scales (*fig.* 185, p. 47) £0 17 6

186. THE GARDENER'S RAIN GAUGE, as described in Symon's work on "Rainfall," and from which many of the results quoted in his monthly returns are obtained £0 12 6 and £0 15 6

187. **School or Garden Microscope** to be used, either simple or compound, with rack-work six powers, with mirror, condenser, infusioria box, forceps, object and glasses, arranged by L. CASELLA to meet the constant wants of the florist and gardener in examining seeds, animalculæ, etc. . . £1 5 0

188. *THE GARDENER'S OR COTTAGE BAROMETER (*fig.* 188, p. 47) . 0 12 6

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* "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 popularizing 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. 188.

FIG. 177.

FIG. 182.

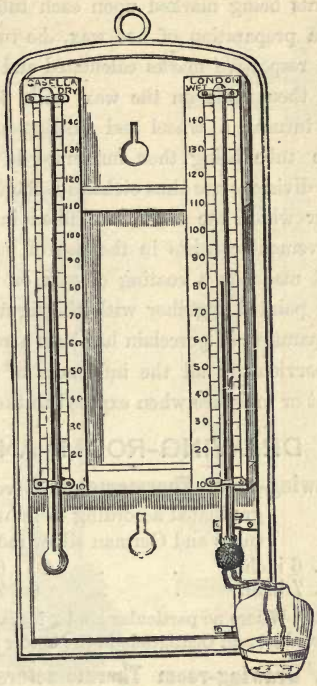


FIG. 185.

189. **Plantation or Farm Barometer** £1 10 0

190. PLANTATION OR FARM BAROMETER, more ornamental (*fig.* 182) 2 0 0

This instrument has been carefully prepared under the suggestions of Dr. Mann, Vice-President of the Meteorological Society, to meet the special need of a trustworthy indicator of the weather for farmers and planters. It is scrupulously correct, and has the further advantage of being made portable or otherwise by the most inexperienced without possibility of injury.

THERMOMETERS.

The extended application of the use of thermometers to the various branches of the arts and manufactures, as well as the precision and delicacy required in their construction, renders a complete description here of all the varieties impossible. In all branches of chemistry thermometers have long been indispensable, and but few processes of manufacture are now conducted without their use. For most of these purposes the following list will be found to contain the most suitable arrangement, and fresh lists are published by L. CASELLA from time to time of every new kind brought into use. Besides the actual make of many of these thermometers, the mode of dividing is of the greatest importance; this is done on all CASELLA'S thermometers of precision by means of a very beautiful arrangement of dividing engine, devised by the great Ramsden, and now applied with the utmost facility to this purpose, certain

points being marked upon each tube, the stems are coated with black, or immersed in a preparation of hot wax, the tube is then laid upon the engine, the distances of the respective marks calculated and arranged. On setting the engine the divisions are then made on the wax with the dividing needle with mathematical precision, by turning a wheel and shifting and re-arranging the tube from time to time. The tube being then immersed in a preparation of fluoric acid for a few seconds, the divisions are thus etched in, the tube is then washed in water and the wax removed, after which the marks are filled in with a preparation of black. Another great improvement consists in the use of porcelain slips or scales. The divisions on these are first made on a coating of wax or black, as in the case of the tubes, then cleaned off, and painted together with the figures, and permanently burnt in, whilst an improved preparation of porcelain has been arranged by L. CASELLA, by which they are rendered impervious to all the influences of dyes or coloring-matters, or changes arising from frost or moisture when exposed to the weather.

DRAWING-ROOM AND HOUSE THERMOMETERS.

Drawing-room Thermometers, ivory, on ebony or boxwood, double scales, *i.e.*, graduated according to Fahrenheit and Reaumur, or Centigrade, with enamel tubes and German silver mountings; very neat and easily read.

192. 6 inch.	.	.	£0	6	6	194. 8 inch.	.	.	£0	9	0
193. 7 inch.	.	.	0	7	6	195. 10 inch.	.	.	0	12	6

*** Where no particular kind of graduation is ordered, Fahrenheit in the plainer kind, and Fahrenheit and Centigrade in the better kinds of thermometers is usually sent.

196. **Drawing-room Thermometers,** ivory scales upon *papier mâché*, in various colors, black, blue, or green, of various shades, very neat, double graduations, viz., Fahrenheit and Reaumur, De Lisle or Centigrade (*fig.* 196, p. 50), seven inch., 9s. 6d.; eight inch. £0 10 6

197. DRAWING-ROOM THERMOMETERS, polished boxwood, elliptic form, bevelled edges, very neat, with German silver or fancy mountings, graduations as above, eight inch, 4s., ten inch, 6s. 6d., twelve inch (*fig.* 197, p. 50) £0 9 6

An excellent and cheap thermometer, very suitable for libraries, churches, etc.

198. **Drawing-Room Thermometer** divided into half-degrees, very sensitive, with mountings, etc., as above, twelve inch £0 14 0

199. DRAWING-ROOM THERMOMETER, eleven inch, on opal, mounted on ebony, with plain clear black figures and divisions, bold and very handsome £0 16 0

200. DRAWING-ROOM THERMOMETER, on opal and mahogany, as above 0 16 0

201. **Boxwood Thermometer** polished, for ordinary use, double scale and enamel tube, 8 inch. £0 3 0

202. BOXWOOD THERMOMETER, eight inch, plain, good, and reliable, well adapted for bed-booms, pantries, wine cellars, etc. . . . 18s. per dozen
Or, if less than 3, 1s. 8d. each.

203. **Six's Self-Registering Thermometers** for wine cellars, greenhouses, etc., to show present temperature and register the past extremes of heat and cold during any period of absence, in japan case with magnet, 8 in., 12s. 6d.; 10 in. £0 15 6

204. SIX'S THERMOMETERS, as above, 12 in., 18s. 6d.; 14 in. . 1 1 0

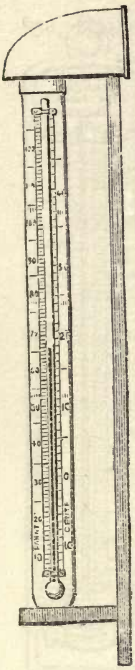


FIG. 209.

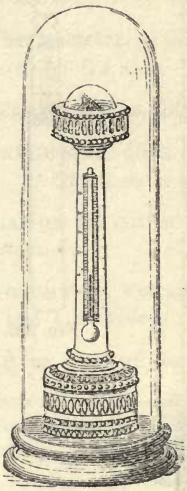


FIG. 207.

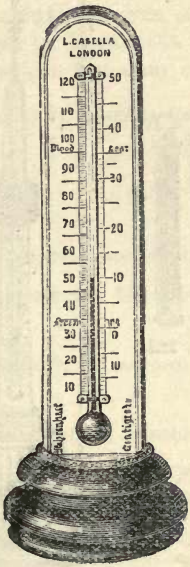


FIG. 205.

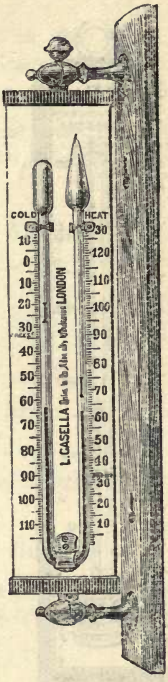


FIG. 210.

204* SIX'S THERMOMETER, as No. 204, on improved porcelain scale for out-door use, 10 inch., £1 5 0; 12 inch. or 14 inch. . . . £1 10 0

205. **Pedestal Thermometer** with ivory scale, on neat ebony base (*fig.* 205), 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

A most convenient form of thermometer, being movable at pleasure to any part of the house.

206. PEDESTAL THERMOMETER, ivory on *papier mâché*, on ebony base with glass shade, graduations, etc., as No. 205, very beautiful . . £0 15 6

207. PEDESTAL THERMOMETER, ivory, handsomely carved, with magnetic sun-dial, arranged to order for any part of the globe (*fig.* 207) . £1 10 0

208. PEDESTAL THERMOMETERS in various elegant designs, handsomely carved in ivory, with ebony base and glass shade (*fig.* 208), p. 50 £1 1 0 to £3 3 0

WINDOW THERMOMETERS.

209. **Window Thermometer,** ivory scale, enclosed in glass cylinder, mounted to revolve to any angle of sight, in mahogany frame, with copper roof for protection from rain (*fig.* 209), 8 inch, 15s. 6d.; 10 inch. £1 1 0

210. WINDOW THERMOMETER (Six's self-registering), showing past heat and cold during absence, as well as present temperature, very clear and distinct, on opal or improved porcelain, with indelible black figures and divisions, on mahogany bracket to revolve to any required angle (*fig.* 210), 10 inch., £1 15s.; 12 inch. or 14 inch. £2 0 0

As an out-door registering window thermometer this arrangement leaves nothing to be desired. See description of this principle p. 17.

Fig. 196.

Fig. 222.

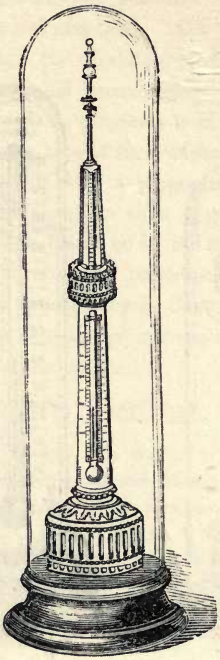


Fig. 208.

Fig 220.

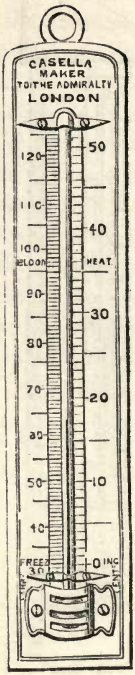


Fig. 197.

212. Window Thermometer (non-registering), on opal glass or improved porcelain scales, revolving in brackets on mahogany frame, etc., as No. 210, 10 inch. £1 12 0

213, **Cottage Window Thermometer,** with boxwood scale, revolving in mahogany frame, economically arranged for general use, 4s. 6d.; or with double graduations (*fig.* 177), p. 47 . . . . . £0 5 0

TRAVELLING OR POCKET THERMOMETERS,

Plain, self-registering, or in neat morocco cases, with ivory scales, range 0° to 130° more or less, as required for climate, graduated according to Fahrenheit, Reaumur, Centigrade, etc., or to any language.

ON IVORY SCALES.

214. 3 inch.	.	£0	6	0	217. 6 inch.	.	£0 9 6
215. 4 inch.	.	0	7	0	218. 7 inch.	.	0 10 6
216. 5 inch.	.	0	8	6	219. 8 inch.	.	0 13 6

The eight-inch on metal scale, 6s. 6d. to 8s. 6d.

220. **Sensitive Pocket Thermometer,** on delicate ivory or metal scales, 3½-inch, in cylindrical ivory or German silver cases, about ⅜-inch diameter (*fig.* 220) 8s. 6d. to £0 10 6

222. The same, in revolving German silver or light brass cases, ⅝-inch diameter, (*fig.* 222) £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.

223. **Alpine Maximum and Minimum Thermometer,** divided on the stems, on polished boxwood, in pocket case, very portable and convenient (*fig.* 47), p. 16 £1 5 0

224. PORTABLE MAXIMUM AND MINIMUM THERMOMETER, on metal scales, larger size, divided on the stems, as arranged by L. CASELLA for Dr. Livingstone, and Captains Burton, Speke and Grant, in mahogany case . £2 2 0

225. **Maximum Thermometer,** as designed by L. CASELLA for the Alpine Club, divided and figured on the stem £0 10 6

226. MINIMUM THERMOMETER, ditto, ditto 0 8 6

227. PLAIN THERMOMETER, ditto, ditto 0 7 6

The three in small mahogany case, £1 10s.

228. SOLAR RADIATION MAXIMUM THERMOMETER, black bulb, figured and divided on the stem £0 11 6

229. ALPINE HYGROMETER, wet and dry bulb, in morocco case, 6 inches long by 2 wide, and 1 inch deep £2 2 0

230. RAIN GAUGE, as arranged for Dr. Livingstone, 3 inches in diameter 0 17 6

Other instruments for travellers. See Aneroid, No. 112, etc.; Pocket Hypsometer, No. 86; Pedometer, No. 124; Altazimuth, No. 521; Chronograph, No. 126, Nos. 88, 502, and pages 66, 67, 68, 69, 70, etc., etc.

CHEMICAL AND MANUFACTURING THERMOMETERS.

The scales of these thermometers are either etched upon the glass stems, or they are written on paper or milk glass, enclosed in glass tubes, without fittings of metal or wood, so that they can be safely immersed in hot, caustic, or acid liquors (*fig.* 242), p. 52.

The *lowest* point on the scales of these thermometers is generally about 40° or 30° Fahrenheit. The *highest* point to which each ranges, as cited below, is approximate. It may range a few degrees above or under the quotation.

Thermometers with long scales (or wide spaces between the degrees) cost 1s. to 1s. 6d. extra.

Cardboard boxes for the thermometers are included in the following prices :—

	WITH FAHRENHEIT'S SCALE.	212°	350°	500° to 600°
232	Paper Scales, outer tube, ½ to ⅝ inch	2s. 3d.	3s. 0d.	4s. 0d.
233	Paper Scale, outer tube, ⅜-inch. .	2s. 9d.	3s. 6d.	4s. 6d.
234	Milk-glass Scale, outer tube, ½ to ⅝-in.	3s. 6d.	4s. 0d.	5s. 6d.
235	Milk-glass Scale, outer tube, ⅜-inch.	4s. 0d.	5s. 0d.	6s. 0d.
236	Scale on Tube with white back, ⅜-inch.	4s. 6d.	5s. 6d.	5s. 6d.

The thermometers Nos. 233, 235, and 236, have narrow cylindrical bulbs, to enable them to be passed through corks for insertion into retorts, etc.

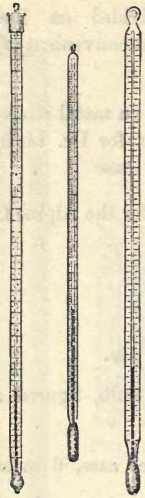


Fig. 242.

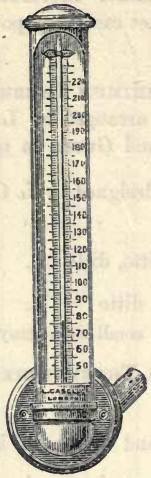


Fig. 252.

Fig. 264.

With Centigrade Scale.	100°	200°	360°
236* Paper Scale	2s. 6d.	3s. 0d.	3s. 6d.
237 Milk-glass Scale	3s. 6d.	4s. 0d.	5s. 0d.
238 Scale engraved on the tube . .	4s. 0d.	5s. 0d.	6s. 0d.
239 Scale on tube with white back .	4s. 6d.	5s. 6d.	6s. 6d.

The thermometers Nos. 236* to 239 are all contained in tubes of ¼ or ⅜-inch. diameter; and the bulbs are narrow and cylindrical, to permit the passage of the thermometer through corks for insertion into retorts, etc.

240. Thermometers as above, with two scales, Fahrenheit and Centigrade, 1s. 6d. each more than if one scale only.

242. **Chemical Thermometers** of greater precision, all glass (*fig.* 242), etched on the stem for more delicate experiments scales Fahrenheit or Centigrade 8 inch. in paper case to 212 Fahrenheit, 100 Centigrade . . . £0 7 6

243. Chemical Thermometer, 9-inch. to 320 cent. . . . 0 9 0

244. Chemical Thermometer, 12 to 15-inch. to 650 Fahrenheit=320 cent. 0 11 6

245. 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 (or as required) in brass case £1 10 0

246. **Chemical Registering Thermometer,** improved on Professor Phillip's principle for registering high temperatures in any position £0 15 6 to £1 10 0

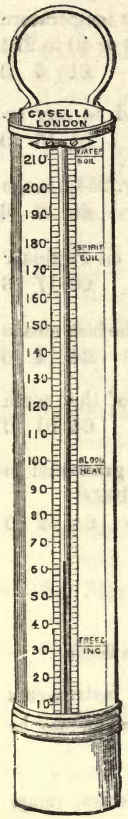


FIG. 262.

FIG. 266.

FIG. 276.

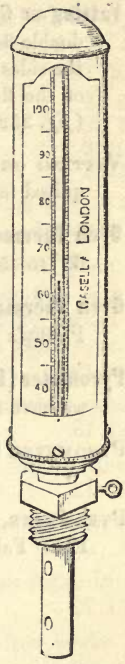


FIG. 278.

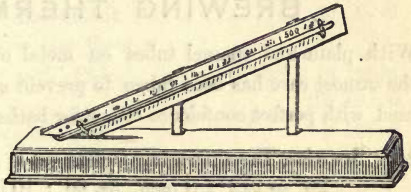


FIG. 254.

MANUFACTURING AND VATTING THERMOMETERS.

247. **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 10 0

248. Ditto, as above, if five feet below the scale 2 15 0

*** Extra lengths at prices increasing in proportion.

249. **Vatting Thermometer,** for brewers and sugar refiners, with hard wood frame and metallic scale, range 30° to 212° (or as required,) projecting 3 feet below scale
£1 8 0

250. VATTING THERMOMETER, as above, 4 feet below the scale . . 1 12 0

252. **Vatting or Gyle Tun Thermometers,** 10-inch., with bold figures and divisions, double flanges, the tube bent back, and protected, for inserting the bulb into the sides of vats or mash tuns and projecting into the fluid, the temperature of the fluid being thus always visible outside. Range 30 to 120 or 40 to 212 (*fig.* 252), p. 52 . . . . . £1 5 0

253. Vatting or Gyle Tun Thermometer, of larger size, bolder, and to any required temperature £1 15 0

254. **Oven Thermometer** on cast iron base, to equalize the temperature (*fig.* 254), range 60° to 450° with baking heats marked on the scale . . £0 12 6

255. **Oven Thermometer,** the same as No. 254, to register extreme heat, on Professor Phillip's principle £0 17 6

256. **Pyrometer (Daniell's),** for measuring the expansion of metals, being the best means we have for ascertaining high temperatures . . . £4 4 0

257. Pyrometer (Gauntlett's), as much used in the metal foundries of the north £4 10 0

258. Pyrometer, improved for general chemical manufacturing purposes, graduated to 1200° Fah., and warranted very efficient, and true up to 900° to 1000° £4 4 0

BREWING THERMOMETERS (*Fig.* 252), p. 53,

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.

259. **Brewing Thermometers,** plain tubes and metal scales, in japanned cases, range 20° to 212°; 8 inch., 3s. 6d.; 10 inch., 4s. 6d.; 14 inch., 5s.

260. **Brewing Thermometers,** enamel tubes, metal scales and japanned cases, 8 inch., 4s. 6d.; 10 inch., 5s. 6d.; 14 inch., 7s. 6d.

262. Brewing Thermometers, enamel tubes, metal scales and copper cases, 8 inch., 5s. 6d.; 10 inch., 6s. 6d.; 14 inch., 11s. 6d.

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

263. Brewing Thermometers, of extra strength, with best enamelled tube, showing 30° to 212°, in strong rivetted copper case, as used in large brewing establishments, 10 inch., 11s. 6d.; 14 inch. £0 16 0

264. **Blind Scale Thermometer,** with ivory pocket scale for reading off, and sliding index to fix at any required temperature, enamelled tube in stout rivetted copper case as above, 10 inch., 16s.; 14 inch. (*fig.* 264) p. 52 £0 18 6

265. Brewing Thermometer, open range, *i.e.*, 40° to 110° in copper case in single degrees, 8 inch., 6s. 6d.; 10 inch., 7s. 6d.; 14 inch. . . £0 12 6

266. **Gyle Tun Thermometers,** with enamelled tubes in single degrees, showing 40° to 120° average, 12-inch. scales on mahogany with protected stem, 2 feet long (*fig.* 266), p. 53 . . . . . £1 10 0

267.	2 feet 6 inch.	£1 12 0	272.	4 feet 6 inch.	2 3 0
268.	3 feet	1 15 0	273.	5 feet	2 7 0
269.	3 feet 6 inch.	1 17 6	274.	5 feet 6 inch.	2 10 0
270.	4 feet	2 0 0	275.	6 feet	2 15 0

276. Mash Tun Thermometers, enamelled tubes, single degree showing 100° to 212° same size as above (*fig.* 276), p. 53 . . . 5s. each extra

277. **Steam or Hot Water Thermometer,** small size, to 220°, brass tube, plain and bold, 7-inch. scale, with nut screw, for showing the temperature of water pipes above 2 inches diameter in heating apparatus; carefully packed and water-tight, with screw plug for closing the tube when the thermometer is not in use £1 8 0

278. Steam or Hot Water Thermometer, of larger size, with porcelain scale, the tube projecting 4 inches, (*fig.* 278), p. 53 . . . £1 12 0

279. **Superheated Steam Thermometer,** as made by L. Casella for the Government £1 8 0

280. Iron Mercury Cup, occasionally used with the above, or for closing the opening when the thermometer is not in use . . . £0 3 6

282. **Varnish Maker's Thermometer,** 3 feet long, with 12-inch. brass scale, in iron case £1 15 0

283. **Hot Blast Thermometer,** of milk glass for testing hot air at iron works £0 6 0

284. **Vinegar Maker's Thermometer,** to 120° Fahrenheit . . 0 1 6

Gas thermometers, see Gas Gauges.

285. **Sugar Boiling Thermometers,** 3 feet, with 12-inch. scales to 280°, in japan cases £1 10 0

286. Sugar Boiling Thermometers, in copper cases . . 1 15 0

GAUGING INSTRUMENTS, FOR MALSTERS, DISTILLERS, TIMBER MERCHANTS, ETC.

287. **Complete set of Gauging Instruments,** as used by the Board of Customs, with book of directions and boxwood calipers for warm climates . £3 13 6

288. Complete Set of Gauging Instruments, also adapted for oil gauging 4 4 0

289. **Hull Calipers,** for measuring square timber, 12 inches, 25s.; increasing 1s. for every 2 inches up to 36; and 2s. ditto, up to 48 inches

290. Bow Calipers, for round timber, 10 inches 17s.; increasing 1s. per inch up to 48 inches

Iron Bar Measures for use with the above:—

292. 3 feet $\frac{3}{4}$-square, divided on four sides £0 15 0

293. 3 feet $\frac{5}{8}$-square, divided on two sides, with handle . . . 0 11 0

294. Plank Rule Caliper, 12-inch. 0 4 6

295. Scribing Iron 0 3 6

296. **Pocket Scribing Iron** £0 3 6
297. Norway Rag Stones 0 1 0
298. 6 feet Tape, with inches on one side and qr. girt on the other . 0 4 6

Timber Contenting Rules:—

299. 18 inch. 0 9 6
300. 24 inch. 0 13 6
302. 36 inch. 0 18 6
303. **Timber Cubing Rules,** 3 feet 0 16 0
304. **Combined Timber and Plank Rules,** 18 inch. . . . 1 8 0
305. **Timber Measuring Rods,** painted, 5, 10, 16 and 20 feet, in feet and quarters 5s. 6d., 8s. 6d., 14s., and £1 0 0
306. Timber Measuring Rods, 5, 10, 16 and 20 feet, in feet and inches 8s., 12s., 19s., and £1 6 0

If jointed, each joint extra 4s.

307. **Spirit Rules,** showing the quantity in any spirit cask whose capacity does not exceed 20 gallons, with line of inches and tenths, and diagonal line, 3 to 6 feet, 4 to 12 fold . . . . 5s. 6 to £1 1 0 each
308. Spirit Rules, same as above in one piece . . 5s. to 7s. 6d. „
309. **Screw Spile Rods,** boxwood, with line of inches and tenths and diagonal, 30 to 60 inches . . . . . 6s. to 9s. each

Same price with vinegar dips when required.

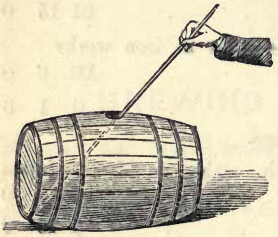


Fig. 319.

310. **Table Rods for the outs of Casks,** 4 and 5 feet, lancewood, imperial or old wine £0 5 6 and £0 6 6
312. Table Rods for the outs of Casks, 4 and 5 feet, brass, ditto ditto £2 12 6 and £3 0 0
313. Dip Tape, in inches and tenths with plumb £0 2 6
314. **Ullage and Casting Rules,** 4½ to 24-inch., boxwood 6s. 6d. to 12s. each
315. Ullage and Casting Rules, 4½ to 12-inch., ivory 12s. 6d. to £1 8 0
316. **Valuation and Reducing Rules,** 6 to 24-inch., boxwood 3s. to 8s. „
317. Valuation and Reducing Rules, 6 to 12-inch., ivory 10s. to £1 0 0
318. **Steel Oil Rods,** 3 to 6 feet, round, in inches, tenths and diagonals £1 0 0 to £1 6 0
319. **Beer Rule or Dipping Rod,** 4 feet (*fig.* 319) . . . 0 5 6
320. Beer Rule or Dipping Rod, superior, for hot climates . 0 6 6
322. Beer Rule or Dipping Rod, 3 to 4 feet, 4 to 8 fold. 5s. 6d. to 11s. 6d. each.

Directions for Use.—This rule will show the ullage in any regular made cask, let it be either lying or standing. Example:—Suppose a barrel or 36-gallon cask is present on ullage, and that it is standing, or S.S.; seek for such on the rule, viz., barrel 36 gallons, S.S.; dip the cask perpendicularly, and the wet inches on that line will be the number of gallons therein. Should the cask be lying, or S.L., seek for such, viz., barrel 36 gallons, S.L., the wet will also indicate the contents, or ullage. Whatever be the full contents of the cask, a similar result will be found by looking on that part of the rule where such is denoted, observing that each size cask has two scales, or lines, viz., for S.L. and S.S.

To find the full contents of a cask when such is not marked thereon, or known, with that part of the rule marked "imperial gallons" dip the cask as in the engraving, and the mark at B is the number of gallons it will contain when full.

323. **Boxwood Screw Stick,** for malt gauging, with line of inches, tenths and diagonal, 30 to 72 inches . . . 6s. to 10s. 6d. each

324. Lancewood Malt Rods, in one piece with line of inches, and tenths and diagonal, 24 to 60 inches . . . 2s. 6d. to 5s. 6d. each

325. Flat Malt Rods, in brass, with line of inches and tenths, 24 to 60 inches, 10s. to 20s. each.

326. **Flat Malt Rods,** steel, 24 to 60-inch. . . . 7s. 6d. to 14s. „

327. Malt Float, brass, for metal rod £0 6 0

328. Brass Plate, with handle 0 2 6

329. **Brass Plate,** to fit small screw stick 0 1 6

330. Malt Receivers, three sizes . . . 2s. 6d., 5s., and 0 6 6

332. **Corndrometer,** see Specific Gravity Instruments.

333. Rule or Gauge, for measuring horses, to close up in form of walking stick £1 0 0

334. Cattle Gauge, with tape measure and plain instructions, showing the exact weight and value of the animal £0 8 6

335. Malt Dippers, 18 to 24 inches . . . 2s. 6d. to 3s. each

336. **Malt Tapes,** best linen, in box (Casella's improved corrected), 400 inches 8s.; increasing 1s. per 100 inches to 1000

337. Malt Rules or Veries, 6 to 24 inch, boxwood . 6s. 6d. to £0 14 0

338. Malt Rules or Veries, ivory 6 inch 15s., 9 inch 26s., 12 inch. £1 13 0

339. **Bale Calipers,** with satinwood blades for measuring ships' cargoes, 3 feet 12s.; increasing 1s. per foot to 9 feet; and 2s. 6d. ditto, from 9 to 14 feet

340. Bale Calipers, with mahogany blades, inlaid with boxwood, for measuring indigo, etc., 4 feet, 18s.; 5 feet, 20s.; 6 feet, 22s.; 7 feet £1 4 0

342. Gauge for Measuring Rope, boxwood with brass caliper . 0 4 0

343. **Gauge for Measuring Rope,** ivory with German silver ditto 0 15 0

344. Float Gauges, with satinwood blades, 2 feet, 4s. 6d.; increasing 6d. per 6 inches to 8 feet; and 1s. ditto from 8 to 12 feet.

345. Club Caliper, boxwood, brass bound for measuring tea chests, etc. £1 15 0

Copper Measures:

346. ½ gill	. . .	£0	4	6	353. 1 gallon	. . .	£0	11	6
347. 1 „	. . .	0	5	0	354. 2 „	. . .	1	16	6
348. ½ pint	. . .	0	5	6	355. 3 „	. . .	1	2	6
349. 1 „	. . .	0	6	0	356. 4 „	. . .	1	9	0
350. 1 quart	. . .	0	7	6	357. 5 „	. . .	1	16	0
352. ½ gallon	. . .	0	9	0					

358. **Graduated Glass Measures:** 1 gill, cylinder shape, graduated in tenths, 3s.; 4, 6, and 8 gill, graduated in quarters, 6s., 7s. 6d., and £0 9 0

All measures are in strict conformity with Her Majesty's Exchequer.

359. **Set of Standard Measures,** gun metal, from ½ gill to 1 gallon, in oak case with lock and key, and 7 plate glasses in separate oak case, complete £15 10 0

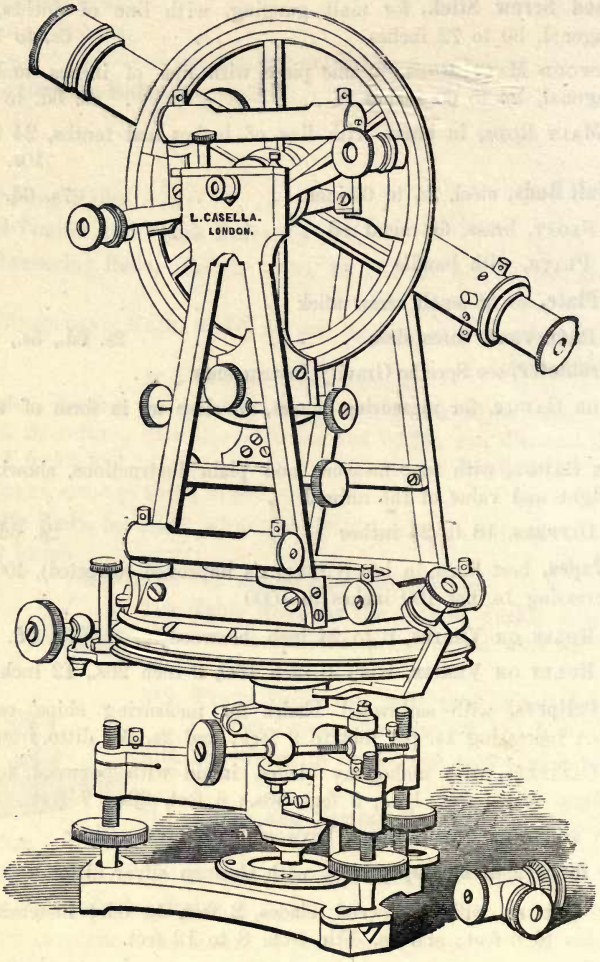


FIG. 375.

SURVEYING INSTRUMENTS.

THEODOLITES, LEVELS, CIRCUMFERENTERS, ETC.

In submitting the accompanying list of instruments to surveyors, engineers, architects, etc., care has been taken to enumerate such only as embrace the latest improvements.

Where extra strength or rigidity has been required for any particular service, this has been carefully given, and where lightness or great portability has been wanted, as in light and handy instruments for travellers, or preliminary surveys, the utmost care has been taken to retain sufficient rigidity and to adapt all to the present advanced state of mechanical science.

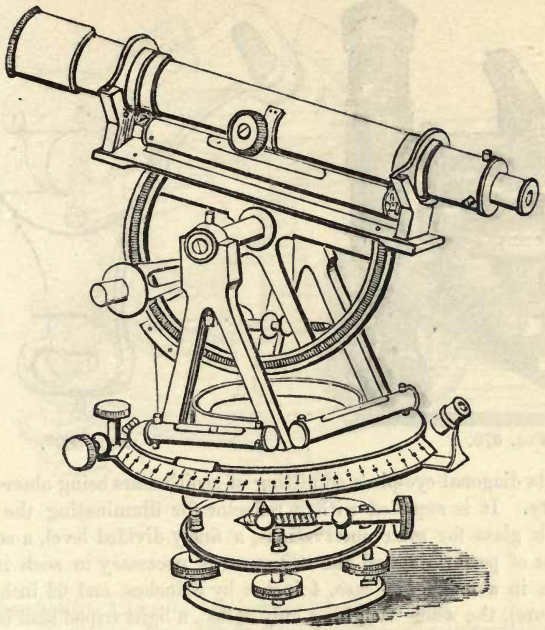


FIG. 366.

360. **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

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

363. „ 4-inch., ditto, with two telescopes . . 24 0 0

364. „ 5-inch., ditto, with one telescope . . . 22 10 0

365. „ 5-inch., ditto, with two telescopes. . . 27 0 0

366. „ 6-inch., verniers reading to 20 seconds, divided on silver, in mahogany case and tripod stand, complete (*fig.* 366) . £28 10 0

367. **Theodolite,** 6-inch., ditto, with two telescopes . . 34 10 0

368. „ 7-inch., with extra large telescope, verniers reading to 10 seconds, divided on silver, with case and stand as above . . £35 0 0

369. THEODOLITE, 7-inch., ditto, with two extra large telescopes . 44 0 0

*** The above Nos. 360 to 369 if with locking plate and tripod screw adjustment (as *fig.* 375), instead of the usual parallel plates are for the 3 inch., 22s., 4 inch., 30s., 5 inch., 45s., 6 inch., 60s., 7 inch., 75s. each extra; and if divided on the brass circles instead of on silver, 3 inch., 22s., 4 inch., 30s., 5 inch., 37s., 6 inch., 45s., 7 inch., 60s. each less in price.

370. **The Traveller's Transit Theodolite,** arranged by L. CASELLA as a small light portable instrument for Alpine and military surveying, and occasional astronomical observations. In designing this instrument the object has been to condense into the least possible bulk the smallest instrument with which useful results can be obtained. Its telescope gives it the advantage of optical power, and it has complete 3-inch. circles, both horizontal and vertical, with verniers showing to one minute; it can therefore be used not only as a theodolite for terrestrial surveying, but also as an *altazimuth* for determining time, latitude, and azimuth, astronomically. It will be found convenient in

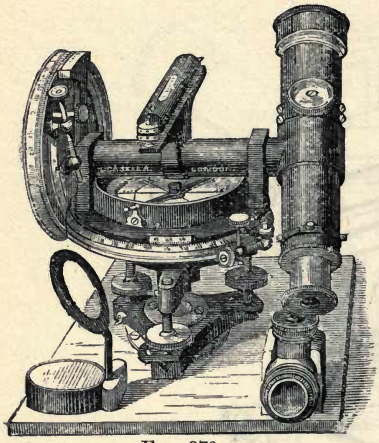


FIG. 370.

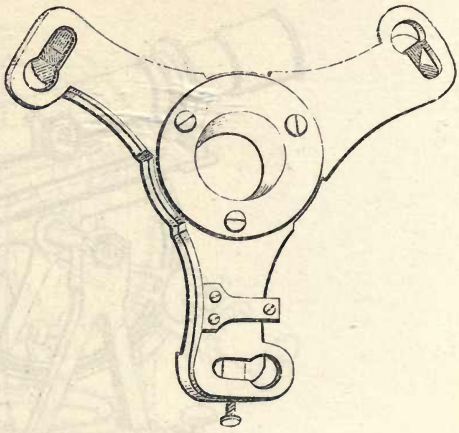


FIG. 382*.

use, its diagonal eye-piece admitting of zenith stars being observed with perfect facility. It is supplied with a reflector for illuminating the wires at night, a dark glass for solar observations, a finely divided level, a compass, and the means of performing all the adjustments necessary in such instruments. It packs in a mahogany case, 4 inches by 5 inches, and 6¾ inches long (outside measure), the whole weighing only 3½lbs., a light tripod staff is also added. A paper descriptive of the instrument was read at the meeting of the British Association at Exeter, 1869, in section E, by Lt.-Col. A. Strange, F.R.S., Inspector of Scientific Instruments, India Department (*fig.* 370). . £15 15 0

*** For mining surveys where closer dividing, as well as angles below the base line, are required, the size of this instrument is increased to 4, 5, or 6 inch. circles, divided to 30 or 20 seconds, with larger telescope and compass in proportion, the handy portable character of the instrument still being preserved; the prices are £19 10s., £24, and £30.

372. TRAVELLER'S TRANSIT THEODOLITE, as above, with the telescope in centre, the supports being raised to allow it to revolve vertically. In this arrangement though the height is increased, the zero or centre is found more exact in very close measurements, and an arrangement is added by which the horizontal circle may be set to zero at each observation without disturbing the adjustment £18 0 0

373. **Transit Theodolite,** 4-inch., with locking plate, etc., as 375, the circle divided on silver, with verniers reading to one minute, in mahogany case and tripod stand, complete £25 10 0

374. TRANSIT THEODOLITE, 5-inch., verniers reading to 30 seconds, divided on silver, complete, with locking plate, as above. . . . £29 10 0

375. TRANSIT THEODOLITE, 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.* 375), p. 58 £34 10 0

376. **Transit Theodolite,** as above, with illuminated axis, axis level and lantern £38 0 0

377. TRANSIT THEODOLITE, as above, with two telescopes . . 45 10 0

378. **Transit Theodolite,** 7-inch., with transit axis and vertical circle, axis level and lantern, with tripod base, etc., as No. 375 above . . £43 10 0

379. TRANSIT THEODOLITE, 8-inch., as above . . . 51 0 0

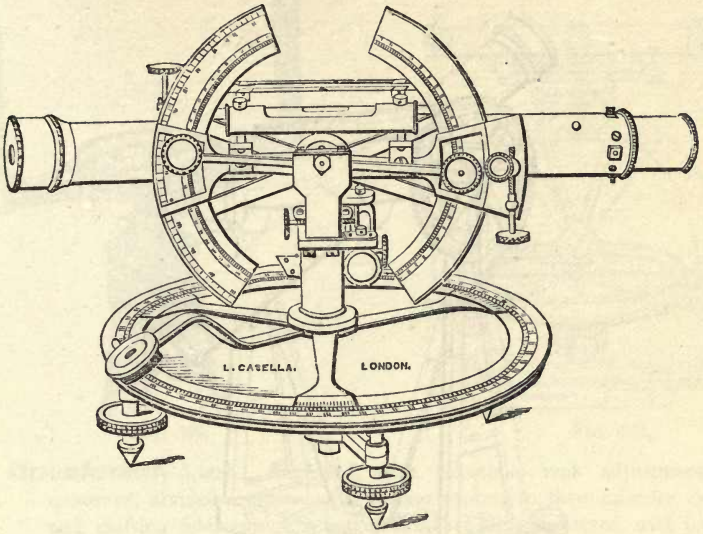


FIG. 382.

380. **Transit Theodolite,** 12-inch., for horizontal angles only . £40 0 0

*** The above theodolites from 373 to 380 have improved locking plates or tripod screw adjustment (as *fig.* 375), for stability, etc., but the 4, 5, and 6 inch. may be had with parallel plates if preferred, at 30s., 45s., and 60s. each less respectively; and if divided on the brass circles instead of on silver, the 4, 5, 6, and 7 inch. would be 30s., 37s., 45s., and 60s. each less in price.

382. **Everest's Theodolite** (*fig.* 382), 4-inch., with verniers reading to one minute, divided on silver, with triple adjusting screws, separate triangular locking plate (*fig.* 382*), p. 60, mahogany case and tripod stand, complete £19 10 0

383. EVEREST'S THEODOLITE, 5-inch., as above, reading to thirty seconds 22 0 0

384. **Everest's Theodolite,** 6-inch., verniers reading to twenty seconds, divided on silver, complete as above £26 10 0

385. EVEREST'S THEODOLITE, 7-inch., as above . . . 35 0 0

TRANSITS AND CIRCLES.

Portable Transit Instruments with divided circles, double verniers and microscopes, cross axial level, three micrometric eye-pieces, diagonal eye-piece, illuminating lanterns, graduated scales to levels, adjusting screws, etc., complete (*fig.* 393), p. 62, packed in red deal case:—

WITH CAST IRON STANDS.

386. Fourteen inch., 1½-inch. object glass as above, much used for testing and timing chronometers £20 0 0

387. Twenty-inch., 1¾-inch., ditto, ditto 22 10 0

388. Twenty-four-inch., 2-inch., ditto, ditto 25 0 0

389. Thirty-inch., 2½-inch., ditto, ditto 38 10 0

WITH BRASS STANDS.

390. Twenty-inch., 1¾-inch. object glass 26 0 0

392. Twenty-four-inch., 2-inch. object glass 29 0 0

393. Thirty-inch., 2½-inch. object glass 44 0 0

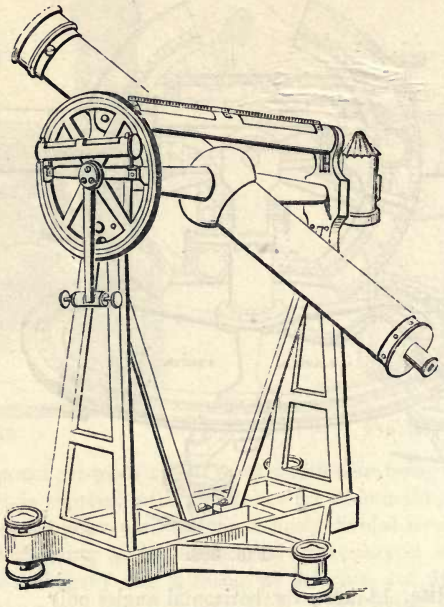


FIG. 393.

394. **Transit Instrument** of superior construction, furnished with two setting circles divided to minutes, and especially adapted for mounting on stone piers, 42 inch., 3¼-inch. object glass £67 10 0

395. **Reflecting and Repeating Circles,** of various construction to order.

396. **Altitude and Azimuth Instruments** with circles, divided on silver, reading micrometers, etc., complete to order.

*** For astronomical telescopes, see index.

CIRCUMFERENTERS OR MINERS' DIALS, CROSS SIGHTS, ETC.

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

The sizes quoted are those of the dials, the sights being much further apart. (See *fig.* 400), p. 63.

397. **Circumferenter,** 4-inch., with folding sights, in mahogany case, and jointed oak stand, with extra points for using at half-length . . £5 5 0

398. CIRCUMFERENTER, 5-inch., as above, with divided cover . . 7 7 0

399. **Circumferenter,** 5-inch., with divided circle to compass, sights, cross levels, stand, etc., complete as above £9 0 0

400. CIRCUMFERENTER, 6-inch., improved, with rack adjustments, divided cover, vernier reading to three minutes, cross levels, folding sights, ball and socket joint and jointed legs, with spare points to use at half length (*fig.* 400), p. 63 £10 10 0

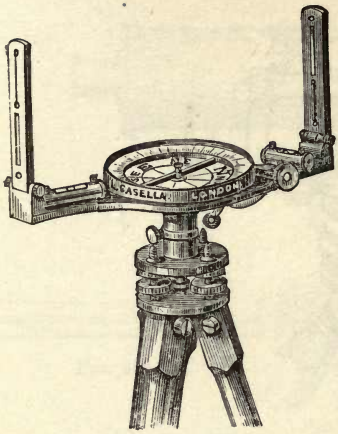


FIG. 400.

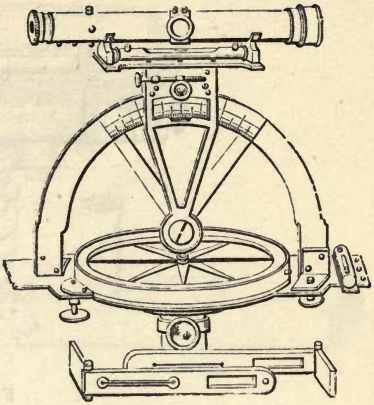


FIG. 402.

401. **Circumferenter,** 5-inch., improved, with telescope, rack adjustments, centre quadrant, divided compass, with vernier reading to three minutes, cross levels and shifting folding sights, ball and socket joint and stand, with jointed legs and spare points to use at half length (*fig.* 402) . . £15 0 0

402. CIRCUMFERENTER, 6-inch., improved, as above . . 16 10 0

403. MINERS' SAFETY LAMPS. (See Chemicals).

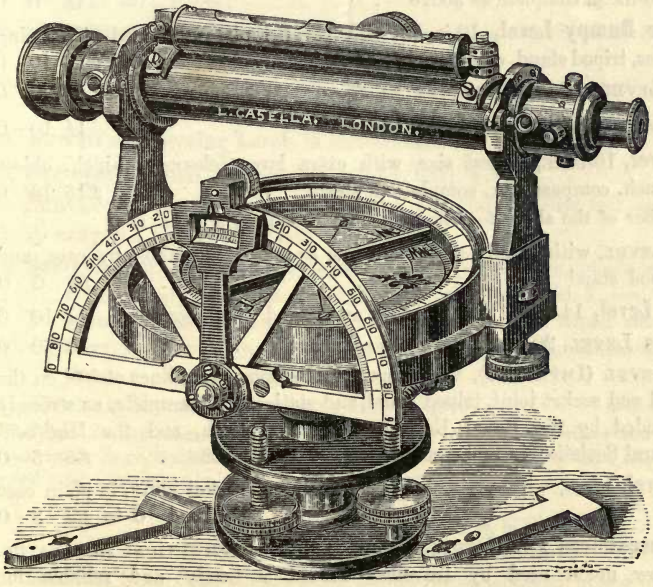


FIG. 404.

404. HEADLEY'S DIAL, much improved, with telescope, extra large compass (6-inch.), with brass cover, spare sights, raised arc divided to 1 minute, with capstan head, screw adjustment, parallel plates, and jointed legs to use at whole or half length (*fig.* 404) £16 10 0

404* HEADLEY'S DIAL, as above, with ball and socket joint without telescope £13 10 0

As plain, stout, practical instruments for rough work in mines, etc., these instruments can hardly be excelled.

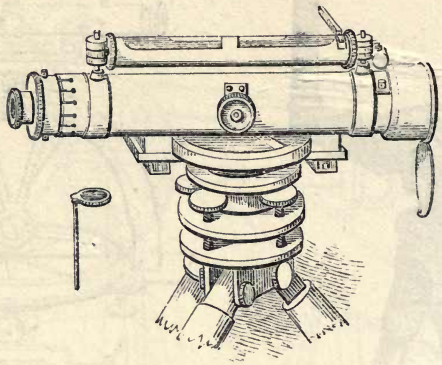


Fig. 409.

LEVELS.

405. **Y. Level,** 12-inch., with parallel plates, divided silver ring to compass, two eye-pieces, screw drivers and levers, tripod stand, etc., complete in mahogany case £12 0 0

406. Y. Level, 15-inch., complete as above 13 10 0

407. Y. Level, 18-inch., complete as above 15 0 0

408. Y. Level, 20-inch., complete as above 18 0 0

409. **Gravatt's, or Dumpy Level,** 10-inch., with parallel plates, divided silver ring to compass, tripod stand, etc., complete in mahogany case (*fig.* 409) £13 10 0

410. Gravatt's Level, 12-inch., complete as above . . 14 0 0

411. Gravatt's Level, 14-inch., complete as above . . 14 10 0

412. **Gravatt's Level,** 16-inch., largest size, with extra large telescope, 2-inch. object glass, 5-inch. compass, etc., complete as above . . £15 15 0

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

413. A Simple Level, with parallel plates and one eye-piece, in mahogany case, and light tripod stand £6 0 0

414. **Troughton's Level,** 14-inch., with compass and tripod stand, complete 11 10 0

415. Troughton's Level, 20-inch., complete as above . . 13 10 0

416. 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.* 416), p. 65 . £5 5 0

417. **Drainage Level,** brass, with plain sights, and ball and socket joint, in plain case £1 4 0 to £2 8 0

419. **Mountain Barometers** and Casella's Improved Hypsometrical Apparatus, being now much used by travellers abroad as handy and reliable for measuring heights in rough mountain districts, may be also classed amongst surveying instruments. See Nos. 15, 16, 85, and 86, also the Mariotti, or Boylean pocket standard barometer, No. 88 and Addenda.

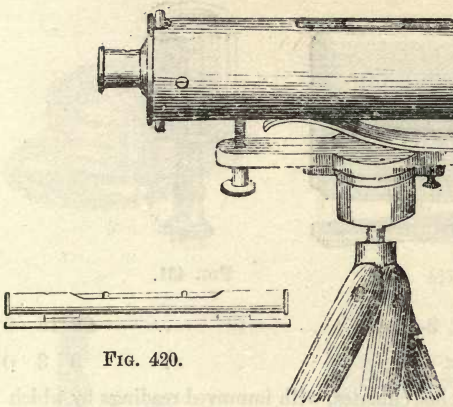


FIG. 420.

FIG. 416.

FIG. 426.

Brass Pocket Levels, with adjusting screws, in maroon cases (*fig.* 420):

420. 4 inch.	. .	£0 7 6	424. 10 inch.	. .	£0 18 0
422. 6 inch.	. .	0 10 6	425. 12 inch.	. .	1 5 0
423. 8 inch.	. .	0 13 6			

426. **Spirit Levels** (*fig.* 426), mounted in mahogany frames, with brass plates, 6 inch., 3s.; 8 inch., 3s. 8d.; 10 inch., 4s. 6d.; 12 inch. . . £0 5 6

427. CLINOMETER LEVEL, brass, 6-inch., with level, sights and graduated arc, for determining inclination of strata, etc., etc., in neat case with socket for staff, (*fig.* 427), p. 66 . . . . . £1 14 0

428. CLINOMETER LEVEL, as above, 9-inch., available also for draining and levelling, £2 15 0

429. PLAIN DRAINAGE LEVEL, with sights, spring adjustment beneath, brass-pointed tripod stand in mahogany case, Ordnance pattern . . £4 5 0

430. **Burrell's Reflecting Level,** in maroon case . . . 1 5 0

431. **Surveyor's Cross,** octagonal form (*fig.* 431), p. 66 . . 0 10 6

432. SURVEYOR'S CROSS, with movable head, and divided circle and compass 2 2 0

433. SURVEYOR'S CROSS, with ball and socket 2 10 0

434. **Surveying Square or Pantometre** (brass), with compass, telescope, and rackwork, divided body with screw adjustment, inverted divided semicircle, and level triangular base with adjusting screws, in case, with tripod stand £5 0 0

434*. SURVEYING SQUARE OR PANTOMETRE, as above, with universal joint, without stand £4 0 0

435. OPTICAL SQUARES, for showing right angles . . 15s. 6d. to 1 1 0

The last six instruments are useful for setting out perpendiculars and horizontals, the optical square in particular being very portable; a survey involving right angles only may be effected very expeditiously by it.

LEVELLING STAFFS,

With Foreign or English Graduations.

436. **Levelling Staff, Sopwith's,** 14 feet, 3-draw, brass mounted, of best make £2 5 0

437. SOPWITH'S LEVELLING STAFF, as above, 16 feet . . 2 15 0

438. SOPWITH'S LEVELLING STAFF, as above, with socket fittings, 3-joint 3 0 0

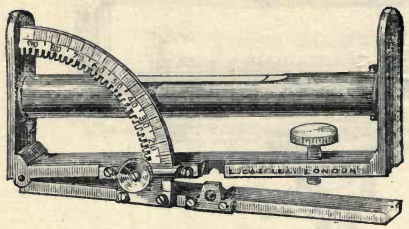


FIG. 427.

FIG. 431.

439. **Levelling Staff, Gravatt's,** 17 feet, 3-draw . . . £2 15 0

440. **Metford's Levelling Staff,** 13 feet 3 3 0

441. LEVELLING STAFF, half-round, for hot climates, with improved readings by which they are clearly visible at full one half greater distance than those of ordinary make, especially arranged for India by Colonel A. Strange, F.R.S., chief of the Scientific Department of the Indian Government . £3 3 0

442. LEVELLING STAFF, 14 feet, 3-draw, half-round, as especially made for the Ordnance and Indian Government (SOPWITH'S) . . £3 3 0

The above staffs are figured and divided on sheets thoroughly prepared against wet, and all the influences of climate and the weather; some, however, prefer them painted on the wood, in which case they are 10s. each extra.

They are also painted in foreign measure as Metric, Danish, Rhineland or Prussian, at 3s. each extra.

443. **Levelling Staff,** 10 feet, folding in two, light and handy, for drainage levelling £1 4 0

444. LEVELLING STAFF, as above, 8 feet 1 2 0

PRISMATIC, SURVEYING, AND MINING COMPASSES, ETC.

445. **Prismatic Compass,** with sights plain, in maroon or sling case, 1½-inch, £1 4 0; 2-inch., £1 8 6; 2½-inch., £1 13 6; 3-inch., £1 18 6; 3½-inch., £2 2 6; 4-inch. £2 6 0

446. PRISMATIC COMPASS, with sights, shades, and mirror, in maroon or sling case (*fig.* 446), p. 67, 1½-inch., £1 10 0; 2-inch., £1 18 6; 2½-inch., £2 3 6; 3-inch., £2 8 6; 3½-inch., £2 13 6; 4-inch. . . £2 16 0

Either of the above with extra light aluminium ring, 10s. to 14s. additional.

447. **Prismatic Compass Tripod Stand,** plain, with horizontal motion £1 5 6

448. PRISMATIC COMPASS TRIPOD STAND, with ball and socket joint for horizontal and vertical motions £1 12 0

449. PRISMATIC COMPASS, 2¾-inch., with sights, aluminium ring, in maroon case; Ordnance and War Office pattern £2 10 0

450. **Kater's Azimuth Pocket Compass,** with magnetic floating card and folding sight, for estimating angular distances on land or at sea . £2 10 0

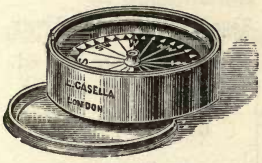


FIG. 486.

FIG. 485.

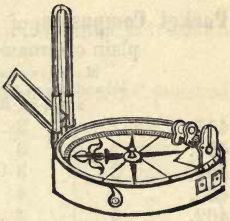


FIG. 447.

FIG. 470*.

FIG. 470.

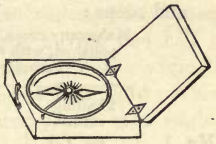


FIG. 457.

MINERS' COMPASSES,

In square mahogany boxes ¼ to 1-inch thick outside, with sights and covers, bar needles, agate caps and stops.

	3-inch. square.	4-inch. square.	5-inch. square.
452. **Miners' Compasses,**	£1 1 0	£1 3 0	£1 5 0

453. MINERS' COMPASSES, with floating card, same sizes and prices as above.

454. MINERS' COMPASSES, with silvered divided ring, bar needle, etc.:

4-inch. square.	6-inch. square.	8-inch. square.
£1 12 6	£2 0 0	£2 10 0

455. MINERS' COMPASSES, with silvered divided ring, etc., as above, and two levels:

4-inch. square.	6-inch. square.	8-inch. square.
£2 2 0	£2 10 0	£2 17 6

456. **Mining or Surveying Compass,** on mahogany, with cover, 7½-inch. divided metal dial with needle and stop, raised divided metal circle, telescope and two levels £3 3 0

456*. MINING OR SURVEYING COMPASS, with tangent screw adjustment to telescope and triangular base, with adjusting screws and tripod stand, complete £8 10 0

For tropical climates or glaring light, Nos. 456 and 456* (of foreign make), can have black dials and white figures when preferred.

For preliminary surveys as well as for general bearings from time to time, these plain hardy instruments are justly held in high estimation.

MAGNETIC POCKET COMPASSES,

Of superior quality, the indications of which may be fully relied upon irrespective of price. The most sensitive and durable being those with bar needles, with agate stones or jewels in the centres.

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

		Mahogany cases* with lid and stops (*fig.* 457) p. 67. 2 to 4-in. square.	Round leather cases† 2-in. circle.	Brass cases† 1⅜ to 2⅝-in. circle.	Round electrum cases.†	Round ivory cases.†
457.	No. 1	3s. 0d.	2s. 0d.	3s. 0d.	3s. 6d.	4s. 6d.
458.	„ 2	3 4	or with	3 6	4 6	7 0
459.	„ 3	3 6	floating card	4 6	5 6	9 0
460.	„ 4	4 0		5 0	6 6	
462.	„ 5	4 6	2s. 6d.			
463.	„ 6	6 6				

No. 1 to 6 in mahogany, if with floating card, 6d. each extra.

* In mahogany cases, if with rounded edges and French polished, 6d. extra.

† Stops to any of those thus marked (†), 1s. each extra.

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

		Mahogany cases, French polished, with rounded corners.		Leather cases.	Brass cases.		Electrum cases.	
		Floating card.	Bar needle.	Blue needle.	Floating card.	Bar needle.	Floating card.	Bar needle.
464.	No. 1	6s. 6d.	6s. 6d.	3s. 3d.	5s. 6d.	6s. 6d.	7s. 6d.	7s. 6d.
465.	„ 2	7 0	7 6	3 4	6 0	7 6	8 0	8 6
466.	„ 3	7 6	7 6	3 8	6 6	8 6	9 0	10 6
467.	„ 4	8 6	8 6	4 6	8 0	10 0	11 0	12 0
468.	„ 5	9 6	9 6					
469.	„ 6	11 6	12 0					

Pocket Compasses, in the form of a watch (*fig.* 470 and 470*), p. 67, with best bar needles, stops, and enamel plates:

		Gilt or electrum.	Silver.			Gilt or electrum.	Silver.
470.	No. 1	£0 14 6	£1 2 0	473.	No. 4	£1 0 0	£1 11 0
471.	„ 2	0 15 0	1 5 0	473*.	„ 5	1 2 0	
472.	„ 3	0 17 6	1 8 0				

Pocket compasses same sizes, in form of hunting watches, at a small extra cost.

474. **Moonlight Compass,** with transparent dial, clear and visible by star or moonlight, No. 1, with bar needle, agate cap and stop, 17s. 6d.; moonlight compass No. 2 . . . . . £1 4 0

475. MOONLIGHT COMPASS, with divided ring . £1 1 0 and 1 8 0

476. **Equestrian or Gregory's Compass,** especially arranged for use on horseback, in brass case, plain, 10s. 6d.; jewelled . . . £0 13 6

476*. EQUESTRIAN OR GREGORY'S COMPASS, watch form, gilt, 21s.; silver 1 10 0

477. DIPPING NEEDLE COMPASS (CASELLA'S), with 3-inch. needle and hard chrysolite bearings, for showing the dip of the needle in any locality, as well as its declination, in neat pocket case £1 1 0

478. **Improved Magnetic Indicator or Equestrian Compass,** in which a powerful flat bar needle on jewelled centres is placed beneath the compass dial, with the usual index above, the movement of the needle being so firm and sensitive as to adapt it admirably for use on horseback, watch form, 2-inch. (outside) £1 10 0

479. **Casella's Compass for the Blind,** this compass is of strong make, in neat mahogany case, 2½ inch. square by ½ inch. thick, with raised letters and stop, so arranged that blind persons (by feeling with their fingers) can with confidence and ease tell their exact local position or bearing, independent of any other object, within 2 or 3 degrees . . . £0 7 6 to £0 15 0

Boating or Yachting Pocket Compasses, with floating dials and gimbal movement, by which the dial is always perfectly horizontal:

482. **Gimbal Pocket Compasses,** with chrysolite cap and floating card, in round polished metal cases with lid; size of compass card:

1¼-inch.	1½-inch.	2-inch.	2½-inch.	3-inch.
14s. 6d.	15s. 6d.	17s. 6d.	£1 0 0	£1 3 0

If silver-plated 3s. to 7s. extra.

483. **Boating Compasses,** richly gilt, in morocco case, about 1¾-inch. diameter £0 18 6

484. Boating Compasses, silver-plated 0 15 6

485. Gilt Gimbal Compasses, in mahogany case, very excellent and reliable for boating or yachting purposes (*fig.* 485), p. 67 . . £0 17 6

486. **Singer's Patent Compass,** for bad light or defective vision, this arrangement consists of a white or mother-of-pearl card plate, having one half painted black, with the usual divisions (*fig.* 486), p. 67; the effect in obscure light is very striking, the points being clearly visible in the darkest night; it is applied to the boating, pocket, or any of the preceding compasses at a slight extra cost, pocket sizes for travellers, 7s. 6d.; 12s. 6d.; and . £1 1 0

487. Singer's Patent Compasses, boating sizes, in neat polished mahogany cases with jewelled centres, very superior and sensitive, 4¾ inch. outside £1 12 0

488. Singer's Patent Compasses, boating sizes, 4¼ inch. outside . 1 8 0

489. Larger sizes in brass, for boats or ships, with best needle and agate cap, £1 4s.; £2 2s.; and £3 3 0

490. **Trinket Compasses,** in form of lockets, globes, half globes, with gimbals, small watches, etc., in neat designs for the watch chain or waistcoat pocket, in gold, silver, gilt, etc., ¼ inch and upwards, from . 2s. 6d. to £2 2 0

492. **Damp Detectors,** being a very easy and sensitive means of ascertaining the exact state of damp or dryness of sheets or clothes; small size for the waistcoat pocket, in morocco case £0 5 6

493. Damp Detectors, with pendants 0 7 6

494. Damp Detectors, strongly gilt 0 10 6

CLINOMETERS AND BOX SEXTANTS.

495. **Clinometer, or Geological Compass,** for ascertaining the dip or inclination of strata, hills, etc., with index, showing the inclination in degrees and inches per yard, in square mahogany box, 4½ inch. by ¾ inch. thick . £0 10 6

496. Clinometer, or Geological Compass, 3-inch. . . 0 7 6

497. Clinometer, or Geological Compass, smaller size . . 0 6 6

495 to 497, if with best bar needles, 2s. each extra.

The inclination scale upon these clinometers, gives the value of any angle, as follows:—The angle having been ascertained from the divided arc upon the instrument, refer to that degree in the column marked *Angle*, and opposite, in another column, will be found the rise or fall in any given measured distance; thus, say the degree shown on the divided arc is 18, opposite to this number on the scale is 3, this indicating one part rise or fall in three, one foot in three, etc.

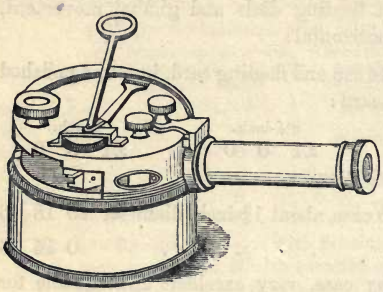


Fig. 507.

Fig. 502.

498. **Clinometer,** 12-inch., plain boxwood, with divided semicircle, inclination scale and plumb, for roughly estimating the inclination of roads, drains, strata, etc. The divisions on the arc show degrees and inches of elevation per yard. Price, in pull off case £0 16 6

499. Clinometer, 12-inch., boxwood, brass jointed, with divided arc and inclination scale, forming also a pocket rule £1 0 0

500. **Clinometer,** with spirit level, magnetic compass, and inclination scale, folding to 6 inch. £1 5 0

502. Clinometer, with two levels and sights, compass, inclination scale, and scale of fathoms in 6-inch. case. Best quality (*fig.* 502) . . £1 17 6

503. Clinometer, with bar needle to compass, and independent motion in the joint £2 2 0

504. **Vivian Clinometer,** in mahogany case 4½-inch. square by 1½-inch. thick, with two levels, divided arc and scales, very complete . . £2 2 0

505. Clinometer, brass, 6-inch., with level, sights, arc of inclination, etc. 1 14 0

506. **Box Sextant,** plain, in maroon case 3 10 0

507. Box Sextant, with telescope, in case (*fig.* 507) . . 4 4 0

508. Box Sextant, with telescope and supplementary arc, in case . 5 5 0

509. **Box Sextant,** as above, with levels, in case . . . 5 15 0

510. Box Sextant, with telescope, levels, supplementary arc, and divided circle for difference of hypothenuse and base £6 0 0

512. Leather Sling Case for Box Sextant, with strap for portability 0 7 6

513. **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 (*fig.* 513), p. 71 £9 0 0

514. Perambulator, with metal-bound wheel, for hot climates . 12 12 0

515. Perambulator, with metallic wheel, East India Company's pattern, expressly for India and tropical climates £14 10 0

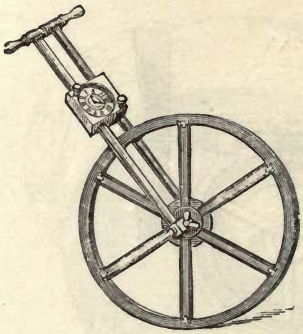


Fig. 513.

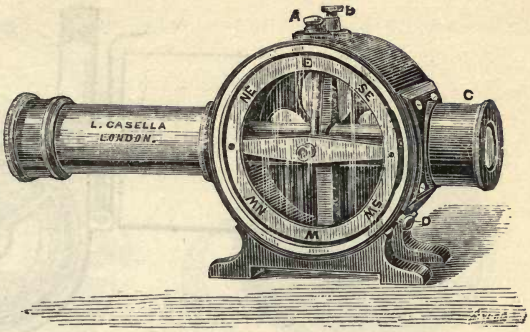


Fig. 521.

516. **Opiesometer, or Pocket Perambulator,** for measuring curved lines on maps, etc. 3s. 6d. and 4s. 6d.

517. **Trocheameter,** 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 10 0

518. **Current Meter,** for showing the rate of flow of tide in any stream or river, and the amount in gallons per hour flowing off (*fig.* 518) p. 72 £5 10 0

519. Current Meter (Double), in case 7 inch. by 2 inch., circuit representing twelve miles; answering also for ascertaining the rate of a ship's speed £6 10 0

520. Tide Gauge (Self-Recording) (*fig.* 72), p. 24, for showing the rise and fall of water in rivers, canals, locks, or any bodies of water, the rate of evaporation, etc., showing the exact time at which any increase or reduction may have occurred; see also No. 72 . . . . . £32 0 0

521. **Pocket Altazimuth, Casella's,** for travellers and military surveys, improved and modified by the kind assistance of Francis Galton, Esq., F.R.S. Altitudes, azimuths, compass-bearings, clinometric degrees and levels, are all obtainable by this strong and handy, but accurate little instrument, whose diameter is 2¼ inches, thickness 1⅛ inch., and weight 5½ oz. The advantages of its use have been so increased by the recent addition of an excellent telescope, as to make it really perfect for the various purposes to which it can be applied (*fig.* 521) £5 5 0

LAND CHAINS.

522. **Land Chains,** best machine made, Government pattern, with three sawn oval connecting rings, brass swivel handles, and usual marks. Two pole, 5s.; fifty feet, 5s. 6d.; Gunter's four pole, or sixty-six feet, 7s. 6d.; one hundred feet, 8s.

523. Land Chains, same pattern as above, rather lighter, 6d. to 1s. each less, or with only two intervening oval rings, 1s. to 2s. each less.

524. Land Chains, machine made, of best steel wire, hardened, tempered, and japanned with three sawn oval connecting rings, best swivel handles and marks, two pole, 7s.; fifty feet, 7s. 6d.; Gunter's four pole, or sixty-six feet, 13s.; one hundred feet, 14s.

Strong, light, and very convenient.

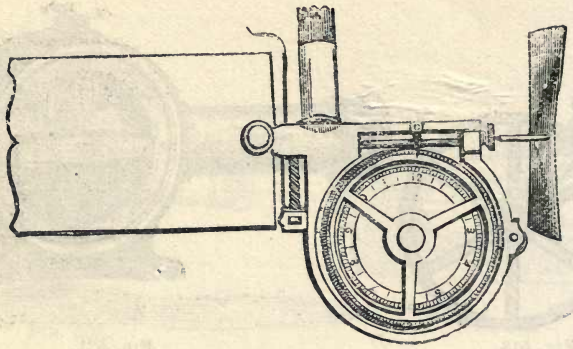


FIG. 518.

525. **Arrows for Land Chains,** of best japanned steel wire, hardened and tempered, 15 inch. long, 10 to the set for No. 524, 1s. 6d. per set.

526. ARROWS FOR LAND CHAINS, 15 inch. long, 10 to the set for No. 522, 1s. 2d. per set.

527. **Tape Measures,** to wind up, in leather cases, with folding handles, and best fine linen tape:

24 feet.	33 feet.	40 feet.	50 feet.	66 feet.	75 feet.	100 feet.
4s. 0d.	4s. 3d.	4s. 6d.	5s. 9d.	6s. 6d.	7s. 0d.	8s. 6d.

528. BEST TAPES ONLY (without cases), for the above:

24 feet.	33 feet.	40 feet.	50 feet.	66 feet.	75 feet.	100 feet.
1s. 2d.	1s. 6d.	1s. 10d.	2s. 3d.	3s. 0d.	3s. 4d.	4s. 0d.

529. TAPE MEASURES as No. 527, with tapes of second quality, 6d. each less.

530. **Tape Measures,** patent metallic, in hard leather cases, with folding handles:

24 feet.	33 feet.	40 feet.	50 feet.	66 feet.	75 feet.	100 feet.
5s. 0d.	5s. 9d.	6s. 6d.	7s. 0d.	8s. 0d.	9s. 0d.	11s. 6d.

532. TAPES ONLY (without cases), for the above:

24 feet.	33 feet.	40 feet.	50 feet.	66 feet.	75 feet.	100 feet.
2s. 3d.	3s. 0d.	3s. 6d.	4s. 0d.	5s. 0d.	5s. 6d.	8s. 0d.

533. **Tape Measures** (CASELLA'S improved corrected), in best hard leather cases with folding handles. The usual tendency of all tape measures to increase by expansion has induced L. CASELLA to give his best care to arresting this defect; the following list therefore of CASELLA'S corrected tapes he can confidently recommend as greatly improved in this particular, and certainly the most correct of any he has met with (*fig.* 533), p. 73:

33 feet.	50 feet.	66 feet.	75 feet.	100 feet.	120 feet.	150 feet.
5s. 3d.	6s. 3d.	8s. 0d.	9s. 0d.	11s. 6d.	13s. 6d.	16s. 0d.

534. **Measuring Tape** (Ordnance pattern), 50 feet, corrected as above, with yards, feet, inches, one 10ths and one 100ths, in strong leather case, with folding handles and rollers £0 12 0

535. **Patent Flexible Steel Tapes,** in hard leather cases as above, marked with links on the back, 33 feet or 2 poles £1 1 0

536. PATENT FLEXIBLE STEEL TAPES, 66 feet or 4 poles . . 1 16 0

537. PATENT FLEXIBLE STEEL TAPES, 9 feet, 9s. 6d.; 6 feet, 7s. 6d.; 3 feet, for the pocket £0 5 0

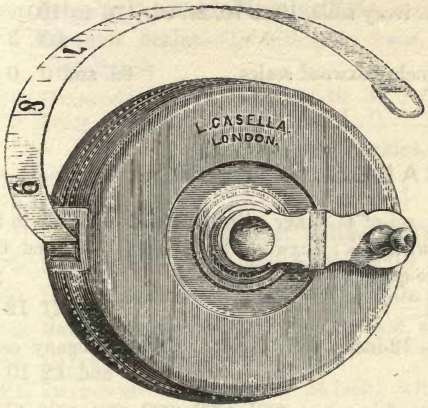


FIG. 533.

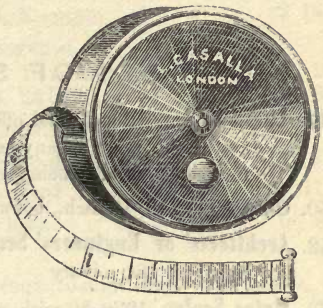


FIG. 538.

538. **Improved Spring Pocket Tape Measures,** with linen or electrotyped steel tapes, in brass, German silver, pearl or shell cases, with or without stops, 3 to 6 feet tapes; brass, from 1s. to 2s. 6d. each; German silver (*fig.* 538) 2s. 6d. to 0 5 0

SCALES, SQUARES, RULES, ETC.

539. **Metford's Improved Set of four Pocket Scales,** for architects and surveyors, in Russia leather case, £2 16s., or two in separate case . £1 10 0

Each scale is 6 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 17 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, besides the French mètre, the Rhineland foot = the Prussian and Danish foot. The Spanish vara, Russian vershokes, or any other foreign measure may be substituted if preferred.

Plotting Scales, ivory, divided on both edges, single or in sets:

540.	12 inch., 10×10, 20×20, to 50×50, 8s. 0d.; 6 inch. ditto .	£0	5	0
542.	12 inch. 60 to 70, 9s. 0d.; 6 inch. . .	0	6	0
543.	12 inch. 80 to 100, 10s. 6d.; 6 inch. . .	0	8	0

PLOTTING SCALES, boxwood, divided on both edges:

544.	12 inch., 10×10, 20×20, to 50×50, 2s. 2d.; 6 inch. . .	0	1	8
545.	12 inch. 60 to 70, 2s. 4d.; 6 inch. . .	0	1	9
546.	12 inch. 80 to 100, 2s. 9d.; 6 inch. . .	0	2	0

547. **Offset Scales** to match the 12-inch. ivory scale, 10 to 70, 2s. 6d.; 70 to 100 £0 3 4

548. OFFSET SCALES to match the 12 inch. boxwood scales . 8d. and 0 0 10

SETS OF SCALES IN CASES.

549. **Chain Scales,** 12-inch. and offsets, set of 6, either with both sides alike or in feet and links, in mahogany case with lock; boxwood, 21s.; ivory, 50s. and 60s. the only difference being in the quality of the ivory.

550. CHAIN SCALES, 18-inch., boxwood £1 12 0

552. **Architects' or Engineers' Scales,** 12-inch., fully divided, 6 in mahogany case; boxwood, 18s.; ivory . . . £2 2 0 and £2 10 0

553. **Metre Scales,** 12-inch., with offsets, 6 in a case, ·001, ·002, ·003, ·004, ·005, ·006; boxwood, 25s.; ivory £3 3 0

554. METRE SCALES, same as above, with English on the opposite edge, boxwood, 25s. ivory £3 3 0

555. **Chain Scales,** 6-inch., set of 6 in morocco case; boxwood, 10s. 6d.; ivory £1 1s. and £1 5 0

556. CHAIN SCALES, 4-inch., as above, ivory 0 15 0

557. CHAIN SCALES, 6-inch., set of 3; 10, 40, 20, 50, 30, and 60, in morocco case, ivory, 12s. 6d.; 4-inch. ditto £0 9 6

558. **Offset Scales,** 6-inch., $1\frac{3}{4}$ inch. wide, set of 6 in morocco case; boxwood, 12s. 6d.; ivory £1 16 0

559. OFFSET SCALES, 4-inch., ivory, set of 6 in morocco case, 25s.; 3 inch. ditto, ivory £1 1 0

560. OFFSET SCALES, set of 3 in morocco case, ivory 6 inch., 20s.; 4 inch., 14s.; 3 inch £0 10 0

562. TWO SMALL IVORY SCALES, 3-inch., in one case, one 20, 30, 40, and 50, the other $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{16}$, $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 6s.

SCALES, *fully divided,* Architects' or Engineers', to sixty divisions to the inch, may be had in any of the above cases in place of chain scales.

563. **Computing Scale,** much improved, containing any two of the following scales, 1, 2, 3, 4, 5, and 6 chains to the inch. . . . £0 18 0

564. UNIVERSAL COMPUTING SCALE, as used in H. M. Tithe Commission Office, containing 1, 2, 3, 4, 5, 6 chains to the inch, and 6 inches and 5 feet to the mile complete in mahogany case £3 0 0

565. EXTRA SCALES made to the above 0 4 0

566. COMPUTING HORN PAPER 10, 20, 30, 40, 50, or 60 per sheet . 0 4 0

567. UNIVERSAL SCALE, builders', 12-inch., containing 14 scales, boxwood, 2s. 6d.; ivory, 8s. 6d.

568. UNIVERSAL SCALE, architects' and engineers', 12-inch., containing 17 scales, boxwood, 5s., ivory, 12s. 6d., 18 inch. boxwood, 8s. 6d.

569. **Tebay's Universal Planning Rule,** ivory, 16s. 6d.; boxwood, 8s. 6d.

Marquois Scales.—In mahogany cases, as supplied to the Cadets' College, at Sandhurst:

570. Boxwood . . .	£0	10	6	573. Brass . .	£2	10	0
572. Ivory . . .	2	2	0	574. Electrum . .	3	15	0

Gunter's Scales.—Boxwood.

575. 12 inch. . . .	£0	3	0	577. 18 inch. . .	0	2	4
576. 15 inch. . . .	0	2	0	578. 24 inch. . .	0	3	0

Engineer's Slide Rules.—Newest design.

579. ROUTLEDGE'S, ivory, with book, £1 10s.; boxwood . . 0 7 6

580. HAWTHORN'S, ivory, with book, £2 10s.; boxwood . . 0 11 6

582. **Hoare's Double Slide Rule,** boxwood, with book . . 0 8 6

583. BAILEY'S DOUBLE SLIDE RULE 1 5 0

584. IMPROVED SLIDE RULE, 24-inch., with single, double, and cube radius, new gauge points, designed and arranged by James Watt and Co. £1 1 0

585. ENGINEER'S RULE, 2 feet, 4 fold, designed by Col. Hyde Mint, Calcutta, beautifully made, with German silver slides, one with calipet end, fitting flush with end of rule, and divided by vernier to ·001 of inch., with metre scale and Birmingham wire gauge, improved gauge points, and engraved on the joint, most complete £2 0 0

Pocket Rules:

586. 1 foot, 4 fold, ivory, 2s. 6d. to 5s. 6d.; ditto, boxwood, 1s. 6d. to £0 2 6

587. 2 foot, 4 fold, ivory, 6s. 6d. to 11s. 6d.; ditto, boxwood, 2s. 6d. to 0 4 6

588. 2 foot, 4 fold, ivory, bevelled edges, with chain scales for engineers, 15s. to 21s.; boxwood, ditto, 6s. 6d. to 9s. 6d.

589. **Sectors,** ivory, 4s. to £0 8 6

Every variety of scales, English and foreign, ivory and boxwood, including Ordnance and Board of Health scales, kept in stock and made to order.

STATION POINTERS.

Station pointer or double arm protractor, with which two angles relative to a base may be taken together; a convenient instrument for plotting or sketching in new countries where magnetic bearings may lead to error, from local and various causes unknown.

590. 12 inch., with 6-inch. circle	£6	6	0	593. 24 inch., with 7-inch. circle	£8	10	0
592. 18 inch., with 7-inch. circle	7	0	0	594. 30 inch., with 8-inch. circle	11	0	0

595. 36 inch., with 10-inch. circle, divided on silver to 1 minute £16 16 0

PENTAGRAPHS,

As supplied to the Indian Government, much improved, for copying or extracting portions of plans of land to a reduced scale, enlarging drawings, etc.,

COMPLETE IN MAHOGANY CASES.

596. 18 inch. . .	£4	0	0	598. 30 inch. . .	£6	0	0
597. 24 inch. . .	5	0	0	599. 36 inch. . .	7	10	0

600. 42 inch. (*fig.* 600), p. 76 . . . £8 18 0

602. **Eidograph,** Professor Wallace's, admirably adapted for reducing plans, as in proportion 1 to 2, 9 to 25, etc., 30-inch., £10 0 0; 36-inch. £11 17 6

*** Larger sizes to order.

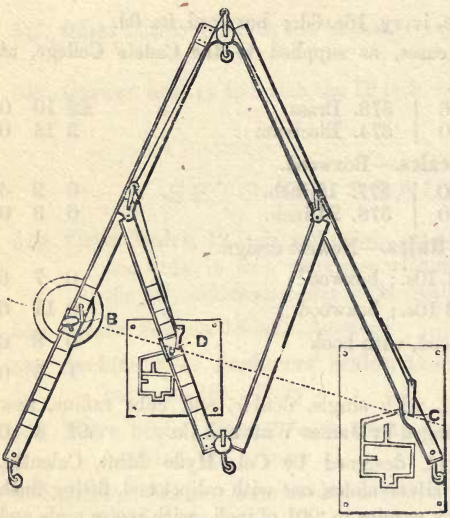


Fig. 600.

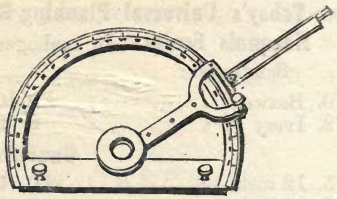


Fig. 614.

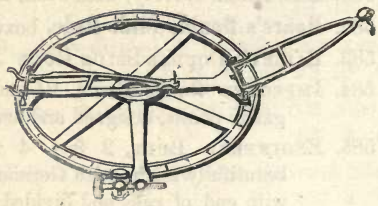


Fig. 621.

PROTRACTORS,

IVORY, SIX INCH.

603. With plain scale, etc. . £0 3 0 | 605. Best, fully divided . £0 5 6
604. Same, more fully divided 0 4 0 | 606. Same, with roller . 0 15 6

607. **Horn Semicircular** (*fig.* 607), p. 77, 3 to 8 inch., 0s. 6d. to . 0 2 0

608. Horn Circular, 2s. 0d. to 0 8 6

Semicircular (*fig.* 609), p. 77.

	Brass.	German Silver.		Brass.	German Silver.
609. 6 inch. .	£0 7 6	£0 10 0	611. 8 inch. .	£0 11 0	£0 15 0
610. 7 inch. .	0 9 0	0 12 0	612. 9 inch. .	0 13 0	0 17 0

613. 10 inch. 0 15 0 1 0 0

614. 8 inch., with vernier and arm, in mahogany case (*fig.*) 4 0 0 4 15 0

Circular.

	Brass.	German Silver.		Brass.	German Silver.
615. 6 inch. .	£0 14 0	£0 19 0	617. 8 inch. .	£1 0 0	£1 6 0
616. 7 inch. .	0 17 0	1 2 0	618. 9 inch. .	1 2 0	1 10 0

619. 10 inch. 1 5 0 1 14 0

620. 6 inch., with one vernier, reading to one minute, in mahogany case :

Brass.	Brass divided on Silver.	German Silver.
£2 18 0	£3 12 6	£3 10 0

Brass Circular Protractors,

Furnished with clamp and tangent screws, folding arms, and double verniers, divided to twenty-seconds, in mahogany cases (*fig.* 621) :

	Divi'ed on brass.	Divided on silver
621. 6 inch.	£5 0 0	£5 15 0
622. 7 inch.	6 0 0	6 15 0
623. 8 inch.	6 15 0	7 10 0

624. **Architects' Curves** in great variety, from 6s. 6d. the set of twelve (*fig.* 624).

Fig. 624.

Fig. 635.

Fig. 642.

Fig. 669.

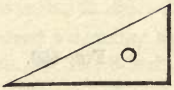


Fig. 669*.

Fig. 607.

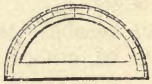


Fig. 609.

Radii or Railway Curves of the strictest precision.

625. A Set of Fifty Railway Curves in cardboard, from 5 to 110 inches radius, in solid mahogany case £2 2 0

626. A Set of One Hundred Railway Curves, from 1 inch. to 25 feet radius in solid mahogany case £4 0 0

627. **A Set of One Hundred Railway Curves,** in pear-tree or mahogany, in strong mahogany case £5 15 0

628. A Set of Fifty Railway Curves, ditto, ditto . . 2 18 0

629. A Set of Fifty Railway Curves, in zinc or brass, in extra strong mahogany case £6 10 0

630. **Slopes,** for railway work, set of eight, 6 inch., 9s.; set of eight, 8 inch., 11s.

632. **Mechanical or Ship's Curves.** The Admiralty or Trinity House set of twenty-five, in pear-tree or vulcanite £1 1 0

633. Ditto, ditto, in brass 2 5 0

634. Batterns Lancewood, for ship draughtsmen, set of twelve . 0 10 6

PARALLEL RULES,

Ebony (*fig.* 635).

635. 6 inch. . .	£0 0 9	638. 15 inch. . .	£0 3 6
636. 9 inch. . .	0 1 6	639. 18 inch. . .	0 4 3
637. 12 inch. . .	0 2 3	640. 21 inch. . .	0 5 0

641. 24 inch. £0 6 0

Rolling Parallel Rules, ebony (*fig.* 642):

	Plain edges.	Divided Ivory edges.		Plain edges.	Divided Ivory edges.
642. 6 inch. .	0 4 6	0 7 0	644. 12 inch. .	0 8 6	0 12 6
643. 9 inch. .	0 6 6	0 9 6	645. 15 inch. .	0 10 6	0 15 6
646. 18 inch.				0 13 6	0 18 0

647. Rolling Parallel Rules, ebony, with brass bridges, from 6 to 9 inches long, per inch, 1s.; 12 to 24 inches long, per inch, 11d.

648. Rolling Parallel Rules, ebony, with brass bridges and divided edges, from 9 to 12 inches long, 1s. 1d. per inch.; 12 to 24 inches long, 1s. per inch.

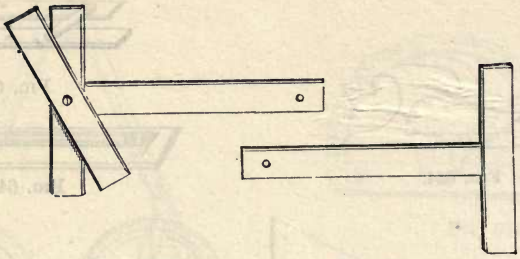


FIG. 656*. FIG. 656.

649. ROLLING PARALLEL RULES, brass, from 6 to 9 inches long, per inch, 1s. 10d.; from 12 to 24 inches long, with lift screws, per inch, 1s. 10d.

*** The above (649), with divided edges, the figures engraved, 6d. per inch extra.

650. ROLLING PARALLEL RULES, German silver, from 6 to 9 inches long, 2s. 8d. per inch; from 12 to 24 inches long, with lift screws, 2s. 6d. per inch; if with divided edges, 4d. per inch extra.

652. **Captain Field's Parallel Rule,** an improved and simple means of setting off ship's courses and bearings on charts, with instructions.

15 inch.	18 inch.	24 inch.
£0 7 6	£0 9 6	£0 13 0

CAPTAIN FIELD'S IMPROVED ROLLING PARALLEL RULE, engine divided to degrees and compass points:

	Brass.	German Silver.
653. 12 inch.	£2 0 0	£2 15 0
654. 18 inch.	2 15 0	3 5 0
655. CAPTAIN TOYNBEE'S IMPROVED PARALLEL RULE . .		1 1 0

T SQUARES, EBONY.

	Plain heads. (Fig. 656).	Shifting bevel piece and clamp screw. (Fig. 656*).		Plain heads. (Fig. 656).	Shifting bevel piece and clamp screw. (Fig. 656*).
656. 18 inch.	£0 3 6	£0 4 6	659. 33 inch.	£0 6 8	£0 8 6
657. 24 inch.	0 4 6	0 5 6	660. 36 inch.	0 7 6	0 9 6
658. 27 inch.	0 5 6	0 6 6	661. 42 inch.	0 9 6	0 11 6
662. 30 inch. . . .	£0 6 0			£0 8 0	

*** The above sizes, in mahogany, with plain heads, one-third less in price than the ebony, the material the very best seasoned and only one kind.

T DRAWING SQUARE, with mahogany angular blade, solid ebony edges, double rabitted, and screwed on:

663. 18 inch. . .	£0 3 0	665. 36 inch. . .	£0 7 0
663*24 inch. . .	0 4 6	666. 42 inch. . .	0 8 0
664. 30 inch. . .	0 5 6	667. 48 inch. . .	0 10 6
668. 60 inch.	£0 16 6		

This plan allows the set square to pass over the head and the edge of the drawing board, it is very strong, easily repaired, and has been more commended than any other kind of square.

669. **Angles and Set Squares,** in every variety, from 3s. 6d. per doz. (*fig.* 669, 669*), p. 77.

SET SQUARES, 30° or 45°, in mahogany frames, with solid ebony edges and corners keyed with brass:

670. 8 inch.	£0	4	3	672. 12 inch.	£0	6	6
671. 10 inch.	0	5	6	673. 15 inch.	0	7	6

674. 18 inch. £0 8 6

These angles can be made to any required size, and are warranted for all climates.

675. SET SQUARES, improved vulcanite, very hard, will bear washing, and suitable for any climate 45°, 4-inch., 10d.; 5-inch., 1s.; 6-inch., 1s. 3d.; 7-inch., 1s. 4d.; 8-inch., 1s. 8d.; 9-inch., 2s. 2d.; 10-inch. £0 3 0

675*. SET SQUARES, improved vulcanite, as above, 60°, 4-inch., 9d.; 5-inch., 10d.; 6-inch., 1s.; 7-inch., 1s. 3d.; 8-inch., 1s. 4d.; 9-inch., 1s. 8d.; 10-inch. £0 2 2

Straight Edges, for architects and engineers, with one edge bevelled.

STRAIGHT EDGE, in mahogany or pear-tree:

676. 12 inch.	£0	0	3	680. 36 inch.	£0	1	0
677. 18 inch.	0	0	6	682. 42 inch.	0	1	4
678. 24 inch.	0	0	8	683. 48 inch.	0	2	2
679. 30 inch.	0	0	10	684. 60 inch.	0	3	0

685. 72 inch. £0 4 6

STRAIGHT EDGE, ebony edged.

686. 12 inch.	£0	0	9	690. 36 inch.	£0	2	6
687. 18 inch.	0	1	0	692. 42 inch.	0	3	0
688. 24 inch.	0	1	6	693. 48 inch.	0	4	0
689. 30 inch.	0	2	0	694. 60 inch.	0	5	6

695. 72 inch £0 6 6

STRAIGHT EDGES, best bright steel.

696. 12 inch.	£0	3	6	700. 36 inch.	£0	11	0
697. 18 inch.	0	5	0	702. 42 inch.	0	15	0
698. 2d inch.	0	7	6	703. 48 inch.	0	16	0
699. 30 inch.	0	9	6	704. 60 inch.	1	0	0

705. 72 inch. £1 5 0

	in. in. 16×12	in. in. 23×16	in. in. 31×23	in. in. 42×29	in. in. 55×33
706. **Drawing Board,** ⅝-inch, pine, with clamps	1s. 6d.	2s. 6d.			
707. DRAWING BOARD, ⅝-inch, brass slot ledged	2s. 6d.	4s. 0d.	6s. 0d.	9s. 0d.	
708. DRAWING BOARD, improved ebony edge		5s. 0d.	8s. 0d.	12s. 6d.	18s.

709. DRAWING BOARD, 5 feet 10 inch. by 3 feet, 30s.; ditto, 5 feet 10 inch by 4 feet 2 inch. £2 2 0

710. TRACING BOARD, plate-glass, rising frame, 23 × 16, 30s.; 31 × 23, 40s.; 42×29 £2 10 0

712. TRESTLES of solid make, in hard wood, 14s. and 18s. the pair.

MATHEMATICAL DRAWING INSTRUMENTS

Arranged at first in cheap sets, beginners seldom requiring separate instruments; each instrument, however, may be had separately, both of the best and plain kinds, care is taken to combine with each set only such parts as are most useful in proportion to the price; this rule extends to the finest sets and instruments enumerated; the arrangements of joints and needle points being of the latest improved, and the pens such only as are found to give the highest satisfaction.

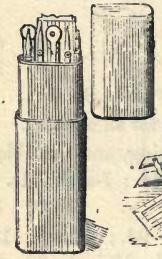


Fig. 713.

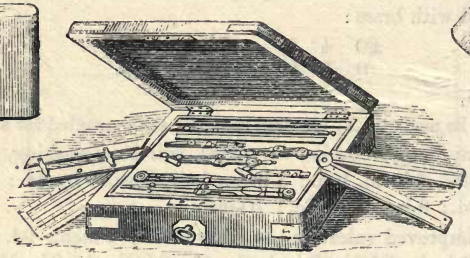


Fig. 724.

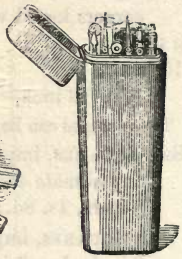


Fig. 717.

713. Set, consisting of compasses, usual size, with pen and pencil point, black lead pencil, and divided scale (*fig.* 713), 3s. 6d., or in mahogany case, 4s. 6d.

714. Set, consisting of compasses with pen and pencil point as above, one pair of short compasses, and boxwood scale in black pocket case, 4s. 6d., or in mahogany case £0 5 6

715. Set, with large and small compasses, bow pen and pencil point, extra bow pen, drawing pen, dotting wheel, black lead pencil, and divided scale in mahogany case £0 8 6

716. Set, with large and small compasses, etc., etc., as No. 715, but better finished, with bow compass and horn protractor extra . . . £0 12 6

717. Set, as No. 716, with ivory scale and ebony parallel rule extra, in fish skin case (*fig.* 717), 15s. 6d., or in mahogany case with lock . £0 17 6

718. Set, in mahogany case, with compasses, ink and pencil points, 5-inch. divider, bow pen and pencil, drawing pen, pencil, sector, protractor, ebony parallel rule, and steel key £1 1 0

Well suited, in brass or electrum, for schools or public institutions.

719. Set, as No. 718, with instruments in electrum . . . £1 8 0

720. Set, as used at Addiscombe Training College, with 6-inch. best brass compasses with sector joints, ink and pencil points, lengthening bar, bow pen and pencil, 5-inch. best divider, large and small drawing pen, knife key, military protractor, sector, parallel rule, and set of marquois scales, in 13-inch. polished mahogany box with lock and key £2 6 0

722. Set, as above, with instruments in electrum, . £2 12 6 and £3 5 0

723. Set of electrum instruments in rosewood case, lined with silk velvet, containing 6-inch. compasses, best sector joint, with ink and pencil points and lengthening bar, bow pen and pencil, set of three spring bows, hair divider, large and small drawing pen, pricker, knife key, and three ivory scales £3 5 0

724. Set of Electrum Instruments, in rosewood case, 7-inch., with silk velvet lining, bound with electrum for warm climates, with best tumbler lock and key, containing 6-inch. compasses, pen and pencil points, all with best sector joints, and improved points for needles, bow pen and pencil, lengthening bar, hair divider, set of three spring bows, large and small drawing pen, pricker, and knife key, with either three architect's or engineer's scales, or ivory sector, protractor and parallel rule (*fig.* 724) . . £5 0 0

725. **Set,** the same as No. 724, but with case not bound and the points not to hold needles £4 10 6

726. SET of best electrum instruments in walnut or rosewood case, lined with silk velvet and bound with electrum, with best tumbler lock and key, containing improved 6-inch. compasses with pen and pencil points, bow pen and pencil with best double joints and improved points for needles, lengthening bar, improved 5-inch. hair divider, set of three spring bows, with points to hold needles, proportional compasses engine divided, large and small drawing pens, railway or road pen, pricker, knife key, with three best ivory scales for architects or engineers, or ivory protractor, sector, and rolling parallel rule £7 15 0

727. SET OF SUPERIOR ELECTRUM INSTRUMENTS, in walnut case, bound with electrum, with silk velvet lining, two trays, and Hobbs's patent lock and key, containing 6-inch. compasses with pen and pencil points, bow pen and pencil all with best double joints and improved points for needles, long and short lengthening bar, 5-inch. hair divider, set of three spring bows with improved points for needles, best proportional compasses engine divided, railway or road pen, three assorted drawing pens, pricker, knife key, improved vulcanite angles and curves, best ivory protractor, rolling parallel rule, sector, and set of three metrical or duodecimal scales . . . £10 15 0

Electrum instruments of highest finish and quality in 13-inch. magazine cases, Nos. 728 or 729 being admirably adapted for public presentation.

728. **Set of Electrum Instruments,** in handsome walnut case, bound with electrum with best silk velvet lining, two trays, and Hobb's patent lock with two keys, containing 6-inch. compasses, bow pen and pencil, all with double joints and improved points for needles, pen and pencil points, with long and short lengthening bar, needle pointed beam compasses, with fine screw adjustment, triangular compasses, 9-inch. proportional compasses engine divided, 4½-inch. best double jointed compasses with ink and pencil points, and improved needle points, 5-inch. divider, 4-inch. best hair divider, three best spring bows, with improved points for needles, best railway or road pen, wheel pen with improved set of dotting wheels, four assorted drawing pens, needle pricker, screw keys for instruments, 6-inch. circular protractor, six 12-inch. best boxwood scales with offsets, 12-inch. electrum rolling parallel rule, with metrical and duodecimal divisions, set of angles and curves, ten cakes of colors, Indian ink, camels' hair and sable brushes and pallet £21 0 0

729. SET OF ELECTRUM INSTRUMENTS, in handsome walnut case, bound with electrum and lined with best silk velvet, with drawer for colors, two trays, and best patent lock with two keys, containing 6-inch. compasses, bow pen and pencil all with double joints and improved points for needles, pen and pencil points, with long and short lengthening bar, needle-pointed beam compasses, with fine screw adjustment, 9-inch. proportional compasses engine divided, 4½-inch. best double jointed compasses with ink and pencil points and improved needle points, 5-inch. hair spring divider, three spring bows, three drawing pens assorted, dotting wheel pen with set of wheels, railway or road pen, screw keys for instruments, needle pricker, tracer, six architect's scales, or six chain scales with offsets, 12-inch. rolling parallel rule with electrum bridge and ivory edges, divided metrically or duodecimally, set of angles and curves, and horn protractor, with ten cakes of color, Indian ink, pallet, and best sable hair brushes £15 10 0

730. **Set of Electrum Instruments,** in handsome walnut case, bound with electrum, best patent lock, and silk velvet lining, containing 6 inch. compasses, with double joints and improved points for needles, pen and pencil points and lengthening bar, 4-inch. double jointed compasses with pen and pencil points, and improved point for needles, bow pen and pencil with double joints and needle points, set of three spring bows, hair spring divider, beam compass heads with ink and pencil points and fine adjustment, proportional compasses engine divided, three assorted drawing pens, dotting wheel pen with set of wheels, railway or road pen, needle pricker, tracer, knife key, six 12-inch. best boxwood chain scales with offsets, 12-inch. rolling parallel rule with ivory divided edges, protractor, angles and curves . . . £9 15 0

732. Set of Electrum Instruments, in rosewood, walnut, or mahogany case with silk velvet lining and Hobbs's lock and key, containing 6-inch. best compasses with double joints, pen and pencil points and lengthening bar, hair spring divider, bow pen and pencil with double joints, proportional compasses engine divided, beam compass heads with ink and pencil points and fine screw adjustments, three spring bows, three drawing pens assorted, railway or road pen, needle pricker, tracer, knife key, 12-inch. rolling parallel rule with ivory edges, set of three chain scales with offsets, horn protractor, angles and curves £7 12 6

733. **Set of Electrum Instruments,** in rosewood or mahogany case, with silk velvet lining, and tumbler lock and key, containing 6-inch. compasses with best sector joints, pen and pencil points, lengthening bar, bow pen and pencil, railway or road pen, hair spring divider, needle pricker, large and small drawing pen, set of three spring bows, beam compass heads with pen and pencil points, and knife key, 12-inch. ivory engineer's or architect's scale, 12-inch. rolling parallel rule, set squares, curves, and horn protractor £5 10 0

Sets of Instruments, in pocket cases of best Russian or morocco leather, with best electrum instruments, assorted to order at corresponding prices.

Military and Government Sets of Cases as follow:—

734. **Set of Instruments,** in skin cases (Sappers' and Miners') . £0 12 6

735. Set of Instruments, East India Company's pattern . . 1 4 0

736. Set of Instruments, Woolwich pattern . . . 1 12 6

737. Set of Instruments, Ordnance pattern . . . 2 15 0

738. Set of Instruments, Admiralty pattern . . . 3 10 0

*** The above five sets of instruments, in German silver will be one third extra.

DRAWING INSTRUMENTS WITHOUT CASES.

739. Drawing Instruments without Cases, half-set, viz., compasses 6-inch. or 4½-inch. with best sector joint, ink and pencil points, lengthening bar and knife key.

Brass.	Electrum.	Extra Quality.
£0 14 0	£0 17 6	£1 2 0

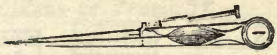


Fig. 749.

Fig. 770.

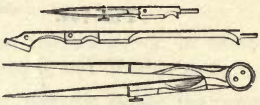


Fig. 745.

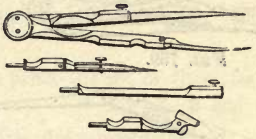


Fig. 740.

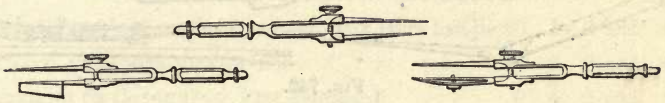


Fig. 776.

740. **Drawing Instruments without Cases,** half-set, as No. 739, with one knee-joint to compass (*fig.* 740).

Brass.	Electrum.	Extra Quality.
£0 15 6	£1 2 0	£1 5 0

742. Drawing Instruments without Cases, half-set, as above, with double joint to compass (*fig.* 742), p. 84.

Brass.	Electrum.	Extra Quality.
£1 0 0	£1 5 0	£1 10 0

743. Drawing Instruments without Cases, half-set, as above, best double joints with improved points for needles.

Electrum.	Extra Quality.
£1 10 0	£1 16 0

744. Drawing Instruments without Cases, half-set, with 9-inch. compasses, points, etc., as No. 739, for large drawings.

Brass.	Electrum.
£1 6 0	£1 17 6

745. **Plain Compasses,** 6-inch., with ink and pencil point only (*fig.* 745), 1s. 8d., 2s. 6d., 5s., and 7s. 6d. each.

746. Tubular Compasses, 5 or 7-inch., with improved slides and best joints in electrum £1 12 6

747. Tubular Compasses, with improved points for needles . 1 17 6

748. Maroon Case for ditto, if required . . . 0 4 6

749. **Triangular Compasses** (*fig.* 749), 5-inch., best electrum with movable bar £0 17 6

750. Beam Compass Heads, or Trammels, electrum, with steel points and ink and pencil points £0 10 6

752. **Beam Compass Heads,** with improved needle points and screw adjustment £0 17 6

753. Beam Compass Heads, as used in the India Office, with eccentric adjustment £2 2 0

Fig. 759.

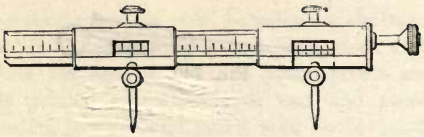


Fig. 754.

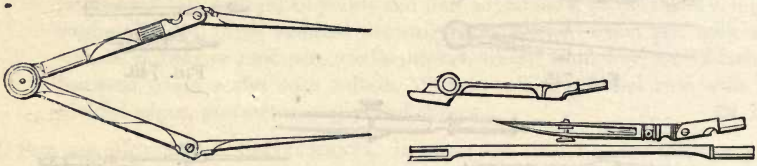


Fig. 742.

754. Beam Compass Heads, Ordnance pattern, divided to read to ·01 inch. (*fig.* 754).

Brass.	Electrum.
£1 12 0	£2 2 0

755. **Electrum Tubular Beam Compass,** three draw, extending to 30 inches, and closing up to twelve inches, with steel points and ink and pencil points, best quality £1 12 6

756. Electrum Tubular Beam Compass, with screw adjustment, and improved points for needles £2 5 0

758. Proportional Calipers, 12-inch., £2 5s.; 9 inch. . . 1 18 0

759. Proportional Compasses, 6-inch., electrum, fully divided (*fig.* 759) 1 5 0

760. **Proportional Compasses,** with adjustment . . . 1 12 6

762. Proportional Compasses, 9-inch., electrum fully divided . 1 15 0

763. Proportional Compasses, with adjustment . . . 2 8 0
If in maroon case, extra, 2s. 6d. and 3s. 6d.

764. Wholes and Halves or Bisecting compasses in electrum . 1 1 0

POCKET COMPASSES.

765. **Pillar Compasses,** in electrum, with reversing ends, forming a complete set of drawing instruments, best quality only . . £1 5 0

766. Pillar Compasses, with lengthening bar . . . 1 15 0

767. Napier Compasses, in electrum, with ink and pencil point to revolve, best £1 5 0

768. Napier Compasses, in silver 2 2 0

769. Pocket Divider, with sheath, 3 to 5 inches . £0 4 6 to 0 5 6

DIVIDERS OR COMPASSES.

770. Divider Sector Joint (*fig.* 770), p. 83, best quality, brass, 2s. 6d.; electrum 0 4 6

772. Divider Sector Joint, with hair spring, brass, 5s. 6d.; electrum 0 6 6

773. **Bow Pens or Pencils,** single joints, brass, 1s. 6d. and 2s. 6d. each; electrum £0 4 6

774. Best Double-jointed Ink or Pencil Bow, in electrum, each 0 8 0

775. Best Double-jointed Ink or Pencil Bow, with points to hold needles, each £0 9 0

776. Steel Spring Bows, in electrum (*fig.* 776), p. 83, the set of three forming ink, pencil, and divider, each . . . £0 7 6 and £0 10 6

777. Steel Spring Bows, the points to hold needles, finest quality only 1 1 0

If in maroon case, extra, 1s. 6d. and 2s. 6d.

778. **Drawing Pens,** best steel and electrum, with ivory handle £0 1 8 and 0 2 6

779. Drawing Pens with turn up nibs . . 0 3 0 and 0 4 0

780. Bordering or Colouring Pen, improved . 0 4 6 and 0 5 0

782. **Lithographic Pen** . . . . 0 2 6 and 0 3 0

783. Railway or Road Pen, best quality only . . . 0 6 0

784. Dotting or Wheel Pen, improved with set of wheels, very best 0 7 6

785. Needle Pricker, with reserve for needles, improved . . 0 2 6

786. Tracer 0 1 6

787. **Opisometer or Map Metre,** very convenient for measuring curved distances on maps (in case) £0 3 6

788. Six Very Best Drawing Pens, assorted, to fit one handle in maroon case £0 13 6

789. Lithographic Crow Quill or Mapping Pen, with handle, per dozen 0 2 0

Particular attention is requested to the excellence of all the above pens and the constant satisfaction they are giving.

790. **Centrolinead,** improved, 42-inch. bar, with brass joints and studs £1 12 6

792. Semi-elliptic Trammels, of best make, brass, £2 10; electrum 3 3 0

796. Camera Lucida, and Claude Lorraine Glasses, see Nos. 1567 and 1572.

797. **Eidograph,** see No. 602.

798. Pentagraph, see Nos. 599 to 600.

799. Drawing Boards, see Nos. 706 to 710.

800. Paper and Colors, see index.

THE METRIC SYSTEM.

On account of the importance attached by scientific and commercial men to the use of the metric system of weights and measures, and its gradual extension throughout the world, and at the request of James Yates, Esq., F.R.S., the oldest and most active vice-president of the association formed to aid in its universal adoption, the following list of articles is here inserted. They are nearly all of English manufacture, and are selected from an immense variety on account of their fitness for teaching the system and their adaptation for use in scientific pursuits, in commerce, foreign and domestic, and in trades and employments of every kind.

WEIGHTS.

801. **Brass Weights,** viz., 1 kilogram to ½ milligram, very exact, in mahogany case, per set £3 15 0

802. Brass Weights, viz., the ½ kilogram to $\frac{1}{50}$ of a gram, in mahogany case, per set £3 3 0

803. Set of Weights, ½ gram with its subdivisions to $\frac{1}{1000}$ of a gram, platinum, in ebony case, £1 10s.; aluminium in mahogany case . . £1 5 0

804. Weights, from 50 grams to 1 milligram, for scientific chemists 1 15 0

805. Nest of Brass Weights from the ½ kilogram to the gram . 0 10 0

806. Set of Cast Iron Weights, viz., 5, 3, 2, 1 kilogram . . 0 10 6

Several of the coins of the metric system are weights, *e.g.*, the franc, which is silver, weighs 5 grams. The piece of 20 centièmes, also of silver, weighs 1 gram. The centième, which is bronze, weighs 1 gram. (See Tarnier's "Tableaux du Système Métrique.")

MEASURES OF CAPACITY.

807. **Rodwell's Cubic Decimetre,** showing the origin of the litre . £0 6 0

808. Cubic Decimetre, with top layer divided into 100 cubic centimetres 1 0 0

809. Litre, Double Litre, and Double Decilitre, in wood, mounted with tin-plate £0 1 0

810. Litre, Half Litre, Double Decilitre, Decilitre, Half Decilitre, Double Centilitre, of pewter £0 7 6

812. Litre Wine Bottle, ... 0 0 6

813. **Glass Bottles,** litre and half-litre.

814. Apothecaries' Measure, cubic centimetres compared with fluid ounces, £0 1 0

815. Hectolitre, principal measure for corn, etc.

816. Dowling's Synoptic Table, showing the measures and weights of the system in their real dimensions, and in their relation to one another, with hand-book £0 15 0

MEASURES OF LENGTH.

817. **British Association Mural Standard,** showing the metre and yard in apposition, for the comparison of measures in public situations, on white porcelain, in a mahogany frame £5 0 0

818. Metre, consisting of five links, which are connected by four hinges with springs of blue steel £0 7 6

819. Rickard's School Metre, with printed questions and answers. 0 6 6

820. Metre, with yard graduated, paper or tape . . . 0 0 1

822. Metre, with hinges, four fold, of boxwood . . . 0 3 0

823. **Half Metre or Cubit,** four fold, of boxwood . . . 0 2 6

824. Metre, of steel riband, in maroon case, roulette . . 0 1 6

825. Measuring Tape, with steel wire inserted, double dekametre, or chain (*i.e.* 20 metres) or 100 links £0 7 6

826. Land Chain of 100 links or double decimetres, = 20 metres, of varnished steel, with appendages of brass £0 12 0

827. **Link, or Double Decimetre,** of hard steel, graduated to fifths of millimetres, £0 7 0

828. Cubit, or Half Metre, graduated to fifths of millimetres, of hard steel 0 5 0

829. Link, or Double Decimetre, of pearwood, folding with a hinge 0 1 6

830. **Hand, or Decimetre,** solid £0 1 0

832. Hand, or Decimetre, divided with hinge so as to fold . . 0 1 0

833. Link, or Double Decimetre, bevelled, graduated to half millimetres, scale of three links, with slide £0 6 0

834. Æsthesiometer, for measuring sensation . . . 1 1 0

835. The Anglo-French Ready Reckoner or Guide to the Metric System with comparative tables of capacity, weights, and lineal measure. By R. Rickard, Professor of Mathematics, at King Edward's School, Birmingham £0 1 0

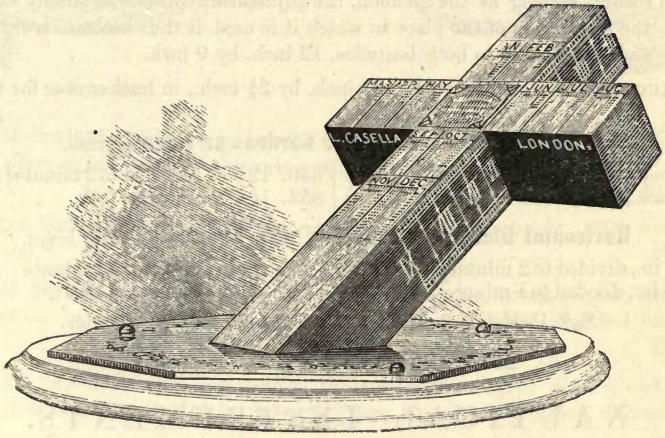


Fig. 846.

SUN DIALS

Vertical and horizontal, adapted to every position and latitude, of various forms.

836. **Magnetic Dials,** for the pocket, suitable for any latitude, in neat polished hard-wood box, with cover and best agate cap (*fig.* 836), p. 89, 2-inch. £0 5 0

837. Magnetic Dials, in polished mahogany case . . . 0 5 6

838. Magnetic Dials, in bronzed round metal case . . . 0 6 6

839. Magnetic Dials, plated or gilt, 5s. 6d. and 7s. 6d. extra.

The above are handy and strong, and well suited for travellers ; a stop to either 1s. extra.

840. **Universal Sun Dial,** for any position north or south of the line, with folding arc and gnomon, by which it is set at pleasure to any latitude (*fig.* 840), p. 89, in morocco case, 2½-inch. divided circle, £1 4 0; 3-inch., £1 6 0; 3½-inch. £1 14 0

842. Universal Sun Dial, with two levels, adjusting screws, bar needle agate cap and stop, divided circle, 2½-inch., £2 10 0; 3-inch., £2 18 0; 3½-inch. £3 8 0

843. **Universal Sun Dial,** with improved gnomon, bar needle, two levels, and adjusting screws, in morocco or mahogany case, 2½-inch., divided circle, £3 8 0; 3-inch., £3 15 0; 3½-inch., £4 4 0; 4½-inch. £5 5 0

In ordering either of the above, it should be stated whether it is for north or south latitude.

844. Universal Sun Dial, as above, but divided to serve for both latitudes: 2½-inch., divided circle, £4 4; 3-inch., £4 12; 3½-inch., £5; 4½-inch. £6 6 0

845. **Universal Ring Sun Dial,** in the form of a ring, answering for both latitudes, in polished mahogany case, 3 inch. to 5 minutes, £1 14; 4 inch., £2 2; 6 inch. to 2 minutes £2 15 0

846. Crucial Sun Dial, in bronze (*fig.* 846), p. 88. In this interesting arrangement the figures and divisions are marked on the sides of the cross, the angles and corners serving as the gnomon, the adjustment consists in simply raising it to the co-latitude of the place in which it is used, it thus becomes truly universal, and suited alike to both latitudes, 12 inch. by 9 inch. . £8 8 0

847. Crucial Sun Dial, as above, 3½ inch. by 2½ inch., in leather case for the pocket £2 10 0

Horizontal Sun Dials, for Gardens or Lawns, brass.

848. 6 inch., divided to 5 minutes £1 1 0 | 850. 12 inch., divided to 2 minutes £4 4 0
849. 8 inch., divided to 5 „ 2 10 0 | 852. 15 inch., divided to 2 „ 5 15 0

Horizontal Dials, very superior, with Equation Table, brass.

853. 10 in., divided to 2 minutes £3 12 0 | 855. 15 in., divided to 1 minute £7 10 0
854. 12 in., divided to 1 minute 5 5 0 | 856. 18 in., divided to 1 „ 12 15 0

*** Pedestals for dials and vertical dials made to order.

NAUTICAL INSTRUMENTS.

SEXTANTS AND QUADRANTS,

Including such only as combine the latest improvements and are in constant general use. The metal quadrant having greatly supplanted those in ebony, has in no way however lessened the care given to their construction; the rigidity and seasoning of the wood in these instruments will therefore be found to adapt them to the utmost for the varying climates in which they are used.

857. **Pillar Sextant** (superior), 7-inch. radius, divided on silver, with verniers reading to ten seconds, four telescopes, spring tangent screw, seven neutral shades, star finder and swing reflector, very superior, in best polished mahogany case £15 10 0

858. Pillar Sextant, as above, with platinum arc and gold verniers 17 10 0

859. Best Plain Pillar Sextant, with four telescopes, best colored shades, divided on silver to ten seconds, with swing reflector . . £12 0 0

860. Metal Sextant, with bridge handle, very superior, with capped adjustment, spring tangent screws, four telescopes, seven shades neutral tint, divided on silver to ten seconds, with swing reflector, in polished mahogany case £11 10 0

If with star finder, 12s. 6d. extra.

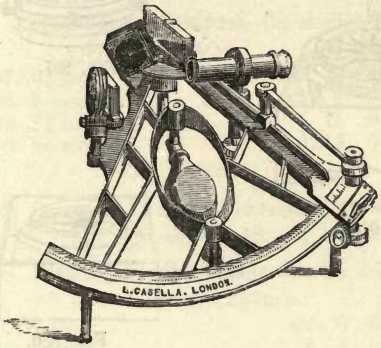


Fig. 863.

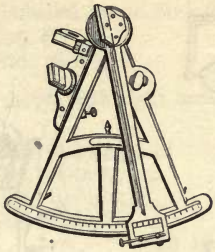


Fig. 874.

Fig. 836.

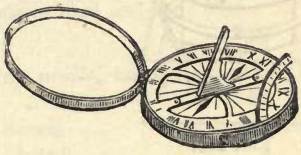


Fig. 840.

862. **Metal Sextant,** with bridge handle, four telescopes and seven shades, divided on silver to ten seconds, with swing reflector, in polished mahogany case (*fig.* 862) £10 10 0

863. Metal Sextant, best triangular oval or diamond limb (*fig.* 863), complete as above £9 5 0

864. **Metal Sextant,** plain, flat limb, with three telescopes, seven shades, divided on silver to ten seconds, in mahogany case, a good plain practical instrument £7 0 0

865. Ebony Sextant, with best centre, three telescopes, seven shades and ground glass reflector, divided on ivory to fifteen seconds, in polished mahogany case £4 15 0

866. Box Sextants, see Surveying Instruments, p. 70.

867. **Ebony Handle Quadrant or Half Sextant,** divided on ivory to half minutes, with best centre, seven shades and vertical adjustment, in mahogany case £3 15 0

868. Ebony Handle Quadrant, or Half Sextant, with plain centre 3 12 6

869. Best Metal Quadrant, or Half Sextant, divided on silver to fifteen seconds, with best centre, seven shades, reflector, and adjusting screw, in mahogany case £4 15 0

870. Metal Quadrant, divided on silver to fifteen seconds, with best centre, shades, etc., as above £4 10 0

872. **Metal Quadrant,** with plain centre 4 5 0

873. Ebony Quadrant, plain, divided on ivory to one minute, in polished mahogany case £1 17 6

874. Ebony Quadrant, double tangent (*fig.* 874) . . . 2 2 0

875. **Ebony Quadrant,** double tangent, divided to one minute, with three back shades, and vertical screw adjustment, in mahogany case . £2 10 0

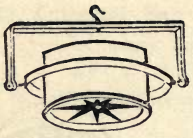


FIG. 887.

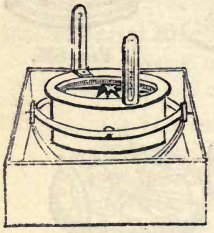


FIG. 919.

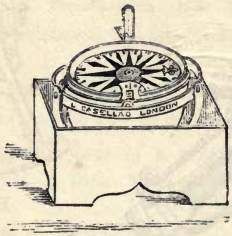


FIG. 918.

FIG. 897.

FIG. 880.

ARTIFICIAL HORIZONS.

876. **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. £1 15 0

877. ARTIFICIAL HORIZON, plain, mercurial, with hard-wood bottle, trough, etc., in mahogany case £2 15 0

878. **Artificial Horizon,** mercurial, of the best construction, Ordnance pattern, metal-roof, trough and iron bottle £3 15 0

879. ARTIFICIAL HORIZON, as above, smaller size . . . 3 5 0

SHIPS' COMPASSES AND BINNACLES.

The following ships' compasses, with hard sapphire and ruby centres, are constructed and arranged with the utmost care to adapt them for the altered conditions of ship building, those in particular described as *for iron ships* are found by the increasing sale to be superior in permanence and power of magnetic adjustment to any other arrangement.

Ship-Steering Compasses, with brass bowls, in gimbals and strong oak cases. (*fig.* 880):

880. 6-inch. outside . £0 10 0 | 884. 9-inch. outside . £0 15 0
882. 7-inch. „ . 0 12 0 | 885. 10-inch. „ . 0 16 0
883. 8-inch. „ . 0 13 0 | 886. 11-inch. „ . 0 18 0

The same, with wooden bowls instead of brass, one-half the price.

887. **Hanging or Tell-tale Compass,** with beam plate and clamp screws, large size 6¼ inch. card (*fig.* 887) £1 13 9

888. HANGING OR TELL-TALE COMPASS, mid size, 5-inch. card . 1 1 0

889. HANGING OR TELL-TALE COMPASS, small size, 4-inch. card. . 0 17 6

890. **Amplitude Compass,** in oak box, with shifting sights for land bearings, 10-inch., £1 4 0; 11-inch. £1 6 0

892. STORM COMPASS, with bell gimbals, in oak box, 10-inch, £1 4 0; 11-inch., £1 5 0

893. STORM COMPASS, transparent, with bell gimballed storm card, 6½-inch. £1 6 0

993* 7-inch., card . £1 10 0 | 995. 8-inch. . . 1 18 0
894. 7½-inch. . . 1 15 0 | 896. 8½-inch. . . 2 2 0

Transparent Compass, for skylights, as above, with light card for fair weather, (*fig.* 897), p. 90:

897. 6½-inch., card . £1 3 0 | 902. 8½-inch., card . £1 15 0
898. 7-inch., „ . 1 6 0 | 903. 9½-inch., „ . 2 2 0
899. 7½-inch., „ . 1 11 0 | 904. 10-inch., „ . 2 10 0
900. 8-inch., „ . 1 14 0 | 905. 11-inch., „ . 3 3 0

906. 12-inch. £3 10 0

907. DIPPING NEEDLE COMPASS, large size, with storm card and cone centre, in oak box, 10-inch., £1 18 0; 11-inch. . . . £2 0 0

908. **Dipping Needle Compass,** with double dipping needle, transparent storm card and cone centre, 6½-inch. £1 18 0

909. 7-inch. . . £2 0 0 | 912. 8-inch. . . 2 10 0
910. 7½-inch. . . 2 5 0 | 913. 8½-inch . . 3 0 0

914. BEST BRASS ARMS (square form), from Nos. 897 to 913, 6s. to 7 s.6d. per pair extra.

915. **Best Prismatic Azimuth Compass** (SIR SNOW HARRIS'), with ring of *pure copper*, revolving wheel and edge bar needle card with sapphire centre cap, in mahogany box, particularly suited for iron vessels. Though slow in action, this is perhaps the most reliable and permanent compass made . £7 10 0

916. TRANSPARENT COMPASS, for iron vessels, with pure copper ring, 7½-inch. card, best needle and sapphire centre cap £5 5 0

917. STEERING COMPASS, for iron vessels, with pure copper ring, in oak box, 7½-inch. card, best needle, etc., as above £4 4 0

918. BEST PRISMATIC AZIMUTH COMPASS, Admiralty pattern, with divided ring and shifting sights, in mahogany box (*fig.* 918), p. 90 . . £5 5 0

919. KNIGHT'S AZIMUTH COMPASS, with folding sights, in mahogany box (*fig.* 919), p. 90 £4 10 0

920. BEST TRIPOD STANDS, for either of the above compasses . 1 4 0

923. **Plain Azimuth Compass,** in oak case 2 15 0

924. LIQUID COMPASS, much improved, especially suited for iron steamships, with best needle and sapphire centre, in oak case, 5-inch, card . . £3 18 0

925. 6-inch., card . £4 4 0 | 926. 7-inch., card . 4 15 0

BOAT COMPASSES, small and very portable, brass, with gimbals, agate caps, etc.:

927. No. 1, card, 1¼-inch. £0 12 6 | 929. No. 3, card, 2-inch. £0 16 6
928. No. 2, card, 1½-inch. 0 15 0 | 930. No. 4, card, 2½-inch. 0 17 6

932. No. 5, card, 3-inch. . . . £1 1 0

For surveying compasses, see pages 66 and 67.

For other boating compasses and pocket and trinket compasses, see pages 68 and 69.

933. **Best Steel Needles,** for ships' compasses, from 3 to 6½ inches, 6s. per doz.; 7 to 7¾ inches., 7s. per doz.; 8 inches, 7s. 6d. per doz.; 9 inches, 8s. 6d. per doz.

934. METAL CAPS with best agate centres of superior hardness for the above needles 9s. 6d. per doz.

935. BEST METAL CAPS, with ruby centres, per doz. . . . £0 12 6

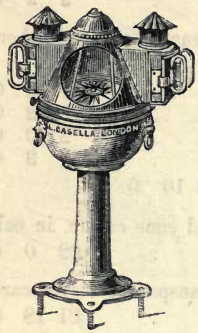


FIG. 956.

FIG. 955.

FIG. 954.

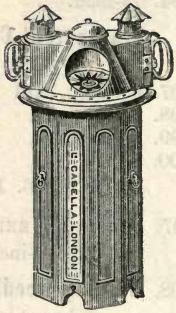


FIG. 953.

936. **Best Metal Caps,** the finest and hardest made, with sapphire centres, 1s. each extra

937. HARD METAL CAPS, 4s. 6d. each extra.

938. BEST MOUNTED TALC COMPASS CARDS, covered, with agate caps, £1 1s., £1 4s., and £1 8s. per doz.

939. **Talc Flies for Ships' Compasses,** not mounted.

940. 9-inch. . £0 7 6	944. 7½-inch. . £0 5 0	947. 6-inch. . £0 4 2
942. 8½-inch. . 0 5 8	945. 7-inch. . 0 4 6	948. 5-inch. . 0 3 4
943. 8-inch. . 0 5 6	946. 6½-inch. . 0 4 6	949. 4-inch. . 0 2 6

950. SHIPS' CHRONOMETERS, eight days, by the best London makers £42 0 0

951. BEST BRASS BINNACLE TOPS, with lamps attached, of the helmet, globe, or lighthouse form, for ships' binnacles, 9-inch., £4 4s.; 10-inch., £4 10s.; 11-inch. £5 0 0

952. **Best Binnacle Tops,** as above, without lamps, 9-inch., £2 5s.; 10-inch., £2 10s; 11-inch. £2 18 0

953. SHIP'S BINNACLE, best make, of French polished mahogany (*fig.* 953), with much improved lanterns, lamps and shade with deck plates and bolts, 10-inch., £7 4s.; 11-inch., £7 17s. 6d.; 12-inch., £8 10s.; 13-inch. £9 10 0

954. SHIP'S BINNACLE, dolphin pattern, all brass, japanned and gilt (*fig.* 954), with improved lamps, etc., as above, 11-inch., £10; 12-inch., £10 10s.; 13-inch., £12 5s.; 14-inch. £13 10 0

955. SHIP'S BINNACLE, with twisted bright brass body (*fig.* 955), with lamps, etc., as above, 12-inch., £12 15s.; 13-inch., £14 5s.; 14-inch. . £15 15 0

956. **Ship's Binnacle,** best make, highly finished, bright brass, plain pattern (*fig.* 956), 10-inch., £12; 11-inch., £13 10s.; 12-inch., . . £15 0 0

957. BOAT BINNACLE, in square mahogany, with lamp on top . 2 12 6

957*YACHT BINNACLE, all brass, with lamps . . . 5 10 0

958. MAST HEAD BINNACLE, 12-inch., with one lamp and band for mast 5 0 0

N.B.—Compasses are not included in any of these prices, the extra cost for usual kinds being 12s. to £1 10s.

SHIPS' SCUTTLES, DECK LIGHTS, ETC.

Ships' deck lights of stout glass lenses and prisms of the following sizes most in use, all other sizes being kept and made to order:—

959. PRISM DECK LIGHTS, 10-inch. × 4-inch., 6d. per lb.; average weight, 7½ lbs. each.

960. **Prism Deck Lights,** 11-inch. × 4½-inch., 6d. per lb.; average weight, 8½ lbs. each.

961. CIRCULAR DECK LIGHTS of stout plano-convex lenses, 6-inch., 2s. 3d. each, average weight 4½ lb.; 7-inch., 3s. each, average weight 6 lb.; 7¼-inch., 3s. 6d. each, average weight 7 lb.

962. FLAT GLASS CIRCULAR SIDE LIGHTS, with ground edges, 6½-inch. diameter × ½-inch thick, 2s. 2d. each; 6½-inch. diameter × ⅝-inch. thick, 2s. 7d. each.

Ships' Scuttles, glazed, complete in very stout brass:

ROUND.					SQUARE.				
Outside diameter.	Clear aperture (door open).				Outside dimensions.	Clear aperture (door open).			
963. 8-inch.	4¾-inch.	£0	13	0	967. 10	7½-inch.	5½ × 4-inch.	£0	17	6
964. 9-inch.	4¾-inch.	0	14	0	968. 10½	7½-inch.	6¾ × 4½-inch.	0	17	6
965. 10-inch.	5¾-inch.	1	1	0	969. 11	8-inch.	6¾ × 4½-inch.	1	1	0
966. 11-inch.	7½-inch.	1	10	0	970. 12	9-inch.	7½ × 5½-inch.	1	8	0

972. SHIPS' LAMPS AND SIGNAL LIGHTS, made strictly according to the last Admiralty order, by which the small size side lights hitherto in use for port and starboard are prohibited; No. 1, port or starboard, allowed for small vessels only, say under 50 or 100 tons, but even this size might cause trouble in foreign ports. The next size, or No. 2, is suited for all vessels of whatever size or tonnage.

973. PORT AND STARBOARD LAMPS, JAPANNED, best quality, No. 1, £1 16s. per pair; No. 2, £2 8s. per pair.

	No. 1, per pair.	No. 2, per pair.
974. PORT AND STARBOARD LAMPS, JAPANNED, 2nd quality	£1 10 0	£2 2 0
975. **Port and Starboard Lamps, Copper,** stout, best quality	3 16 0	4 12 0
976. PORT AND STARBOARD LAMPS, COPPER, 2nd quality	3 4 0	4 2 0

The difference in quality consists in one being of stronger and heavier make than the other.

977. **Circular Anchor Lamps, Japanned,** best quality, 11s., 13s., and. £0 16 6

978. CIRCULAR ANCHOR LAMPS, COPPER, best quality, £1 6s., £1 12s., and 1 16 0

979. GLOBULAR ANCHOR LAMPS, JAPANNED, best quality . . 0 6 6

980. GLOBULAR ANCHOR LAMPS, COPPER, best quality . . 0 14 0

982. MAST-HEAD LAMPS, JAPANNED, best quality, £1 4s., £1 10s. . 2 0 0

983. MAST-HEAD LAMPS, COPPER, best quality, £1 15s., £2 2s. . 2 16 0

984. **Tricolor Steering Lamps, Japanned,** best quality, £1, £1 3s. 1 8 0

985. TRICOLOR STEERING LAMPS, COPPER, best quality, £1 12s., £1 16s. 2 5 0

Cabin, boiler, engine-room, binnacle lamps, etc., etc., and hand lanterns of every form.

986. **Fog Horns,** BEST JAPANNED, per dozen, 10s., 18s., £1 6s. . £1 16 0

987. FOG HORNS, BEST BRASS, per dozen, £1 2s., £1 19s., £2 10s. . 3 7 0

988. DOUBLE FOG HORNS, BEST JAPANNED, per dozen . . 0 18 0

Double Fog Horns, BEST BRASS, per dozen . . . 1 18 0

990. KEY'S PATENT FOG SIGNAL, giving a louder and longer blast than the fog horn . . . . . £0 10 6 to £0 15 0

990* SPEAKING TRUMPETS, in brass, small size, 4s. 6d.; middle size, 6s.; large size, each £0 7 6

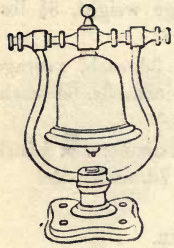


FIG. 995.

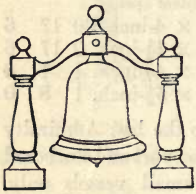


FIG. 994.

FIG. 997.

FIG. 1000.

FIG. 1002.

992. **Hand Fog Bells,** turned edges and crown, from 8s. 6d. upwards.

993. HAND FOG BELLS, polished, about 2s. extra.

994. **Ships' Bells,** with turned brass bracket supports (*fig.* 994), 6-inch., £1 11s.; 8-inch. £2 14 0

995. SHIPS' BELLS, with lyre frame bracket support (*fig.* 995) 6-inch., £1 18s.; 8-inch. £3 0 0

996. SHIPS' BELLS, very handsome with dolphin bracket . . 10 10 0

The following ships' logs and sounding machines are well known and appreciated; they include only such as are used on board her Majesty's vessels and the principal mercantile marine :—

997. MASSEY'S PATENT LOG, in box, with directions (*fig.* 997) £3 3 0

998. **Massey's Patent Improved Frictionless Propeller Log** (*fig.* 998), p. 95 3 5 0

Durability, constant and regular action, with lightness and facility in towing, are the great recommendations of this log.

999. MASSEY'S PATENT SOUNDING MACHINE . . . £3 5 0

1000. **Walker's Patent Harpoon Ships' Log,** No. 1 (*fig.* 1000) . 2 12 6

1002. WALKER'S PATENT HARPOON SHIPS' LOG, No. 2 (*fig.* 1002) . 2 12 6

1003. WALKER'S PATENT detached log, No. 3. . . . 2 12 6

1004. **Walker's Patent Sounding Machine** (*fig.* 1004), p. 95, to use with the ordinary ship's lead £2 12 6

1005. FRIEND'S PATENT LOG, in box 5 0 0

1006. FRIEND'S PATENT SOUNDING LEAD 3 10 0

1007. **Burt's Patent Sounding Machine or Buoy Nipper,** with rachet improvement for showing the vessel's speed £1 10 0

1008. POWDER MAGAZINES, of strong sheet copper, tinned inside, with three lids and padlocks of brass to hold

10 lbs.	25 lbs.	30 lbs.	50 lbs.	100 lbs.
£1 2 0	£1 15 0	£1 18 0	£2 10 0	£4 15 0

Fig. 1004.

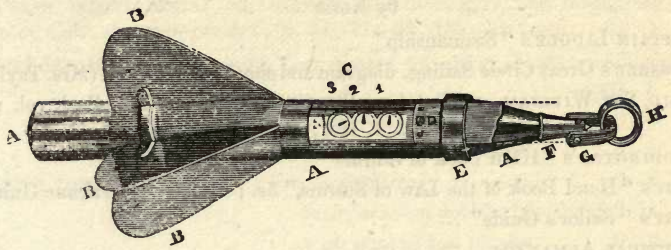


Fig. 998.

1009. **Current Meter** (Double), to be used as a log (see surveying instruments, No. 519, page 71).

1010. Time Glasses, in plain oak frames, 2 hours, 3s. 6d.; 1 hour, 1s. 8d.; ½ hour, 1s. 6d.; ¼ hour . . £0 1 4

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

1011. **Log Glasses,** 14 or 28 seconds, in oak frames, with best metal sand, per pair £0 2 6

1012. Log Glasses, in brass frame, hermetically sealed, per pair . 0 5 0

1013. Tea Broker's Sample Time Glass, in plain wood frame . 0 1 6

1014. **Auctioneer's One Minute Time Glasses,** in neat turned wood case, for the waistcoat pocket £0 5 6

Bunting in every variety.
Signal Flags „ „
Codes of Signals „

Royal Standards, Ensigns, Union Jacks, and Foreign Flags, of every kind.

In addition to the preceding List of Nautical Instruments, there are several others in constant use referred to under their respective classes, thus:—

Marine Barometers and Sypiesometers, see "Meteorological Instruments," pages 4, 5, and 40.

Aneroid Barometers (now much required for marine purposes), pages 34 and 35.

Ordinary Marine and Deep Sea Thermometers—Nos. 26, 27, 48, Salinometers, etc.

Hygrometers (now much used at sea, especially in connection with the barometer, the best form for marine purposes being Mason's), see Nos. 50 to 57, and 185.

Anemometers and Air Meters, for measuring the force and velocity of the wind and currents of air, see pages 25 to 30.

Marine Telescopes, see pages 119 and 120.

Improved Binocular and Night Glasses, see pages 125 to 127.

Amongst the books supplied by L. Casella which bear on the theory and practice of navigation, great circle sailing, the law of storms, etc., are also the maps, charts, and sailing directions, published by the Admiralty, and others including the latest surveys and discoveries, books and maps of the Ordnance Survey of Great Britain, and others. English and foreign publications of the meteorological department of the Board of Trade, as wind and current charts, etc., etc.

The **Epitome of Navigation,** by Mrs. Janet Taylor . .	£0 16 0
„ „ „ by Norie	0 16 0
Captain Liddle's "Seamanship" . . „ „	0 1 0
Russell's Great Circle Sailing, diagram and chart of the world (Mrs. Taylor's)	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.; Birt's "Hurricane Guide"	0 3 0
Birt's "Sailor's Guide"	0 0 6
Nautical Almanacs	0 2 6
Hannay and Dreschin's ditto	0 0 8
Log and Cargo Books, etc.	
Ganot's Physics, 4th edition, enlarged by Dr. Atkinson, omitted from p. 38	0 15 0

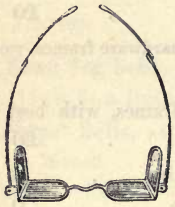


Fig. 1033.

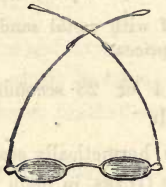


Fig. 1022.

Fig. 1035.

Fig. 1082.

1074. 1081.

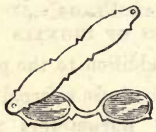


Fig. 1040.

SPECTACLES.

In the following list the utmost care has been taken to adapt all, not only to the sight, but also to the features, and even to the country in which they are likely to be used.

In the general list given below, a few of a good plain description are inserted at very low prices for asylums, workhouses, prisons, and charitable institutions, every care being taken as to the correct working and arrangement of the glasses; the reduction in price being effected chiefly by the plain character of the mounting as well as their being sold only by the dozen.

1015. **Good Plain Blue Steel Spectacles,** per doz., 10s., 12s., and £0 15 0

1016. Good Plain White Metal or German Silver Spectacles, much used in warm or moist climates, per doz., 9s. 6d., 11s. 6d., 15s., 18s., and £1 1 0

1017. **Fine Steel Spectacles,** single joint, best glasses, for either short or weak sight £0 7 6

1018. „ „ „ best Brazilian pebbles . . 0 10 6

1019. „ „ „ with neutral tint glasses. 0 8 6

1020. Fine Steel Spectacles, double joints, best glasses . . 0 8 6

1022. „ „ „ best Brazilian pebbles (*fig.* 1022) 0 11 6

1023. „ „ „ with neutral tint glasses 0 9 6

1024. **Fine Steel Spectacles,** slanting or angular, with best periscopic glasses to suit the curve of the eye, for very delicate and sensitive vision £0 10 6

1025. Fine Steel Spectacles, slanting or angular, with periscopic pebbles 0 13 6

1026. **Fine Light Steel Spectacles,** blue or straw coloured, invisible, with best grooved glasses, and with sides to curl round the ears, for riding, etc. £0 10 6

1027. Extra Fine Light Steel Spectacles, as above . . 0 14 6

1028. „ „ „ „ with best Brazilian pebbles 0 17 6

1029. **Fine Light Steel Spectacles,** with corrective bridge for very prominent eyes or low noses, with best round glasses. . . . £0 15 0

1030. Fine Light Steel Spectacles, as above, pebbles . . 0 18 6

1032. „ „ „ „ neutral tint glasses (any shade) £0 14 6

The above Nos. 1026 to 1032 are much liked and recommended for fishing, riding, or shooting with.

1033. **Best Eye-protectors,** double joints, with tinted glasses, front and side, horse-shoe shape, small size, very neat (*fig.* 1033), p. 96 . . £0 14 0

1034. Best Eye-protectors, as above, large size . . £0 7 6 to £0 15 0

1035. **Best Eye-protectors,** double joints, with fine blackened brass-wire gauze shields, and neutral tint glasses (admirable for India and other warm climates) (*fig.* 1035), p. 96 . . . . . £0 17 6

1036. Best Eye-protectors, as above, with crape shields . . 0 17 6

1037. „ „ „ as No. 1035, with plain dark-wire gauze shield 0 7 6

1038. Best Eye-protectors, full size, in strong best blue steel frames, with globular or concave convex neutral tinted glasses, various shades . £0 10 6

1039. Best Eye-protectors or Goggles, with elastic sides, fine gauze shields and neutral tint glasses, for protection against snow, dust, or in railway travelling . . . . . £0 3 6 to £0 8 6

1040. **Occhiombras or Transparent Eye-shades** (Calkin's patent), in four colors, viz., brown, black, green, and blue (*fig.* 1040), p. 96 . . £0 6 6

These eye-protectors are of very light framework covered with thin transparent gauze, the support on the nose being almost invisible; they protect the eyes from wind and dust as well as the sun, giving at the same time perfect ventilation, and may thus be used during even violent exercise.

1042. Other eye-shades of the most approved kinds, for shading and protecting the eyes, without obstructing the free circulation of air on the forehead, from £0 1 6 to £0 7 6

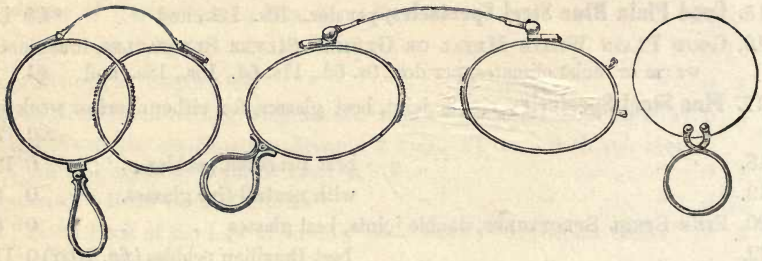


FIG. 1063. FIG. 1058. FIG. 1070.

1043. **Best Steel Spectacles,** double joints, with cataract glasses £0 10 6 to £0 15 0

1044. „ „ „ cataract pebbles 0 15 6 to 1 1 0

1045. BEST STEEL SPECTACLES, with prismatic or cylindrical lenses, carefully arranged for various distortions and imperfections of vision . £0 15 6 to £1 1 0

1046. **Fine Steel Spectacles,** richly gilt, for warm climates, for short or weak sight £0 10 6

1047. FINE STEEL SPECTACLES, as above, single joints, best Brazilian pebbles 0 13 6

SILVER SPECTACLES AND EYE-GLASSES, ETC.

1048. **Silver Spectacles and Eye-glasses,** in about the same forms and varieties as the above, per pair extra . . . . £0 5 6 to £0 7 6

Silver pins and screws only are employed in their make. They are thus particularly recommended for India and other warm or moist climates, where steel is liable to corrode.

GOLD SPECTACLES AND EYE-GLASSES,

WITH BEST CRYSTAL GLASSES OR PEBBLES.

1049. **Fine Gold Spectacles,** for near or weak sights, single joints, for ladies £1 7 6 to 2 5 0

1050. „ „ „ „ with double joints, for gentlemen £1 10 0 to £2 10 0

Either of the above, if with Brazilian pebbles, 5s. per pair extra.

1052. **Fine Gold Spectacles,** slanting or angular, with best periscopic glasses to suit the curve of the eye, for very delicate or sensitive vision £1 10 0 to £2 10 0

1053. The above, if with Brazilian pebbles . . . 5s. per pair extra

1054. **Fine Gold Spectacles,** perlevisean, or invisible (for riding), with best grooved glasses, with sides to curl round the ears . £1 10 0 to £2 2 0

1055. Or if with Brazilian pebbles . . . . 5s. per pair extra.

1056. **Fine Gold Spectacles,** with corrective bridge, for very prominent eyes or low noses, with best glasses, grooved edges . . £1 15 0 to £2 10 0

1057. FINE GOLD SPECTACLES, as above, with Brazilian pebbles 2 0 0 „ 2 15 0

The above Nos. 1054 to 1057 are much liked, and recommended for fishing, riding, or shooting with. Any of the above fitted with neutral tinted glasses of any tint or shade required. The forms are all oval, but if preferred round, in glasses 5s., in pebbles 7s. 6d. to 10s. per pair extra.

1058. **Eye-glasses,** fine gold, oval eyes, with two springs and light spring bridge for thin or narrow nose (*fig.* 1058) . £1 16 0 to £2 5 0

Fig. 1068. Fig. 1069.

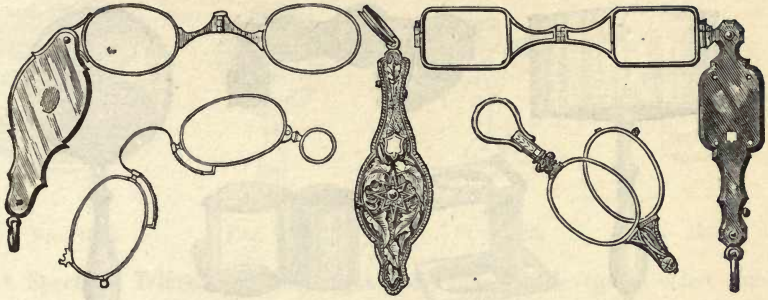


Fig. 1059. Fig. 1064. Fig. 1062.

1059. **Eye-glasses,** fine gold, oval eyes, Japanese, most agreeable to wear, and adapted for every variety of features (*fig.* 1059) . £1 16 0 to £2 10 0

1060. **Eye-glasses,** fine gold, oval eyes, Parisian or double elastic bridge, for medium or narrow features . . . . £1 16 0 to £2 10 0

1062. Eye-glasses, fine gold, oval eyes, with spring centre, double or reversing action, to fit on the nose or hold in the hand, richly chased, much liked for ladies (*fig.* 1062) . . . . . £2 10 0 to £3 10 0

1063. Eye-glasses, fine gold, round eyes, with light spring bridge and fancy handle (*fig.* 1063), p. 98, adapted for full sized features, £2, £2 10 0 and £3 0 0

Locket or Folding Hand Eye-glasses for ladies, with self-acting springs; with best crystal glasses, oval and oblong square (*figs.* 1064, 1068, and 1069):

1064. Eye Glasses, fine gold, 15 to 18 carat, solid sides, richly chased (*fig.* 1064) £8 8 0 to £10 10 0

1065. „ „ „ „ open work, richly chased £5 0 0 £7 0 0 and £11 0 0

1066. „ „ silver gilt, oval floral pattern, enamelled £2 2 0 £2 10 0 and £3 3 0

1067. „ „ „ „ richly chased £1 10 0 £2 2 0 and £2 15 0

1068. „ „ fine ivory or pearl, and best gilt (*fig.* 1068) £1 5 0 to £1 15 0

1069. „ „ tortoise-shell sides, with fine gilt mountings, best quality (*fig.* 1069) £1 1 0 and £1 10 0

Besides the above locket eye-glasses a great variety in various mountings are kept in Ivory, Shell, Pearl, Ormolu, and Gold, of the richest patterns and most elegant designs.

Single Eye-glasses, in fine gold mountings, for ladies or gentlemen:

1070. „ „ with fine gold handle and no rim (*fig.* 1070), p. 98 £0 17 6

1072. „ „ with fine gold eye-rim . . . 0 14 6

1073. Single Eye-glasses, in fine gold, with neat handles for ladies £1 5 0 £1 12 0 and £2 0 0

Single Eye-glasses, in Tortoise-shell Mounting, for ladies and gentlemen:

1074. Eye-glass, with tortoise-shell rim (*fig.* 1074), p. 96, best crystal glass £0 2 6

1075. „ „ „ best Brazilian pebble . 0 4 6

FIG. 1102.

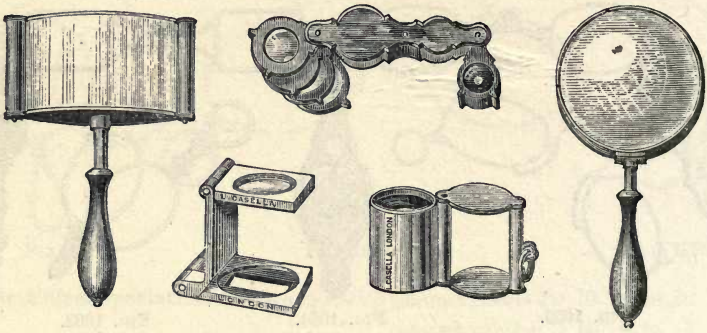


FIG. 1096. FIG. 1105. FIG. 1103. FIG. 1095.

1076. **Eye-glass,** with tortoise-shell rim and handle, best crystal glass £0 4 0

1077. „ „ „ „ Brazilian pebble . £0 7 6

1078. EYE-GLASS, with steel rim let into the groove glass . . 0 3 0

1079. „ „ „ „ „ pebble . 0 6 6

1080. EYE-GLASS, with milled edge and with hole for cord, glass . 0 2 0

1081. „ „ „ „ „ pebble (*fig.* 1081), p. 96 £0 5 6

Folding or Double Eye-glasses, in tortoise-shell or steel frames:

1082. FOLDING OR DOUBLE EYE-GLASSES, in best tortoise-shell mounting, without spring (*fig.* 1082), p. 96 . . . £0 5 6 to £0 7 6

1083. „ „ „ with centre spring 0 8 6 to 0 12 6

1084. FOLDING OR DOUBLE EYE-GLASSES, in best tortoise-shell mounting, with light steel spring bridge . . . . £0 7 6 to £0 12 6

1085. **Folding or Double Eye-glasses,** in best tortoise-shell mounting, with fine gold spring bridge, very handsome £1 1 0

1086. FOLDING OR DOUBLE EYE-GLASSES, fine steel mounting, with double springs and light steel bridge . . . . £0 7 6 to £0 10 6

1088. FOLDING OR DOUBLE EYE-GLASSES, fine steel, straw color, with double springs, and light steel bridge, Japanese pattern (as No. 1059), most agreeable to wear and adapted for every variety of features . . . £0 11 6

The above spectacles when supplied singly are all in suitable cases. When cases are required for the eye-glasses they are charged extra, average 1s. Fancy cases in morocco, velvet, plaid, chagrine, shell, etc., etc., for spectacles and eye-glasses in every variety.

SPECTACLE TRIERS.

1089. **Spectacle Triers,** a set of eight pairs of convex glasses of graduated sights, with the sights marked, from plain preservers to those required for middle age, in neat horn mounting £1 5 0

FIG. 1098.

FIG. 1097.

FIG. 1100.

FIG. 1106.

1089*. **Spectacle Triers,** containing eight pairs, from middle age to oldest sights, in neat horn mounting £1 5 0

1090. SPECTACLE TRIERS, for near or short vision, consisting of seven pairs of concave glasses of graduated sights, with the focus marked on each from No. 1 to No. 7, in neat horn mounting £1 8 0

1092. SPECTACLE TRIERS, as above, from No. 8 to No. 14, in neat horn mounting £1 12 0

1093. **Trial Lenses,** a complete series for every sight, consisting of 36 pairs of convex and 36 pairs of concave spherical lenses, 18 pairs convex and 18 pairs concave cylindrical glasses, with 12 prisms, 2 blank discs, 4 discs with small apertures, 3 colored glasses assorted, of most approved tints, with graduated adjusting frame for holding the various lenses, in mahogany case complete £7 0 0

1094. TRIAL LENSES, as above, consisting of 24 pairs convex and 24 pairs concave spherical lenses, 9 each convex and concave cylindrical glasses, 6 prisms, 2 blank discs, 2 discs with small apertures, 3 colored glasses of most approved tints, with graduated adjusting frame for holding the various lenses, in mahogany case complete £5 10 0

1095. **Hand Reading Glasses,** of best make, for examining maps or photographs, in German silver, with polished ebony or ivory handles (*fig.* 1095), p. 100:

Size.	Ebony.	Ivory.	Size.	Ebony.	Ivory.
$1\frac{5}{8}$ inch.	£0 1 8	£0 3 0	$3\frac{3}{4}$ inch.	£0 6 6	£0 9 6
$2\frac{1}{8}$ „	0 3 0	0 3 6	4 „	0 7 6	0 11 6
$2\frac{5}{8}$ „	0 4 0	0 5 6	$4\frac{3}{8}$ „	0 11 6	0 17 6
$3\frac{1}{4}$ „	0 5 0	0 7 6	$4\frac{3}{4}$ „	0 13 6	1 0 0

The above glasses in brass (gilt) 1s. to 3s. 6d. each extra.

1096. HAND READING GLASSES, oblong square, in German silver, with polished ebony handles (*fig.* 1096), p. 100; $2\frac{3}{4}$ inch., 3s. 6d.; 3 inch., 4s.; $3\frac{1}{4}$ inch., 4s. 6d.; $3\frac{3}{4}$ inch. £0 5 6

1097. **Hand Reading Glasses,** as No. 1095, in polished hardwood frames, with brass sockets (*fig.* 1097); 3 inch., 7s. 6d.; $3\frac{1}{2}$ inch., 8s. 6d.; 4 inch., 10s. 6d.; $4\frac{1}{2}$ inch., 12s. 6d.; 5 inch., 15s. 6d.; 6 inch., £1; 7 inch. . . £1 4 0

1098. MAGNIFYING LENSES, single, in horn or shell mountings, folding for the pocket, very convenient for florists, mineralogists, etc. (*fig.* 1098), 1s. to £0 4 6

1099. MAGNIFYING LENSES, double, in horn or shell mountings, 2s. to 0 7 6

1100. „ „ triple, to use together or separately, in horn or shell mountings (*fig.* 1100), 3s. to £0 10 6

1102. **Improved Magnifying Lens,** being a combination of three lenses, mounted in tortoise-shell, for use together or separately, with diaphragm and large field Coddington at opposite end, for suspension or the waistcoat pocket (*fig.* 1102), p. 100 . . . . . £0 13 6

1103. **Coddington Lenses,** of high magnifying power, very useful for opaque objects, as minerals, etc., in German silver (*fig.* 1103), p. 100, 4s. 6d., 5s. 6d. and £0 7 6

1104. Stanhope Lenses, in German silver mountings, 3s. 6d. to . 0 5 6

1105. **Linen or Cloth Provers,** to fold, for the pocket (*fig.* 1105), p. 100, 1s. 6d. to £0 5 6

1106. Watchmakers' Eye-glasses (*fig.* 1106), p. 101, 1s. 6d. to . 0 2 6

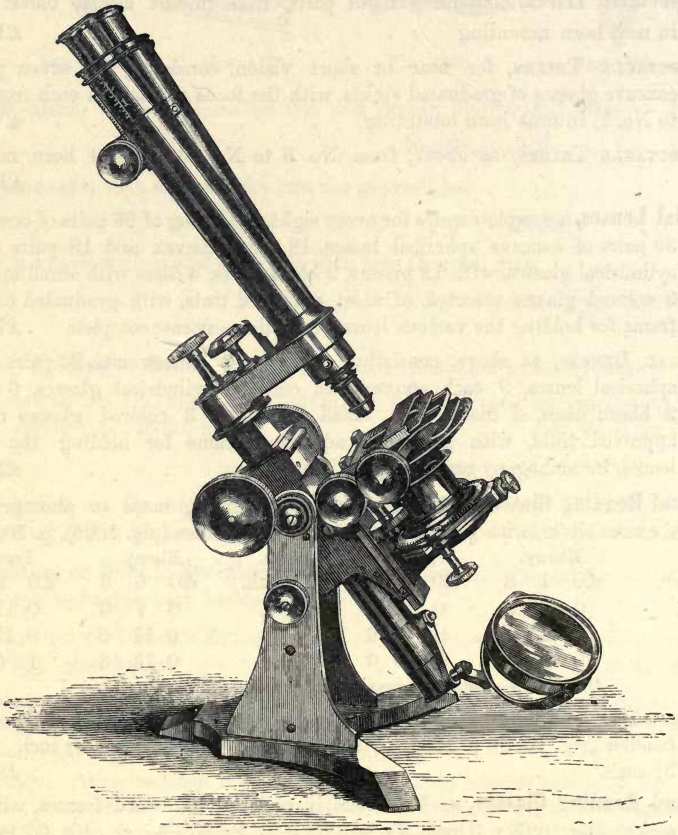


Fig. 1107.

MICROSCOPES.

In the following list of microscopes the desire has been not so much to describe the most costly as the most useful and practical kinds. With this view every real improvement has been adopted and described, whether as desirable refinements, or such as are really required in the practical working and use of the instrument. The fact being kept

in view, that the high refinements of the most costly, are by no means essential for the interesting practical investigations of the chemist or physician; who are often unwilling to incur an outlay that is cheerfully expended on the highest refinements of powers or the elegant arrangement embodied in instruments for presentation.

BEST COMPOUND MICROSCOPES,
WITH MUCH IMPROVED EXTRA WIDE BAR TO RACK-WORK.

FIRST SERIES.

1107. **Superior Large Compound Microscope,** of latest improved construction, with long divided draw tube, bar motion, extended to work with 4-inch. objective, improved thin goniometer stage for oblique light, divided to 360 degrees, with 1-inch. rectangular motion and best object-holder with spring clip, the whole stage being worked round by means of a rack and pinion, concentric with the axis of the object glass. The fine adjustment is of the best lever construction, with divided milled head for correcting the objective to the thickness of glass covering the object, improved sub-stage, with rotary motion and rectangular adjustment divided to 360 degrees, especially adapted for correctly centering the illuminating apparatus, with plain and concave mirrors, on jointed arm for oblique light illumination, improved expanding diaphragm, 2 Heugenian eye-pieces, A and B, and eccentric clamp for fixing the instrument at any inclination required (*fig.* 1107), p. 102 . . £29 10 0

1108. If in polished mahogany cabinet, with 3 drawers, packing, etc., complete, extra £2 12 6

1109. Or, in best Spanish mahogany case, with mouldings, extra . 3 15 0

1110. The above microscope, with Wenham's binocular arrangements, with divided draw tubes and 2-inch. rack and pinion motion for adjusting to different widths of eyes, and 2 extra eye-pieces, A and B . . £35 10 0

The binocular part of this instrument is so arranged that the bodies can be readily removed so as to use it either as a binocular or monocular instrument of the very finest description, price, if so arranged with both bodies £37 10 0

1112. **Superior Large Compound Microscope,** with divided draw tube and improved thin compound stage, having rotating plate, object-holder, and 1 inch. of motion in rectangular directions, best lever fine adjustment (similar to the preceding), sub-stage with rotating wheel divided to 360 degrees, and complete adjustments for centering illuminating apparatus, plain and concave mirrors, on double-jointed arm for oblique illumination, improved expanding diaphragm and 2 eye-pieces, A and B (*fig.* 1112), p. 104 . . £23 10 0

1113. If in polished mahogany cabinet, with 3 drawers, packing, etc., complete, extra £2 5 0

1114. Or, in best Spanish mahogany case, with mouldings, extra . 3 3 0

1115. If with Wenham's binocular arrangement, similar to No. 1110, with suitable additional eye-piece, extra £6 10 0

1116. **Superior Microscope Stand,** as above, but of smaller size, with ¾-inch rectangular motions to stage, rotating plate to thin top stage, object clamp and best lever fine adjustment, complete sub-stage, double jointed arm to mirrors, diaphragm, and 2 eye-pieces, A and B £17 10 0

1117. If with Wenham's binocular arrangement with 1½-inch. rack and pinion motion to draw tubes, and 1 additional eye-piece, extra . . £5 5 0

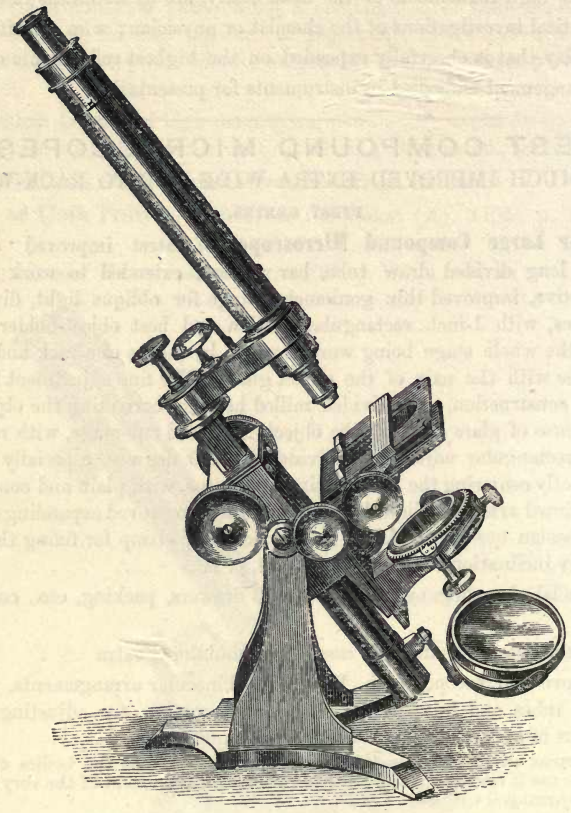


FIG. 1112.

1118. **Improved Binocular Microscope Stand,** as No. 1116, but without the sub-stage £15 15 0

1119. If in polished mahogany cabinet, with packings for apparatus, extra 1 8 0

1120. Or, in best Spanish mahogany case, with mouldings, extra . 2 0 0

1122. **Superior Monocular Microscope,** as No. 1116, but without sub-stage 13 10 0

1123. If in polished mahogany case with packing for apparatus, extra. 1 5 0

1124. Or, in best Spanish mahogany case, with mouldings, extra . 2 2 0

1125. **Binocular Microscope Stand,** like No. 1118, but of smaller size, with ½-inch motions to stage, diaphragm and sliding plate, with fitting for apparatus, lever fine adjustment, double mirrors with jointed arm, and 2 eye-pieces, A or B £14 10 0

1126. The above microscope, if monocular 11 0 0

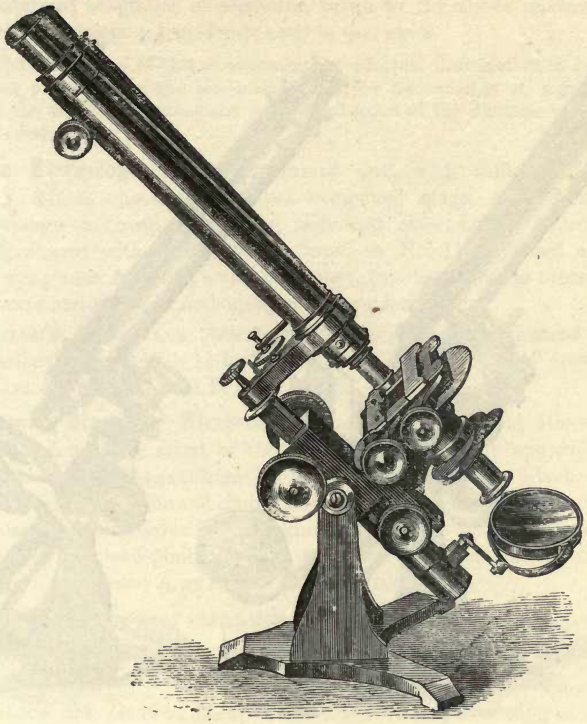


Fig. 1129.

1127. **Presentation Binocular Microscope,** of extra large size, and very superior and elegant finish. The thin concentric stage is the latest improved, and divided to 360 degrees. The stage plates are divided to the 50th of an inch in rectangular directions, with vernier for measuring the natural size of objects under examination, and acting also as a finder in viewing diatoms, etc., being worked round by means of an inverted crown rack. The sub-stage is also of the newest construction, with complete universal motions, etc., divided as above, clamp to axis of stand, best lever fine adjustment, double-jointed arm to mirrors with clamp milled head. The bodies are of extra large diameter, improved expanding diaphragm, stage and bottle forceps, pliers, extra large condenser on stand with 3-inch. condensing lens, polarizing apparatus, with extra large prisms and complete set of eye-pieces, viz., two each of A, B, and C £55 10 0

1128. **Handsome Glass Shades,** with richly moulded black stand, are often supplied with either of the foregoing and most of the following microscopes, instead of mahogany cases, at 12s. 6d. to £1 10s. each.

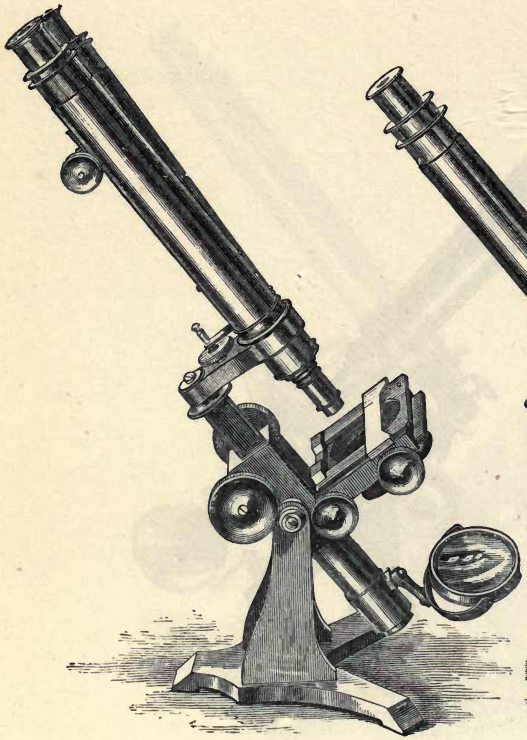


FIG. 1135.

FIG. 1139.

IMPROVED MICROSCOPES.

SECOND SERIES.

The reduction in cost of the following microscopes is chiefly obtained by their great popularity and the numbers that are made at a time. Though so moderate in cost and less elaborate in finish, they are optically quite equal to the dearer kinds, whilst the stability and precision of movement being carefully seen to, purchasers ordering from a distance may do so with the utmost confidence.

1129. **Superior Binocular Microscope,** with goniometer stage, divided to 360 degrees and worked round by the hand, ¾-inch rack and screw motion in rectangular directions, improved object-plate and clamp, lever fine adjustment, 2-inch. rack motion to divided draw tubes, simple sub-stage, with vertical motion for focussing achromatic condenser, etc., jointed arm to mirrors, and one pair of eye-pieces, A or B (*fig.* 1129), p. 105 . . . £18 10 0

1130. If in polished mahogany case with packing complete, extra . 1 5 0

1132. An improved adaptation of analysing prism to the above renders it really the best microscope (at moderate cost) in use, extra . . £1 5 0

N.B.—The advantages of this arrangement are effectual illumination in both bodies, the analyser being placed above the binocular prism, the transmission of a greater amount of light without the distortion, consequent upon a reduction of the distance between the objective and binocular prism.

1133. **Large Microscope,** with crane-formed arm, with sufficient bar motion for the 4-inch. objective, improved compound stage, with ¾-inch motion in rectangular directions, rotating plate and object-holder, improved lever fine adjustment with divided milled head, as No. 1107, jointed arm to mirror, 2 eye-peices, A and B, stand condenser, live box, dipping tubes in case, stage forceps and pliers, in mahogany case, complete . . £18 0 0

1134. Wenham's Binocular Arrangement to this stand, instead of the above monocular form, with 1½-inch. rack and pinion motion to draw tubes, and 2 extra eye-pieces, A and B, extra £5 0 0

1135. **Improved Binocular Microscope,** as used by the Royal Microscopic Society of London. The stand of this instrument is highly approved by the best authorities, and has sufficient bar motion to work with the 4-inch. objective, with rotating object plate and clamp, mechanical stage, with ¾-inch motions in rectangular directions, lever fine adjustment, Wenham's binocular arrangement, with 1¼-inch. rack and pinion motions to draw tubes, jointed arm to mirrors, and pair of eye-pieces, A or B (*fig.* 1135), p. 106 . . £12 0 0

1137. If in polished mahogany case, extra 1 2 0

1138. The above instrument of monocular construction with mirrors and 2 eye-pieces, A and B £9 9 0

1139. Superior Six Guinea Monocular Microscope, consisting of improved brass stand, with extended bar motion to work with 4-inch. objective, lever fine adjustment, sliding or spring stage, with revolving diaphragm of apertures, plain and concave mirrors, on jointed arm, and one eye-piece, A or B (*fig.* 1139), p. 106 . . . . . £6 0 0

1140. If in polished mahogany case, extra 0 15 6

1142. **The Student's Improved Binocular Microscope,** similar to the preceding, with fine adjustment for high powers, improved lifter motion to draw tubes, for adjusting to the width of the eyes, sliding stage mirrors and pair of eye-pieces, A or B (*fig.* 1142), p. 108 . . . £6 6 0

1143. The spring stage (*fig.* 2), p. 108, can be adapted to the above at an extra cost of £0 6 6

This instrument forms an excellent basis for a compound stand, the lever stage or the ordinary compound rack and screw stage, can be readily adapted to it; it is also provided with tube fitting to receive all requisite accessory apparatus; the following is very suitable for this instrument:—

1144. **Polarizing Apparatus** £1 8 0

1145. Parabola. 0 18 0

1146. Spot Lens 0 9 0

1147. Stage Forceps 0 3 6

1148. Live Cage 0 3 6

1149. Double Nosepiece 0 12 6

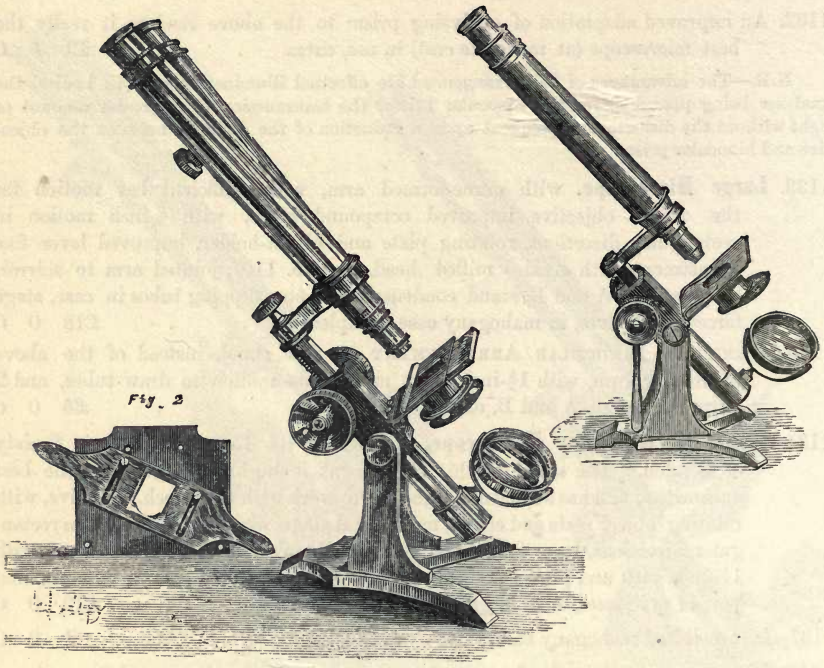


Fig. 1142. Fig. 1158.

1150. **Stand Condensers** £0 10 0

1152. Wenham's White Cloud Illuminator . . . 0 12 0

1153. Frog Plate 0 5 6

1154. Mahogany Cabinet, with packings for all the above apparatus 0 15 0

1155. The above stand and apparatus, if taken in one . . . 11 0 0

1156. **The Student's Complete Monocular Microscope,** with rack motion to bar and lever fine adjustment for high powers, large sliding stage, plain and concave mirrors, one eye-piece, A or B, stand condenser, live box, stage forceps and pliers, superior English achromatic objective to separate, forming 1-inch, ½-inch and ¼-inch power, in neat polished mahogany case (*fig.* 1156), p. 109 £6 6 0

1157. To this microscope is sometimes added a polarizing apparatus, £1 1s., and also an improved lever stage, with ½-inch rectangular motions by which it is especially adapted for use with large zoophyte trough or stage plate £1 13 6

1158. **Cassella's Popular Educational Microscope** (*fig.* 1158), consisting of an excellent and convenient stand, with coarse and fine adjustments, tube fitting to stage for apparatus, large diaphragm, one eye-piece, A or B, an excellent English achromatic forming 1-inch, ½-inch, and ¼-inch, powers of 40 degrees angular aperture £3 10 0

1159. Or in mahogany cabinet case 4 0 0

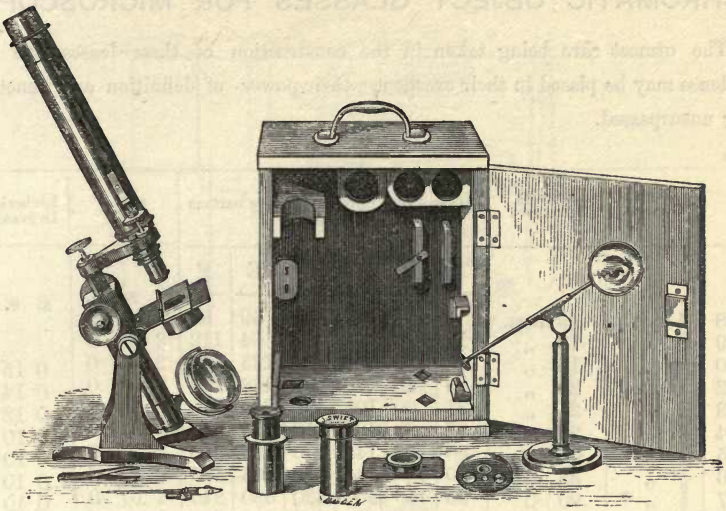


FIG. 1156.

1160. **Small Popular Microscope,** as above, with foreign objective of nearly similar powers, with rack-work, spring clip to stage, concave mirror, animalculæ cage, and one eye-piece, with forceps and 9 objects in drawer, in mahogany case complete £2 5 0

1162. **Garden or Seed Microscope,** a simple and compound instrument expressly arranged by L. CASELLA, for the various requirements of gardeners, and also as an excellent companion to the aquarium and the sea side (*fig.* 1162), p. 111, in mahogany case 4 inch. × 3 inch., and 1½ inch. deep; with plain practical instructions £1 5 0

MICROMETERS.

1163. 100-THREAD SCREW MICROMETER, of best construction, with drum divided to 100 . . . . . £5 5 0

1164. **Jackson's Eye-piece Micrometer,** with adjusting screw . 1 3 0

1165. EYE-PIECE for the above 1 5 0

1166. MICROMETER CIRCLE to fit eye-piece 0 7 6

1167. „ on 3 × 1 inch. glass slide . . . 0 6 0

ACHROMATIC OBJECT GLASSES FOR MICROSCOPES.

The utmost care being taken in the construction of these lenses, the fullest confidence may be placed in their excellence, their power of definition and penetration being unsurpassed.

	Object Glasses.	Angular Aperture.	Magnifying Powers with the various Eye-pieces.						Price.			Lieberkuhns, In brass box.		
			A	B	C	D	E	F	£	s.	d.	£	s.	d.
1168	4-inch.	9 degs.	9	16	25	38	59	82	1	5	0			
1169	3 „	12 „	13	20	35	56	84	112	2	0	0			
1170	2 „	15 „	20	32	55	90	135	180	2	0	0	0	15	0
1172	1½ „	20 „	25	40	70	112	168	224	2	0	0	0	14	0
1173	1 „	25 „	37	60	105	170	255	340	2	0	0	0	12	6
1174	1 „	22 „	37	60	105	170	255	340	1	6	0	0	10	0
1175	⅔ „	52 „	60	100	145	270	405	540	3	0	0	0	10	0
1176	⅔ „	35 „	60	100	145	270	405	540	2	10	0	0	10	0
1177	½ „ *	90 „	95	153	265	420	630	840	4	10	0	0	10	0
1178	½ „	55 „	95	153	265	420	630	840	3	0	0	For Binocular		
1179	$\frac{4}{10}$ „ *	110 „	140	220	370	650	975	1300	5	5	0	0	10	0
1180	¼ „ *	120 „	195	310	540	850	1275	1700	4	15	0			
1182	¼ „	100 „	195	310	540	850	1275	1700	3	5	0			
1183	$\frac{1}{5}$ „ *	135 „	225	400	612	860	1040	1460	5	5	0			
1184	$\frac{1}{6}$ „ *	140 „	320	510	700	910	1360	1820	5	15	0			
1185	⅛ „ *	150 „	420	670	900	1200	1800	2400	7	7	0			

Those marked * have an adjustment for covered and uncovered objects.

SECOND SERIES.

1186.	3-inch.	10 degs.	. . . . .	£1 5 0
1187.	2 „	13 „	. . . . .	1 5 0
1188.	1 „	18 „	. . . . .	1 5 0
1189.	½ „	40 „	For Binocular . .	2 2 0
1190.	¼ „	85 „	. . . . .	2 10 0
1192.	¼ „	75 „	. . . . .	2 5 0
1193.	¼ „	60 „	. . . . .	1 15 0

THIRD SERIES—Separating Glasses.

1194.	Forming 4 & 2-in.		. . . . .	£1 10 0
1195.	3 & 1½ „		. . . . .	1 10 0
1196.	2 & 1 „		. . . . .	1 10 0
1197.	¼ „	40 degs.	Forming three powers	1 1 0

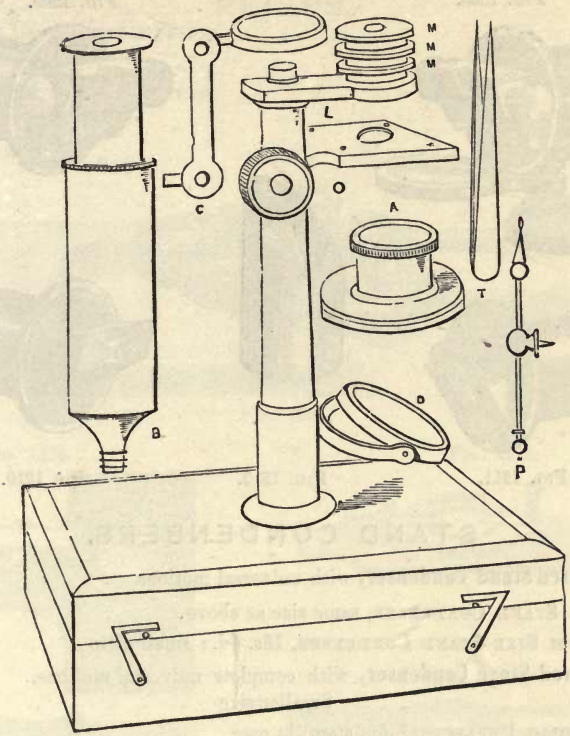


FIG. 1162.

1198. **Improved Achromatic and Tinted Condenser,** of 90 degrees angular aperture; constructed as a perfect substitute, at a moderate cost, for a large number of the separate pieces of illuminating apparatus; it is also an excellent sub-stage, so essential to the compound microscope, and is applicable to all microscopes having sufficient depth beneath the stage. It is suitable for all objectives from the 2 inch. to the one-fifth, and is tinted for correcting the yellow rays of artificial light; with rack and pinion motion for focussing, and is an excellent spot lens; large diaphragm with rotating cap, in which are fitted three discs for stops for oblique light, small diaphragm of apertures, polarizing prism, selenite diaphragm with two selenite films and clear aperture, for illuminating with low powers £4 12 6

1199. Or with parabola 5 10 0

1200. An extra combination of 135 degrees angular aperture can be adapted for use with powers from 1 inch upwards £1 10 0

1902. **Improved Achromatic Condenser,** with diaphragm for dark ground and oblique illumination, being a modification of No. 1198 . £2 15 0

Fig. 1208.

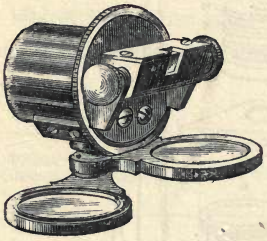
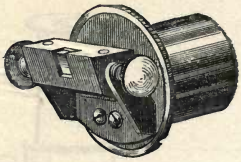
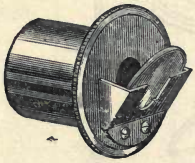


Fig. 1209.





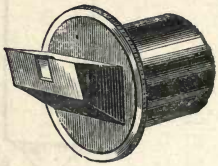


Fig. 1211. Fig. 1212. Fig 1210.

STAND CONDENSERS.

1203. **Improved Stand Condenser,** with universal motions . . £1 12 0
1204. Large Stand Condenser, same size as above. . . 1 8 0
1205. Medium Size Stand Condenser, 15s. 6d.; small ditto . 0 12 6
1206. **Improved Stage Condenser,** with complete universal motions, 0 17 0
1206*. „ „ „ Smaller size . . . 0 10 0
1207. Parabolic Reflector* (on stem) in case . . . 1 5 0

* By means of this reflector the objective in use can be removed and another one substituted without altering the adjustment of the reflector. It is also applicable to all powers from 4 inch. upwards.

CAMERA LUCIDAS.

1208. **Wollaston's Camera Lucida,** with frames (*fig.* 1208) . . £1 5 0
1209. „ „ „ without frames (*fig.* 1209) . 0 17 6
1210. Simple Form of Camera Lucida „ (*fig.* 1210) . 0 14 0
1211. **Beales's Neutral Tint Camera Lucida,** with 3 glasses of different shade (*fig.* 1211) £0 9 6
1212. Simple Form of Ditto (*fig.* 1212) 0 5 6

STAGE FORCEPS.

1213. **Large Size Best Stage Forceps** 0 8 6
1214. „ „ Mineral Forceps 0 16 6
1215. Forceps, with arm and universal joint . . . 0 12 0
1216. **Second Quality Large Stage Forceps** 0 5 0
1217. „ „ Small „ „ 0 3 6

PLIERS.

1218. Large Best Bottle Pliers £0 5 6
1219. Second Size „ „ 0 4 6
1220. Large Best Stage Pliers 0 3 6
1222. Second Size „ „ 0 2 6
1223. Common „ „ 0 1 6

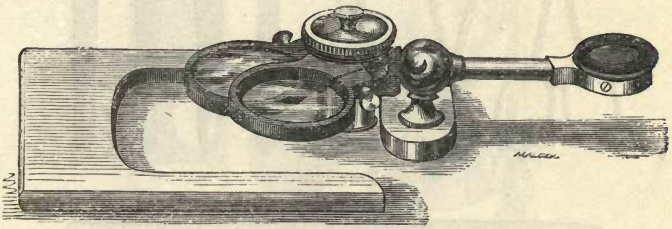


Fig. 1224.

Fig. 1225.

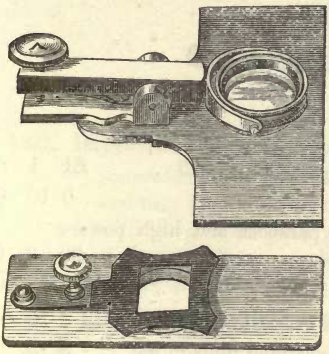


Fig. 1229.

Fig. 1226.

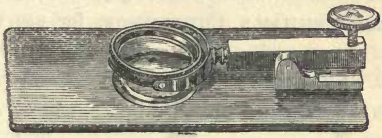


Fig. 1227.

COMPRESSORS.

1224. Piper's Reversible Compressor, for high and low powers, and rotating disc (*fig.* 1224) £1 6 0
1225. Lever Compressor, of best construction (*fig.* 1225) . . 1 5 0

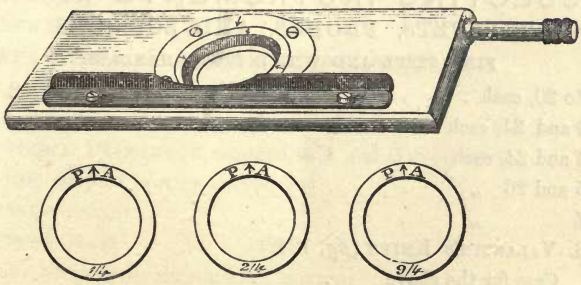


Fig. 1230.

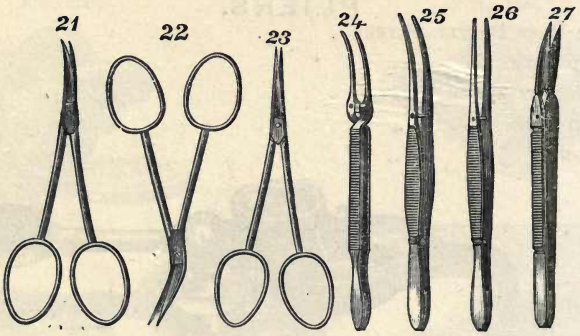


FIG. 1238.

FIG. 1242.

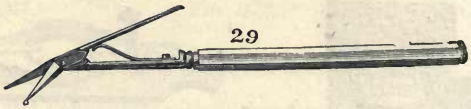


FIG. 1244.

1226. **Smaller Compressor,** of best construction (*fig.* 1226), p. 113 . £1 1 0
1227. SPRING COMPRESSOR (*fig.* 1227), p. 113 . . . 0 16 0
1228. WENHAM'S COMPRESSOR, for use with the parabola and high powers £0 9 6
1229. SMALL COMPRESSOR (*fig.* 1229), p. 113 . . . 0 12 0
1230. **Compound Selenite Stage,** and set of 3 films in box (*fig.* 1230), p. 113 2 10 0
1232. IMPROVED „ „ and set of 3 compound films in box 2 15 0
1233. SERIES OF SELENITES, mounted to sub-stage . . . 2 5 0
1234. TOURMALINE adapted to above, with rotary holder £1 4 0 to 6 6 0
1235. ROTARY STAGE, with selenite films fitted to eye-piece, and spring box for carrying tourmaline or prism £3 3 0

DISSECTING INSTRUMENTS (*fig.* 1238).

SCALPETS, PROBES, AND SCISSORS.

FINE STEEL AND WHITE IVORY HANDLES.

1236. No. 1 to 20, each . . . . . £0 1 2 to £0 2 0
1237. „ 20 and 21, each 0 4 0
1238. „ 23 and 24, each 0 2 6
1239. „ 25 and 26 „ 0 2 6
1240. „ 27 „ 0 5 0
1242. „ 28. VALANTIN'S KNIFE (*fig.* 1242) . . . 0 13 6
1243. Case for the above 0 2 6
1244. „ 29. (*fig.* 1244) . . . 0 9 0

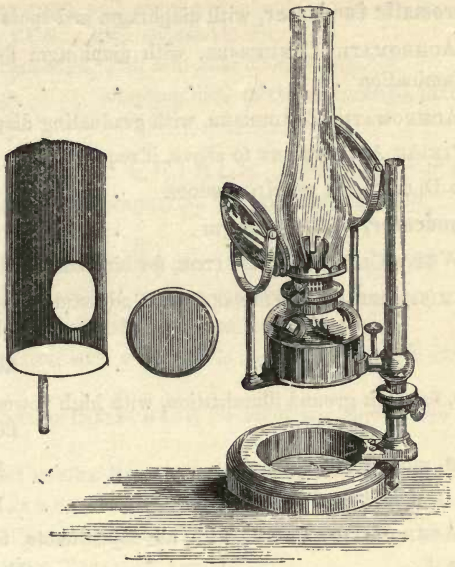


FIG. 1245.

1245. **Improved Microscopic Lamp** (*fig.* 1245). In this arrangement, utility and convenience are combined to the utmost; a clear and brilliant light is obtained and may be subdued, altered in tint, etc., and brought to bear upon any point with the greatest facility, with silvered glass reflector for condenser illumination, porcelain non-conducting lamp shade, circle of blue glass to neutralize the artificial rays, £2 2s.; or without case . . . £1 15 0

If with papier machie shade, 3s. 6d. extra.

APPARATUS FOR COMPOUND MICROSCOPES.

1246.	LARGE SIZED A and B EYE-PIECES, engraved, each								£0	14 6
1247.	„	C	„	„	„				0	16 0
1248.	„	D	„	„	„				0	17 6
1249.	„	E	„	„	„				1	0 0
1250.	„	F	„	„	„				1	3 0
1252.	SMALLER SIZES						£0	7 0 to	0	11 6
1253.	**Kellner's Orthoscopic Achromatic Eye-pieces,** A and B								1	4 0
1254.	„	„	„	„	C				1	5 0
1255.	„	„	„	„	D				1	7 0
1256.	ADJUSTABLE DIAPHRAGM, adapted to A and B eye-pieces								0	16 0
1257.	POINTER, adapted to A or B eye-piece								0	5 6
1258.	CENTERING GLASS								0	12 6
1259.	ERECTING GLASS								0	17 6
1260.	HARLEY SHADES TO EYE-PIECES, the pair								0	3 0
1262.	DOUBLE NOSE-PIECES, 12s., 14s. 6d., £1, £1 4s., £1 10s., and								1	15 0

1263. **Gillett's Achromatic Condenser,** with diaphragm and spots . £4 15 0

1264. Webster's Achromatic Condenser, with diaphragm for dark ground and oblique illumination £2 8 0

1265. Webster's Achromatic Condenser, with graduating diaphragm 3 12 0

1266. Rack and Pinion Adjustment to above, if required . . 0 12 6

1267. Graduating Diaphragm to Microscope . . . 1 5 0

1268. **Kinsley's Condenser,** with diaphragm . . . 3 3 0

1269. Wenham's White Cloud Illuminator, for binoculars £0 14 6 to 2 0 0

1270. Reade's Hemispherical Condenser, with adjusting diaphragm and shutter £1 15 0

1273. Spot Lens . . . . . £0 6 0 to 0 7 6

1274. Paraboloid, for dark ground illumination, with high powers £0 12 0 to 1 10 0

1275. **Amicis Prism,** mounted on stand . . . 1 2 0 to 2 12 6

1276. „ „ mounted to sub-stage . . . 1 15 0 to 2 8 0

1277. Improved Achromatic Prism, with all adjustments, fitted to tail-piece of microscope . . . . . £2 5 0 to £3 5 0

1278. Rectangular Prism, mounted as above . . 1 2 0 to 2 8 0

1279. Nachet's Prism for oblique light, mounted to sub-stage . 1 5 0

1280. Reade's Diatom Prism . . . . 0 14 6 to 1 15 0

1282. Lister's Dark Wells (set of three) and holder . . 0 12 6

1283. Rainey's Light Modifier . . . . 0 5 0 to 0 7 6

1284. Maltwood's Finder 0 7 0

1285. **Frog Plates** . . . . . 0 5 6 to 0 12 6

1286. Sets of Dipping Tubes, in case . . . 0 1 6 to 0 6 0

1287. Glass Troughs . . . . . 0 5 0 to 0 9 0

1288. Morris's Universal Stage Plate . . . 0 5 6 and 0 8 6

1289. **Goniometer,** for measuring the angles of crystals . . 3 15 0

1890. Pair of Double Image Prisms, and selenite film, with fittings to eye-piece, and brass plate with holes £2 10 0

1292. Polarizing Apparatus to Microscope . . £1 4 0 to 3 15 0

1293. **Selenite Films,** various . . . . 0 1 6 to 0 9 0

1294. „ „ in brass slides . . . 0 3 0 to 0 12 6

1295. Crystals, cut to show the optic axis 0 6 0

1296. Tourmalines, mounted . . . . 0 6 0 to 12 0 0

1897. Nachet's Concentric Stage . . . . . from 1 4 0

1298. Micro-Spectroscope, adapted to any microscope, will show two spectra in the field of view at the same time £6 6 0

1299. **Pocket Spectroscope,** will show Fraunhofer's lines, and the bright lines of the metals, etc., £1 5s.; with adjustable slit . . . £1 15 0
1300. Pocket Spectroscope, with achromatic lenses, etc., . . 2 5 0
1302. „ „ adapting ditto to the microscope, extra 0 12 6

MOUNTING MATERIALS AND APPARATUS.

1303. Lawson's Binocular Dissecting Microscope, complete . £2 12 0
1304. Monocular „ „ „ . . 2 2 0
1305. Turntables, for making cells, etc. . . £0 7 6 and 0 10 0
1306. Air Pump, with plate and receiver complete . . . 0 18 6
1307. **Wright's Collecting Bottle and Funnel** . . . 0 6 0
1308. Collecting Stick, with screw bottle and ring, cutting hook, and net ring £0 15 0
1309. Smith's Mounting Instrument, for preparing objects free from air bubbles £0 10 0
1310. Machine for Cutting Sections of Wood, etc. £0 12 6 to 2 2 0
1312. Brass Table and Spirit Lamp, for heating objects in mounting 0 6 6
1313. Glass Stage Plates, various . . . . £0 1 0 to 0 4 6
1314. Glass Dissecting Troughs, various . . . 0 4 6 to 0 12 6
1315. Instrument for Cutting Thin Glass Circles . 1 4 0 and 1 10 0
1316. Injecting Syringe, with stopcocks . . . 0 10 0 to 0 12 6
1317. Writing Diamonds . . . . . from 0 5 6
1318. Cutting Diamonds 0 15 0
1319. Canada Balsam, Asphalt, Gold Size . . per bottle 0 1 0
1320. Deane's Gelatine Medium, Glycerine, etc. . . „ 0 2 0
1322. Thin Glass, in circles and squares, per oz., 6s. and . . 0 4 6
1323. Plate Glass Slips, with ground edges, 3 inch. by 1 inch, per gross 0 12 0
1324. Flattened Crown ditto . . . . „ 0 8 0
1325. Labels for covering objects, per 100 . . . . 0 2 0
1326. Glass Cells, square, round, oblong, and with solid bottoms, per doz., 2s. 6d. to £0 6 6
1327. Object Cases, to hold 3 doz. 0 1 4
1328. „ „ „ 2 „ 0 1 0
1329. „ „ „ 1 „ 0 0 8
1330. „ „ „ ½ „ 0 0 6

*** Every description of Object Cabinet to hold from 3 doz. to 1000 to order.

MICROSCOPIC OBJECTS.

Owing to the difficulty of forming a fairly complete list of these objects, a few only are here enumerated, all interesting new varieties are, however, made up as they appear, and specimens and sections of every kind are prepared to order.

Geological Microscopic Sections prepared with the utmost care.

Sections of limestones from Bath, Bristol, East Indies, West Indies, Germany, Italy, Ireland, Lancashire, etc.

Transverse and longitudinal sections of Fossil wood from Australia, Antigua, Bristol, Cromer, Dudley, East Indies, West Indies, Egypt, Folkstone, Isle of Portland, Isle of Sheppey, Isle of Wight, and other parts of England.

Sections of Flint, containing ammonites, sponge, etc.

Transverse and vertical sections of Bone, various.

Scales of Fishes, various. Sections for the Polariscope. Alabaster, English and Italian Agate. Ammonites, Brighton Pebble, black and white Marble, Granite, various, Labrador and other Spar.

1332. **Human Bone,** a set of twelve slides, illustrating its growth and structure, each £0 1 6

1333. URINARY DEPOSITS, set of twelve, each slide . . . 0 1 6

1334. INJECTED PREPARATIONS, and other animal tissues, each slide . 0 1 9

1335. RECENT AND FOSSIL BONES of mammals, reptiles, birds, and fishes, transverse and vertical sections, each slide £0 1 3

1336. **Recent and Fossil Teeth,** transverse and vertical sections, each slide 0 1 3

1337. BLOOD DISCS, pigment cells, skin, etc., each slide . . 0 1 3

1339. BLOOD DISCS—Syren and lepidosyren 0 1 9

1340. SPICULES AND GEMMULES of sponges and gorgonias, each slide 0 1 3

1342. **Shells,** sections of various species of, each slide. . . 0 1 3

1343. ECHINI SPINES, sections of, in great variety, each slide. . 0 1 3

1344. **Entomological Preparations**—antennæ, eyes, feet, hairs, scales, skins, spiracles, stings, stomachs, tongues, tracheæ, wings, acari, and parasites, each slide £0 1 3

1345. **Vegetable Preparations**—sections of woods, petals, siliceous cuticles, spiral and other vessels, ducts, spores, pollens, hairs, etc., each slide . £0 1 3

1346. **Fossil Woods,** sections of various exogenous and endogenous woods, each 0 0 8

1347. COAL, sections of (many varieties), each slide . . . 0 0 8

TELESCOPES.

In the following list care has been taken to represent the several telescopes, with their powers and capabilities, precisely as they will prove to the purchaser.

The fabulous descriptions so often put forward are strictly avoided, so that intending purchasers may see from the description given, the exact article they intend to have, being assured that any statement made in its favour will be amply justified by the result. In first trying a telescope attention should be given to the difference between a heavy or dull atmosphere and that of a bright and clear one, as in viewing a clock or signal at four miles' distance under the former condition, it would not show so well as at twelve miles, or even greater distance under the influence of a light and clear atmosphere.

Fig. 1350.

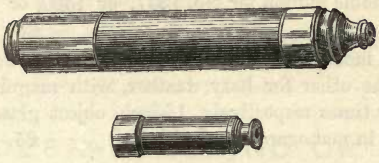


Fig. 1369.

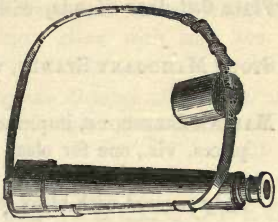


Fig. 1374.

1348. **Day or Night Telescope,** specially for use at sea, being so arranged as to admit the greatest amount of light in dark or foggy weather, with mahogany body and spray shade, one or two draw £0 18 6

1349. Day or Night Achromatic Pilot Telescope, one or two draw, with sun-shade, and covered with leather, . . £0 17 6 and £1 5 0

1350. Day or Night Telescope, of superior quality, with large object glass (*fig.* 1350) £1 10 0

1352. Deck Telescope, very superior, with larger object glass, and increased means of illumination, mahogany or covered with leather . . £2 10 0

1353. **The Midshipman's Telescope,** of taper form, one draw $1\frac{5}{8}$-inch. object glass, light and portable, covered with leather, 2 feet when shut, with sling straps £2 2 0

1354. Midshipman's Telescope, $1\frac{3}{4}$-inch. object glass, Government regulation pattern, 2 feet when shut, with navy signals, sun-shade and sling straps (*fig.* 1354) p. 122 . . . . . £2 10 0

1355. The Navy Telescope, 30-inch., one draw, taper form, with 2-inch. object glass and straps £2 15 0

1356. **Signal Telescope,** 3 feet, with taper body, covered with leather, one draw, with $2\frac{1}{4}$-inch. object glass £3 10 0

The above three telescopes, as well as the three following, combining as they do great light and power, together with superior portability, are fast supplanting all others in the Royal and Mercantile Navy.

1357. Marine Telescope, taper form, much improved, 30 inches when shut, drawing out to 36 inches, with extra large eye-piece for increase of light, $2\frac{1}{4}$-inch. object glass, with caps and portable strap attached, as useful and good an instrument as a naval officer need have . . . £4 0 0

1358. Merchant or Navy Signals, affixed to either, at 5s. 6d. extra.

1359. Compass, fitted to cap of ditto, 5s. 6d. to 15s.

1360. Marine Telescope, one draw, 40 inches when shut, $2\frac{3}{4}$-inch. object glass, with pancratic tube to increase or diminish the power, and adapt it at pleasure for dark or clear weather, the light and power of this glass showing clearly an amount of distant detail, often of the utmost importance on board ship £5 10 0

1362. **Taper Telescope,** as above, 50 inches when closed, with $3\frac{1}{4}$-inch. object glass, an important instrument, as also No. 1366 or 1367, for pilot stations, lighthouses, as well as telegraph signal stations along the coast . . £7 10 0

1363. **Plain Out-door Stands,** with double motion for No. 1357, or 1360, or 1362 £1 5 0

1364. STOUT MAHOGANY STANDS, with double motion for No. 1357, or 1360, or 1362 £3 3 0

1365. MARINE TELESCOPE, improved, and much used in the Indian navy, with two eye-pieces, viz., one for clear and the other for hazy weather, with magnifying powers of thirty-five and twenty times respectively, $1\frac{7}{8}$-inch. object glass, the body covered with black leather, in mahogany case, with lock £5 5 0

1366. MARINE TELESCOPE, improved, etc., etc., as above, the two eye-pieces magnifying sixty and thirty-five times respectively, $2\frac{1}{8}$-inch. object glass, covered body, three feet when closed, in mahogany case, an excellent form of marine telescope for the deck £7 10 0

1367. **Sea Coast or Station Telescope,** with 4 foot brass body, 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 . . . £21 0 0

PORTABLE OR TOURISTS' TELESCOPES FOR THE POCKET (as *fig.* 1369) p. 119.

Lightness and portability, with great power and clearness, are the chief characteristics of the following, the smallest of which shows Jupiter's satellites very beautifully.

Length when shut.	Length when in use.	Aperture of object glass.	Magnifying power in diameters.	Price in plain mountings.
1368. 3-inch.	12-inch.	1-inch.	12 times	£1 1 0
1369. $5\frac{1}{2}$-inch.	15-inch.	$1\frac{1}{4}$-inch.	15 times	1 10 0
1370. 8-inch.	22-inch.	$1\frac{3}{8}$-inch.	20 times	2 2 0
1372. 13-inch.	28-inch.	$1\frac{3}{4}$-inch.	25 times	2 10 0

* No. 1372 is sometimes coverd with black leather, with end caps and straps for suspension, at an additional cost of 10s. 6d. A pancratic eye-draw is also often applied, by means of which the power may be increased at pleasure to 28 and 32, which should however only be used in very clear weather; extra charge, 7s. 6d.

1373. TOURISTS' TELESCOPE, in black morocco, 2 draw, 18-inch., drawing out to 24 inch., and closing up to 8 inches, $1\frac{3}{4}$-inch. object glass, with sun-shades, caps and straps £2 15 0

A variety of other pocket telescopes at lower prices, are kept as well as others, with a greater number of draws and ornamental mountings. All varieties may be had in German silver mounting, at about one-fifth extra charge.

MILITARY OR RIFLE TELESCOPES.

1374. CASELLA'S IMPROVED MILITARY OR TARGET TELESCOPE, 30 inch., 2 draw, closing up to 12 inch., $2\frac{1}{8}$-inch. object glass, with pancratic eye-draw to increase or diminish the power, for dark or clear weather, with sling caps and strap, as used by the leading members of the rifle corps (*fig.* 1374), p. 119. In clear weather the rifle-hits at 1100 yards are perfectly visible with this telescope, whilst in ordinary weather they are seen with it at 1000 yards off. It will show the time by a clock at six miles distance, and the form of the rocks of Calais from Dover, a distance of twenty-one miles . . . £3 10 0

1375. CASELLA'S IMPROVED MILITARY OR TARGET TELESCOPE, as above, 3 feet 4, draw closing up to 11 inch., $2\frac{1}{8}$-inch. object glass, with caps and straps (*fig.* 1375), p. 122 . . . . . £4 0 0

1376. SHORT MICROMETER TELESCOPE, for showing the distance of soldiers, as used by the Prussian military staff, with $1\frac{1}{10}$-inch. object glass, £1 4s. 0d.; $1\frac{4}{10}$-inch., £1 10s. 0d.; $1\frac{7}{10}$-inch. £1 15 0

DEER-STALKING OR RIFLE TELECOPES.

The increased light and wider field of view required for deer-stalking are carried to their utmost limits in these telescopes, which are guaranteed to be unsurpassed by any in use; they are equally adapted for military or rifle purposes.

1377. **Deer-stalking Watchman's Telescope,** as No. 1373 above . £2 15 0

1378. DEER-STALKING TELESCOPE, 30 inch., 3 draw, closing up to 10 inch., $2\frac{1}{4}$-inch. object glass, black bronzed, covered with black morocco, with sunshade in black sling case £6 10 0

The *ne plus ultra* of a deer-stalking telescope. A micrometer eye-piece can be added to the above, by which the exact shooting distance of the deer or antelope may be known. Extra, 15s. 6d.

1380. CASELLA'S IMPROVED TARGET TELESCOPE, with pancratic eye-draw, rack adjustment, $2\frac{1}{4}$-inch. object glass, and firm light tripod stand with attached board, lined, for registering the marks; length when in use, 44 inches, in strong 3 foot case, with lock £9 9 0

With this target telescope signal marking is dispensed with, as it shows the hits or bullet marks clearly at 1200 yards range; it is also an excellent telescope for private use on raised situations, or any position commanding an extensive view of the sea.

1382. **Telescope Clip or Holder,** to fasten to the window frame £0 15 0 to £2 0 0

1383. BRASS TRIPOD TABLE STANDS, from . . . 2 0 0 to 4 0 0

1384. ROUND MAHOGANY STAFF OR STAND, with telescope clip for either of these telescopes . . . . . £2 0 0 to £2 5 0

PORTABLE ASTRONOMICAL TELESCOPES,

WITH STANDS IN CASES COMPLETE.

The growing taste for the study of astronomy, together with the comfort of a convenient form of traveller's telescope, for celestial as well as terrestrial observations, is fully met by the following short list of telescopes. The powers quoted are such as are thoroughly suited to the instrument even in the hands of inexperienced observers, though in each case higher powers could be added with advantage if required.

1385. POCKET ASTRONOMICAL TELESCOPE, 1 foot, 6 draw, closing to $3\frac{3}{4}$ inch., with small clip support, and extra astronomical power, in morocco case, showing Jupiter's satellites very beautifully, powers 12 to 20 times (*fig.* 1385), p. 122 £2 5 0

1386. **Portable Astronomical Telescope,** 2 foot, 4 draw, closing up to 8 inches, $1\frac{7}{10}$-inch. object glass, one extra astronomical power, shade, and clip stand, powers 25 to 60 times, in mahogany case £6 10 0

1387. PORTABLE ASTRONOMICAL TELESCOPE, 30-inch., 4 draw, closing up to $10\frac{1}{2}$ inch., 2-inch. object glass, shade, sun-shade, extra astronomical power, stand and clip, powers 30 to 80 times, in mahogany case . . £7 10 0

Fig. 1385.

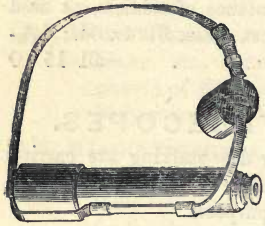


Fig. 1375.

Fig. 1354.

1388. Portable Astronomical Telescope, 3 foot, 4 draw, closing to 12 inches, 2¼-inch. object glass, powers 36 to 100 times, stand, etc., in case, complete £9 0 0

ASTRONOMICAL TELESCOPES.

1389. **Astronomical Telescope,** with brass body, 30-inch., object glass 2½-inch. clear aperture, two terrestrial and two astronomical eye-pieces of 30, 50, 80 and 110 powers respectively, rack-work, sun-shades, or dark glasses to eye-pieces, vertical rack and horizontal motion, with handsome brass tripod stand, in mahogany case, complete (*fig.* 1389) . . . £11 10 0

Shows clearly Jupiter's satellites and ordinary double stars.

1390. Strong Garden Stand, to suit the above. . . . 1 15 0

1392. Astronomical Telescope, 3 feet focal length, 2½-inch. object glass, with pancratic eye-draw, giving powers 35, 45, and 55, and astronomical powers of 80 and 150 respectively, rack work, sun shades, or dark glasses to eye-pieces, with stand, etc., etc., complete, as above . . . £18 10 0

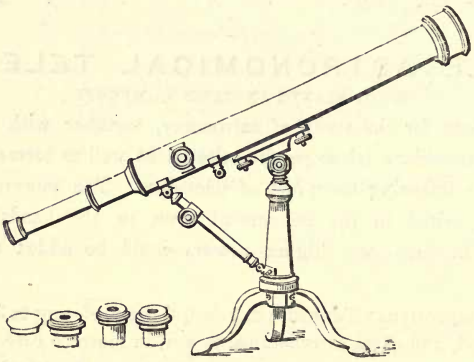


Fig. 1389.

1393. **Astronomical Telescope,** 3½ feet focal length, 2⅞-inch. aperture, with pancratic day-draw, giving powers 35, 45, 60 and 70; 3 astronomical powers of 100, 150, and 200 respectively, star-finder, vertical rack, and rack adjustment, dew cap and 2 dark glasses or sun-shades to 2 eye-pieces, with pillar and claw stand, in mahogany case, with lock £25 0 0

If without finder, in which form it is mostly supplied, £2 less.

ASTRONOMICAL TELESCOPES AND STANDS,

WITH UNIVERSAL AXIS.

1394. ASTRONOMICAL TELESCOPE, 3¼-inch., clear aperture, 4 foot focal length, mounted in polished brass, with sliding draw and rack adjustment, star-finder, dew cap, pancratic day-draw, giving powers of 40, 50, 60, and 70; 3 astronomical eye-pieces, magnifying to 100, 150, and 200 respectively, with different shades, of glass to sun caps, in stained pine case £25 0 0

1395. ASTRONOMICAL TELESCOPE, 4½ feet focal length, 3¼-inch. object glass, complete, as above £28 0 0

1396. **Astronomical Telescope,** as above, 4 feet 9-inch. focal length, with 3¾-inch., aperture, four day powers of 45, 55, 65, and 75, four astronomical powers of 100, 150, 200, and 250 respectively, and diagonal eye-piece, in case, as above £35 0 0

1397. ASTRONOMICAL TELESCOPE, 5 foot focal length, and precisely as No. 1394, but with 4-inch. aperture and 5 astronomical powers, viz., 100, 150, 200, 250, and 300, in case, complete £45 0 0

1398. ASTRONOMICAL TELESCOPE, with 4½-inch. aperture, and astronomical powers of 100, 150, 200, 250, and 300 . . . . £58 0 0

EQUATORIAL MOUNTINGS.

1399. **Universal Equatorial Axis,** to carry Nos. 1394, 1395, or 1396 telescopes, with 6-inch. hour or declination circles, divided on silver, with the latest improved motions, in strong pine case £33 0 0

1400. UNIVERSAL EQUATORIAL AXIS, of larger size, to carry Nos. 1397 or 1398 telescopes in strong pine case £40 0 0

1402. STRONG OUT-DOOR LATH OAK STAND, for axis, No. 1399 or 1400 6 6 0

1403. IRON PILLAR, for ditto 7 10 0

1404. HIGHER POWERS, added to either of the above telescopes, at £0 15 0 to £1 5 0 extra.

1405. **Diagonal Eye-pieces** fitted to either of the above telescopes, £1 3s. to £1 10 0

1406. FIRST SURFACE REFLECTION PRISM, for the sun . . 0 17 6

1407. TOTAL REFLECTION PRISM, for the sun 1 10 0

1408. ILLUMINATING APPARATUS 2 12 6

1409. ASTRONOMICAL EYE-PIECES (Huyghenian), Nos. 1 and 2 magnifying to 65 and 85 £0 15 6

1410. ASTRONOMICAL EYE-PIECES (Huyghenian), Nos. 3, 4, and 5, magnifying to 125, 200, and 250 . . . . . £1 1 0

1412. ASTRONOMICAL EYE-PIECE (Huyghenian), No. 6, magnifying to 400 1 6 0

1413. **Astronomical Eye-piece** (Huyghenian), No. 7, magnifying to 600 1 11 6

1414. ACHROMATIC EYE-PIECES, in which the field is more limited, but applied to reflecting telescopes, on the planets their power is very superior, average cost 5s. to 15s. dearer than the above.

1415. ANNULAR MICROMETER, with eye-piece £1 5 0

1416. MICROMETER, on glass, divided to parts of inches or in millimètres £0 12 6
1417. **Parallel Wire Micrometers,** £3 3s. 0d., £4 10s. 0d., and . 6 10 0
1418. „ „ „ with position circles, £4 10s. 0d., £6 10s. 6d., and £13 0 0
1419. SLIPPING PIECE for use, with ditto 3 10 0
1420. DOUBLE IMAGE DYNAMETER 3 10 0
1422. PEARL SCALE „ 1 0 0
1423. READING MICROMETERS, from 4 10 0

OBJECT GLASSES—FIRST QUALITY.

IN BRASS CELLS.

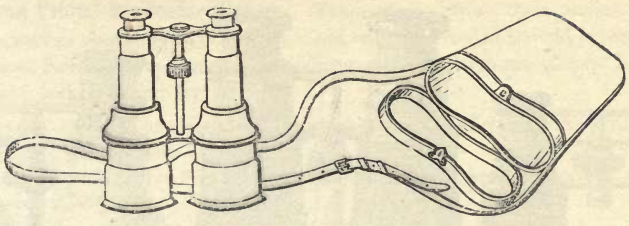
	Diameter.	Focus Average.	Price.
1424.	1-inch.	9-inch.	£0 4 6
1425.	$1\frac{1}{8}$-inch.	10-inch.	0 5 0
1426.	$1\frac{7}{16}$-inch.	15-inch.	0 7 0
1427.	$1\frac{3}{4}$-inch.	20-inch.	0 10 6
1428.	2-inch.	27-inch.	0 17 0
1429.	$2\frac{1}{4}$-inch.	30-inch.	2 15 0
1430.	$2\frac{3}{4}$-inch.	42-inch.	6 0 0
1432.	3-inch.	42-inch.	7 7 0
1433.	$3\frac{1}{4}$-inch.	42-inch.	10 10 0
1434.	$3\frac{1}{2}$-inch.	48-inch.	12 12 0
1435.	$3\frac{3}{4}$-inch	48-inch.	15 10 0

OBJECT GLASSES—SECOND QUALITY.

WITHOUT CELLS.

	Diameter.	Focus Average.	Price.
1436.	1-inch.	9-inch.	£0 2 8 and £0 3 6
1437.	$1\frac{1}{8}$-inch.	10-inch.	0 3 6
1438.	$1\frac{7}{16}$-inch.	15-inch.	0 3 6 „ 0 4 3
1439.	$1\frac{1}{2}$-inch.	18-inch.	£0 4 3
1440.	$1\frac{5}{8}$-inch.	18-inch.	0 5 0
1442.	$1\frac{3}{4}$-inch.	20-inch.	0 6 0 „ 0 8 6
1443.	2-inch.	27-inch.	0 8 0 „ 0 8 6
1445.	$2\frac{1}{8}$-inch.	20-inch.	0 10 6
1446.	$2\frac{1}{4}$-inch.	30-inch.	0 12 6 „ 0 13 0
1447.	$2\frac{3}{8}$-inch.	34-inch.	0 17 0 „ 1 1 0
1448.	$2\frac{11}{16}$-inch.	42-inch.	1 5 0 „ 1 8 0
1449.	3-inch.	42-inch.	1 12 6 „ 2 2 0
1450.	$3\frac{3}{16}$-inch.	42-inch.	2 15 0 „ 2 16 0
1451.	$3\frac{3}{8}$-inch.	48-inch.	4 0 0 „ 5 0 0
1452.	$3\frac{3}{4}$-inch.	48-inch.	5 5 0

*** The cheaper of the above glasses are generally of rather longer focus than those named.



BINOCULAR, OPERA, FIELD, OR PILOT GLASSES.

The great convenience of binocular glasses in the opera and picture gallery, as well as for out-door use and at sea, is well known; they should however as far as possible be especially adapted for each of these purposes; thus, as a rule, large glasses are most suitable for use at sea, whilst portability, with reduced size and weight, expanded range, and clear sharp definition, are for the opera and field.

Single Achromatic Opera Glasses in flexible cases.

1453. SMALL SIZE PERSPECTIVE GLASS, for waistcoat pocket, covered with black or dark fancy morocco, 1-inch object glass. An excellent companion for the picture gallery or lecture hall £0 7 6

1454. PERSPECTIVE GLASS, ditto, ditto, ivory and gilt . . 0 12 6

1455. PERSPECTIVE GLASS, ivory and gilt, $1\frac{1}{8}$ object glass . . 0 16 6

1456. PERSPECTIVE GLASS, with fancy morocco . . . 0 10 6

If with six glasses and higher power 5s. and 7s. 6d. each extra.

Binocular Achromatic Opera Glasses, in flexible cases, covered with black or dark fancy morocco.

1457. Object glass $1\frac{1}{10}$ diameter £0 15 6 | 1459. Object glass $1\frac{7}{10}$ diameter £1 2 0
1458. „ „ $1\frac{3}{10}$ „ 0 18 6 | 1460. „ „ 2 in. „ 1 5 0

Well suited for the opera and picture gallery.

BINOCULAR OPERA GLASSES, covered, etc., as above, finest quality, with twelve glasses.

1462. Object glass $1\frac{1}{10}$ diameter £1 10 0 | 1464. Object glass $1\frac{7}{10}$ diameter £1 18 0
1463. „ „ $1\frac{3}{10}$ „ 1 13 0 | 1465. „ „ 2 in. „ 2 2 0

The following binocular opera glasses, of the finest quality, with carefully connected triple achromatic object glasses and eye-pieces in the various fancy mountings described, in handsome velvet cases, will be found admirable as presents, their quality and beautiful appearance being unsurpassed.

IVORY AND BEST GILT, WITH TWELVE GLASSES (*fig.* 1469), p. 126,

1466. Object glass $1\frac{1}{10}$ diameter £1 18 0 | 1468. Object glass $1\frac{7}{10}$ diameter £2 12 0
1467. „ „ $1\frac{3}{10}$ „ 2 4 0 | 1469. „ „ 2 in. „ 3 0 0

SHELL AND BEST GILT, WITH TWELVE GLASSES,

1470. Object glass $1\frac{1}{10}$ diameter £2 0 0 | 1473. Object glass $1\frac{7}{10}$ diameter £2 10 0
1472. „ „ $1\frac{3}{10}$ „ 2 4 0 | 1474. „ „ 2 in. „ 3 3 0

ORMOLU WITH TWELVE GLASSES, with rich ornamental bodies engraved; colored, and best gilt, very chaste, and beautiful,

1475. Object glass $1\frac{1}{10}$ diameter £2 18 0 | 1477. Object glass $1\frac{7}{10}$ diameter £3 17 0
1476. „ „ $1\frac{3}{10}$ „ 3 6 0 | 1478. „ „ 2 in. „ 4 10 0

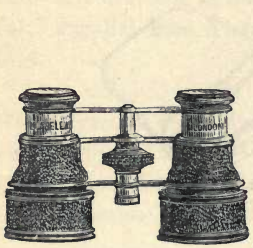


FIG. 1489.

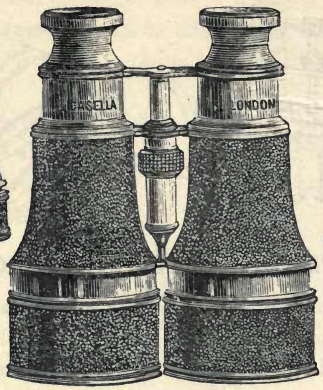


FIG. 1498.

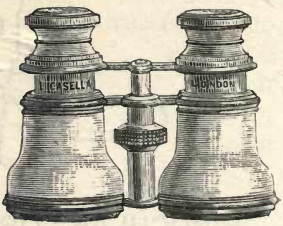


FIG. 1469.

PEARL AND BEST GILT, WITH TWELVE GLASSES,

1479. Object glass $1\frac{1}{10}$ diameter £2 5 0 | 1482. Object glass $1\frac{7}{10}$ diameter £3 0 0
1480. „ „ $1\frac{3}{10}$ „ 2 12 0 | 1483. „ „ 2 in. „ 3 10 0

With engraved white chased ALUMINIUM bodies, extra light, with twelve glasses,

1484. Object glass $1\frac{1}{10}$ diameter £3 8 0 | 1485. Object glass $1\frac{7}{10}$ diameter £4 5 0

Together with larger sizes and others in various fancy mountings.

Binocular Field or Opera Glasses, covered with black or dark fancy morocco, in flexible cases, with shade and sling, small size, finest quality, with twelve glasses (*fig.* 1489), the larger sizes with stout patent leather sling cases,

1486. Object glass $1\frac{1}{10}$ diameter £2 2 0 | 1488. Object glass $1\frac{7}{10}$ diameter £2 10 0
1487. „ „ $1\frac{3}{10}$ „ 2 6 0 | 1489. „ „ 2 in. „ 2 18 0

The same sizes and quality covered as above, in ALUMINIUM, being about one-third the weight, and much liked for warm climates, with cases,

1490. Object glass $1\frac{1}{10}$ diameter £4 10 0 | 1493. Object glass $1\frac{5}{10}$ diameter £6 0 0
1492. „ „ $1\frac{3}{10}$ „ 5 10 0 | 1494. „ „ 2 in. „ 6 10 0

1495. Ditto, as above, extra large, object glass $2\frac{2}{10}$ diameter £7 7 0

Binocular Field or Marine Glasses, covered with black or dark morocco; Emperor pattern and size, with sun or spray shades. Finest quality, with twelve glasses, the size and weight being reduced to the utmost, in best sling case (*fig.* 1498),

1496. Object glass $1\frac{3}{4}$ in. diameter £3 0 0 | 1497. Object glass 2 in. diameter £3 10 0

1498. Object glass $2\frac{1}{4}$ diameter . . . £4 0 0

The above are excellent glasses for military purposes, owing to their power, and extended field of view.

BINOCULAR FIELD OR MARINE GLASSES, as the above, having same appearance but in ALUMINIUM, being about one-third the weight; an important reduction in these sizes for warm climates.

1499. Object glass $1\frac{3}{4}$ in. diameter £6 6 0 | 1500. Object glass 2 in. diameter £7 7 0

1502. Object glass $2\frac{1}{4}$ diameter . . . £7 15 0

A neat firm sling case of black or patent leather, or of natural colour (for India) is supplied with these glasses.

Captains' and Pilots' Binocular Glasses. These glasses, from their perfect definition, as well as convenience in use, have not only superseded the old inverting night glass, but are now regarded as indispensable for look-out glasses, both in the navy and merchant service.

1503. CAPTAINS' AND PILOTS' GLASSES, bronzed and covered with black leather, object glass 2¼ in. diameter £4 4 0

These glasses from the large field of view and moderate cost, are recommended with much confidence, as great favourites in the service.

1504. CAPTAINS' AND PILOTS' GLASSES OF FINEST QUALITY, with twelve glasses, and increased power; same color as the above, object glass 2¼ in. diameter £6 15 0

Binocular or Field Glasses, superior, with eight glasses and increased power, though of smaller field in proportion to the object glass; japanned and black leather mounting, with sling case and strap,

1505. Object glass $1\frac{5}{10}$ diameter £1 17 6 | 1507. Object glass 2 in. diameter £2 5 0
1506. „ „ $1\frac{7}{10}$ „ 2 2 0 | 1508. „ „ 2¼ „ 2 15 0

Binocular, Field, and Opera Glasses (black morocco), with three revolving eye-pieces to increase or diminish the powers, and adapt them at pleasure, for the opera, the country, or the seaside; both long and short vision are fully met in this excellent arrangement, whilst even in the theatre this combination of powers is found of great convenience. In collapsing sling case,

1509. Object glass $1\frac{5}{10}$ diameter £3 6 0 | 1512. Object glass 2 in. diameter £3 18 0
1510. „ „ $1\frac{7}{10}$ „ 3 12 0 | 1513. „ „ 2⅛ „ 4 4 0

If with spray or sun-shade, 12s. each extra.

THREE CHANGE OPERA GLASSES as above, ALUMINIUM, in collapsing sling cases,

1514. Object glass $1\frac{5}{10}$ diameter £6 0 0 | 1516. Object glass 2 in. diameter £6 15 0
1515. „ „ $1\frac{7}{10}$ „ 6 6 0 | 1517. „ „ 2¼ „ 7 15 0

MARINE, PILOT, OR FIELD GLASSES, three change, covered with black morocco, in aluminium, of extra light weight as above, with sun or spring-shades extra, also very convenient for tourists,

1518. Object glass $1\frac{5}{10}$ diameter £6 18 0 | 1520. Object glass 2 in. diameter £7 15 0
1519. „ „ $1\frac{7}{10}$ „ 7 7 0 | 1522. „ „ 2⅛ „ 8 8 0

1523. Object glass 2¼ in. diameter . . £9 0 0

Single Military Field Glasses, three change, as No. 1509, with sling cords or straps and sun or spray shades.

1524. Object glass $1\frac{7}{10}$ diameter £1 6 0 | 1526 Object glass 2⅛ diameter £1 12 6
1525. „ „ $1\frac{9}{10}$ „ 1 10 0 | 1527. „ „ $2\frac{3}{10}$ „ 1 16 0

Distance telescopes as used by the Prussian military staff, see Telescopes, No. 1376.

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 their becoming almost as noble a means of instruction as printing itself.

1528. **Stereoscope,** plain, transparent, with best cosmoramic fixed lenses and reflector, in mahogany £0 7 6

1529. STEREOSCOPE, as above, in walnut or rosewood . . . 0 9 0

1530. STEREOSCOPE, of superior make, transparent, etc., as above, with hinged top mahogany, 11s. 6d.; walnut, 13s. 0d.; rosewood, 14s.; zebra wood £0 16 6

1532. **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

1533. STEREOSCOPE, cosmoramic, square, with sliding body for focal adjustment, hinge front and best reflector, in various fancy woods, as above, mahogany, £1 13s.; 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.

1534. 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 £5 10 0 to £7 10 0

1535. **Cabinet or Panoramic Stereoscope,** with convex top for 100 paper or 50 glass slides, with double reflectors and superior achromatic lens, with rack and pinion, revolving at pleasure and admitting two persons to look at the same time. In this arrangement the slides are always clean, being kept in their position in the stereoscope, instead of separate as in the ordinary way, in walnut or mahogany . . . . £5 10 0 to £8 0 0

An elegant ornament for the drawing-room.

1536. CABINET OR PANORAMIC STEREOSCOPE, the same as above, arranged for one observer only £5 5 0

STEREOSCOPIC SLIDES,

Including only the very best of each kind, the difference in price arising from the greater or less difficulty attending the production of the object. The great variety of stereoscopic slides now before the public receiving as it does daily additions, prevents a general and fixed price list being given; the following, however, will convey a general idea of their prices and kinds, every interesting variety being added as it appears:—

GLASS STEREOSCOPIC VIEWS.

1537. **Glass Stereoscopic Views,** by the leading artists, including Wilson, England, Blanchard, Ferrier, etc., of the chief scenes of interest in the following places, at 4s. 6d. to 5s. 6d. each:—

England.
London and Environs.
Scotland, by Wilson.
Ireland.
France.
Spain.
Russia.
Constantinople and Athens.
America.
Egypt and Nubia, including the leading scenes of the Abyssinian War, and the Suez Canal.

STEREOSCOPIC VIEWS—CONTINUED.

Italy.
Rome.
Switzerland.
Venice.
Germany and the Rhine.
Belgium and Holland.
Denmark.
Norway.
Sweden.
Holy Land and Syria, with the chief scenes of Scripture History.
China.
Japan.
Siam.
Molluccas.
Java.
India, including the leading scenes of the last great East Indian Rebellion.

BEST CARD STEREOSCOPIC VIEWS.

1538. **Best Card Stereoscopic Views** of the following places, 10s. to 15s. per dozen:—

England.
Scotland.
Wales.
Ireland.
English Lake Scenery.
Exteriors and Interiors of English Cathedrals.
Series of London Views.
Egypt and Nubia.
Holy Land.
India.
China.
Italy.
Switzerland.
America.
France.
Belgium.
Spain.
Holland.
Herculaneum and Pompeii.

1539. HAES'S well-known Series of the Animals in the Zoological Gardens, 18s. per dozen.

1540. **Stereoscopic Slides,** interesting coloured groups, 10s. 6d., 12s. 6d., and 15s. per dozen; best ditto, 18s. per dozen.

1542. Groups from Life, Rustic Scenes, Cattle, Domestic and Comic Groups. Still Life Subjects: Game, Flowers, Fruit, Vegetables, etc., coloured, each 1s. to 2s.

1543. **Crystal Palace Views,** showing the various courts and points of greatest interest, 13s. per dozen; transparent on glass, 5s. each.

1550. Illuminated Views and Groups, showing two effects (day and night), 2s. to 2s. 6d.

1552. Instantaneous Stereoscopic Pictures of the Moon, Clouds, Waves of the Sea, etc., on glass, from £0 6 0

1553. Instantaneous Stereoscopic Pictures of the Moon, Clouds, Waves of the Sea, etc., on paper 0 1 6

1554. Elegant fancy boxes, to hold from three to six dozen slides, 1s. 6d. to 10s. 6d.

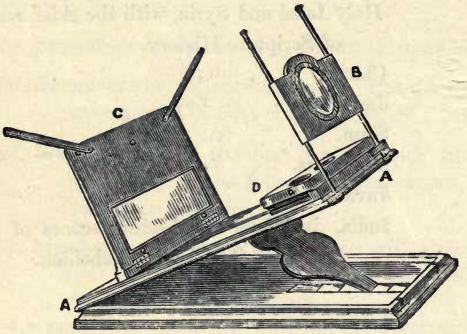


Fig. 1560.

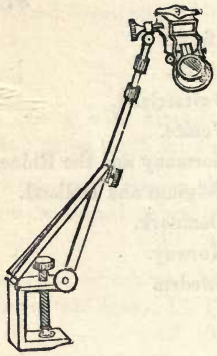


Fig. 1567.

CAMERAS, PRISMS, MIRRORS, ETC.

Neomonoscopes, for giving stereoscopic effect to Carte-de-Visite portraits, of which it holds twelve.

1556. Neomonoscope, covered with plain cloth . . . £0 1 0

1557. Neomonoscope, in mahogany polished, with large lens . . 0 2 6

1558. Neomonoscope superior, in ebony, and gilt or red; large lens . 0 5 6

Graphoscopes, for developing and giving beautiful stereoscopic effect to landscapes, and the various productions of photography, forming also an excellent stereoscope for opaque or transparent objects (*fig.* 1560):

1559. Graphoscope in mahogany, in neat case, complete . . £2 12 6

1560. Graphoscope in walnut 3 3 0

1562. Graphoscope in walnut; extra large size . . . 5 5 0

1563. 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

1564. Phantoscope, for projecting figures in air, being one of the illusions of the concave mirror £2 10 0

1565. Polemiscope, by which an object is seen, though an opaque body be placed before it, 12s. to £1 10 0

1566. Cylindrical or Distorting Mirrors, in rosewood frames, 8 inch. by 6 inch., £1 10s. 0d.; 9 inch. by 7 inch. £2 0 0

1567. **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.* 1567) . . . . . £1 12 6 and £2 5 0

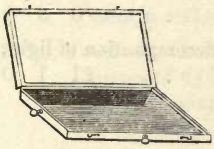


FIG. 1572.

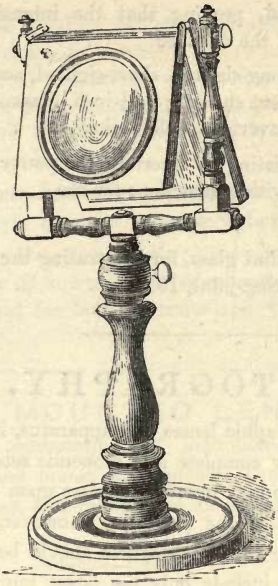


FIG. 1574.

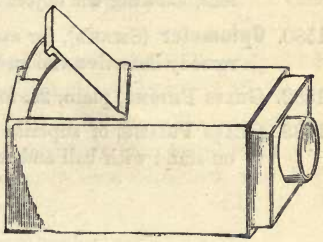


FIG. 1569.

1568. PORTABLE MAHOGANY DRAWING BOARD AND TRIPOD STAND, occasionally used with the camera lucida . . . £1 5 0 and £1 15 0

1569. CAMERA OBSCURA, for making sketches and portraits from nature, best make, for pictures, 7 × 5 *(fig.* 1569) . . . £0 10 6 and £0 15 0

1570. **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, pages 138 to 141.

1572. **Claude Lorraine or Convex Black Glass Mirrors,** in morocco cases, much used to facilitate the delineation of landscapes in perspective *(fig.* 1572), 5⅛ by 6¼, 15s. 6d.; 5⅛ by 7½, £1; 6¼ by 8¾, £1 7 6d.; 7½ by 9½ . £1 15 0

1573. COLOURED GLASSES OR CLAUDE LORRAINE TINTS, to illustrate the effect of colours on pictures, in horn or tortoise-shell case, 3s. 6d. to . £0 12 6

1574. **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.* 1574) £2 2 0

1575. 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

1576. **Dental Mirror** *(concave)*, for magnifying and examining at pleasure the inner surface of the teeth, in folding silver frame, for the pocket £0 16 6

1577. OPTHALMOSCOPE, of much importance, for viewing the interior and back surface of the eye 15s. 6d. to £1 5 0

1578. **Optical Model of Pyramid,** proving that the intensity of light must be inversely as the square of the distance . . . £1 2 0

1579. 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

1580. **Optometer** (Smee's), for assisting to ascertain the power of glasses required to remedy defective vision, with instructions for use . . £2 10 0

1582. Glass Prisms, plain, 2s. to 0 5 0

1583. Glass Prisms, of superior flint glass, for illustrating the decomposition of light, on stand with ball and socket-joint, 15s. to . . . £1 1 0

PHOTOGRAPHY.

In the following list of photographic lenses and apparatus, including only the latest improvements, for beginners, a few complete and economic sets are arranged as under, to show the cost at which any one may practically enter upon the subject, completing their work without any extra cost; the perfection, however, to which the photographic art has attained, requiring that each article should be separately enumerated, the list of cameras and chemicals include only the latest improved, and such as are perfect for their purpose in every way. The stands and other appliances are of the same character.

The following lenses by the most eminent English and foreign makers are perfectly adapted to the various cameras enumerated, and are supplied at the same price as charged by the makers. The lower priced lenses, though not so extensively known, are however selected with the utmost care, and are found to give every satisfaction. A specimen portrait of these last-named lenses may be had with the lens, when required, without any extra charge.

Sets of Photographic Apparatus, with chemicals, etc., etc., complete.

1584. No. 1. For portraits on glass with double achromatic lens, in brass mounting with rack and pinion, expanding camera with stand, ground glass focussing screen, and dark slide for three sizes of plates, gutta-percha bath and dipper, plate box and glass plates; 6 oz. nitrate of silver solution, 2 oz. sensitive collodion, 1 pint each developing and fixing solution, 2 oz. each black and white varnish, in stoppered bottles, the whole packed in box complete £2 10 0

1585. No. 2. Larger Set of Apparatus, as above, for plates 4¼ by 3¼, and under, with lenses, camera, stand, etc., larger in proportion, and increased quantity of chemicals £5 5 0

1586. No. 3. Superior Set of Apparatus for portraits and views up to 4¼ by 3¼, either on paper or glass, consisting of best double achromatic lens in brass mounting, with rackwork and waterhouse diaphragms complete, superior double-bodied camera in polished mahogany with tripod stand, ground glass focussing screen, dark slide and plate holders for three sizes of plates, porcelain bath and dipper, 3 doz. glass plates and 3 plate boxes, funnel, pressure frame,

graduated glass measure, set of scales and weights, porcelain dishes, positive and negative collodion, nitrate of silver solution, acetate of soda, pyrogallic acid, albumenized and litmus paper, filter papers, alcohol, prota-sulphate of iron, cyanide of potassium, glacial acetic acid, hyposulphite of soda, chloride of gold, black and white varnishes, etc., in suitable stoppered bottles, in case complete with lock and key £5 10 0

1587. **No. 4 Set for Carte-de-Visite and Stereoscopic Pictures,** with folding tripod for camera and every requisite, complete in box with lock and key £7 10 0

1588. No. 5. Consisting of Larger Set of Apparatus of finest quality, adapted for plates of 6½ by 4¾ and under, with apparatus, chemicals, etc., complete, in proportion, adapted for both portraits and views, in case with lock and key £11 0 0

MOUNTED LENSES.

Improved portrait combination of achromatic lenses, fitted with Waterhouse diaphragms, and rack and pinion adjustment. The focus is measured from the back lens to the ground glass, and taken from an object placed at the usual distance for portraits.

	Diameter.	Combined Focus.	Size of Portrait.	
1589.	1⅝-inch.	3½-inch.	4½ × 3¼	£2 0 0
1590.	2⅛-inch.	5½-inch.	Carte-de-Visite.	4 0 0
1592.	2⅜-inch.	6-inch.	Carte-de-Visite.	4 0 0
1593.	2⅜-inch.	7-inch.	6½ × 4¾	4 4 0
1594.	3-inch.	10½-inch.	8½ × 6	9 9 0

1595. **Stereoscopic View Lens,** of 1¼-inch. diameter and 4½-inch. focus, in brass mounting complete, with rack and pinion adjustment . £1 10 0

*** The definition of these lenses is beautiful and clear to the edge of the picture, the chemical and visual foci are coincident, and the arrangement of the brass work so simple and effective as to require no extra mounting, the whole being in every way equal to those sold at much higher prices; they may be had in pairs or sets of four for taking several pictures on one plate.

ROSS'S IMPROVED PHOTOGRAPHIC LENSES.

PORTRAIT LENSES.

These lenses give fine and correct definition, both at the centre and margin of the picture, and have their visual and chemical-acting foci coincident.

1596. **No. 1. Portrait Lens,** consisting of two achromatic combinations, mounted in tubes, with rack and pinion movement, the lenses 1¾-inch. diameter, and 4½ inch. focal length from the back glass, producing pictures on plates 4¼ by 3¼ inch. and under £5 0 0

1597. A Set of Waterhouse Diaphragms, in morocco case, for ditto 0 15 0

1598. No. 2. Portrait Lens, the lenses 2¼-inch. diameter and 6-inch. focal length, for pictures on plates 5 by 4 inch. and under . . . £8 0 0

1599. A Set of Waterhouse Diaphragms, in morocco case, for ditto 1 0 0

1600. **No. 2A. Portrait Lens,** the lenses 2½-inch. diameter and 7½-inch. focal length, for pictures on plates 5 by 4 inch. and under. This lens produces larger portraits than the above £10 10 0

1601. A Set of Waterhouse Diaphragms, in morocco case, for ditto 1 5 0

1602. No. 3. Portrait Lens, the lenses 3¼-inch. diameter and 10-inch focal length, for pictures on plates 6 by 5 inch. and under . . £16 0 0

1603. A Set of Waterhouse Diaphragms, in morocco case, for ditto 1 10 0

1604. No 3A. Portrait Lens, the front lens 3¼-inch. diameter, the back lens 4-inch. diameter, 12-inch. focal length, for pictures on plates 8½ by 6½-inch., and under £25 0 0

1605. A Set of Waterhouse Diaphragms, in morocco case, for ditto 1 15 0

1606. **Portrait Lens,** the lenses 4½-inch. diameter, 15 inches focal length, for pictures on plates 10 by 8 inches and under £36 0 0

1606*. A Set of Waterhouse Diaphragms, in morocco case, for ditto 2 0 0

1607. Portrait Lens, the front lens 3¼ inches diameter, the back lens 5 inches diameter, 20 inches focal length, for pictures on plates 16 by 14 inches and under £30 0 0

1607*. A Set of Waterhouse Diaphragms, in morocco case, for ditto 2 5 0

QUICK-ACTING CARTE-DE-VISITE LENSES,

WITH WATERHOUSE DIAPHRAGMS AND RACK AND PINION MOVEMENT.

1608. **No. 1. Carte-de-Visite Lens,** consisting of two actinic combinations, 1¾-inch. diameter, 4¼-inches focal length, ; requires from 13 to 14 feet between the subject and the focussing screen of camera . . . £5 15 0

1609. No. 2. Carte-de-Visite Lens, 2 1/10-inch. diameter, 4¾-inch. focal length ; requires from 15 to 16 feet between the subject and focussing screen of camera £6 10 0

1610. No. 3. Carte-de-Visite Lens, 2½-inch. diameter, 6-inch. focal length ; requires from 19 to 20 feet between the subject and focussing screen of camera £11 10 0

1611. No. 3 a. Carte-de-Visite Lens (extra rapid), 3¼-inch. diameter, 6-inch. focal length ; requires the same working space as No. 3, and may be used with full aperture for large vignettes of children . . . £25 0 0

The following table, showing the greatest distance required between the subject and the focussing screen, to produce figures 2¾ inch. and 3 inch. with each of the lenses (the standard being 6 feet), is given as a guide to photographers in their selection of a lens suitable for the length of their operating rooms :—

	For 2¾ inch.	For 3 inch.
No. 1. Carte-de-Visite Lens .	14 feet.	13¼ feet.
No. 2. Carte-de-Visite Lens .	16 feet.	14¾ feet.
No. 3. Carte-de-Visite Lens .	20 feet.	18¾ feet.
No. 3a. Carte-de-Visite Lens .	20 feet.	18¾ feet.

*** In order that the whole image may be in focus, the camera should be placed level and midway of the subject, or thereabouts ; however, some little latitude may be allowed, and the camera placed somewhat higher, when it will require tilting a little. But if the camera be put at an elevation of about five feet, it must be tilted considerably, and a swing back to the camera will be indispensable to get the picture all in focus.

LENSES FOR CABINET PORTRAITS.

These lenses have a flat field, and give remarkably brilliant pictures. They have Waterhouse diaphragms and rack and pinion movement.

1616. **No. 1. Cabinet Lens,** 2¾-inch. clear aperture, 6-inch. focus; should be placed at 14 feet from the sitter £13 0 0

1617. No. 2. Cabinet Lens, 3¼-inch. clear aperture, 8-inch. focus; should be placed at 18 feet from the sitter. £17 10 0

1618. No. 3. Cabinet Lens, 3½-inch. clear aperture, 10-inch. focus; should be placed at 20 feet from the sitter £19 10 0

NEW ACTINIC DOUBLET LENSES,

FOR LANDSCAPES, ARCHITECTURAL SUBJECTS, ENLARGING, AND COPYING.

1619. **Ordinary Doublets.** Angle subtended by diagonal of plate, about 74°; ditto by horizontal base line, about 60°.

Size of Plate.	Diameter of Lenses.	Back Focus.	Equivalent Focus.	Price.	Adapter for Single Lens†
Inch. Inch.	Inches.	Inches.	Inches.	£ s. d.	s. d.
5 × 4	1	4	4½	4 0 0	2 6
6 „ 5 and 7¼ by 4½ .	1 4/10	6	6¾	4 10 0	2 6
8 „ 4½	1½	6¼	7¼	4 15 0	3 0
8½ „ 6½	1¾	6¾	7¾	5 10 0	3 0
10 „ 8	2	8	9	7 15 0	3 0
12 „ 10	2½	9¾	11¼	9 10 0	3 6
15 „ 12	3	12	13¾	12 0 0	4 0
18 „ 16	3¾	16½	18½	17 0 0	5 0
*22 „ 20	4½	19½	22	26 0 0	5 6
*25 „ 21	5⅛	21⅛	24	40 0 0	8 0
*30 „ 24	6	25	28	60 0 0	10 0

* These sizes are made only to order.

† The prices in this column refer to a lengthening tube, which must be screwed on between the front combination and the diaphragms when the lens is used as a single combination. For architectural subjects, when the camera requires tilting, the single lens should be used *in front* of the diaphragm plate; at other times *behind*.

1620. NEW SERIES OF DOUBLETS,

DESIGNATED "SMALL-ANGLE,"

Giving the same amount of subject as the ordinary single combination landscape lens. Angle subtended by diagonal of plate, about 46°; ditto by horizontal base line about 37°.

Size of Plate.	Diameter of Lenses.	Back Focus.	Equivalent Focus.	Price.
Inch. Inch.	Inches.	Inches.	Inches.	£ s. d.
5 × 4* and under . .	1	5½	6	3 15 0
8 „ 4½	1¾	9	10½	5 0 0
8½ „ 6½	2 1/10	11	12½	7 10 0
10 „ 8	2½	13	15	9 0 0
12 „ 10	3	16	18	10 10 0
15 „ 12	3¾	20	22	15 0 0
18 „ 16	4¾	25	28	24 0 0

* This lens is suitable for instantaneous stereoscopic marine views.

LARGER SIZES MADE TO ORDER.

1622. **Stereographic Compound Lens,** for portraits, groups, views, and interiors; diameter of front combination $1\frac{3}{10}$-inch., of back ditto $1\frac{7}{16}$-inch.; $3\frac{1}{2}$-inch. focal length; this lens has a rack and pinion movement, a set of Waterhouse diaphragms, and works instantaneously . . . £4 0 0

1623. Stereographic Compound Lens, without rack and pinion . 3 8 0

1624. Stereographic Single Lens for views, etc., $4\frac{1}{2}$-inch. focal length, $1\frac{1}{4}$-inch. diameter £1 8 0

1625. Stereographic Single Lens, with rack and pinion . . 2 0 0

1626. Stereographic Single Lens, 6-inch. focal length, $1\frac{1}{4}$-inch diameter 1 8 0

1626*. Stereographic Single Lens, with rack and pinion . . 2 0 0

1627. Pair of Stereographic Single Lenses of either $4\frac{1}{2}$ or 6-inch. focal length, with combined rack motion £4 4 0

1628. "The Wilsonian," a single lens (for stereo. and 5 by 4-inch views), 6-inch. focal length, $1\frac{1}{2}$-inch diameter £2 0 0

1629. "The Wilsonian," with rack and pinion . . . 2 15 0

DALLMEYER'S IMPROVED PHOTOGRAPHIC LENSES.

PATENT PORTRAIT LENSES (B). QUICK ACTING LENSES.

1630. **No. 2 B Patent Lens,** with rack and pinion movement. Diameter of lenses $2\frac{3}{4}$ inch. and back focus 6 inch.; especially constructed for carte-de-visite portraits; distance between subject and lens for a standing figure, 18 feet £12 0 0

1632. A Set of Waterhouse Diaphragms, in case for ditto . . 1 5 0

1633. No. 3 B Patent Lens, diameter of lenses $3\frac{1}{2}$ inch. and back focus 8 inch. especially constructed for the new cabinet portraits; distance between subject and lens for a standing figure, 18 feet . . £18 10 0

1634. A Set of Waterhouse Diaphragms, in case for ditto . . 1 10 0

1635. No. 4 B Patent Lens, diameter of lenses $4\frac{1}{2}$-inch, and back focus 12-inches: for pictures $8\frac{1}{2}$ by $6\frac{1}{2}$-inch. Distance for a cabinet portrait, 25 feet £38 0 0

1636. A Set of Waterhouse Diaphragms, in case for ditto . . 2 0 0

1637. PATENT PORTRAIT AND GROUP LENSES (D).

The prices marked below include a set of Waterhouse central diaphragms, and with the exception of No. 3 D, the lenses are mounted in rigid sittings, *i.e.*, without rack and pinion movement.

	Diameter of Lens.	Back Focus	Size of Group.	Size of View.	Price.
	Inches.	Inches.	Inches.	Inches.	£ s. d.
No. 3 D* Patent .	$2\frac{1}{2}$	$10\frac{1}{2}$	$8\frac{1}{2}$ by $6\frac{1}{2}$	10 by 8	8 10 0
No. 4 D* Patent .	$2\frac{7}{8}$	13	10 „ 8	12 „ 10	13 10 0
No. 5 D Patent .	$3\frac{1}{4}$	16	12 „ 10	15 „ 12	17 10 0
No. 6 D Patent .	4	$19\frac{1}{2}$	15 „ 12	18 „ 16	25 0 0
No. 7 D Patent .	5	24	18 „ 16	22 „ 20	42 0 0

* Distance for a cabinet portrait with No. 3 D 18 feet, with No. 4 D 25 feet.

New Patent Stereographic Lens, especially constructed for "instantaneous views," small portraits, groups, interiors, landscapes, etc.

Diameter of front and back combinations, $1\frac{1}{2}$-inch. and $1\frac{1}{4}$-inch. respectively, and $3\frac{5}{8}$-inch. focus from the back glass (equivalent focus 5 inches).

1638. In sliding mount, with Waterhouse central diaphragms, each . £4 5 0

1639. NEW PATENT STEREOGRAPHIC LENSES, as above, with rack and pinion movement, each £4 15 0

N.B.—The front combination can be used alone, as it is (focal length 8 inches), simply by unscrewing and dispensing with the back combination, when, with a small-sized stop, it will be found to cover the $7\frac{1}{4}$ by 4-inch plate.

1640. NEW WIDE-ANGLE LANDSCAPE LENS (PATENT).

The lenses are mounted in "rigid" tubes or settings, with "rotating" stops.

No.	Size of Plate.	Diameter of Lenses.	Equivalent Focus.	Price.	Remarks.
	Inches.	Inches.	Inches.	£ s. d.	
1A	5 × 4	$1\frac{3}{8}$	$5\frac{1}{4}$	3 5 0	
1	$7\frac{1}{4}$ „ $4\frac{1}{2}$	$1\frac{5}{8}$	7	3 15 0	No. 1A and No. 1 are made to screw into the same flange as No. 1 triple achromatic lens.
2	$8\frac{1}{2}$ „ $6\frac{1}{2}$	$1\frac{7}{8}$	$8\frac{1}{2}$	4 10 0	
3	10 „ 8	$2\frac{1}{8}$	10	5 10 0	
4	12 „ 10	$2\frac{1}{2}$	12	7 0 0	
5	15 „ 12	$2\frac{5}{8}$	15	8 10 0	
6	18 „ 16	3	18	10 10 0	No. 2 and 3 screw into No. 2 triple achromatic flange.
7	22 „ 20	$3\frac{5}{8}$	22	14 0 0	
8	25 „ 21	$4\frac{1}{4}$	25	19 0 0	

1642. RAPID RECTILINEAR LENS—PATENT.

Size of View or Landscape.	Size of Group or Portrait.	Diameter of Lenses.	Back Focus.	Equivalent Focus.	Price, Rigid setting.	Price Sliding tube	Price, rack and pinion.
					£ s. d.	£ s. d.	£ s. d.
5 by 4 in.	$4\frac{1}{4}$ by $3\frac{1}{4}$ in.	1 in.	$5\frac{1}{2}$ in.	6 in.	4 10 0	4 15 0	5 5 0
6 „ 5 in.	5 „ $4\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$7\frac{1}{2}$ in.	$8\frac{1}{4}$ in.	5 10 0	6 0 0	6 10 0
$7\frac{1}{4}$ „ $4\frac{1}{2}$ in.	5 „ $4\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$7\frac{1}{2}$ in.	$8\frac{1}{4}$ in.	5 10 0	6 0 0	6 10 0
$8\frac{1}{2}$ „ $6\frac{1}{2}$ in.	6 „ 5 in.	$1\frac{1}{2}$ in.	$10\frac{1}{4}$ in.	11 in.	7 0 0	7 10 0	8 0 0
10 „ 8 in.	$8\frac{1}{2}$ „ $6\frac{1}{2}$ in.	$1\frac{3}{4}$ in.	$12\frac{1}{4}$ in.	13 in.	9 0 0	9 10 0	10 5 0
12 „ 10 in.	10 „ 8 in.	2 in.	15 in.	16 in.	11 0 0	11 10 0	12 5 0
15 „ 12 in.	12 „ 10 in.	$2\frac{1}{2}$ in.	18 in.	$19\frac{1}{2}$ in.	14 0 0	14 15 0	—
18 „ 16 in.	15 „ 12 in.	3 in.	23 in.	$24\frac{3}{4}$ in.	18 0 0	19 0 0	—
22 „ 20 in.	18 „ 16 in.	$3\frac{3}{4}$ in.	28 in.	$30\frac{1}{2}$ in.	25 0 0	26 0 0	—
25 „ 21 in.	22 „ 20 in.	4 in.	31 in.	$33\frac{1}{2}$ in.	30 0 0	31 10 0	—

QUICK-ACTING PORTRAIT LENSES,

SPECIALLY CONSTRUCTED FOR CARTE-DE-VISITE PORTRAITS.

1643. No. 1 B PORTRAIT LENS, consisting of two achromatic combinations, mounted in tube, with rack and pinion movement, the lenses 2-inch. diameter, and $4\frac{1}{4}$-inch. focal length from the back glass, producing pictures on plates, $4\frac{1}{4}$ by $3\frac{1}{4}$-inch. and under £5 10 0

1644. A SET OF WATERHOUSE DIAPHRAGMS, in morocco case . . 0 15 0

Distance between the subject (5 feet 8 inch. high) and the lens, for a figure, $2\frac{1}{4}$ inch., from 12 to 13 feet. The lenses can be had in pairs, or four, of exactly equal foci.

1645. No. 1 B (LONG). Diameter of lenses $2\frac{1}{8}$ inch., back focus $4\frac{3}{4}$ inch., distance from 14 to 15 feet for above standard £6 0 0

This lens is constructed to meet the requirements of those photographers who require to use a longer focus lens than No. 1 B, but who have not sufficient length of gallery for No. 2 B.

1646. **No. 2 B Portrait Lens,** the lenses $2\frac{3}{4}$ inch. diameter, and 6 inch. focal length from the back glass, for pictures on plates 5 by 4 inch. and under . £11 11 0

1647. A Set of Waterhouse Diaphragms, in morocco case . 1 5 0

Distance between the subject (5 feet 8 inch. high) and the lens, for a figure $2\frac{3}{4}$ inch., from 18 to 19 feet.

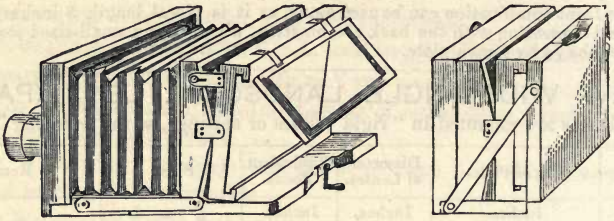


Fig. 1648.

NEW BINOCULAR CAMERA (*fig.* 1648),

For which the only Prize Medal of the Scotch Society was awarded. Focussing from $3\frac{1}{2}$ to 10 inch. can be used for stereoscopic views, cartes-de-visite, or for single pictures on the full size plate, *i. e.*, $7\frac{1}{2}$ by 5, with swing back, screw adjustment for focussing; the bellows body is divided into two distinct chambers by a movable elastic partition.

1648. With one single back for plates $7\frac{1}{4}$ by $4\frac{1}{2}$ £4 15 0

1649. „ „ „ $7\frac{1}{2}$ by 5 . . . 4 18 0

1650. „ „ „ 8 by 5 . . . 5 0 0

1652. Double backs for two prepared plates $7\frac{1}{4}$ by $4\frac{1}{2}$, or $7\frac{1}{2}$ by 5 . 1 0 0

1653. Double backs for two prepared plates 8 by 5 . . . 1 2 0

1654. Leather cases for either of the above, with sling strap and lock 1 2 0

*** *Fig.* 1648 is fitted with the improved folding sideboard, as shown in *fig.* 1658, p. 139. This allows the camera to be used on end when vertical pictures are required.

"It is altogether a most convenient, economical, and portable instrument, well adapted for the combined purpose for which it is intended."—(Vide Report of Jury, Class XIV.)

1655. **Enlarging Cameras,** for the field or studio, of good Honduras mahogany, with double bellows body, screw adjustment, bottom folding back and front, sliding action for adjusting negatives either vertically or horizontally. With inner and negative frames for the different sizes from carte-de-visite to 12 by 10 . . . . . £10 10 0

1656. Enlarging Camera, as above, with inner and negative frames for the different sizes from carte-de-visite to 15 by 12 . . . £15 0 0

1657. Enlarging Camera, as above, with inner and negative frames for the different sizes from carte-de-visite to 18 by 16 . . . £18 0 0

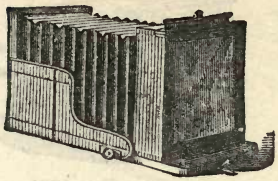


FIG. 1658.

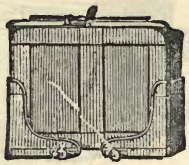


FIG. 1658*.

1658. IMPROVED NEW FOLDING OR BELLOWS CAMERA

(*Figs.* 1658 and 1658*).

This camera is similar in construction to the already well-known binocular camera, and possesses the following advantages: No screws are required for fixing; the focussing is effected from the back by the screw adjustment; the focussing-screen is attached to the camera, and the bellows body is parallel. This will be found of great advantage when using wide angle lenses. It is available either for the studio or field, the range of focus permitting the use of the shortest focus stereoscopic lenses, or any of the wide angle, doublet, or view lenses, as well as the carte-de-visite or cabinet lenses.

These cameras deserve especial examination as well for the perfection of their workmanship as for their perfect adaptation to the purposes for which they are designed.

Cameras for taking Pictures.		Swing Back extra.	Brass Binding.	Russia Leather Bellows.
8½ by 6½	£5 16 0	£0 15 0	£1 0 0	£0 12 0
8½ „ 8½	6 10 0	0 15 0	1 0 0	0 12 0
10 „ 8	6 16 0	1 0 0	1 5 0	0 14 0
10 „ 10	7 10 0	1 0 0	1 5 0	0 14 0
12 „ 10	8 0 0	1 5 0	1 10 0	0 18 0
12 „ 12	8 15 0	1 5 0	1 10 0	0 18 0
15 „ 12	10 0 0	1 10 0	2 0 0	1 5 0
15 „ 15	11 10 0	1 10 0	2 0 0	1 5 0

The above prices include one single back and two inner frames. Double backs can be adapted to the above. For prices, see page 142.

From 8½ by 6½ to 12 by 12 inclusive the cameras are fitted with movable centre partitions and loose inner frame for 7¼ by 4½ plates.

*** If fitted with swing back, the square camera is recommended.

1659. LEATHER CASES for the above, of best solid leather, with sling, straps, lock and handle—8½ by 6½ or 8½ by 8½, £1 4s.; 10 by 8 or 10 by 10, £1 6s.; 12 by 10 or 12 by 12, £1 14s.

1660. LEATHER SLING CASES, for lenses, from 5s. each.

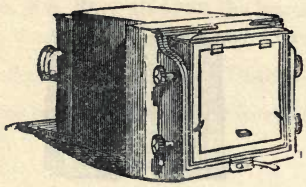


FIG. 1662.

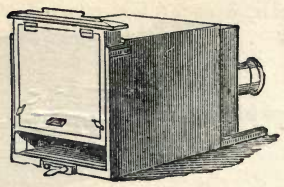


FIG. 1663.

1662. **Improved Cameras** for the portrait room (*fig.* 1662), of best Spanish mahogany, French polished, with screw and rack and pinion action, swinging back for bringing objects at different distances into correct focus, one single back, two inner frames, and focussing screen.

Square. Size.	Price.	Brass Binding.
*6½ inch., for plates 6½ by 4¾ . .	£6 12 0 .	£1 0 0
8½ „ „ „ 8½ „ 6½ . .	9 10 0 .	1 5 0
10 „ „ „ 10 „ 8 . .	12 0 0 .	1 15 0
12 „ „ „ 12 „ 10 . .	14 0 0 .	2 0 0
15 „ „ „ 15 „ 12 . .	18 0 0 .	2 15 0
18 „ „ „ 18 „ 16 . .	22 0 0 .	3 15 0
24 „ „ „ 24 „ 20 . .	30 0 0 .	4 10 0

If the above cameras are framed and panelled, which is recommended, especially for the larger ones, from £2 10s. extra.

* This camera is adapted for any of the new cabinet lenses.

1663. **Improved Camera** for portraits (*fig.* 1663), with screw adjustment for focussing, one single back and two inner frames.

Square. Size.	Price.	Brass Binding.
5 inch., for plates 5 by 4 . .	£2 12 0 .	£0 16 0
6½ „ „ „ 6½ „ 4¾ . .	3 15 0 .	1 0 0
8½ „ „ „ 8½ „ 6½ . .	6 0 0 .	1 5 0
10 „ „ „ 10 „ 8 . .	7 5 0 .	1 10 0
12 „ „ „ 12 „ 10 . .	9 10 0 .	1 15 0
15 „ „ „ 15 „ 12 . .	13 0 0 .	2 10 0
18 „ „ „ 18 „ 16 . .	17 0 0 .	3 5 0
24 „ „ „ 24 „ 20 . .	24 0 0 .	4 0 0

Folding cones can be adapted to the above cameras for copying. Prices from 15s. Double backs can be fitted to the above, also repeating backs for taking two or more pictures on one plate.

Cartes-de-Visite Cameras for the Studio (*fig.* 1664), p. 141,

1664. With one single back only, for plates 5 by 4, or 4¼ by 3¼ . £1 18 0

1665. CARTE-DE-VISITE CAMERA, with repeating back only, for taking two pictures with one lens, on plates 7¼ by 4½, or 6½ by 4¾ . . £3 5 0

1666. CARTE-DE-VISITE CAMERA, with repeating back only, adapted for either one or two lenses, with back for four pictures on plate 8½ by 6½, or two pictures on plate 6½ by 4¼ £6 10 0

Swing back extra for Nos. 1664 and 1665, 15s.; for No. 1666, £1; brass binding extra, for Nos. 1664, 16s.; 1665, £1; 1666, £1 10s.

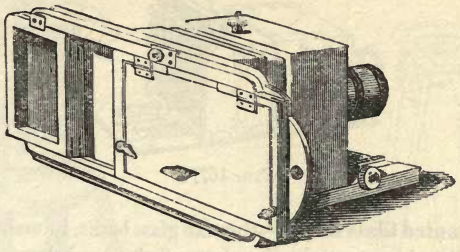


FIG. 1664.

1667. **Box Hood Shutters** to No. 1664 to 1666, from . . . £1 0 0

1668. RACK AND PINION ADJUSTMENT to ditto, extra . . 0 15 0

1669. CABINET PORTRAIT CAMERA, with one single collodion slide only, for plates 6½ by 4¾ £2 10 0

1670. CABINET PORTRAIT CAMERA, with repeating back, for taking two pictures with one lens, on plates 8½ by 6½, or 9½ by 6½ . . . £4 5 0

Swing back, 15s. extra. Brass binding, £1 extra. Rack and pinion adjustment, 15s. extra.

1672. **Improved Diamond Cameo Camera,** can be used as an ordinary 5 by 4 camera, or fitted with repeating back for taking two carte-de-visite pictures on one plate, as *fig.* 1664; price of diamond cameo camera and holder, with 5 by 4 back and glass frame, etc. £3 0 0

SWING BACK, extra 0 15 0

RACK AND PINION ADJUSTMENT, extra 0 15 0

1673. DIAMOND CAMEO HOLDERS fitted to cameras, from . . 1 6 0

1674. DIES AND PRESSES . . . . £3 3 0 and 4 4 0

1675. **Cards,** bearing registration mark, by which photographers are licensed to work the diamond cameo portraits, per 1000 . . . £2 15 0

1676. ALBUMS, PASSE-PARTOUTES, etc., suitable for the diamond cameo portraits.

1677. **Sliding-body Cameras** *(fig.* 1677), p. 142, French polished, with one single back, focussing glass, and two inner frames:

Square.	Size.	Of good Honduras Mahogany. Price.	Of best Spanish Mahogany. Price.	Brass Binding. Price.
5 inches, for plates	5 by 4 and under	£1 8 0 .	£1 18 0 .	£0 16 0
6½ „ „	6½ by 4¾ „	2 0 0 .	2 15 0 .	1 0 0
8½ „ „	8½ by 6½ „	3 10 0 .	4 15 0 .	1 4 0
10 „ „	10 by 8 „	5 0 0 .	7 0 0 .	1 8 0
12 „ „	12 by 10 „	6 15 0 .	9 0 0 .	1 10 0
15 „ „	15 by 12 „	9 0 0 .	12 0 0 .	2 5 0
18 „ „	18 by 16 „	14 10 0 .	18 0 0 .	3 10 0
24 „ „	24 by 20 „	18 0 0 .	25 0 0 .	4 5 0

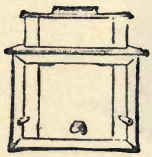


FIG. 1679.

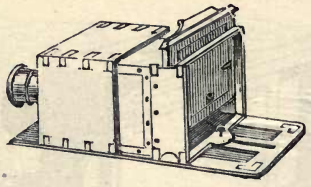


FIG. 1677.

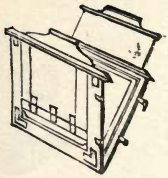


FIG. 1679*.

1678. **Improved Mounted Glass Baths.**—German glass baths, in mahogany cases, French polished, water-tight, for plates of sizes as below :—

	Indiarubber top.	Brass-bnd. extra.	Glass top extra.	In Polished Pine Case, water-tight, Indiarubber top.	Pine Case with hinged top for Studio.
5 by 4 .	£0 18 0	£0 10 0	£0 4 0	£0 14 0	£0 7 0
6¼ „ 4¾ .	1 1 0	0 12 0	0 4 0	0 16 0	0 8 6
7¼ „ 4½, or 7½ by 5,	1 4 0	0 12 0	0 4 0	0 18 0	0 8 6
8½ „ 6½, or 9 by 7,	1 8 0	0 16 0	0 5 0	1 2 0	0 10 6
10 „ 8 .	1 12 0	0 18 0	0 6 0	1 5 0	0 13 6
11 „ 9 .	1 17 6	0 18 0	0 7 0	1 9 0	0 15 0
12 „ 10 .	2 2 0	1 2 0	0 8 0	1 12 0	0 17 0
15 „ 12 .	3 0 0	1 8 0	0 10 0	2 6 0	1 11 0
18 „ 14 .	4 0 0	1 14 0	0 13 0	3 0 0	2 11 0

1679. SINGLE AND DOUBLE BACKS,

OF BEST SPANISH MAHOGANY.

Single Backs, including two inner frames for collodion (*fig.* 1679), and double backs, for paper or prepared plates (*fig.* 1679*) :

Size.	Single Backs.	Double Backs.	Brass bdg. ex.
5 by 5 . .	£0 16 0 .	£0 18 0 .	£0 4 0
6¾ „ 3¼, 6½ by 4¾, 6½ by 6½,			
7¼ „ 4½, 7½ by 5, 8 by 5, 7 by 6	1 0 0 .	1 2 0 .	0 4 0
7½ „ 7½, and 8½ by 6½ .	1 2 0 .	1 5 0 .	0 4 0
8½ „ 8½, and 9 by 7 .	1 4 0 .	1 8 0 .	0 4 0
10 „ 8 . . .	1 8 0 .	1 12 0 .	0 5 0
10 „ 10 . . .	1 10 0 .	1 14 0 .	0 5 6
12 „ 10 . . .	1 12 0 .	2 0 0 .	0 5 6
12 „ 12 . . .	1 14 0 .	2 2 0 .	0 5 6
15 „ 12 . . .	2 5 0 .	2 15 0 .	0 6 0
15 „ 15 . . .	2 10 0 .	3 0 0 .	0 6 0
18 „ 16 . . .	3 0 0 .	3 15 0 .	0 6 6
18 „ 18 . . .	3 5 0 .	4 0 0 .	0 6 6
24 „ 20 . . .	4 5 0 .	5 5 0 .	0 7 0
24 „ 24 . . .	4 15 0 .	5 15 0 .	0 7 6

If the hinges are fitted with silver rivets, 2s. each extra.

1680. **Inner Frames,** with silver wire corners for holding plates in single backs ; outside size of frame, 5 by 5, 1s. 6d. ; 6 by 6, 1s. 9d. ; 7½ by 5, 1s. 9d. ; 7½ by 7½, 2s. ; 8½ by 8½, 2s. 3d. ; 10 by 10, 2s. 6d. ; 12 by 12, 3s. ; 15 by 15, 4s. ; 18 by 18, 5s. ; 24 by 24, 7s. 6d.

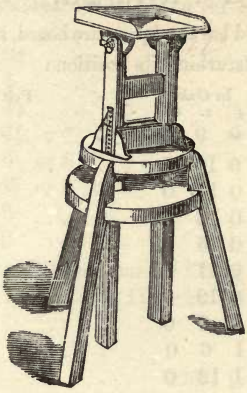


FIG. 1682.

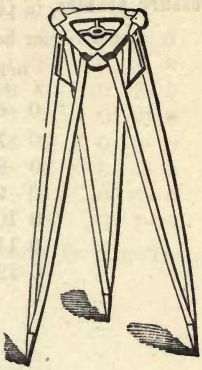


FIG. 1696.

CAMERA STANDS.

1682. **Table Stands** in oak, French polished *(fig.* 1682) . . £1 10 0

1683. TABLE STANDS in oak or white wood 1 4 0

1684. TABLE STANDS in pine, French polished, with rack adjustment . 3 10 0

1685. TABLE STANDS in oak or mahogany, French polished . . 5 0 0

1686. TABLE STANDS larger, in oak or mahogany, for support of large cameras, rack adjustment £8 0 0

1687. **Table Stands** larger, with heavy triangular base, in oak, rack adjustment £12 0 0

1688. ASH TRIPOD STAND, 5-inch. brass triangle top, ¾-inch . . 0 18 0

1689. „ „ „ 6 „ „ „ „ ¾ „ . . 1 1 0

1690. „ „ „ 7 „ „ „ „ ⅞ „ . . 1 4 0

1692. „ „ „ 8 „ „ „ „ . . 1 8 0

1693. „ „ „ 5 „ „ „ „ with jointed legs . 0 18 0

1694. „ „ „ 6 „ „ „ „ „ „ „ . 1 4 0

1695. „ „ „ 8 „ „ „ „ „ „ „ . 1 12 0

1696. **Large Tripod Stand** *(fig.* 1696), with 10-inch. triangular top, of mahogany, adapted for large camera £2 10 0

1697. LARGE TRIPOD STAND, 12-inch. top, of mahogany, adapted for large camera £2 15 0

1698. LARGE TRIPOD STAND, 14-inch. top, of mahogany, adapted for large camera £3 0 0

1699. LIGHT TRIPOD SLIDING STAND for small cameras, the latest improved 1 10 0

IMPROVED PRINTING FRAMES.

1700. **Pressure Frames,** in pine or oak, with hinged bars and pressure board, so that the negative can be examined without disturbing its position:

Size.	In Pine. £ s. d.	In Oak. £ s. d.	Felt Pads extra. £ s. d.
7 by 6	0 6 0	0 9 6	0 0 4
9 „ 7	0 7 0	0 10 6	0 0 4
10 „ 8	0 8 0	0 12 0	0 0 6
11 „ 9	0 9 0	0 13 6	0 0 6
12 „ 10	0 10 0	0 15 0	0 0 8
13 „ 11	0 11 0	0 17 0	0 0 8
14 „ 12	0 12 0	0 19 0	0 1 0
16 „ 13		1 2 0	0 1 6
19 „ 17		1 6 0	0 2 0
23 „ 21		1 12 0	0 2 6
25 „ 23		2 0 0	0 3 0
27 „ 25		2 10 0	0 3 6

1702. **Improved Printing Frames,** with indiarubber cushions, which possess the following advantages:—Equal pressure over the surface of the negative; no risk of breakage in printing; and, being perfectly water-tight, protect the negative from wet.

	In Pine.	In Oak or Mahogany.
Price to take plates up to 5 by 4,	£1 10 0 per dozen.	£1 16 0 per dozen.
6½ by 4¾, 7¼ by 4½, or 7½ by 5	1 16 0 „	2 10 0 „
8½ by 6½	2 8 0 „	3 5 0 „
10 by 8	3 0 0 „	4 0 0 „

"The importance of keeping out the wet from the negative cannot be overrated. These frames effectually prevent breakage and keep out wet."—Mr. V. Blanchard.

1703. **Portable Printing Frames:**

	In Pine.	In Oak.		In Pine.	In Oak.
5 by 4 per doz.	£0 18 0	£1 0 0	7¼ by 4½ per doz.	£1 0 0	£1 10 0
6½ by 4¾ „	1 0 0	1 10 0	8½ by 6½ „	1 10 0	2 10 0

1704. **Plate Boxes.** Boxes for holding one or two dozen glass plates, in white wood or mahogany polished, with V-shaped grooves. These boxes are perfectly light-tight, and can be used for storing prepared plates:

For Plates.	White Wood. One dozen.	White Wood. Two dozen.	Mahogany Polished. One dozen.	Mahogany Polished. Two dozen.
3¼ by 2¾	£0 1 9	£0 2 9	£0 3 6	£0 4 6
4¼ „ 3¼	0 2 3	0 3 3	0 4 0	0 5 0
5 „ 4	0 2 9	0 3 6	0 4 6	0 6 0
6½ „ 4¾, 7¼ by 4½, or 7½ by 5	0 3 3	0 4 0	0 5 3	0 7 6
7 „ 6, or 8 by 5	0 3 9	0 4 6	0 5 6	0 8 0
8½ „ 6½	0 4 0	0 5 0	0 6 3	0 8 6
9 „ 7	0 4 3	0 5 6	0 7 0	0 9 0
10 „ 8	0 4 9	0 6 0	0 8 0	0 10 0
11 „ 9	0 5 6	0 7 0	0 9 6	0 12 0
12 „ 10	0 6 3	0 7 9	0 10 6	0 13 0
15 „ 12	0 8 0	0 11 0	0 16 0	1 0 0
18 „ 16	0 10 0	0 12 0	0 18 0	1 4 0

1705. **Common Plate Boxes for Storing Negatives:**

	To hold one dozen.	Two dozen.	Fifty.	One hundred.
$4\frac{1}{4}$ by $3\frac{1}{4}$	£0 1 0	£0 1 6	£0 2 0	£0 4 0
5 „ 4	0 1 3	0 1 6	0 2 3	0 4 6
$6\frac{1}{2}$ „ $4\frac{3}{4}$	0 1 6	0 2 0	0 2 9	0 5 6
$7\frac{1}{4}$ „ $4\frac{1}{2}$, or $7\frac{1}{2}$ by 5 . .	0 1 6	0 2 0	0 2 9	0 5 6
7 „ 6 or 8 by 5 . .	0 1 8	0 2 3	0 3 0	0 6 0
$8\frac{1}{2}$ „ $6\frac{1}{2}$, or 9 by 7 . .	0 2 6	0 3 0	0 4 0	0 7 0
10 „ 8	0 4 0	0 5 0	0 6 6	0 12 0
12 „ 10	0 4 6	0 6 0	0 7 6	0 14 0

1706. PINE GROOVING for fitting up shelves or cupboards for negative racks, price 1s. per foot, 11 inches wide.

1707. DRAINING BOXES,

For Wet Negatives with Gutta-Percha V-shaped Grooves, and Indiarubber Cushions,

For Plates 5 by 4	£0 5 0
„ $6\frac{3}{4}$ „ $3\frac{1}{4}$	0 6 6
„ $6\frac{1}{2}$ „ $4\frac{3}{4}$, $7\frac{1}{4}$ by $4\frac{1}{2}$, or $7\frac{1}{2}$ by 5	0 6 6
„ $8\frac{1}{2}$ „ $6\frac{1}{2}$	0 8 0
„ 9 „ 7	0 9 0
„ 10 „ 8	0 10 0
„ 12 „ 10	0 12 0
„ 15 „ 12	0 15 0

Improved Edward's Tent, combining all the qualities necessary in a portable dark room, can be erected ready for use in less than two minutes, and is the *only Tent* in which perfect ventilation in secured.

1708. EDWARD'S TENT, in pine polished, for working plates up to $8\frac{1}{2}$ by $6\frac{1}{2}$, complete with tank, trays, spring-clip and tube, and tripod stand . £6 10 0

1709. EDWARD'S TENT, as above, for plates 10 by 8 . . . 7 0 0

1710. „ „ „ „ 12 „ 10 . . . 7 10 0

1712. „ „ „ „ 15 „ 12 . . . 8 0 0

1713. EDWARD'S TENT, brass-bound, of good Honduras mahogany, for India, complete as above, for plates $8\frac{1}{2}$ by $6\frac{1}{2}$ £8 10 0

1714. „ „ as above, for plates 10 by 8 . . . 9 0 0

1715. „ „ „ „ 12 „ 10 . . . 10 0 0

1716. „ „ „ „ 15 „ 12 . . . 11 10 0

1717. **Loose White Calico Covers** for the above, each 12s. 6d., 15s., 17s. 6d., £1.

The following fittings may be had for the above:—

1718. MOUNTED GLASS BATH, in mahogany case, $8\frac{1}{2}$ by $6\frac{1}{2}$, £1 8s.; 10 by 8, £1 12s.; 12 by 10, £2 2s.; 15 by 12 . . . £3 0 0

1719. PLATE DRAINING BOX, which is made to fit inside the water tank, $8\frac{1}{2}$ by $6\frac{1}{2}$, 8s.; 10 by 8, 10s.; 12 by 10, 12s.; 15 by 12 . . £0 15 0

1720. WHITE SQUARE BOTTLES for tents, 16 oz., 10d. each; 4 oz. ditto, 4d. each.

1722. PNEUMATIC PLATE HOLDERS, 3s. 6d. and 4s. 6d. each.

1723. **Filtering and Blotting Paper,** circular, in packets of 100, 6 inch., 9d.; 7½ inch., 1s.; 10 inch., 1s. 4d.; 13 inch., 1s. 10d.; 16 inch. . £0 2 3

1724. BEST WHITE BLOTTING PAPER, per quire . . . 0 1 6

1725. MOUNTS, carte-de-visite, best quality, per 100, 1s.; per 1000 . 0 8 0

1726. **German Glass Baths:**

Inside Measure.	Each.	Inside Measure.	Each.	Inside Measure.	Each.
5½ by 3¾ .	0 3 0 .	8 by 6 .	0 5 0 .	14 by 11 .	0 10 6
6½ „ 4½ .	0 3 6 .	6 „ 8 .	0 5 3 .	17½ „ 13½ .	1 2 0
8 „ 4 .	0 3 9 .	10 „ 7 .	0 6 0 .	20 „ 15 .	2 0 0
8½ „ 5½ .	0 4 9 .	12 „ 8½ .	0 8 0		

Levelling tops of baths for mounting, 2d. per inch on width of bath.

1727. DIPPERS of fluted glass, 6 inch., 5d.; 8 inch., 6d.; 9 inch., 7d.; 11 inch., 9d.; 13 inch., 11d.; 16 inch., 1s. 2d.; 18 inch., 1s. 6d.; 21 inch. . £0 2 0

1728. **German Glass Dishes,** inside measurement, 7 by 3½, 1s. 8d.; 6 by 5, 1s. 8d.; 8 by 6, 2s. 6d.; 10 by 8, 4s. 3d.; 12 by 9, 6s. 3d.; 14 by 12, 9s. 9d.; 17 by 14, 19s.; 20 by 16 . . . . . £1 3 6

1729. CHANCE'S BEST GLASS PLATES.

Size.	Best Patent Plate. Gross. £ s. d.	Extra-thick Polished Crown. Gross. £ s. d.	Usual substance Polished Crown. Gross. £ s. d.	Extra for Bevelled edges. Gross. £ s. d.
2½ by 2 .	0 5 0	0 4 6	0 3 0	0 4 0
3¼ „ 2¾ .	0 10 6	0 7 6	0 5 0	0 4 0
4¼ „ 3¼ .	1 4 0	0 13 0	0 8 6	0 4 0
5 „ 4 .	1 15 0	0 19 0	0 12 0	0 5 0
6¾ „ 3¼ .	1 18 0	1 0 0	0 14 0	0 6 0
6½ „ 4¾ .	2 14 0	1 13 0	0 19 0	0 6 0
7¼ „ 4½ .	2 19 6	1 17 6	1 3 0	0 6 0
7½ „ 5 .	3 12 0	2 4 0	1 9 0	0 7 0
8 „ 5 .	3 14 0	2 7 0	1 11 0	0 7 0
8½ „ 6½ .	5 1 0	3 3 0	1 19 0	0 8 0
	Dozen.	Dozen.	Dozen.	Dozen.
9 „ 7 .	0 10 0	0 6 2	0 4 2	0 0 10
10 „ 8 .	0 12 10	0 7 10	0 5 3	0 0 11
11 „ 9 .	0 17 3	0 9 8	0 7 3	0 1 0
12 „ 10 .	1 1 8	0 12 6	0 9 8	0 1 3
15 „ 12 .	1 16 0	1 1 6	0 16 3	0 1 6

1730. **Vignette Glasses,** 2½ by 2, 6d.; 3¼ by 2¾, 8d.; carte-de-visite, or 4¼ by 3¼, 1s.; 5 by 4, 1s. 3d.; 6¾ by 3¼, 2s.; 6½ by 4¾, 1s. 9d.; 7¼ by 4½, 2s.; 8½ by 6½, 2s. 3d.; 9 by 7, 2s. 6d.; 10 by 8, 3s. 3d.; 11 by 9, 3s. 9d.; 12 by 10, 4s.; 15 by 12 . . . . . £0 7 6

1732. **Ebonite Baths:**

Inside Measure.	Plain. £ s. d.	Air-tight top for Travelling. £ s. d.	Dipper. £ s. d.
5 by $3\frac{5}{8}$ for $4\frac{1}{4}$ by $3\frac{1}{4}$ . .	0 3 0	0 7 0	0 1 0
$7\frac{3}{4}$ „ $5\frac{3}{4}$ „ $6\frac{1}{2}$ „ $4\frac{3}{4}$ . .	0 4 9	0 11 3	0 1 3
$9\frac{1}{2}$ „ $5\frac{1}{2}$ „ $7\frac{1}{4}$ „ $4\frac{1}{2}$, $7\frac{1}{2}$ by 5, or 8 by 5	0 6 0	0 13 6	0 1 6
10 „ 7 „ $8\frac{1}{2}$ „ $6\frac{1}{2}$ . .	0 6 6	0 14 6	0 1 7
12 „ $8\frac{1}{2}$ „ 10 „ 8 . .	0 9 0	0 17 0	0 2 0
$14\frac{1}{2}$ „ $10\frac{1}{2}$ „ 12 „ 10 . .	0 11 6	1 2 6	0 2 7
$17\frac{1}{2}$ „ 13 „ 15 „ 12 . .	0 18 0	1 10 0	0 3 6

1733. Ebonite Trays, inside measure, 5 by $3\frac{5}{8}$, 2s. 6d.; $7\frac{3}{4}$ by $3\frac{3}{4}$, 3s.; 8 by 6, 3s. 9d.; $8\frac{1}{2}$ by $6\frac{1}{2}$, 4s.; $9\frac{1}{2}$ by $7\frac{1}{2}$, 4s. 3d.; 11 by 9, 5s. 3d.; $11\frac{1}{2}$ by $9\frac{1}{2}$, 5s. 6d.; 12 by 10, 6s. 3d.; $12\frac{1}{2}$ by 10, 6s. 9d.; 13 by 11, 7s. 6d.; 14 by 11, 10s.; 15 by 13, 13s. 6d.; 16 by 13 . . . . £0 16 6

Any other size ebonite baths or dishes to order.

1734. **Ebonite Funnels:** 1 oz., 8d.; 2 oz., 10d.; 3 oz., 1s. 1d.; 4 oz., 1s. 3d.; 6 oz., 1s. 5d.; 8 oz., 1s. 8d.; 10 oz., 1s. 11d.; 12 oz., 2s. 1d.; 16 oz., 2s. 7d.; 20 oz., 3s.; 30 oz., 3s. 6d.; 40 oz. £0 4 2

1735. Ebonite Bottles; 1 oz., 1s. 6d.; 2 oz., 1s. 8d.; 3 oz., 1s. 10d.; 4 oz., 2s.; 6 oz., 2s. 4d.; 8 oz., 2s. 7d.; 10 oz., 3s. 2d.; 12 oz., 3s. 6d.; 16 oz., 4s.; 20 oz., 4s. 8d.; 24 oz., 5s. 2d.; 30 oz. £0 6 2

1736. **Ebonite Developing Cups,** in sets of three, per set . . 0 2 3

1737. „ „ „ flanged, in sets of two, per set . 0 2 6

1738. „ Pincers, each 0 0 9

1739. **Pneumatic Plate Holders,** ball pattern 0 3 6

1740. „ „ „ cup pattern 0 4 6

1742. „ „ „ lever pattern . . . 0 4 6

1743. „ „ „ ball with handle pattern . . 0 4 6

1744. Backgrounds, any shade, in flatted oil, painted upon Irish linen, to obviate all damp:—

7 by 8 feet 6 inch. . . £1 5 0	10 by 8 feet 6 inch. . . £1 15 0
8 „ 8 „ 6 „ . . . 1 8 0	12 „ 8 „ 6 „ . . £2 2 0
9 „ 8 „ 6 „ . . . 1 10 0	If panelled or painted views, 10s. extra.

The usual size, painted on calico in flatted oil, plain, 8 by 6 feet, 16s.; if panelled or painted views, £1 1s.; baton and roller, 2s. 6d. extra.

1745. **Porcelain Trays:**—shallow: 5 by 4, 8d.; 8 by 6, 1s.; 10 by 8, 1s. 4d.; 12 by 10, 2s.; 14 by 12, 4s.; 16 by 14, 5s. 6d.; 19 by 15, 7s. 6d.; 24 by 19, 15s. 6d. Deep: 5 by 4, 1s; 8 by 6, 1s. 3d.; 10 by 8, 1s. 9d.; 12 by 10, 2s. 6d.; 14 by 12, 4s. 9d.; 16 by 14; 7s. 6d.; 19 by 15, 9s.; 24 by 19 . £1 0 0

1746. Porcelain Baths, for plates 5 by 4, 2s. 6d.; $6\frac{1}{2}$ by $4\frac{3}{4}$, 3s.; $8\frac{1}{2}$ by $6\frac{1}{2}$, 3s. 6d.; 10 by 8, 6s. 6d.; 12 by 10, 9s.; 16 by 12 . . . £0 18 0

1747. Dippers, for plates 5 by 4, 8d.; $6\frac{1}{2}$ by $4\frac{3}{4}$, 9d.; $8\frac{1}{2}$ by $6\frac{1}{2}$, 1s. 2d.; 10 by 8, 1s. 9d.; 12 by 10, 2s. 3d.; and 16 by 12 . . . £0 2 6

1748. **Porcelain Funnels,** 3 inch., 6d.; 4 inch., 8d.; 5 inch., 1s.; 6 inch., 1s. 3d.; 8 inch. £0 2 3

1749. **Glass Cutting or Shaping Plates,** with bevelled and polished edges, any shape, 2½ by 2, or 3¼ by 2¾, 6d.; 4¼ by 3¼, or carte-de-visite, 9d.; 5 by 4, 1s.; 6½ by 4¾, or cabinet, 1s. 4d.; 8½ by 6½, 1s. 6d.; 10 by 8, 2s. 3d.; 12 by 10, £0 4 6

Special sizes extra.

1750. **Graduated Glass Measures,** 1 dr., 9d.; 2 drs., 10d.; 1 oz., 8d.; 2 oz., 9d.; 4 oz., 1s. 1d.; 5 oz., 1s. 3d.; 8 oz., 1s. 9d.; 10 oz., 2s.; 16 oz., 2s. 3d.; 20 oz., 2s. 6d.; 32 oz., 4s.; 40 oz. £0 5 0

1752. Graduated and Stoppered Bottles, 1 oz., 1s. 6d.; 2 oz., 2s.; 3 oz., 2s. 6d.; 4 oz., 3s.; 6 oz., 3s. 6d.; 8 oz. £0 4 0

1753. Graduated and Capped Collodion Bottles, 2 oz., 2s. 6d.; 4 oz., 3s. 6d.; 6 oz., 4s.; 8 oz. £0 5 0

1754. Cometless Collodion Bottles, 2 oz., 2s. 6d.; 4 oz., 3s. 6d.; 6 oz., 4s. 6d.; 8 oz., £0 5 6

1755. „ „ „ graduated, 2 oz., 3s.; 4 oz., 4s. 3d.; 6 oz., 5s. 6d.; 8 oz. £0 6 6

1756. Spirit Lamps, 1s. 6d., 2s., and 0 3 0

1757. **Developing Measures,** three in a nest, per nest . . 0 1 6

1758. „ „ flanged, each . . . 0 0 6

1759. Glass Funnels, 2 inch., 3d.; 3 inch., 4d.; 4 inch., 5d.; 5 inch., 6d.; 6 inch., 10d.; 8 inch. £0 2 0

1760. Glass Stirring Rods, per doz., 1s. 6d., 2s., and . . 0 3 0

1762. Dropping Bottles, with neck, 1s. 6d. each; octagon, ditto, 9d., 1s., and 0 1 6

1763. Argentometer, 2s. 9d.; solution glass for ditto . . 0 0 9

1764. Glass Pestle and Mortar, 2 oz., 1s. 3d.; 4 oz., 1s. 6d.; 8 oz., 2s.; pints and quarts, 1s. 6d. per lb.

1765 Collodion Filters, each £0 6 6

1766. **Scales and Weights:** grain scales in oak box, round beams, 2s. and 0 2 6

1767. „ „ „ „ in mahogany box, glass pans . 0 5 0

1768. „ „ „ „ brass pillar, one brass and two glass pans, in mahogany box with drawer £1 5 0

1769. Head Rest, simplest form, each 0 3 6

1770. „ „ with cast-iron foot, pillar sliding tube, and rack adjustment for steadying the head £1 5 0

1772. Head Rest, with flat iron foot, double sliding tube suited for adults and children, with ball and socket movement at top . . . £2 10 0

1773. **Developing Stands** 4 inch., 2s. 6d.; 6 inch., 3s. 6d.; 8 inch., 5s.; 12 inch. £0 6 6

1774. Folding Plate Drainers up to 8½ by 6½, 3s. 6d.; 12 by 10, 5s.; 15 by 12 £0 6 6

1775. Plate Holders for holding glass plates up to 8½ by 6½, 4s.; 12 by 10, 6s.; and 15 by 12 . . . . . £0 8 0

1776. Filter Stands, with three rings, each, 3s. 6d., 4s. 6d., and . 0 5 6

1777. STILLS, with refrigerator and connecting tube, for the distillation of water with the aid of common fire in tin, ½ gallon size, 14s.; 1 gallon size, 18s.; 2 gallon size, 27s.; body of copper, ½ gallon size, 25s.; 1 gallon size, 40s.; 2 gallon size £2 10 0

1778. **Photographic Sundries:**

INDIARUBBER WATER BAGS, with handle stop, to hold 3 quarts, 10s.; 1 gallon, 12s.; 1½ gallon, 15s.; American Wood Clips, 9d. per doz.; glass ditto, 1s. 6d. per doz.; Chamois Leathers, 1s., 1s. 6d., and 2s. each; Towels, 9d. each, 8s. per doz.; Yellow Twill for tents, 1s. 3d. per yard; black, 1s. per yard; black velvet, per yard, 1s. 3d.; non-actinic Muslin, 4s. per yard; Indiarubber Gloves, 6s. 6d. per pair; Indiarubber Thumb and Finger Stalls, 4s. per doz.: Circular Spirit Levels, 1 inch. diameter, 2s. 6d.; 1½ inch., 3s. 6d.; 2 inch., 4s.; Corrundum Files, 1s. each; Diamonds for writing, 5s. 6d.; Diamonds for cutting glass, 12s. 6d., 15s., and 20s.; finest ground Patent Plate-glass for focussing screens of cameras: 5 by 4, 6d.; 6½ by 4¾, 8d.; 7½ by 5, 9d.; 8½ by 6½, 10d.; 10 by 8, 1s. 6d.; 12 by 10, 2s. 6d.; 15 by 12 . £0 3 6

1779. **Pure Photographic Chemicals,** of the best quality only, prepared by the first manufacturing chemists in London.

	oz.	lb.
	s. d.	s. d.
ACID, Acetic Glacial, solid at 50°	0 4	5 0
,, Citric	0 4	4 0
,, Formic	0 3	3 0
,, Gallic	1 0	15 0
,, Hydrochloric	0 2	1 0
,, Pyrogallic	5 0	—
,, Nitric	0 2	1 6
,, Sulphuric	0 2	1 6
,, Tannic	1 0	12 0
ALCOHOL, Absolute (sp. gr. 805)	0 6	6 6
,, ,, (sp. gr. 830)	0 4	4 6
,, Methylated per pint, 1s.; per gal., 6s. 6d.		
AMMONIA, Pure	0 2	1 6
AMMONIUM, Bromide	2 0	24 0
,, Chloride	0 2	1 6
,, Iodide	2 0	24 0
BARIUM, Chloride	0 2	2 0
,, Iodide	2 0	24 0
BATH, Nitrate, per pint, 7s.		
BENZOLE, Pure	0 2	2 0
BROMINE, ,,	1 6	—
CADMIUM, Bromide	2 0	—
,, Chloride	2 0	—
,, Iodide	2 0	—
CHLOROFORM, Pure	1 0	12 0
,, Methylated	0 6	8 0
CALCIUM, Bromide	2 0	—
,, Chloride, fused	0 2	1 6
,, Iodide	2 0	—
CHARCOAL, Animal, pure	0 6	6 0

COLLODIONS, Blanchard's New	pint.	½ pint.	¼ pint.
	s. d.	s. d.	s. d.
,, Carte-de-Visite	6 6	3 6	2 3
,, Mawson's	7 6	4 0	2 6
,, Thomas's	7 6	4 3	3 0

	pint.	½ pint.	¼ pint.
	s. d.	s. d.	s. d.
COLLODIONS, Ponting's	15 0	7 6	4 0
COLLODIO-CHLORIDE OF SILVER (Simpson's)	10 0	oz. s. d.	lb. s. d.
COTTON WOOL, prepared		0 6	6 0
DEXTRINE		0 2	1 6
ETHER, Pure Absolute (sp. gr. 7·20)		0 8	8 0
,, Sulphuric		0 6	6 0
,, Methylated		0 3	3 0
GELATINE		0 6	6 0
GLYCERINE, Pure		0 4	4 0
GOLD CHLORIDE, in sealed tubes, in 15 grain tubes, each, 2s. 3d.; doz. 24s.			
GOLD CHLORIDE, ditto, in 60 grain tubes, each, 8s.; doz. 84s.			
GRAPE SUGAR		0 2	2 0
IODINE, Pure		2 0	—
,, Tincture		0 8	—
IRON, Ammonio-citrate		0 6	6 6
,, Protosulphate, Pure		—	0 0
KAOLIN, Washed		—	0 8
LEAD, Nitrate		0 2	1 6
LIME, Chloride		—	0 8
LITMUS PAPER, book 2d.			
MAGNESIUM, Bromide		2 0	24 0
,, Iodide		2 0	24 0
MERCURY, Bichloride		0 6	6 0
POTASS, Bichromate		0 2	1 6
,, Ferridcyanide		0 6	5 6
,, Sulphuret		0 2	1 6
POTASSIUM, Bromide		1 6	—
,, Cyanide		0 6	7 0
,, Fluoride		1 0	—
,, Iodide		1 9	—

	Crystallized. oz. s. d.	Re-crystallized. oz. s. d.	Triple Crystallized. oz. s. d.
SILVER, Nitrate, 50 oz.	3 5	3 8	3 10
„ „ 25 and under 50 oz. . . .	3 6	3 9	3 11
„ „ 10 „ „ 25 „ . . .	3 7	3 10	4 0
„ „ 5 „ „ 10 „ . . .	3 9	4 0	4 3
„ „ 1 „ „ 5 „ . . .	4 0	4 3	4 6
„ Oxide	—	8 6	—

	OZ. s. d.	LB. s. d.
SILVER WIRE, Pure . .	7 6	—
SODA, Hyposulphite . .	—	0 6
SODIUM, Bromide . .	1 6	—
„ Chloride, Pure .	0 2	1 6
„ Iodide . . .	2 0	—
„ Fluoride . .	1 0	—
TANNIN, Pure . . .	1 0	—
TEST PAPER . . book	0 2	—

	OZ. s. d.	LB. s. d.
TRIPOLI	0 4	4 0
URANIUM, Nitrate . .	2 6	—
VARNISH, Amber and Chloroform	1 0	12 0
„ Crystal (Benzine) .	0 4	4 0
„ Hard Spirit . .	0 4	4 0
„ Scœhnee, bottle, 1s. 9d.		
„ Bates's Black, 6d and 1s		
WAX, White Pure . .	0 6	6 0

*** The above prices are subject to variation.

		Per quire.	Per ream.
1780. **Albumenized Papers,** Hart's or Sanford's . .		£0 8 0	£7 0 0
1782. „ „ Marion's		0 9 0	8 8 0
1783. „ „ Best Eagle, Rive, or Saxe Albumi-nized		0 8 0	7 0 0
1784. „ „ Spencer's, London . .		0 8 0	7 0 0

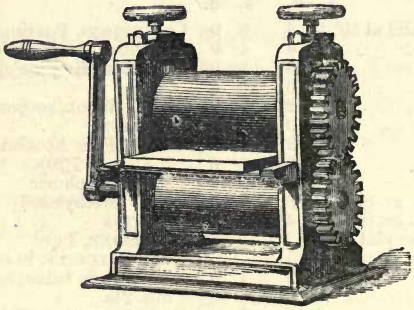


FIG. 1787.

1785. **Carte-de-Visite Press,** with steel rollers, 4 inches long . . £1 13 0

1786. „ „ with metal plate, and polished steel plate 3½ by 7 1 18 0

1787. AMATEUR „ „ „ „ 6 by 9 *(fig.* 1787) 3 5 0

1788. DOUBLE GEARED MACHINE, No. 1, and polished steel plate 12 by 18 7 0 0

1789. Ditto ditto ditto 15 by 21 9 5 0

1790. Ditto ditto ditto 18 by 24 12 0 0

1792. BEVEL GEARING, for lowering both ends at once, 12 by 18, £1 15s.; 15 by 21, £1 15s.; 18 by 24, extra £2 0 0

1793. **Double Geared Machine,** No. 2, with much thicker steel plate roller shafts, running in gun metal bearings, etc., 12 by 18 . . £10 10 0

1794. Ditto ditto, as above 15 by 12 . . 13 15 0

1795. Ditto ditto, as above 18 by 24 . . 17 5 0

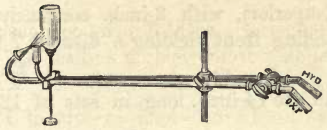


FIG. 1828.

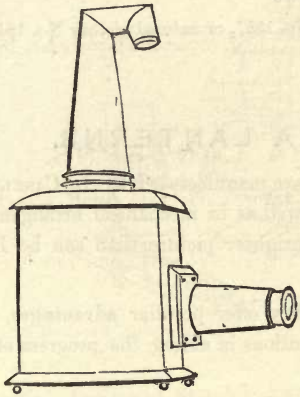


FIG. 1796.

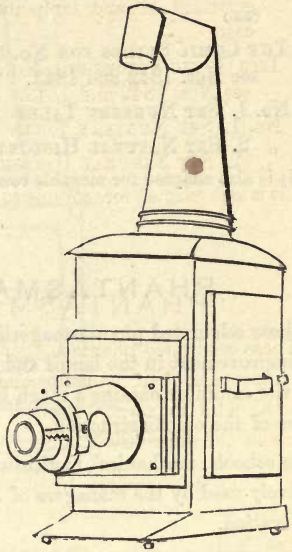


FIG. 1808.

PHANTASMAGORIA AND MAGIC LANTERNS,

DISSOLVING VIEW APPARATUS, ETC.

The whole are of the most approved make, and as each is carefully tested before it is sent out, purchasers may fully rely on their efficiency. The slides also are selected with great care and embrace every novelty; none being included but such as are calculated to improve the mind or contribute to innocent and mirthful recreation.

1796. **Magic Lanterns,** with brass mountings, for exhibiting humorous, astronomical and other subjects, Nos. 1 to 5, giving well-defined pictures of the average size of 2, 3, 4, 5, and 7 feet respectively (*fig.* 1796)

1797. No. 1. MAGIC LANTERN, with 12 slides in box, and 4 pictures or views on each slide £0 7 0

1798. No. 2. MAGIC LANTERN, with 12 slides of 50 figures or views . 0 10 0

1799. „ 3. „ „ with 2-inch. condensing lens . . . 0 10 0

1800. ONE DOZEN COMIC SLIDES, of 50 figures or views in box, for the above 0 10 6

1802. No. 4. MAGIC LANTERN, with 2½-inch. condensing lens . 0 14 6

1803. ONE DOZEN 12-INCH. COMIC SLIDES, of 50 figures, or views in box, for the above £0 15 0

1804. No. 5. **Improved Magic Lantern** (superior), with 3-inch. condensing lens, solarized Argand lamp and brass sliding front yielding a disc of 7 feet; in case £1 12 6

THE COMIC SLIDES FOR No. 5 LANTERN are 14 inch. long, in sets of 12 slides, see Nos. 1842 and 1843.

1806. No. 1. SET NURSERY TALES £1 3 6

1807. „ 2. SET NATURAL HISTORY AND VIEWS . . . 1 3 6

It is also adapted for movable comic slides, No. 1857, or natural history No. 1848.

PHANTASMAGORIA LANTERNS.

These celebrated phantasmagoria lanterns are manufactured by L. CASELLA, with every improvement in the lamps and lenses, as well as in mechanical arrangements, by which the exhibitor obtains a much larger and brighter picture than can be had with lanterns of the old construction.

To schools, mechanics' institutions, etc., they offer peculiar advantages, and are extensively used by the managers of such institutions in aiding the progress of science and education.

1808. **Casella's Improved Phantasmagoria Lantern,** with lenses 3½-inch. diameter, and powerful solarized Argand fountain lamp and reflector; very suitable for schools or public lectures, in case complete (*fig.* 1808), p. 151 £2 18 0

1808*. Or with rack and pinion adjustment to focus the object tube, extra 0 7 6

L. CASELLA strongly recommends this lantern, the size of the lenses enabling the exhibitor to show any of the following pictures or views.

1809. CASELLA'S IMPROVED PHANTASMAGORIA LANTERNS, with mahogany body, lined with tin, 3½-inch. condensing lenses, rackwork to focus object tube, and CASELLA'S improved solarized Argand fountain lamp with best reflector, in case complete. £4 4 0

1810. IMPROVED PHANTASMAGORIA, as above, very superior, with 4½-inch. condensing lenses £5 15 0

These extra-sized lenses secure the perfect definition to the extreme edge of the largest pictures in the following list.

DISSOLVING VIEW APPARATUS.

The beautiful optical effect termed dissolving views, is produced by means of two phantasmagoria lanterns, arranged as No. 1812, standing so that the projected centres of the discs or pictures are coincident, and the dissolving or blending of the pictures affected by the rackwork contrivance in front, which gradually shuts off the image of one lantern, whilst the other becomes clearer and more developed, a fresh picture being in the meantime put into the darkened lantern, and is reproduced or dissolved by reversing the action.

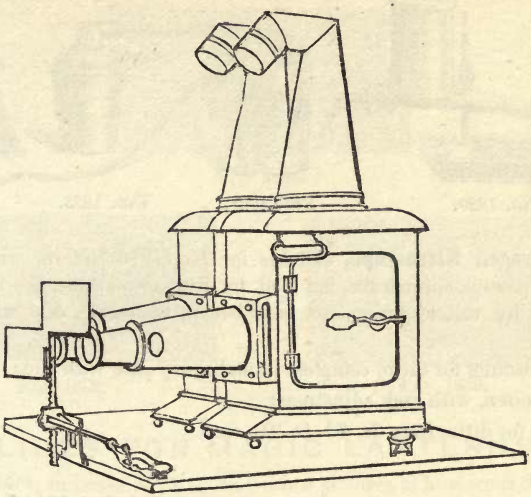


Fig. 1812.

1812. **Casella's Improved Dissolving View Apparatus,** with condensing lenses 3½-inch. diameter, dissolvers moved by rackwork, improved solarized Argand fountain lamps, suitable for lectures or parlour use, and capable of showing with clearness and brilliancy any of the pictures or views referred to in this catalogue, in case complete (*fig.* 1812) £8 8 0

1813. Dissolving View Apparatus, as above, with French polished tin lined mahogany bodies to the lanterns to prevent heating, the whole packed in case, as adapted by the Hon. Council of Education . . . £10 0 0

This apparatus, as well as the next following, is strongly recommended and particularly adapted for the purposes of instruction or amusement, where the expense or treatment of the oxyhydrogen or oxycalcium lights cannot be conveniently undertaken.

1814. Dissolving View Apparatus, with condensing lenses, 4½-inch. diameter, rack adjustment to focus the object tubes, improved solarized Argand fountain lamps, with stout mahogany bodies, etc., in case complete . £12 12 0

The improved oxy-calcium light may be applied at pleasure by the purchaser to any of the lanterns from No. 4 inclusive, they being equally adapted for this or the Argand lamps which accompany them.

1815. The apparatus complete for one lamp, £5 5s.; for two lamps, £6 6s.; see Nos. 1822 to 1828, and *figs.* 1822, 1825, 1827, and 1828.

1816. **Improved Oxy-Hydrogen Dissolving View Apparatus,** adapted for lectures and public institutions, condensing lenses 6 inch. in diameter, with best mahogany bodies, brass fronts and rack adjustment, gas jets, best indiarubber gas bags, to contain supply for two hours, pressure boards, clockwork movement for the lever cylinder, gas retorts for the oxygen and hydrogen gases, flexible connecting tubes with stop-cocks, etc., complete in case, with plain instructions for making the gas, etc., etc. £36 0 0

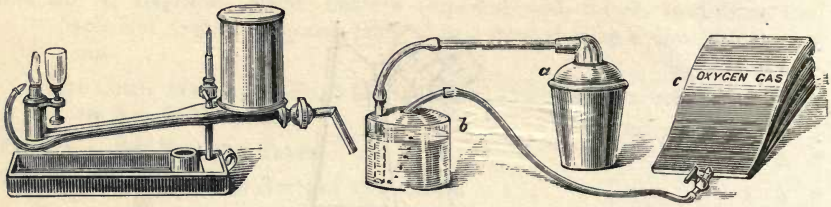


FIG. 1829. FIG. 1827. FIG. 1825. FIG. 1822.

1817. **Oxy-Hydrogen Microscope,** suitable for No. 1816 lantern, with three magnifying powers, animalculæ, flat cell for live animalculæ, the decomposition of water by voltaic action, etc., complete in mahogany case with lock and key £7 10 0

1818. KALEIDOSCOPE for ditto, complete in mahogany case with slide 2 2 0

1819. POLARISCOPE, with rack adjustment 8 8 0

1820. OBJECTS for ditto, from 3s. 6d. to 10s. each.

MAGIC LANTERN APPARATUS.

1822. IMPROVED VULCANIZED INDIARUBBER GAS BAG, wedge-shape, with stop-cock, size 38 by 26, and 20-inch. wedge (*fig.* 1822) . . £3 3 0

1823. **Pressure Boards,** jointed, for the above . . . 0 12 6

1824. SOLID INDIARUBBER TUBING, $\frac{5}{16}$ inch, per foot . . 0 0 5

1825. IRON RETORT (*fig.* 1825), with tube for making oxygen gas . 0 12 6

1826. GAS MIXTURE for making oxygen gas, per lb. . . . 0 1 4

1827. ZINC PURIFIER (*fig.* 1827) for the above retort . . 0 4 6

1828. **Oxycalcium, or House Gas Jet** (*fig.* 1828), p. 151, with stop-cocks and platinum nipple to be connected with an ordinary gas burner . . £0 16 0

1829. OXYCALCIUM, OR SPIRIT LAMP JET (*fig.* 1829), with platinum nipple, to be used when house gas is not available. . . . £0 16 0

1830. LIME CYLINDERS, in one dozen tins, soft, 2s.; hard . . 0 2 6

1832. MICROSCOPE, IMPROVED, with two powers, to attach to any of the lanterns for exhibiting insects, wings, sections of wood, etc. . . £1 18 0

1833. OBJECTS FOR THE GAS MICROSCOPE, prepared in Canada Balsam, consisting of insects, wood sections, ferns, etc., each . . . £0 2 0

1834. **Improved Solarized Argand Fountain Lamp,** with silvered reflector, lamp glass, and cotton stick £0 12 6

1835. IMPROVED SOLARIZED ARGAND FOUNTAIN LAMP, for $4\frac{1}{2}$ inch. lantern 0 17 6

1836. LAMP GLASSES for the $3\frac{1}{2}$-inch. phantasmagoria lantern, each . 0 0 8

1837. LAMP COTTONS „ „ „ „ per dozen 0 0 10

1838. TRANSPARENT SCREENS for exhibiting the pictures through the sheet by any of the apparatus, 7 feet square, 8s. 6d.; 10 feet . . . £0 15 0

1839. OPAQUE SCREENS of canvas, covered with paper and mounted on roller, for exhibiting pictures on the sheet, 7 feet square, 14s. 6d.; 10 feet £1 8 0

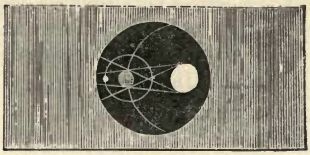


Fig. 1845.

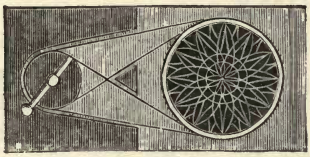


Fig. 1862.

Fig. 1859.

SLIDES FOR MAGIC LANTERNS.

1840. **Comic Slides,** in boxes of 12 slides, with 4 pictures of humorous figures or views to each, for No. 1 lantern, 3s.; No. 2 lantern, 3s. 6d.; No. 3 lantern, 10s; No. 4 lantern £0 15 0

1842. Comic Slides and Views for No. 5 lantern, painted on 3-inch. circles, in boxes of 6 or 7 each, consisting of Fairy and Nursery Tales, as Cinderella, Robinson Crusoe, Blue Beard, John Gilpin, Robin Hood, Jack and the Bean Stalk, Tale of a Tub, Old Man and his Ass, Whittington and his Cat, etc., etc., each £1 10 0

1843. Comic, Movable, or Slipping Glass Slides, showing a variety of figures and subjects, with heads or limbs moving as in nature, for Nos. 3 and 4 lantern, 1s. 4d. each; No. 5 lantern, 1s. 8d. each.

A Ballet Girl
A Naval Engagement
A Pigeon Pie
A Resurrectionist
A Sonambulist
A Vegetarian
A Woodman
"Adieu," in Wreath of Flowers
Artist and Brigand
Barber Shaving
Beware of the Gorilla
Black Drummer
„ Draught
Bottled Porter
Boy Bird's-nesting
British Port
„ Tar
Bull Tossing Dog
Butterfly, Grub, & Chrysalis
Cat and Fish in Globe
Clown falling to pieces
„ moving Eyes
„ Tumbling
„ on Kicking Donkey
Combat with Smuggler
Cook and Flying Goose
„ and Chimney Sweep
„ and Calf's Head
Cottage, with Bridge & Boats
Countryman and Dog changing Heads
Dentist Drawing Teeth
Elephant Tossing Keeper
Excursionist and Diver
Farmer carrying Pig
Fisherman and Cat
Ghost (Donkey in Churchyard)
"Good Night," in Wreath of Flowers
Lighthouse in Storm
Lion and Horse
London Porter
Man Swallowing Rats
Mischievous Monkey
Monkey Dipping Cat
Napoleon's Grave
Parrot Pulling off Man's Wig
Peacemakers
Performing Elephant
„ Acrobats
Performance on Two Chairs
Rabbits O
Sambo Lecturing
Serpent Charmer
Soldiers Drilling (heads shot off)
Tailor and Cabbage
Topsy (moving eyes)
Turk's Head (moving eyes)

COMIC, MOVABLE, OR SLIPPING GLASS SLIDES—(CONTINUED).

Cat's-meat Man
Chinese Punishment
„ Pyramid
Chip of the Old Block
Cobbler at Work
In this Style, 1s. (Portrait of a Donkey's Head)
Irishman Dancing
Lecture on Tobacco
Vesuvius in Eruption
Woman Beating Boy
„ with Cat's head
„ Beating Man

ASTRONOMY.

1844. **Astronomical Slides,** with 34 paintings 2½ inch. diameter, and telescopic views of the moon, planets, comets, etc., for illustrating the various phenomena of the heavens; with 2 movable and 1 lever slide, for Nos. 4 and 5 lanterns £2 12 6

DESCRIPTIVE BOOK, 1s.

1845. ASTRONOMICAL DIAGRAMS (*fig.* 1845), a series of 10 beautifully painted, with rack and pinion movement, by which in 36 diagrams the images produced are made to revolve and illustrate the solar system, theory of the tides, day and night, eclipses, the rotundity of the earth, etc., in case, for Nos. 1808 and 1809 phantasmagoria £5 5 0

1846. ASTRONOMICAL DIAGRAMS as above, for No. 1810 phantasmagoria 7 0 0

Both admirably adapted for public lectures.

1847. GEOLOGICAL SLIDES, 3½-inch. pictures, a series of 32 diagrams, showing the ordinary formations, slips, faults, dykes, fossils, fish, shells, and the extinct animals, with book, in case . . . . £3 3 0 and £4 4 0

1848. **Natural History Slides,** the set of 12, with 4 to each or 48 correct pictures, 3½ inch. diameter, of mammalia, birds, fishes, reptiles, insects, etc., £2 2s.; £3 3s., and £4 4 0

The above are adapted for Nos. 4 and 5 lanterns.

1849. **Series of Slides,** illustrating Ancient and Modern History . £4 4 0

1850. „ „ „ Scripture History . . . 3 3 0

1852. „ „ „ Scripture Zoology and Botany . 3 3 0

1853. „ „ „ Places and Mountains mentioned in the Bible £4 4 0

1854. „ „ „ Manners and Customs of the Chinese 3 3 0

1855. „ „ „ Conchology and Botany . . 3 3 0

1856. PORTRAITS OF CELEBRATED INDIVIDUALS, from . . 0 10 0

1857. COMIC MOVABLE AND SHIFTING GLASS SLIDES (or slip slides); a diversity of subjects, by which the magnified images appear to have life and motion, 2s. 6d., 3s., 3s. 6d., and £0 5 0

1858. **Landscapes, Marine Views, and Railways,** with movable figures, shipping, railway trains, etc. . . . . £0 7 6 to £0 10 6

1859. **Lever Slides** (*fig.* 1859), by which the movements of animals, etc., are imitated, as the horse or swan drinking, etc., for lanterns from No. 4, 5s. 6d. to 7s. 6d. each, and including

Woodman
Lady Riding
Ship at Night
Monkey Dipping Cat
Cow Drinking
Beggar
Grooming Horse
Doctor and Patient
Pat's Welcome to his Pig
Cobbler at Work
Moving Chin
Dying Camel
Fractious Child
Children in Boat
Fiddler
Monkey and Fish
Rubbing in, or Gouty Leg
The Entimologist in full chase
etc., etc.

1860. **Rackwork Slides,** with moving effects, 10s. 6d. each: including

Aquarium, with moving Fishes
Curtain Slide, for giving the effect of a curtain being raised in front of a stage
Fountain Playing, beautiful design and very effective
Rat Slide, Man swallowing Rats
Rolling Wave Effect, 17s. 6d.
The Eidotrope, two revolving perforated metal discs
Watermill, Wheel, revolving
Windmill, Sails, revolving, Daylight
„ Sails, revolving, Moonlight

1862. **Chromatropes** (*fig.* 1862), showing a series of beautiful revolving designs, including the changes of the kaleidoscope, fountains, rat swallower, etc., for No. 4 lantern, 6s. 6d.; larger size, 10s. 6d.; revolving scene with view in centre, 12s. 6d.; windmill, 10s. 6d.; fountain, 10s. 6d.; curtain to roll up . £0 10 6

1863. Chinese Fireworks, consisting of one 3-inch. chromatrope with 12 different designs such as butterflies, Prince of Wales's feathers, etc., in box £1 5 0

1864. Panoramic Views, consisting of a beautiful series of moving figures, moonlight scenes, etc., for lanterns 3 and 4, 5s. 6d. each; for larger sizes, 9s. 6d. each, including:

Eton College, with Boat Sailing
Lake of Como „ „
Tower of London, with Shipping
Greenwich Hospital „
Constantinople „ „
Aurora Borealis, with Reindeer and Sledge
Bay of Naples
View of Rome
Rialto of Venice
etc., etc.

VIEWS IN GREAT BRITAIN AND IRELAND,

On single slides, 3½-inch. pictures, for any of the lanterns above No. 4, 6s. to 7s. 6d. each.

1865. ENGLAND AND WALES.

Alnwick Castle
Arundel „
Berwick-on-Tweed
Canterbury Cathedral
Cardiff Castle
Fountains Abbey, Day
„ „ Moonlight
Hampton Court Palace
Kenilworth Castle
Map of England
„ Saxon England
„ Europe
Menai Bridge
Netley Abbey
Osborne House
Shakspere's House
Snowdon and Llanberis
Stonehenge
Tintern
Warwick
Winchester Cathedral
Windsor Castle, Day
„ „ Moonlight
York Minster

1866. LONDON.

DESCRIPTIVE BOOK, 3d.

Bank of England
British Museum
Buckingham Palace
Custom House
Greenwich Hospital
Guildhall
Houses of Parliament
London, General View
Monument
Post Office
Royal Exchange
St. Paul's
Somerset House
Temple Bar
Thames Tunnel
Tower
Trafalgar Square
Westminster Abbey

1867. OLD LONDON.

Almonry, Westminster
Lambeth Palace
Newgate on Fire
Old London Bridge
Old Royal Exchange
Palace Gate, St. James's
St. John's Gate
St. Paul's Cross
Savoy Palace
Southwark Palace
Whitehall

1868. SCOTLAND.

Abbotsford
Balmoral
Bell Rock Lighthouse
Ben and Loch Lomond
Bothwell Castle
Castle of St. Andrew's
Church of Iona
„ Moonlight
Doune Castle
Dryburgh Abbey
Dunfermline Abbey
Edinburgh, Calton Hill
„ Castle
Falls of Bracklinn
Fast Castle, Dunbar
Fingal's Cave, Staffa
Glencoe
Jedburgh
Lake Menteith
Linlithgow Palace
Loch Leven Castle
Melrose Abbey, Daylight
„ Moonlight
Roslin Castle
„ Chapel
Stirling Castle

1869. IRELAND.

DESCRIPTIVE LECTURE, 1s.

Armagh
Athlone Castle
Carrickfergus Castle
Coleraine Salmon Leap
Connemara Peasant and Spinning Wheel
Cork, Cove Harbour
„ Merchant's Quay
Dublin Bay
Dublin, St. Patrick's Cathedral
Dunluce Castle
Galway, Street in
„ Clare Abbey
Giant's Causeway
„ Portcoon Cave
Holy Cross Abbey
„ „ Interior
Kilkee, Natural Bridges
Kilkenny Castle
Lismore Castle
Meeting of the Waters
Muckross Abbey
Powerscourt Waterfall
Rock of Cashel
The Deserted Village
Waterford Quay
Youghall Abbey

CONTINENTAL VIEWS,

Beautifully painted, 3½-inch. pictures, 6s. 6d. to 9s. 6d. each.

1870. ITALY.

Bellinzona
Genoa, Doria Palace
Itri, Town and Castle
Map of Italy
Milan Cathedral, exterior
Mount Etna and Catania
„ Vesuvius, going up
„ „ coming down
Rome, from the Forum
„ Appii Forum
„ Arch of Constantine
„ Arch of Titus
„ Catacombs, interior
„ Ditto, ditto
„ Coliseum, Moonlight
„ „ Daylight
„ Lion and Gladiator
Rome, Tomb of Curiatii
Tivoli
Turin
Venice Arsenal
„ Bridge of Sighs
„ Doge, Portrait of
„ Ducal Palace
„ „ „ interior
„ Fisherman

ITALY—(CONTINUED).

Naples, Bay of
„ Grotto of Posilipo
„ Maccaroni Shop
Neapolitan Carriage
Pisa, Leaning Tower
„ Cathedral
Pompeii, General View
„ Temple of Venus
Pompeii, Sketch in
Rome, St. Peter's
„ „ interior
„ Panorama of Tiber
„ „ from Capitol
„ The Vatican
„ „ interior of library
„ Tarpeian Rock
Rome, Temple of Jupiter
Venice, General View
„ Gondola
„ Palace La-Cad'Oro
„ Rialto
„ St. Mark's
„ „ interior
„ Campanilla
„ Water Carrier

1872. SWITZERLAND.

Castle of Chillon
„ „ Interior of Dungeon
Lake of Como
„ Geneva
Lucerne
Mount Blanc and Chamouni
„ Chalêt at Chamouni
„ Cascade de Pelerins
„ Disaster, Aug., 1820
Mount Grand Mulets
„ „ Plateau
„ Mer de Glace
„ „ de la Côte
„ De Saussures' Cabin
„ Travellers ascending
„ The Summit
„ Coming Down
„ Hotel de Londres
St. Bernard Convent, Day
„ „ „ Moonlight
„ „ „ Winter
„ „ Alarm Bell
„ „ Dogs
Valley of Inn, Innsbrück
Via Mala
Zermatt

1873. VIEWS ON THE RHINE.

Amsterdam
Bonn
Braubach, Castle of Marksburg
Coblentz
Cologne
„ Cathedral, interior
Godesberg and the Seven Hills
Heidelberg Bridge Castle
„ Court Yard
„ Great Wine Butt
Mayence
Oberwesel
Saint Goar, General View
Schaffhausen
Stolzenfels Castle
Stockholm
Strasbourg
Thurmberg, Castle of Mouse

1874. RUSSIA.

Archangel
Balaclava
Blessing Waters of Neva
Cossacks on the Don
Cronstadt
Ice Hills, Artificial
Ice Sledges
Kremlin, Moscow
Malakoff, Storming of
Statue, Peter the Great
Prisoners going to Siberia
St. Petersburg
„ St. Mary's Cathedral
Sebastopol
Warsaw

1875. OVERLAND ROUTE TO INDIA.

Thirty-one slides, 3½-inch. pictures, exhibiting the principal scenery and incidents of the journey, 6s. 6d. to 8s. 6d. each:

Southampton
Osborne, Isle of Wight
Needles, by Moonlight
Bay of Biscay
Cintra
The Tagus
Alexandria, by Moonlight
Mahmondi Canal
Boulac, Torchlight
Cairo, by Night
The Cemetery of Cairo
The Dead Camel in the Desert
Departure from Suez
Red Sea, Moonlight
Jeddah
Mocha
Aden
Point-de-Galle, Ceylon

OVERLAND ROUTE TO INDIA—(CONTINUED).

Cape Trafalgar
Tarifa
Gibraltar
Algiers
Pantelaria Galeita
Malta
The Central Station
Moors and Arabs on horseback
Encampment by Night
Women drawing Water
Joseph's Well
Madras
Calcutta
Bombay
Hong Kong

1876. VIEWS IN INDIA.

6s. 6d. to 9s. each. LECTURE ON INDIA, 1s.

Agra
„ Taj Mahal
„ „ interior
Benares
Bolan Pass, Dadur
Bombay
Bull Idol Temple
Calcutta
Cawnpore
Cave Temple, Ellora
Ellora Skeleton Group
Delhi, General View
„ Great Mosque
„ Jehunger's Palace
Lucknow
Madras
Map of India
Mosque of Alee Khan
Point-de-Galle
Temple of Juggernat
Travelling in Madras

1877. CHINA.

6s. 6d. to 9s. 6d. each.

Amoy, Entrance to
Canton, General View
„ Street in
Cat Merchant
Chinese Barber
„ Wedding
Court of Justice
Great Wall
Hong Kong, West Point
„ Harbour
Honan, interior of Temple
Itinerant Doctor
Joss House
Nankin Porcelain, Tower
Pekin, Western Gate
Pootoo, Temple of
Tartar General and Troops
Tea Garden
„ Plantation
The Emperor
Travelling Tinker
Visit of Ceremony

1878. JAPAN.

6s. 6d. to 9s. 6d. each. LECTURE ON JAPAN, 1s.

Ambassador to England
Buddhist Temple
Costumes
Domestic Life
Girl Painting
Governor going to a Fire
Imperial Palace
Jugglers and Tumblers
Night Guard, Palace
Simoda Bay
Soldiers at Drill
Spiritual Emperor and Wives
Street in Hakodadi
Temporal Emperor and Wife
Vassal Prince
Wrestlers

1879. AUSTRALIA AND NEW ZEALAND.

6s. 6d. to 9s. 6d. each.

Adelaide
Bee Hunting
Bush Road
Chief's Hut, N.Z.
Collecting the Horses
Dingoes at Sheepfold
Heke and his Wife, N.Z.
Kangaroo Hunt
Lyre Bird
Melbourne
„ Collins Street
„ Port of
Merri Creek, Natives
Natives with Shield
Native Pah, N.Z.
Portrait of Chief, N.Z.
River Murray
Sydney
„ University
Tattooing a Chief, N.Z.
War Canoes „
„ Clubs „
„ Dance „
„ Speech „

1880. WONDERFUL PHENOMENA IN NATURE.
Beautifully painted 6s. 6d. to 9s. 6d. each.

Air Volcanoes
Blue Grotto, Capri
Boiling Spring
Cave of Adelsburg
„ Adullam
„ Arta
„ Fingal
Coral Reef
Dropping Well
Falls of Zambezi
Giant's Causeway
Grotto of Antiparos
„ Montserrat
Icebergs
Jorulla, Mexico
Land Storm, Rainbow
Mirage in Desert
„ Arctic Regions
Natural Bridges
Rapids
Sand Storm
Snow Bridges
Stromboli
Submarine Volcano
Waterspouts
Whirlpools

1882. VIEWS IN CANADA AND AMERICA.
6s. 6d. to 9s. 6d. each.

America, Map of
Charleston
Falls of Montmorency
„ Niagara
„ Trenton, Moonlight
Indians and Squaws
Indian Buffalo Dance
Indian Medicine Man
Mississippi, Moonlight
Montreal
„ Victoria Bridge
New York
Richmond
River St. Lawrence
River St. Lawrence, Rapids and Rafts
San Francisco
Thousand Isles
Quebec
Washington
„ President's House

1883. ARCTIC REGIONS.
6s. 6d. to 9s. 6d. each.

Breaking open Cairn
Building Snow Huts
Erebus and Terror
Exploring Party
Field of Ice
Greenland Whalers
Hecla and Griper
Icebergs
M'Clintock's Interview
M'Clure in Arctic Dress
Map, Parry's Discoveries
Rescue of Sir John Ross
Sledging Expedition
Terror thrown on Ice
Winter Quarters

1884. SOUTH AMERICA.
6s. 6d. to 9s. 6d. each.

Bahia, from Public Gardens
Bay of Carthagena
Catching Wild Cattle
Chincha Guano Islands
Indian Sorcerer
Lima, Capital of Peru
Pizarro entering on Conquest of Peru, 1531
Reception of Columbus by Ferdinand and Isabella, 1493
Rio de Janeiro

1885. AFRICA AND THE AFRICANS.
6s. 6d. to 9s. 6d. each.

Agades in the Desert
Amazon of Dahomey trampling on her Victim
Capture of Slave
Foola Village
Hamlet of Kanembo
Mesurata Chief
Moorish Horsemen
Negro Town
Katema on shoulders of his Minister
Lake Tchad
Sierra Leone in 1800
„ 1856
Slaves driven to Coast in Chains
Slave Ship, interior of
„ Capture of, by British Cruiser
Zambesi Falls, near view
„ Bird's-eye view
Zulu Kaffirs, Natal

1886. ABYSSINIAN EXPEDITION.

6s. 6d. to 9s. 6d. each.

Halting-place of Hilailcea, Tekonda Pass
Group of Shohos at the Hamhamo Spring
Shoho Village of Akoo, head of Annesley Bay
Woman Grinding Corn
Battle of Arogee, before Magdala, April 13
Storming of Magdala, April 13
King Theodore as he lay dead at Magdala
Houses where English Prisoners were confined
Destruction of Magdala
Dejatch Alamaeo, son of King Theodore
Departure of the released Prisoners from Head-quarters' Camp

1887. PARIS.

6s. 6d. to 9s. 6d. each.

General View with the Seven Bridges
Arc de Triomphe du Carrousel
Palace of the Tuileries
The Louvre
Hôtel de Ville
Column of July on the Place de la Bastile
The Madeleine
Column of Austerlitz, Place Vendôme
Hôtel des Invalides
Conciergerie (the prison of Marie Antoinette) and Pont-aux-Change
Notre Dame
Porte St. Denis
Abbey of St. Denis

1888. VIEWS OF THE FRENCH REVOLUTION.

7s. 6d. to 11s. 6d. each.

Marie Antoinette, Queen of France
Procession of Tiers Etat, in Paris
Attack on the Bastile by the Revolutionists, A.D. 1789
Portrait of M. Necker, the Director-General
The People driving Foulon from Vitry to Paris
March of the Women of Paris to Versailles
Portrait of Mirabeau
Lafayette preserves the Life of the Queen
Fête of the Federation in the Champ de Mars, A.D. 1790
The Temple, where Louis and his Family were imprisoned
The Populace compelling Louis XVI. to adopt the "Red Cap," A.D. 1792
Execution of Louis XVI., A.D. 1793

1889. LIFE OF BUNYAN AND HIS PILGRIM'S PROGRESS.

Twenty-seven views, 6s. 6d. and 9s. 6d.

1890. 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 15 0 and £10 0 0

1892. Wreck of an Emigrant Ship, 6 subjects, 2½ inch., £2 5s. 6d.; 3 inch., £4; 3½ inch. £4 4 0

1893. 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

1894. **Mount Etna or Vesuvius,** 4 subjects, day and night, eruption, etc., 2½ inch., £1 18s.; 3 inch., £2 2s.; 3½ inch. . . . £3 10 0

1896. Cinderella, 13 subjects, 2½ inch., £2 4s.; 3 inch. . . 3 17 6

1897. Tale of a Tub, 7 subjects, 2½ inch., £1 5s.; 3 inch. . . 2 5 0

1898. ROBINSON CRUSOE.

5s. 6d. each.

Crusoe Shipwrecked
„ loading his Raft
„ steering his Raft from Wreck
„ discovers Goats on the Island
„ kills a Goat, captures a Kid
„ finds Turtles and Penguins
„ Family at Home
„ alarmed at Footprints
„ in his Fort
Crusoe rescues Friday from Savages
Friday instructed in Boat-building
Crusoe and Friday rescue Spaniards
„ sees an English Ship
Capt. of Mutineers hung at Yard-arm
Crusoe arrives at Lisbon
Friday's antics with the Bear
The Wolves driven off
Crusoe settles in England

1899. TALE OF A TUB.

5s. 6d. each. DESCRIPTIVE BOOK, 9d.

The Tiger Asleep
„ Awake
Approach to Disturbance
The Artful Dodge
Look before you Leap
Under Cover
Increasing the Interest of the Tail
Climax, a Knotty Point

1900. PUSSY'S ROAD TO RUIN.

5s. 6d. each. DESCRIPTIVE BOOK, 1s.

Dame Tabby's Advice
Industrious Habits
Pussy's First Mouse
Grimalkin's Temptation
The Moonlight Walk
Its Ill Effects
A Garotte Robbery
Robs her Best Friend
Advice Neglected
Vanity her Ruin
Captured and Condemned
Repentance in Prison

1902. THE MILLER, HIS SON, AND THE ASS.

5s. 6d. each.

Feeding Ass, last time
Driving him to Market
The Boy rides
The Old Man rides
They both ride
They carry the Ass
The Ass falls over the Bridge
Moral over a dead Ass

1903. DICK WHITTINGTON.

5s. 6d. each.

Sets out for London
Employed by the Merchant
Purchases a Cat
Sends the Cat in his Master's Ship
Whittington's Stone and Bow Bells
Cat sold to a great African Chief
Captain of the "Unicorn" brings back the gold
Whittington marries his Master's Daughter

1904. WILD SPORTS OF THE WORLD.

9s. 6d. each.

Bear Hunt among the Chippeways
Bee Hunting in Australia
Bison Hunting by Indians in Snow Shoes
Elephant and Hunter
„ protecting Young
„ Harnessed for War
„ driven into Corral
Hunter Treeing the Leopard
Kangaroo Hunt, Australia
Killing the Panther
Lion Fight
Maldonata and her Puma
Shooting White Rhinoceros
Seal Spearing in Greenland
Snake Hunting by Natives of Australia
Tiger and Alligator fighting
Tiger Hunting on Elephants
„ „ the Death spring
Whaling, attack by Boats
Wild Horse Hunting with Lasso
Wolf attacking Traveller in Russia
Wolf Pit for trapping Wolves

1905. LIFE AND JOURNEYS OF ST. PAUL.

M'Leod's Travels of St. Paul (Descriptive Book), 1st, 2nd, and 3rd journeys and voyage to Rome, 70 subjects, including Ancient Jerusalem, Stoning of St. Stephen, Conversion of Saul, Saul andElimas the Sorcerer, Ancient Athens, the Ephesians burning their Books, Jerusalem, Paul before Agrippa, together or separately, 7s. 6d. to 10s. 6d. each.

1906. Nineveh and its Remains, 14 subjects, together or separately, 6s. to 7s. 6d. each, including City of Mosul from Tigris, Obelisk found at Nineveh, etc.

1907. VIEWS IN THE HOLY LAND.

3½-inch. paintings, 5s. 6d. to 7s. each, 90 subjects. M'Leod's Book on Palestine, 1s. 6d.

Ajalon, Valley of
Askelon
Baalbec, Ruins of
Babylon
Beirout
Bethany
Bethlehem
„ Rachel's Tomb
Cana of Galilee
Capernaum
Cæsarea
Church, Holy Sepulchre
Damascus, General
„ interior of House
„ Mosque
Dead Sea
Druse Marriage
Ephesus
Elim, Pillar of Cloud
Gethsemane
Hebron
Jerusalem, Ancient
„ Modern
„ Golden Gate
„ Mosque of Omar
„ Street in
Jericho, Plains of
Lake of Tiberias
Map of Wanderings of Israelites
Mount Ararat
„ Carmel
„ Hermon
Mount Hor
„ Lebanon
„ Olives
„ Sinai and Horeb
„ „ Summit
Pool of Hezekiah
„ Siloam
Ramah (Arimathea)
Red Sea
Sardis
Sidon, from the Sea
Smyrna
„ Street in
Sodom, Destruction of
Tripoli, in Syria
Valley of Jehoshaphat

1908. SCRIPTURE HISTORY SCENES.

9s. 6d. each, 80 views or subjects.

Garden of Eden
Death of Abel
Deluge
Ark and Dove
Concealing of Moses
Finding of Moses by Pharaoh's Daughter
Departure of the Israelites
Israelites Pursued by the Egyptians

SCRIPTURE HISTORY SCENES—(CONTINUED).

Assuaging of the Waters
Noah's Sacrifice
Burial of Sarah in Cave of Machpelah
Eliezer and Rebekah at the Well
Joseph Dreams
„ Cast into the Pit
„ Sold to the Ishmaelites
„ Coat of many Colours
„ Interprets Dreams in Prison
„ Interprets Pharaoh's Dream
Simeon detained
Cup found in Benjamin's Sack
Joseph makes himself known
Jacob sets out for Egypt
Meeting of Jacob and Joseph
Jacob before Pharaoh
Embalming of Joseph
Passage of the Red Sea
Miriam the Prophetess
Moses striking the Rock
Balaam and Balak's Sacrifice
Fleeing to the City of Refuge
The Child Samuel Praying
David and Goliath
Elisha Raising the Shunammite's Son
Daniel in the Lion's Den
„ Interprets Writing on the Wall
The Wise Men from the East
Adoration of the Magi
„ „ Shepherds
Christ Walking on the Sea
Good Samaritan
Miraculous Draught of Fishes

1909. THE BOTTLE.

Eight scenes by CRUIKSHANK, 9s. 6d. each.

The Bottle introduced at Home
Pawn their Clothes to Supply it
An Execution on the Furniture
Driven into the Streets to Beg
Death of a Child from Want
The Fearful Quarrel
Results in Murder
The Maniac and his Children

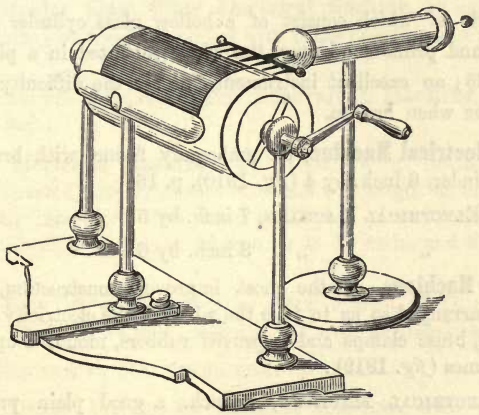


FIG. 1910.

ELECTRICAL INSTRUMENTS AND APPARATUS.

The increased interest attaching to electricity in its various extensive applications, induces the utmost care in the efficiency and workmanship of the following:

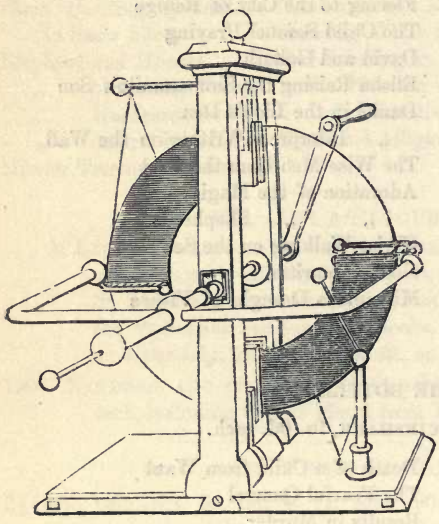


FIG. 1919.

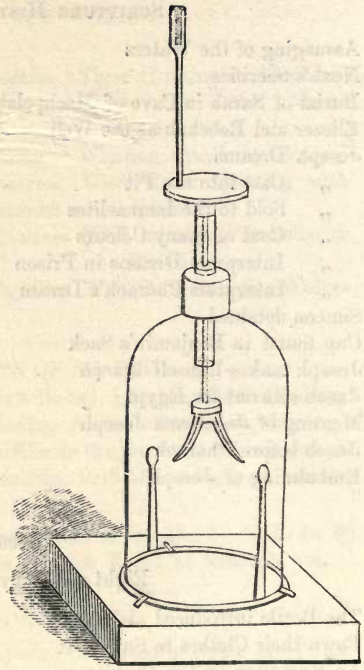


FIG. 1953.

CYLINDER ELECTRICAL MACHINES,

The essential parts of which consist of a hollow glass cylinder as the electric, an insulated rubber and prime conductor, the whole mounted in a plain useful manner (*fig.* 1910), p. 165; an excellent instrument, but for the difficulty of fitting and replacing the cylinder when broken.

1910. **Cylinder Electrical Machine,** on mahogany frame, with brass conductor and glass cylinder, 6 inch. by 4 (*fig.* 1910), p. 165 . . £1 0 0

1912. CYLINDER ELECTRICAL MACHINE, 7 inch. by 5 . . 1 8 0

1913. „ „ „ 8 inch. by 6 . . 2 0 0

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 plate, brass clamps and improved rubbers, mounted upon polished mahogany frames (*fig.* 1919):

1914. PLATE ELECTRICAL MACHINE, 9 inch., a good plain practical instrument £1 12 6

1915. „ „ „ 9 inch., of best make . 2 15 0

1916. „ „ „ 12 „ ditto . . 3 10 0

1917. „ „ „ 12 „ ditto, with double receiving forks £5 0 0

1918. **Plate Electrical Machine** 15 inch., of best make, with double receiving forks £6 10 0

1919. „ „ „ 18 „ ditto, ditto (*fig.* 1919), p. 166 8 0 0

1920. „ „ „ 24 „ ditto, ditto . . 10 10 0

1922. „ „ „ 30 „ ditto, ditto . . 15 15 0

Larger sizes made to order.

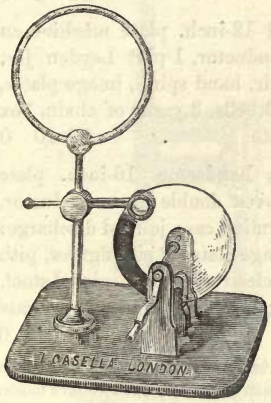


Fig. 1934.

1923. **Plate Electrical Machine,** on mahogany frame, with massive cylindrical brass conductor, mounted on two glass pillars, new form, inexpensive and efficient, 16-inch. plate . . £4 4 0

1924. Plate Electrical Machine, as above, 18-inch. £5 5 0

1925. **Ebonite Plate Electrical Machine,** mounted in mahogany, with cylindrical brass conductor, on two pillars as above, with plate 16 inches diameter . . . £4 0 0

1926. Ebonite Plate Electrical Machine, as above, 18 inch. diameter . . . £5 5 0

The strength and durability of the plates of these machines adapt them admirably for carriage to India and the colonies.

1927. **Woodward's Double Circular Glass Plate Electrical Machine,** in handsome mahogany frame with negative and positive conductors, 12-inch. £11 11 0

1928. Woodward's Double Circular Glass Plate Electrical Machine, as above, 18-inch. £16 16 0

1929. **Harris's Circular Glass Plate Electrical Machine,** 18-inch., with mahogany open rectangular frame, mounted with brass negative and positive conductors, £18 0 0

1930. Harris's Circular Glass Plate Electrical Machine, as above, 24-inch. £21; 3-feet £42 10 0

Winter's Plate Electrical Machine (*fig.* 1934), with insulated mounting, and metallic covered ring by means of which the length of an electric spark may be greatly increased; thus the 6 inch. plate gives about a 3 inch. spark, the 12 inch. about 5 to 6 inch., 18 inch. 9 to 10 inch., and the 24 inch. 10 to 12 inch.

1934. Winter's Electrical Machine, as above, 9 inch., £2 6s.; 12 inch., £3 16s.; 18 inch., £6 15s.; 24 inch., £12 15s.; if with insulated cushion £16 0 0

1935. Holtz's Electrical Machines made to order.

1336. Circular Glass Plates, for electrical machines, with polished edges and centre holes:

9-in.	diameter.	$\frac{1}{4}$-in.	thick.	£0 9 6	24-in.	diameter.	$\frac{3}{8}$-in.	thick.	£1 18 0
12-in.	„	$\frac{1}{4}$-in.	„	0 11 6	30-in.	„	$\frac{3}{8}$-in.	„	2 13 0
16-in.	„	$\frac{5}{16}$-in.	„	0 17 6	36-in.	„	$\frac{1}{2}$-in.	„	4 17 6
18-in.	„	$\frac{5}{16}$-in.	„	1 4 0	48-in.	„	$\frac{5}{8}$-in.	„	10 0 0
20-in.	„	$\frac{3}{8}$-in.	„	1 9 0					

1937. ELECTRICAL TUBE, closed and rounded at both ends, with small hole at one end, 24 inch. long by ¾ inch, 1s. 3d.; 36 inch. long by 1 inch £0 1 6

Electrical Machines with Apparatus, fitted in box with lock and key.

1938. SET OF ELECTRICAL APPARATUS, consisting of cylinder machine, 7 inch. by 5 inch., with brass conductor, Leyden jar, hand spiral, head of hair, image plate, 2 pith figures, whirl, discharger, brass chain and amalgam, in case, £2 6 0

1939. **Set of Electrical Apparatus,** consisting of a best 12-inch. plate machine on polished mahogany stand, with double brass conductor, 1 pint Leyden jar, jointed discharger with glass handle, head of hair, hand spiral, image plates, pith ball stand and 6 pith balls, 2 figures, set of 3 bells, 3 yards of chain, box of amalgam, and stout brass clamp in box complete . £5 10 0

1940. SET OF ELECTRICAL APPARATUS, consisting of a handsome 16-inch. plate machine on polished mahogany stand, with improved double brass conductor, battery of 6 quart Leyden jars, in tray with cover forming case, jointed discharger with glass handle whirl, spiral and head of hair, image plates, 3 pith figures, pith balls, set of 3 bells, orrery, Bennett's and Henley's electrometers, insulated stool, exhausting syringe, falling star in vacuum tube; thunder-house, pistol, brass clamp, chain and amalgam, complete in case . . £10 10 0

*** In electrical experiments it is important that all parts of the apparatus should be slightly warmed at a distance from the fire, and 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 add to its efficiency. The amalgam, if too dry, may be moistened by adding a very small portion of lard.

1941. **Glass Cylinder,** for showing electrical excitation, when rubbed with a warm and dry piece of silk or fur £0 1 6

1942. BRASS CYLINDER, mounted with insulating handle, for showing that metals, if properly insulated, become charged when excited by silk or fur £0 4 6

1943. SOLID CYLINDERS of shellac and sealing wax, for illustrating the resinous electrical excitation, 5s. 6d. and £0 8 6

1944. **LEYDEN JARS and BATTERIES,** for accumulating electricity:

½ pint.	£0	2	6	3 pint	£0	5	6
Pint	0	3	0	2 quart	0	7	6
Quart	0	4	0				

Electrical Batteries or combinations of Leyden jars varying in numbers and size of jars, mounted in frames, with this arrangement quantity and intensity of electricity may be obtained to any extent.

1945.	ELECTRICAL BATTERY, consisting of	4	No.	2	Leyden jars	in	frame	£1	4	0
1946.	„	„	„	4	„	3	„	„	„	1	12	6
1947.	„	„	„	6	„	3	„	„	„	2	5	0
1947*.	„	„	„	12	„	4	„	„	„	5	0	0

1948. AUTOMATIC PHOTOSTAT for electric light. By this simple instrument the battery current is made to regulate the distance between the carbon points, so that a steady and continuous light is maintained (*fig.* 1948) £1 18 0

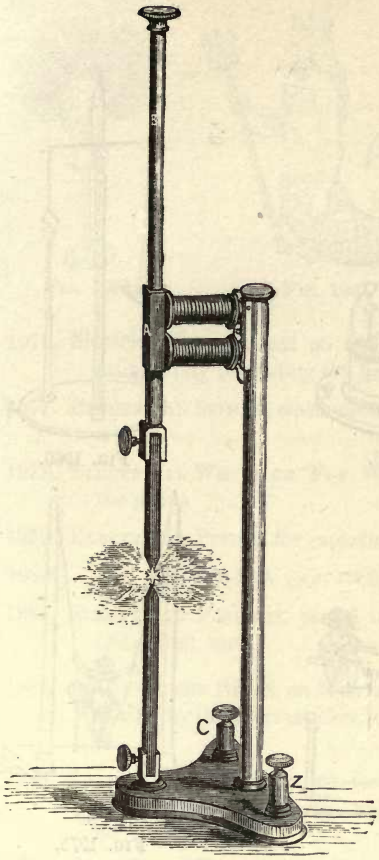


FIG. 1948.

1949. IMPROVED PHOTOSTAT, by which a powerful and uniform light is uninterruptedly maintained £9 9 0

ELECTROMETERS, etc., for measuring electrical tension:

1950. CAVALLO'S PITH BALL ELECTROMETER (*fig.* 1950), p. 170 £0 9 0

1952. HENLEY'S QUADRANT ELECTROMETER, with boxwood graduated arc, 3s. 6d.; with ivory arc (*fig.* 1952), p. 170 £0 7 6

1953. BENNETT'S GOLD LEAF ELECTROMETER (*fig.* 1953), p. 166, with an improved mode of insulation and stand, with ½ pint, 1 pint, and 1 quart jars, 6s., 11s., £0 15 0

1954. SINGER'S ELECTROSCOPE, with condensing plate and joint £1 17 6

1955. HAÜY'S NEEDLE ELECTROSCOPE. This portable and delicate instrument is employed chiefly in ascertaining the electrical state of mineral substances £0 8 0

1956. HARE'S SINGLE LEAF ELECTROSCOPE, 15s. to . . £1 0 0

1957. **Tate's Electroscopes,** viz., small collection as described in Tate's "Electricity," per box . £0 7 6

1958. GUTTA-PERCHA INSULATING SUPPORTS, 5 inch. high, with needle tops for the above, per pair £0 1 6

1959. GUTTA-PERCHA INSULATING SUPPORTS, with flat tops, per pair 0 1 6

1260. LANE'S DISCHARGING ELECTROMETER, large size with jar . 0 12 6

1962. **Cuthbertson's Discharging Electrometer** . . . 2 10 0

1963. COULOMB'S TORSION ELECTROMETER, for measuring small quantities of electricity with precision and its attractive and repulsive force (*fig.* 1963), p. 170, from £1 15 0

1964. HARRIS'S UNIT JAR ELECTROMETER, with graduated slide for charging other jars or batteries with known proportion of electricity . £1 10 6

1965. 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.* 1965), p. 170 . £3 18 0

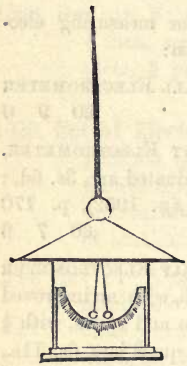


FIG. 1950.

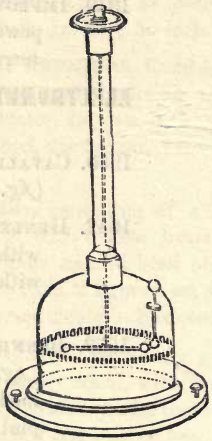


FIG. 1963.

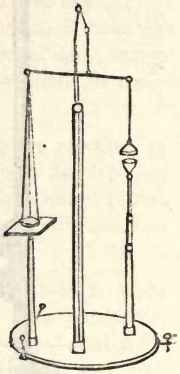


FIG. 1965.

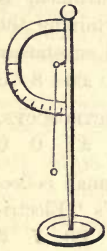


FIG. 1752.

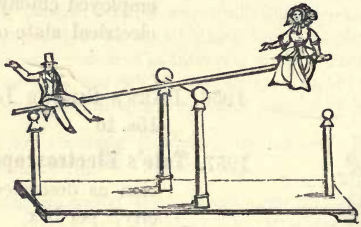


FIG. 1980.

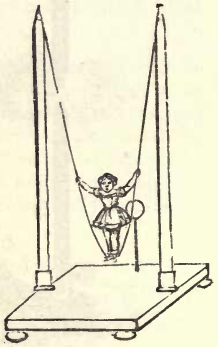


FIG. 1975.

APPARATUS.

1966. INSULATING STOOLS, polished mahogany, with glass legs, 12 by 10 inches, 10s.; 14 by 12 inch., 14s.; 16 by 14 inch. . . . £0 18 0

1967. ELECTROPHORUS, best, with two metallic and an intervening ebonite plate, for obtaining the electric spark £1 0 0

1968. EGG-SHAPED GLASS, with stop-cock, to show light in vacuo . 1 15 0

1969. **Electrical Flask,** with brass cap and valve for exhaustion . 0 6 6

1970. „ SPORTSMAN, consisting of Leyden jar, carved figure of sportsman, and pith birds on brass conductor (*fig.* 1970), p. 171 . £0 18 0

1972. DIAMOND JAR, 1 pint 0 6 0

1973. BRASS CHAIN, per yard 0 0 4

1974. BUCKET AND SYPHON 0 4 6

1975. ELECTRICAL SWING, for show ng the repulsion of bodies similarly electrified (*fig.* 1975) £0 7 6

FIG. 1993.

FIG. 1982.

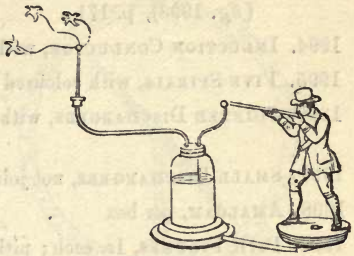


FIG. 1970.

1976. **Electrical Swan,** placed on the surface of a vessel of electrified water, will be attracted by presenting the finger £0 2 0

1977. ELECTRICAL SPIDER, when electrified will be attracted by a ball, but repelled by a point £0 1 0

1978. ELECTRICAL WHIRL OR FLY WHEEL, rotating by dispersing electricity from the points £0 2 9

1979. ELECTRICAL PISTOL, for exploding oxyhydrogen gas . . 0 5 6

1980. „ SEE-SAW (*fig.* 1980), p. 170 . . . 0 9 6

1982. ELECTRICAL FIGURES, carved in cork, representing Neptune, mermaids, etc. (*fig.* 1982), each £0 4 0

1984. SET OF THREE BELLS, on brass beam to suspend from the conductor, and made to ring by the alternate blows of a brass ball suspended by a silk cord £0 5 6
to 0 8 6

1985. FRENCH BELL EXPERIMENT, for illustrating the chiming of bells, one bell being connected with the inner, and the other with the outer coating of a Leyden jar £0 11 6

1986. ELECTRICAL ORRERY, representing the motions of the sun, earth, and moon £0 7 0

1987. GAMUT OF EIGHT BELLS, on a mahogany stand, with an electrical fly or whirl carrying a clapper, and supported by a glass spiral luminous revolving tube, the clapper at the same time striking each of the bells in succession £1 10s., or carefully tuned £2 10 0

1988. **One Spiral or Luminous Tube,** with whirl at the top, which, when charged, revolves and presents a moving spiral stream of electric light £0 10 6

1989. HAND SPIRAL OR LUMINOUS TUBE, consisting of two glass tubes with brass caps, the inside one covered with spangles of tin-foil, giving a spiral stream of electric light £0 3 6

1990. FALLING STAR OR AURORA TUBE, with valve for exhaustion . 0 10 6

1992. HENLEY'S UNIVERSAL DISCHARGER, for voltaic or frictional electricity, with press and table for deflagrating metals or exposing various substances to electrical action; also charcoal forceps for showing the electric light, mounted on mahogany table £1 5 0

1993. **Head of Hair,** showing that bodies similarly electrified repel each other (*fig.* 1993), p. 171 . . . . . £0 3 0

1994. INDUCTION CONDUCTOR, with insulated stand and two pith balls 0 7 6

1995. FIVE SPIRALS, with coloured glass tubes and revolving centre £1 4s. to 1 10 0

1996. JOINTED DISCHARGERS, with brass arms and insulated glass handles, 7s. 6d. to £0 12 6

1997. SMALL DISCHARGERS, not jointed, with glass handles . . 0 2 6

1998. AMALGAM, per box 0 1 0

1999. PITH FIGURES, 1s. each; pith balls, per dozen . . . 0 0 9

2000. PITH BALL STAND, illustrating electrical attraction and repulsion 0 3 6

2002. **Pith Image Plates,** with brass stands . . . 0 8 6

2003. THUNDER HOUSE AND POWDER HOUSE COMBINED, for illustrating the use of lightning conductors £1 5 0

2004. THUNDER HOUSE, for showing the use of lightning conductors 0 5 6

2005. STURGEON'S APPARATUS, for igniting gunpowder, alcohol, ether, etc., by electricity £0 8 6

2006. LUMINOUS NAMES OR WORDS, on glass plates, with pieces of tin foil. May be rendered luminous in the dark by means of electric light, 7s. 6d. to £0 10 6

2007. TWO GLASS ELECTRICAL JARS, one of them belted and supported on a glass insulated pillar. This apparatus was employed by Franklin for the analysis of the principles of the Leyden jar . . . £0 10 6 to £0 18 0

2008. TIN FOIL, per roll 0 2 0

2009. **Mahogany Model of an Obelisk,** to illustrate the properties of lightning conductors . . . . . £0 6 6 to £0 11 0

2010. BALLOONS OF GOLDBEATERS' SKIN, they readily ascend when filled with ordinary gas, 9-inch., 1s.; 10-inch., 2s. 3d.; 12-inch., 2s. 9d.; 16-inch. £0 3 6

2012. BALLOONS, pear or fish shape, 5s. 6d., and upwards.

2013. TATE'S BOOK ON ELECTRICITY 0 0 9

MAGNETIC AND ELECTRO-MAGNETIC INSTRUMENTS AND APPARATUS.

Instruments classed under the foregoing head are employed to exhibit magnetic phenomena, whether produced naturally or artificially; but more especially their relation in respect to each other, their reciprocal action and the direction they assume when freely suspended.

2014. **Magnetic Steel Needles,** of various lengths and forms, with central hard metal caps for suspending on pointed stands, for illustrating the influence of terrestrial magnetism as to the horizontal directive force, and the polarity of a magnetic body, by its attractive and repulsive qualities in relation to similar and dissimilar poles (*fig.* 2014), p. 175, 5s., 7s. 6d., 10s., and £0 15 0

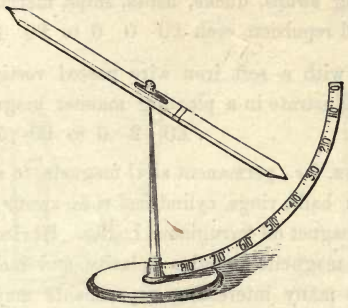


FIG. 2020.

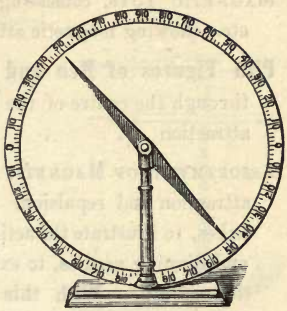


FIG. 2019.

2015. **Horizontal Steel Bar Needles,** for delicate magnetic investigations. These needles are of various shapes and dimensions, mounted with central agate or ruby caps, and every precaution taken in selecting the finest steel as well as its treatment in forming the needles, and the method employed in the magnetization; 2-inch., 2s. 6d.; 3-inch., 4s. 6d.; 4-inch., 6s.; 6-inch. £0 7 6

2016. BRASS STAND, with fine steel point for the suspension of horizontal magnetic needles (*fig.* 2016), p. 175 . . . . £0 2 6 to £0 4 6

2017. POUILLET'S ASTATIC NEEDLES, composed of a pair of steel needles alike in their form and intensity, placed parallel one above the other on a common centre of motion with the similar magnetic poles in opposite directions, by which the directive tendency of the earth's magnetism is nearly neutralized if not overcome (*fig.* 2017), p. 175 . . . . £0 7 6 to £1 1 0

2018. SMALL DIPPING NEEDLE, with slender brass graduated quadrant, upon which the needle shows the dip. If this be moved along a bar magnet, it illustrates the relative situations and tendencies of a needle when acted upon by the earth's magnetism. For when placed on the middle or equatorial part, the mutual actions of the north and south poles balance each other, and cause the needle to stand exactly parallel to the bar; but as the needle is slid towards either extremity, it will be inclined according to its distance from the magnetic poles (*fig* 2018), p. 175 . . . . £0 18 0 to £1 10 0

2019. **Small Dipping Needle,** with graduated circular brass ring, on which the needle shows the inclination or dip due to terrestrial influence. When the apparatus is passed over a bar magnet, a popular illustration is afforded of the action of the earth's magnetism (*fig.* 2019) . . £0 18 0 to £1 1 0

2020. MAGNETIC NEEDLE, arranged to admit of its moving in a vertical as well as in a horizontal plane. This arrangement of the needle, with its standard and graduated arc, furnishes an instrument adapted well to show the real influence of terrestrial magnetism on magnetic bodies, having free motion in all directions (*fig.* 2020) . . . . £1 1 0 to £1 5 0

2022. MAGNETIC NEEDLES, mounted on stands, for ascertaining the polarity of mineralogical specimens £0 5 0

2023. MAGNETIC TOYS, consisting of floating swans, ducks, fishes, ships, mermaids, etc., showing magnetic attraction and repulsion, each £0 0 6 to £0 5 0

2024. **Pith Figures of Men and Women,** with a soft iron wire passed vertically through the centre of the figure, to illustrate in a pleasing manner magnetic attraction . . . . . £0 2 6 to £0 5 0

2025. ASSORTMENT OF MAGNETIC APPARATUS, *i.e.*, permanent steel magnets, to show attraction and repulsion. Soft iron balls, rings, cylindrical rods, swans and fishes, to illustrate the action of the magnet on ferruginous bodies. Horizontal and dipping needles, to exhibit their magnetic directive polarity and inclination or dip. With this apparatus many interesting experiments may be performed to elucidate the facts in magnetic science £2 2 0 to £3 3 0

2026. APPARATUS TO ILLUSTRATE BARLOW'S MAGNETIC COMPENSATOR, for neutralizing the effect of local attraction on the ship's compass. Consists of a magnetic compass with a piece of soft iron placed so as to represent the guns, anchors, cables, etc., with another mass of iron to compensate for the derangement of the compass produced by the iron in the vessel £3 3 0 to £5 5 0

2027. NATURAL LOADSTONE, mounted in soft iron cheeks for concentrating its power, with soft iron armature for increasing its lifting power, and to preserve its magnetic properties . . . . . £3 3 0 to £5 0 0

2028. SLICED PIECES OF LOADSTONE OR NATURAL MAGNET . £0 1 6 to 0 7 6

BAR MAGNETS,

Adapted for the experimental elucidation of that property conferred on bodies composed of iron, whereby, under certain conditions, they acquire the powers of polarity, attraction of unmagnetic iron, attraction and repulsion of magnetic iron, and the influence of inducing magnetism in other iron not previously magnetic.

2029. **Bar Magnets,** strongly magnetized, of the best steel, in boxes, per pair, 6 inches long, 2s. 6d.; 7 inches long, 3s. 6d.; 8 inches long . . £0 4 6

2030. BAR MAGNETS, of cylindrical steel, for sustaining rotating apparatus, or revolving on their axis, or inserting within hollow wire coils to illustrate the elementary experiments on magneto-electricity, 5s., 7s. 6d., 10s., and . £0 15 0

2032. MAGAZINE OR BATTERY OF STRAIGHT BAR MAGNETS, united by screws; a useful arrangement for impregnating other bars with the magnetic properties £1 1 0 to £2 10 0

Horse-shoe Magnets. In this form of the artificial magnet both poles are brought near to each other, and the extremities being made smooth, the magnet acquires an increased power of sustaining weights (*fig.* 2035), p. 175:

Long.	Per dozen.	Long.	Each.
2033. 2½ inch.	£0 2 6	2036. 11 inch.	£0 4 6
2034. 4 inch.	0 6 6	2037. 15 inch.	0 7 0
2035. 7 inch.	1 2 0	2038. 20 inch.	0 13 0

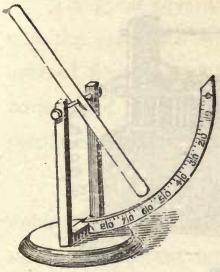


FIG. 2018.

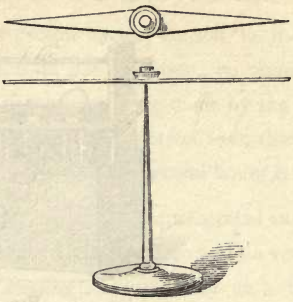


FIG. 2014.

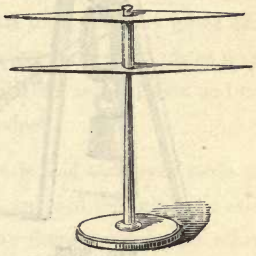


FIG. 2017.

FIG. 2044.

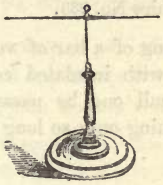


FIG. 2016.

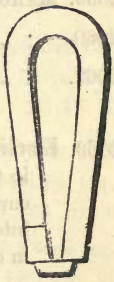


FIG. 2035.

Compound Horse-shoe Magnet, of several single horse-shoe magnets held together by screws, and having a proper armature greatly increases the magnetic power, not only for suspending weights but also in capability of making other magnets (*fig.* 2044):

	Long.	Bars.	Each.		Long.	Bars.	Each.
2039.	3 inch.	2	£0 1 8	2048.	6 inch.	4	£0 10 6
2040.	6 inch.	2	0 6 6	2049.	8 inch.	4	0 15 6
2042.	9 inch.	2	0 8 6	2050.	10 inch.	4	1 0 0
2043.	12 inch.	2	0 13 6	2052.	12 inch.	4	1 5 0
2044.	4 inch.	3	0 5 0	2053.	6 inch.	6	0 15 0
2045.	8 inch.	3	0 11 0	2054.	8 inch.	6	1 2 0
2046.	10 inch.	3	0 15 6	2055.	10 inch.	6	1 10 0
2047.	12 inch.	3	1 0 0	2056.	12 inch.	6	1 15 0

With intermediate and proportionate prices according to size and number of bars, as 10-inch. with 12 bars, £3 3s.; 14-inch. ditto, £5 5s.; up to 30-inch. with 12 bars, £15.

2058. BAR MAGNETS, in pairs, from 12 to 24 inches long, very powerful and permanent, as used for adjusting iron vessels, per lb. . . . £0 1 2

THE WEIGHTS vary slightly, but the average weight of a pair 24 inch. long, of usual width and thickness, viz., 1½ inch. by ¼ inch is about 5lbs. 3oz.

DITTO, DITTO, 18 inch. long, 1½ inch. by ¼ inch is about 4lbs.

DITTO, DITTO, 12 inch. „ 1 inch by ¼ inch is about 1¾lbs.

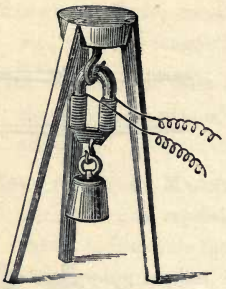


FIG. 2063.

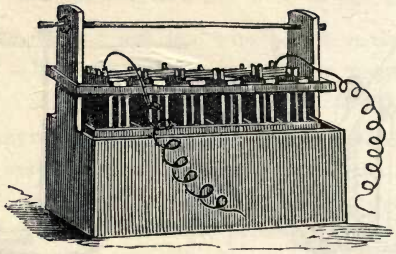


FIG. 2069.

2059. MAHOGANY BOXES for pair 2-feet magnets . . each £0 2 3

2060. „ „ 18-inch. „ . . „ 0 2 9

2062. „ „ 12-inch. „ . . „ 0 1 9

See also magnetic needles for ships No. 933.

2063. **Electro Magnet on Stand** (*fig.* 2063), consisting of a bar of very soft iron bent in the form of a horse-shoe, and covered with insulated copper wire. If a current from a galvanic battery, even a small one, be passed through it, an intense magnetic power is produced, continuing only so long as the battery is in contact £0 14 0

VOLTAIC OR GALVANIC APPARATUS, ETC.

Voltaic instruments are employed to exhibit a peculiar form of electric influence, obtained under particular circumstances by chemical action producing certain effects on bodies not usually obtained in the ordinary course of electrical excitation, as friction, etc., 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.

2065. DANIELL'S BATTERIES, copper cylinders, 6 by 3 inches, 5s.; 9 by 3½ inches, 7s. 6d.; 12 by 4 inches £0 10 6

2066. SETS OF DANIELL'S CONSTANT BATTERIES, with copper cylinders 20 inch. by 3½, in wooden frames. The compound circuit readily exhibits both the *quantity* and *intensity* effects. Any number of batteries may be used as a set, but Daniell preferred a series of ten. Ten batteries with suitable connexions in wooden frame. £4 4 0

2067. SETS OF DANIELL'S CONSTANT BATTERIES, a compound circuit of six batteries 6 inches high, complete with connexions on mahogany tray . £2 5 0

SMEE'S VOLTAIC BATTERY.

The great advantages of this battery consist in its power, as well as simplicity, and the ease with which it is put in action, no obnoxious or unpleasant gases are evolved from it, and the attachment being made by the binding screws, old plates may be removed and new ones added with perfect ease, thus with one acid solution and no porous diaphragm, continuous action for several hours is obtained.

The solution consists of one part of concentrated sulphuric acid and seven parts of water; in preparing it put the water first into a glass vessel and add the sulphuric acid slowly (to prevent much heating), a little only at a time; there must be no other acid added to it, nor salts of any kind; let the mixture become cold before putting it into the battery.

2068. **Smee's Battery,** single cell with platinized silver plate and two amalgamized zinc plates, in round earthenware or glass jar, with two binding screws, 1 pint, 7s.; 1 quart, 9s. 6d.; 2 quart £0 16 0

2069. SMEE'S BATTERY, a set of 6 in square porcelain cells, in mahogany tray with plates, and appendage for raising the plates from the acid when required, etc., pint size, £3; a set of 6 ditto, ditto, quart size (*fig.* 2069), p. 176 £3 10 0

The general arrangement of this set, and the facility with which the leading facts connected with galvanism, as the decomposition of water, deflagrating metals, etc., etc., may be shown by it, adapts it admirably for public instruction.

2070. **Educational Set of Apparatus,** viz., electro-magnetic coil machine, Smee's battery, galvanometer, Ritchie's experiment, Oersted's ditto, electro-magnet on mahogany stand, Barlow's wheel and permanent magnet, in coloured deal case, with lock and key £5 5 0

GROVE'S BATTERY.

The solutions required for this battery are concentrated nitric acid unmixed, in the platinum or porous cell, and diluted sulphuric acid in the zinc or glass cell, the proportions being 7 of water to 1 of sulphuric acid.

2072. **Grove's Platinum Battery** (single), in flat glass cell, with porous lining, pair of zinc plates, 2 brass connectors, size of platinum, 4 inch. by 2 inch. £0 12 6

2073. GROVE'S BATTERY, as above, 5 cells in mahogany frame, the platinum plates 6½ by 3 inch., the proper size (for safety) to use with Ruhmkorff's coil £4 10 0

2074. GROVE'S BATTERY, of 8 cells, the platinum plates 6½ by 3½ inch., in handsome polished mahogany frame with brass fittings complete . £6 10 0

2075. GROVE'S BATTERY, mounted in plainer form, with 10 cells in black wood frame, the platinum plates 2 by 3½ inch. £4 5 0

2076. GROVE'S BATTERY, with set of 8 cells 3 12 0

2077. „ „ „ „ 4 „ 2 0 0

2078. „ „ for producing electric light, 40 cells, in 4 batteries of 10 cells each £17 0 0

2079. GROVE'S BATTERY, of greater power, with larger platinum plates, viz., 3 by 5 inch., 10 cells in black wood frame £6 10 0

2080. A combination of 4 of these forms, a powerful battery for giving electric light, being so constructed that nearly the whole surface of the platinum is exposed to the action of the acid £25 0 0

2082. **Bottle Batteries** (*fig.* 2082), p. 183. The neatness of these batteries, together with the effectual way in which evaporation is prevented, renders them most popular where appearance and cleanliness is desired; ½ pint size, 10s. 6d.; 1 pint size, 12s. 6d.; 1 quart size, £1; 2 quart size, £1 15s.; 4 quart £2 15 0

The 2 quart and 4 quart size have 5 carbon plates and 2 zinc, the former exposing 48 square inches surface and the latter 112 square inches.

Bunsen's Carbon Batteries, with zinc cylinders, square carbon blocks, porous cells, glass cells, and connecting screws, complete:

2083. FIRST SIZE, carbon 1¼ by 4¼ inches £0 6 6

2084. SECOND SIZE, „ 1½ „ 6¼ „ 0 9 0

2085. THIRD SIZE, „ 1¾ „ 8 „ 0 10 6

The solutions for these batteries are concentrated nitric acid for the porous or carbon cell, and diluted sulphuric acid for the glass cell, the proportions being 1 of acid to 7 of water.

2086. **Carbon Cups,** of best make, ⅜ to ½ inch diameter and 3 inch. long, for deflagrating metals, per dozen £0 7 0

2087. CARBON POINTS, for electric light, per foot, 1s.

2088. CARBON PLATES AND BLOCKS:

3⅞ by 2½	.	£0	0	10	7¼ by 3	.	£0	2	3
4 „ 2	.	0	0	8	7¾ „ 4	.	0	2	6
4½ „ 3½	.	0	1	2	5 „ ½ by ½	.	0	0	9
5½ „ 3½	.	0	2	0	6 „ 1½ „ ½	.	0	1	3
5 „ 2¼	.	0	1	0	8 „ 1¼ „ ¼	.	0	2	0
6 „ 2	.	0	1	3	9½ „ 1⅞ „ 1¾	.	0	2	6
6 „ 3¾	.	0	2	3	12 „ 1¾ „ 1¾	.	0	3	6

Carbon cut for battery plates, blocks, trays, and cups, points for electric light, crucibles, experimental work, etc., etc., and platinized to order.

DR. CALLAN'S CAST-IRON BATTERIES,

Consisting of flat cast-iron cells with porous linings and flat amalgamated zinc plates, a binding screw connected with the iron cell, and a copper band soldered to the zinc.

The solution for the porous or zinc cell being 1 of strong ordinary sulphuric acid to 7 of water, and for the iron cell concentrated nitric acid.

2089. FIRST SIZE, with iron cell, 5½ inches long by 5½ inches deep, and 1⅜ inches wide £0 6 6

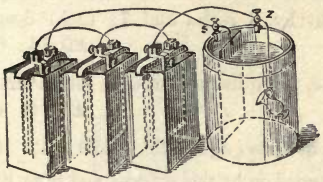


FIG. 2106.

FIG. 2099.

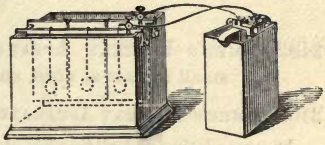


FIG 2103.

2090. A SET OF SIX CELLS, as No. 2089, in stout wooden tray . . £2 5 0

2092. SECOND SIZE, with iron cell, 7 inches long by 6½ deep, and 1⅝ wide 0 10 6

2093. A SET OF SIX CELLS, as above, in stout wooden tray . . 3 5 0

2094. DR. CALLAN'S MAYNOOTH BATTERY.

For the Maynooth battery, as above, it is said that the most effective solutions are a mixture of equal parts of concentrated nitric and sulphuric acids for the iron cell, and a mixture of 2 parts of sulphuric and 1 of nitric acid with 18 parts of water for the zinc cell.

This battery is said to be far more powerful than Groves's, see Brooks's "Natural Philosophy, 1867," page 434, price rather lower than No. 2089.

2095. MANGANESE BATTERY.

The porous cell that contains the plate of carbon is filled up with a pulverized peroxide of manganese and water, the porous cell stands in a glass cylinder containing a stout zinc rod, and a solution of sal-ammoniac in water, quart cell . £0 4 6

This battery is said to continue in constant action for one year, having a little water occasionally put to it; it is much used for telegraphs, especially in houses, as it gives off no fumes.

Davy's Sulphate of Mercury Battery, in which the acid of the carbon cell is replaced by a paste of powdered sulphate of mercury and water, and the dilute acid of the zinc cell by water only; it is very constant, and its power is 1¼ times that of Daniell's. Much used in France for telegraphy:

2097. SMALL SIZE, 2s. 6d.; larger size consisting of a pint glass bottle (square) with a carbon plate, zinc rod, and fittings complete . . . £0 5 6

ELECTRO-METALLURGICAL APPARATUS.

Electrotype apparatus, extensively used for obtaining by voltaic action exact copies of medals and plaster casts, ancient and modern, as well as fac-similes of engraved copper plates, wood engravings, etc.

2098. **Electrotype Apparatus,** consisting of glazed earthenware jar, porous pot, zinc rod, and wire for mould, pint size, 2s. 6d.; quart size . £0 3 6

2099. SINGLE CELL APPARATUS (*fig.* 2099), very convenient in form and simple in operation, with porous cell, zinc plate, wire and binding screw, suitable for copying medals, seals, plaster casts, etc., 5s. 6d., 7s. 6d., and . £0 10 6

2100. ELECTROTYPE TROUGH, with sliding bars, on which to place the object to be copied, 1 porous cell, 1 copper plate, 2 wires for moulds, 4 movable binding screws, complete in mahogany box, 7 inch. by 8 inch., and 7½ inch. deep £0 14 6

2102. SMEE'S BATTERY APPARATUS, with separate precipitating trough for several small medals at once, and plaster casts . . . £1 0 0

2103. SMEE'S BATTERY APPARATUS, for larger medals or casts (*fig.* 2103), p. 179 1 12 6

Electro-plating and gilding are also now extensively carried on by this process, and from its perfection as well as simplicity, must almost in time become familiar in every household; *fig.* 2106, p. 179, represents the apparatus in action, and the small hand book "Electro Metallurgy," price 2s., gives every further requisite information.

2104. **Apparatus for Electro-Gilding or Plating,** with glass precipitating trough and 1 Smee's battery £0 17 6

2105. APPARATUS, with 2 Smee's batteries 1 6 0

2106. „ „ 3 „ „ (*fig.* 2106), p. 179 . 1 15 6

2107. APPARATUS, for coating metallic bodies with aluminium and silicium, 7s. 6d. to £0 10 6

2108. **Platinized Silver,** averaging about 4 oz. to the square foot, as required, per oz. £0 11 0

2109. GOLD WIRE AND PLATE, per dwt., 8s.; silver ditto, per oz. . 0 8 0

2110. COPPER WIRE AND PLATE, of any thickness; amalgamated zinc plates of all sizes, per lb. £0 1 6

2112. SULPHATE OF COPPER, per lb. 0 0 6

2113. GOLD AND SILVER SOLUTION, per lb., 1s. 9d. and . . 0 3 0

2114. BINDING SCREWS, of various forms and descriptions, each 6d., 8d., 10d., and £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.

2115. **Volta-meter or Apparatus for Decomposing Water,** with separate tubes for collecting the oxygen and hydrogen gases, small size 8s. 6d. to £0 15 6

2116. VOLTA-METER OR APPARATUS FOR DECOMPOSING WATER, large size, very suitable for the lecture table, from £1 0 0

2117. V TUBE, for decomposing neutral salts, etc., with platinum plates and brass support, on mahogany frame £0 7 0

2118. GLASS GLOBE, for exhibiting brilliant voltaic light in vacuo . 1 12 0

2119. **Gassiot's Vacuum Tubes,** the various forms for showing the electrical stratifications in discharges, as first manufactured by L. CASELLA, for the extended and interesting experiments of Mr. Gassiot, and exhibited by him in illustration of his Bakerian lecture at the Royal Society, and also at the meetings of the British Association, 1858 and 1859 (see Royal Society's Reports, etc). In every variety, 7s. 6d. to £1 10 0

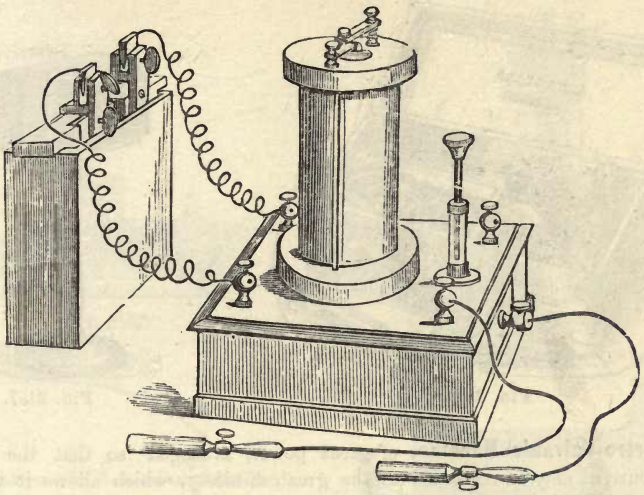


Fig. 2123.

ELECTRO-GALVANIC MACHINES,
FOR ADMINISTERING MEDICAL GALVANISM.

Amongst other enumerations of diseases in which the following machines are effective, are tooth-ache, tic-doloreux, neuralgia, rheumatism, paralysis, spasms, ague, etc. On this subject Abernethy says, "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, F.R.S., says, in *The Medical Times*, "Medical agents will do much in the treatment of disease, but magneto-electricity does more." On consulting the opinions of the highest medical authorities on this subject, it would seem that for most diseases a power of mitigation or removal is thus given as startling as it is effective.

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, without producing the least unpleasant sensation

2122. Electro-Galvanic Machine, with a pint Smee's battery, galvanic coil, a pair each of cylinder and sponge directors, and medical apparatus, packed in mahogany case £2 10 0

2123. Electro-Galvanic Machine, of larger size, with a quart Smee's battery, vaginal director and surgical discs, medical apparatus, etc., as above, complete (*fig.* 2123) £3 5 0

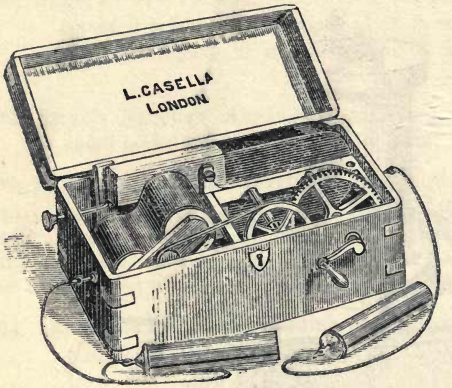


FIG. 2126.

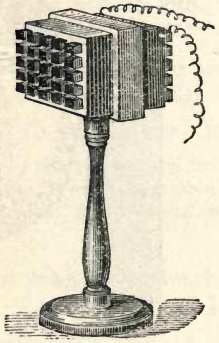


FIG. 2157.

2124. **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 either in its mildest form or its greatest intensity, with two Smee's batteries, pair each of 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

2125. ELECTRO-GALVANIC APPARATUS, arranged especially for hospitals or foreign service, with all the necessary apparatus, directors, etc., very elegant and complete £14 0 0

2126. **Magneto-Electric Machine and Apparatus.** A most convenient and portable apparatus for the administration of MEDICAL ELECTRICITY; no acid or other fluids are required; it is always ready for use, and so arranged that the strength of the current is regulated at pleasure for the most feeble or strongest person (*fig.* 2126). Admirably adapted for exportation, and suitable alike for all climates £2 2 0

2127. MAGNETO-ELECTRIC MACHINE AND APPARATUS, improved, with lever motion to work with the hand or foot, by means of which the patient can apply it personally without requiring assistance . . . £3 3 0

2128. IMPROVED MAGNETO-ELECTRICAL MACHINE, with circular magnet, arranged to pass the currents only in one direction, and of any strength required by either the most robust or delicate patient, on mahogany stand, either in case or with glass shade £2 10 0

2129. INSULATED PLATES, for directing the current, per pair . . 0 8 6

2130. NEEDLE DIRECTOR 0 3 0

2131. **Improved Magneto-Electrical Machine,** very powerful, with double wires, movable coils, mahogany stand, etc., available for diagnetic experiments £10 0 0

2132. SMALL SELF-ACTING ELECTRO-MAGNETIC COIL MACHINE, for medical purposes £0 18 6

2133. MEDICAL GALVANIC COIL, much improved and can be regulated for application to an infant as well as the most obstinate cases, in mahogany box £1 0 0

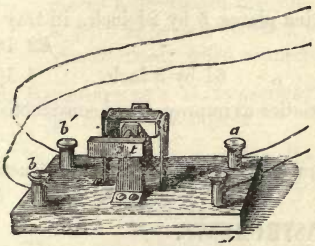


FIG. 2137.

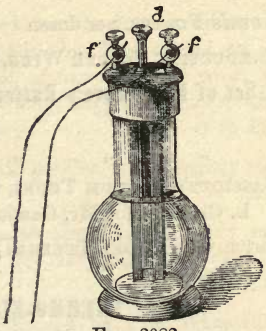


FIG. 2082.

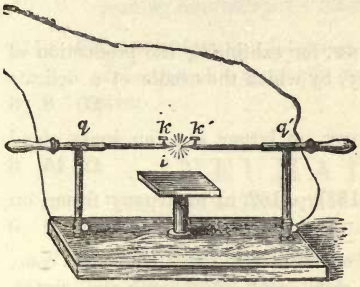


FIG. 2138.

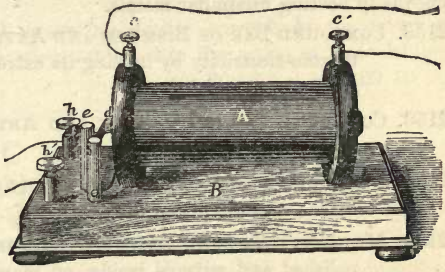


FIG. 2136.

2134. MEDICAL COIL, improved, with sulphate of mercury battery, very portable, in form of a book £4 0 0

2135. PRIMARY COIL, with handles for giving shocks, and very useful for increasing the intensity of galvanic batteries £0 18 6

2136. **Rhumkorff's Induction Coil,** small size, with vacuum tubes and illustrated description complete, for showing a number of very beautiful and instructive experiments (*fig.* 2136) £5 5 0

2137. COMMUTATORS of various sizes, for reversing the action of the galvanic current (*fig.* 2137), 10s. and upwards.

2138. UNIVERSAL DISCHARGERS (*fig.* 2138), 8s. 6d. to . . £1 5 0

IMPROVED RHUMKORFF'S COILS OR INDUCTORIUMS.

2139. INDUCTORIUMS, each from . . . £5 0 0 to £10 0 0

2140. „ „ to give 2½-inch. spark in air . . . 12 10 0

2141. „ „ „ 4 „ „ . . . 15 10 0

2142. „ „ „ 6 „ „ . . . 21 0 0

Inductoriums of larger size made to order, the spark being strictly proportioned to the length of wire employed.

2143. **Magnetic Electric Exploder,** in mahogany case with 2 keys . £16 10 0

2144. „ „ „ „ 6 „ . 17 10 0

2145. INDUCTION COIL, especially arranged for blasting purposes, in strong oak case £9 15 0

2146. **Insulated Wire,** for connections, per 100 yards . . 0 18 6

2147. APPARATUS FOR EXPLODING GUNPOWDER. Improved magnetic exploder £6 0 0

2148. ABEL'S FUSEES, per dozen £0 2 3

2149. CONDUCTING COPPER WIRE, with two coatings of gutta-percha, per yard, 4½d.

2150. **A Set of Five Grove's Batteries,** with platina plates, 5 by 2¼ inch., in tray £2 18 0

2152. „ „ „ „ 6½ by 3 inch. 4 10 0

2153. GASSIOTT'S VACUUM TUBES, in all their varieties as improved and constructed by L. CASELLA for Mr. Gassiott.

2154. IMPROVED MODEL TELEGRAPH with apparatus, book of signs and instructions, complete £4 5 0

THERMO-ELECTRICAL INSTRUMENTS.

These instruments are for demonstrating the evolution of electric currents by unequally heating dissimilar metals.

2155. COMPOUND 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 8 6

2156. COMPOUND BAR OF BISMUTH AND ANTIMONY, of larger size, on brass stand £0 15 6

2157. **Melloni's Thermo-Electric Battery** (*fig.* 2157), p. 182, in mahogany frame, on brass pedestal £2 10 0

2158. MELLONI'S THERMO-ELECTRIC BATTERY, of large size, with movable cone, polished and silvered inside, on massive stand, with lengthening and jointed motion, exceedingly sensitive, as used by Professor Tyndal . £4 4 0

2158*. EXTRA CONE for the above 0 10 6

2159. 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

2160. **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

2162. APPARATUS for Oersted's experiments, showing the deflection of the magnetic needle and its tendency to form a right angle with the wire transmitting the current of electricity, with 2 cups and 3 inch. needle . £0 7 6

2163. DITTO, DITTO, of larger size cups and 6-inch. needle . . 0 9 6

2164. „ „ „ „ „ „ . . 0 12 6

GALVANOMETERS, FOR MEASURING GALVANIC CURRENTS.

2165. 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

2166. CUMMING'S GOLD LEAF 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.

2167. **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 6 inches long, supported on an agate cap, vibrate freely when connected with a battery. £3 5 0 to £5 0 0

2168. Bachoffner's Galvanometer, with astatic needles, on mahogany stand and glass shade, complete. £0 18 0

2169. 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

2170. Melloni's Magnetic Galvanometer, improved by Prof. Wheatstone, with reading microscope for measuring very feeble currents of electricity £5 10 0

2172. **Galvanometer,** for detecting and measuring electric currents by the extent of deflection of a magnetic needle, when subjected to the action of a conducting wire . . . . . £0 7 6 and £0 10 6

PNEUMATIC APPARATUS,

FOR DEMONSTRATING THE PRINCIPLES OF ELASTIC FLUIDS, MORE ESPECIALLY THE MECHANICAL PROPERTIES OF AIR.

The following air pumps are of the newest forms, being nearly all on the double piston principle of Professor Tate, now exclusively used where the highest amount of exhaustion is required.

By a recent improvement the valves are easily removed or replaced by the owner at pleasure for purposes of cleansing, etc.

The screws and attachments are all of the same thread, so that the several pieces may be easily fitted to each other.

When the pump is out of use for a length of time, a little oil should be applied by pouring a small quantity, say half a tea-spoonful in the centre hole *a* (*fig.* 2193), p. 187, when a few strokes of the piston will convey it over all the working parts of the pump; a little tallow should be rubbed over the edges of the receiver, before fixing it on the plate; stop-cocks should always be kept open, and when the pump is not in use the various parts should be well cleaned, and the nut screws be screwed in at *a* and *c* to prevent the admission of dust.

The practice of testing pumps by means of the syphon gauge, though much in use, is often deceptive, thus: a speck of air at the closed end of the gauge will give a fallacious appearance to the action of the pump by depressing the mercury more or less according to the size of the air-speck; a full length gauge in which the mercury is drawn up, though inconvenient on account of its length, is therefore far preferable where a delicate test of vacuum is required.

2173. **Air Pump,** small size, with receiver for preparing microscopic objects £0 12 6

2174. Air Pump, single barrel, $\frac{7}{8}$-inch diameter, 5 inches high, $4\frac{1}{2}$-inch. ground plate, mounted on mahogany stand. £1 1 0

2175. Receiver, for the above 0 3 0

2176. **Air Pump,** sloping barrel, 9 inches by $1\frac{3}{8}$, $5\frac{1}{2}$-inch. plate, bell glass receiver, and stop-cock, to retain a vacuum when removed from the pump, on mahogany stand (*fig.* 2176), p. 189 . . . . . £2 5 0

2177. **Tate's Double Action Air Pump,** with 2 pistons in one barrel, for exhausting or condensing purposes. On this plan the air is drawn from the receiver in the centre of the barrel, and expelled at the two extremities, the exhaustion being more perfect than can be obtained by any other arrangement. Length of barrel 16 inches, bore $1\frac{3}{8}$ inches, stroke $8\frac{1}{2}$ inches, size of plate 7 inch. diameter, mounted on stout brass clamp, with key, syphon gauge, and screw piece for connecting flexible tube, complete . £3 14 0

An excellent instrument, will exhaust in a receiver of 80 cubic inches to 1-10th inch, and readily freeze water over sulphuric acid in a receiver of 300 cubic inches.

2178. Bell Glass Receiver, for ditto £0 5 6

2179. **Tate's Improved Air Pump,** size and form as above, but mounted on a solid iron plate, with 4 legs, for screwing or clamping to the table, with syphon gauge £3 14 0

Separate Appliances, if wanted, as on *fig.* 2186, p. 188, viz.

2181. Clamp (J) 0 3 6

2182. Extra Screw between the pump plate and the stop-cock, for connecting extra plate (H) when required, with spare nut . . . £0 3 6

2183. **Extra Plate** (H), of cast-iron, with three legs, very convenient for drying chemicals in vacuo, or freezing water over sulphuric acid, with plate-glass surface, air tube, and stop-cock, complete, as shown by G F, three sizes, viz., 8 inch., 14s. 6d.; 10 inch., 18s. 6d.; 12 inch. . . £1 5 0

2184. Flexible Connecting Tube (E), 3 feet, best wired, with screw (D) adapted for the joint and stop-cock £0 5 6

2185. Flexible Connecting Tube, if with stop-cock . . 0 8 0

The exhaustion of either of the separate plates is shown by the attached syphon gauge. One connecting tube serves for any number of the separate plates, each having a stop-cock to retain the vacuum (*fig.* 2186).

2186. **Tate's Double Action Air Pump,** for exhausting or condensing, as above, with extra fittings, viz., screw for adapting flexible tube to the pump, 1 extra plate 8 inches diameter, with stop-cock, pan for sulphuric acid, connecting tube and joint, flat glass receiver $6\frac{1}{2}$ inches diameter, glass capsule for evaporation in vacuo as Leslie's experiment for freezing water, etc., with strong iron clamp, complete (*fig.* 2186), p. 188 . . . £5 15 0

2187. Tate's Air Pump, as above, but about double the size and power, with 17-inch. barrel, of $1\frac{3}{4}$-inch. bore and $9\frac{1}{2}$-inch. stroke, mounted on strong iron stand with iron legs, etc., 10-inch. plate, with extra joint and arm, and syphon gauge, being the largest and most powerful form of Tate's pump which can be worked without rack-work or other mechanical arrangement £8 8 0

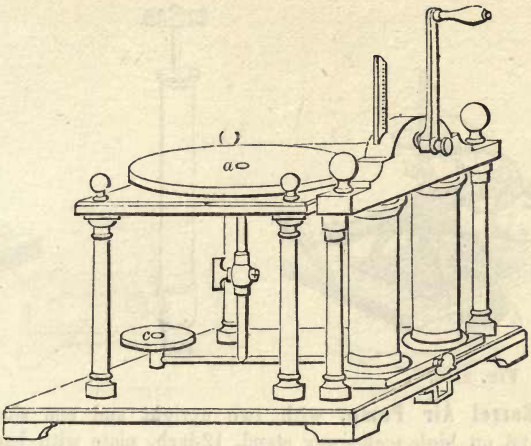


FIG. 2193.

2188. TATE'S AIR PUMP, of extra large size, for easy and rapid action, worked by winch, crank, and fly-wheel, with 12-inch. upright barrel, of 2½-inch. bore and 6-inch. stroke, the valves working in oil, with iron framework, polished mahogany stand, 10-inch. raised plate, syphon gauge, and ascending mercurial gauge of 33 inches £19 0 0

With this pump a vacuum to within quarter of an inch is easily obtained in large vessels within five minutes, by which it is found of much value in many preparations connected with the arts and manufactures.

2189. **A Small Portable Barometer,** to accompany the above, for comparison with the ascending syphon gauge when required . . £1 5 0 to £2 10 0

2190. DOUBLE BARREL AIR PUMP, with 5½-inch. plate and clamp . 3 10 0

2192. „ „ „ 6¼ „ „ . 4 4 0

2193. AIR PUMP, double barrel 6½ inches long by 1½-inch. bore, 5-inch. stroke, and 8 inch. plate, on mahogany stand, with stop-cock (*fig.* 2193) £8 10 0

2194. DITTO, without gauge plate, gauge, and key . . . 7 10 0

2195. AIR PUMP, double barrel 7 inches long, with 1¾ inch. bore and 5¾ inch. stroke, 10-inch. plate, on mahogany stand with pillars, small gauge plate, syphon gauge, clamp and key, very perfect and handsome . . £12 12 0

2196. **Treble Barrel Air Pump,** being the most improved arrangement for rapid exhaustion at lectures, or the more perfect vacuum required in delicate researches, with 7-inch. upright barrels, of 1¾-inch. bore and 5½-inch. stroke, 10-inch. plate, with raised pillars, and syphon gauge, on mahogany stand, with Tate's single horizontal barrel in addition for very accurate exhaustion, very handsome £17 0 0

In this admirable arrangement large receivers are quickly exhausted in the ordinary way till the mercury falls, say to ½ or ¼ inch, when Tate's attached horizontal barrel is brought into action and the exhaustion reduced by it to, say 1-10th or 1-20th of an inch at temperature 60, or even more at lower temperatures.

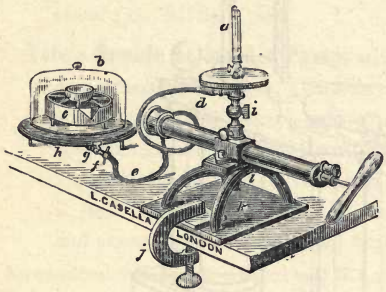


FIG. 2186.

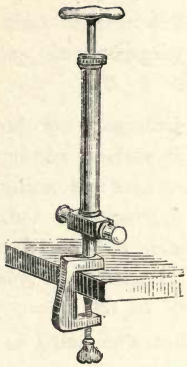


FIG. 2204.

2197. **Treble Barrel Air Pump,** with two upright and one single barrel as No. 2196, on high mahogany stand, 12-inch. plate with barometer gauge, syphon gauge and key £35 0 0

The gauges having the mercury boiled in them and absolutely deprived of air, these pumps will exhaust them to 1·20th inch at a temperature of 60, or 1-40th at lower temperatures, a degree of perfection but seldom obtained in pumps of the ordinary construction, at much greater cost.

Larger pumps with fly-wheels or other modifications made to order.

PNEUMATIC APPARATUS, in sets, by means of which with either of the pumps, the whole action of air, with its wonderful influence of 15lbs. pressure on every square inch may be demonstrated

2199. **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 10 0

2200. EDUCATIONAL SOCIETIES' SET OF PNEUMATIC APPARATUS (larger size), consisting of air-pump on mahogany stand, with sloping barrel 1½ inch diameter and 9 inches long, 5½-inch. brass plate with stop-cock 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, filtering 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 £6 6 0

SYRINGES, WITH FEMALE SCREWS AT THE END.

If with stop-cocks, 3s. each extra.

2203. EXHAUSTING SYRINGE, 6-inch. barrel, ¾-inch bore, 5s. 6d.; ditto 8-inch. barrel, 1¼-inch. bore, 12s. 6d.; ditto 9-inch. barrel, 1¾-inch bore . £1 5 0

2204. **Exhausting and Condensing Syringes,** with clamp and cross-piece (*fig.* 2204), to screw to a table or board, 6-inch. barrel, ⅞-inch. bore, 17s. 6d.; ditto 8-inch. barrel, 1¾-inch. bore £1 6 0

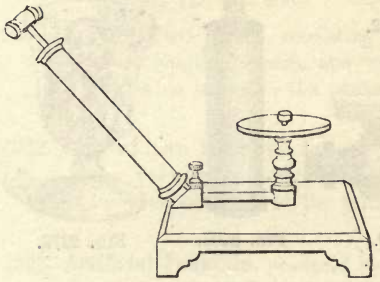


Fig. 2176.

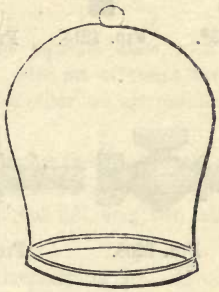


Fig. 2223.

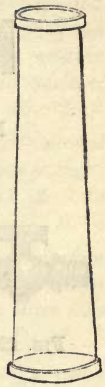
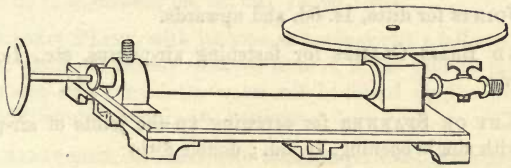


Fig. 2223.*



2205. Tallow Holder of polished mahogany, with screw (*fig.* 2205), p. 190 £0 1 6

Vacuum gauges for air pumps, etc., see Nos. 2321 to 2323.

Brass Connectors and Stop-cocks, carefully ground and of best quality; the same in polished iron, being one-half extra in cost:

2207. Stop-cock, with 2 male screws (*fig.* 2207), p. 190 . . £0 3 0

2208. „ with 1 male and 1 female screw (*fig.* 2208), p. 190 0 3 0

2209. „ with male or female thread at one end, and the other conveniently turned for connecting caoutchouc tube . . . £0 3 0

2210. Stop-cock, with male or female screw and union joint for attaching flexible tube (*fig.* 2210), p. 190 . . . . . £0 5 0

POLISHED BRASS CONNECTORS.

2212. Connectors, with two male or two female screws (*fig.* 2212), p. 190 0 1 0

2213. „ with one male and one female screw . . 0 1 0

2214. Blank Nuts to stop openings or cover screws when not in use, each 0 1 0

2215. Three Way or Four Way Connectors with male or female screws as required, (*fig.* 2215), or (*fig.* 2215*), p. 190, each . . . £0 2 6

2216. Bladder Piece, or socket to tie in the neck of a bladder with female screw for stop-cock £0 0 9

2217. Ditto, ditto, with longer end for connecting flexible tube to brass fittings, with male or female thread £0 0 9

FIG. 2215*.

FIG. 2215.

FIG. 2212.

FIG. 2207.

FIG. 2208.

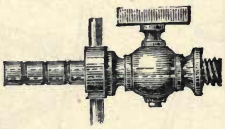


FIG. 2210.

FIG. 2205.

FIG. 2276.

2218. **Connectors,** with smooth end for uniting different sized flexible tubes, 6d. and upwards.

2219. UNION JOINTS for ditto, 1s. 6d. and upwards.

2220. IRON AND BRASS CLAMPS for fastening air-pumps, etc., 1s. 6d., 3s. 6d. and upwards.

2222. BRASS KEY OR SPANNER for screwing up the joints of air-pumps, connectors, etc., with single opening, 1s. 6d.; double ditto . . £0 2 0

GLASS RECEIVERS, FOR AIR-PUMPS (*figs.* 2223 and 2223*) p. 189,

With flanged rims, ground, ready for use:

2223. BELL RECEIVER for Tate's pump, No. 2177, 7 inch. in diameter, 8 inch. high £0 4 6

2223*. FLAT BELL RECEIVER for Tate's pump, 6½ to 7 inch. in diameter, and 3½ to 4 inch. high, for use in freezing water in vacuo £0 2 6 and £0 3 0

2224. TALL BELL RECEIVERS for the large pumps: 7 inch. wide, 11 inch. high, 5s. 6d.; 8 inch. wide, 12 inch. high, 9s. 6d.; 8½ inch. wide, 10½ inch. high, 6s. 6d.; 9 inch. wide, 12 inch. high, 10s. 6d.; 9½ inch. wide, 14 inch. high £0 17 6

2225. **Flat Bell Receivers** for large pumps: 8 inch. wide, 6 inch. high, 4s. 6d.; 9 inch. wide, 6½ inch. high £0 7 6

2226. TALL BELL RECEIVER for the small air-pump, No. 2174, 4 inch. wide over flange, 6 or 7 inch. high £0 3 6

2227. RECEIVERS, bell shape or cylindrical, with ground flange at bottom, and neck with ground flange at top. The upper diameter from 2 to 2½ inch.; 7 inch. wide, 6 inch. high, 4s. 6d.; 7½ inch. wide, 10 inch. high, 7s. 6d.; 7½ inch. wide, 12 inch. high, 9s. 6d.; 8 inch. wide, 11 inch. high, 10s. 6d.; 10 inch. wide, 14 inch. high £0 15 6

2228. **Receiver,** cylindrical form, ground flange at the bottom; at the top a narrow neck closed by a brass cap having a female screw; 7 inch. wide, 8 inch. high, 7s.; 8¼ inch. wide, 10 inch. high, 11s.; 10½ inch. wide, 12 inch. high £0 16 0

2229. **Madgeburg 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 stop-cock attached. This apparatus demonstrates the pressure of the air which nearly equals 15lbs. for every square inch. of surface, 11s. 6d., 15s. 6d., and £1 2 6

2230. 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 12 6 to £2 0 0

2232. Guinea and Feather Apparatus, showing that the resistance of air diminishes the velocity of falling bodies more or less according to their densities, whilst in vacuo both fall at the same rate; one fall, 9s.; two falls, 12s.; three falls £0 17 6

2233. **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, 5s. 6d., 7s. 6d., and . . £0 10 6

2234. Single Transit Plate, with jet pipe and stop-cock; a tall receiver being placed upon the plate and the air removed from it, if the tube be immersed in water and the stop-cock turned, the water will be forced up the pipe, thus forming a beautiful fountain within the receiver . . . £0 8 6

2235. Double Transferer, on stand with fountain jet and 2 glass receivers 2 2 0

2236. Bacchus Experiment, illustrating the elasticity of air . 1 1 0

2237. **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 stop-cock as an outlet for impure air. Painted wooden figures are supplied, and a burning spirit lamp may be placed under the bell £1 5 0

2238. Glass Flasks, with brass cap and stop-cock, illustrating the influence of diminished pressure in facilitating ebullition; they may also be employed for weighing air or any other gaseous fluid . . . £0 7 6

2239. 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 leaden weight, thus illustrating the elasticity of air 7s. 6d. to £0 12 6

2240. **Expansion and Compression Bottles,** to illustrate the pressure and expansive power of air, each £0 1 3

2242. Valves for ditto, each 1s.; cage for ditto . . . 0 3 0

2243. Fruit and Taper Stand, each 0 2 0

2244. Flint and Steel Apparatus, for proving that sparks cannot exist without air £0 18 6

2245. Beam and Stand, with cork or globe 0 10 0

2246. Copper Bottle, beam and stand, for weighing air and gases . 2 2 0

2247. Filtering Cup, for mercurial shower, with receiver . £0 5 6 to 0 10 6

2248. Plate, with wooden disc, for proving the porosity of vegetables 0 5 6

2249. **Respiration Glass,** illustrating the inspiration, etc., of the lungs £0 6 0

2250. Hand and Bladder Glasses, mounted for illustrating the pressure and percussion of the atmosphere . . . £0 2 0 and £0 2 6

2252. **Leslie's Apparatus,** for freezing water in a vacuum, with receiver 5 inches diameter, 6s. 6d.; 7½ inches £0 12 6

2253. Bell Experiment, for illustrating that air is essential to sound 0 6 6

2254. Sliding Rod, plate, and collar of leather . £0 9 6 and 0 12 6

2255. Torricellian Experiment, with connections and flexible tube 0 15 6

2255*. „ „ having the barometer fixed in the cap of the glass receiver (the column to descend) £1 1 0

2256. Syringe and Lead Weight 0 10 0

2257. **Pocket Condensor or Fire Syringe,** for instantaneous light, with amadou £0 3 6

2258. Model of Water Pump, with glass barrel . . . 1 5 0

2259. Condensed Air Fountain, with syringe and jets, complete . 3 17 6

2260. Mercurial Vacuum Gauge 0 3 6

2262. Philosophical or Water Hammer . . . £0 3 0 to 0 5 6

HYDROSTATICS AND HYDRAULICS,

Comprising such instruments and apparatus as illustrate the properties of fluids and that part of mechanical science which relates to their forces and motion.

2263. **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

2264. Ditto, in glass 0 4 6

2265. 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, 15s. to £1 10 0

2266. **Hydrostatic Bellows,** illustrative of the principle that fluids give equal pressure in all directions, the force being proportionable to the perpendicular height of the column of fluid . . . . . £1 15 0 to £3 3 0

2267. Bramah's Hydrostatic Press (working model), highly finished to scale, with keys and breaking irons, complete to 30cwt. . . . £12 12 0

An iron bar 6 inches long by ½-inch. thick may be broken by it.

2268. Hydrostatic Press (working model), of smaller size, for pressing substances or raising weights to 400lbs. £6 6 0

2269. Hydraulic Press, for pressing or lifting, giving a measured gauge pressure up to 3 tons on the square inch, with pressure plates arranged to order £25 0 0

Various forms and sizes made to order.

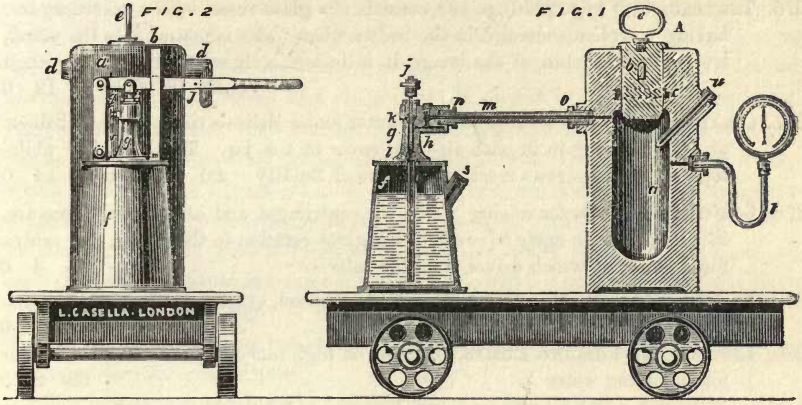


FIG. 2270.

2270. HYDRAULIC TESTING APPARATUS (*fig.* 2270),

As expressly constructed by L. CASELLA by desire of the Admiralty, for determining the effect of deep sea pressure on the thermometers employed for testing its temperature £35 0 0

FIG. 1 shows a section of the apparatus, A being a strong cast-iron cylinder about 27 inches long by 13 inches wide, *a* is a hollow receptacle about 16 inches deep by 6 inches wide; *b* a steel plug of proportionate size; and *d* a receptacle through which the steel key *d d* in FIG. 2 passes to hold the plug down; the other general arrangement is that of the usual hydraulic pump, the water being forced through the connecting tube *m*.

FIG. 2 shows the general end view of the apparatus.

The pressure to which it is generally used for testing the deep sea thermometers is 2½ to 3 tons on the square inch = 2500 fathoms depth in the sea. (See deep sea thermometers, p. 17.)

2272. **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 £4 4 0

Hydraulic pressure gauges, see pressure gauges, p. 198.

2273. ARCHIMEDES SCREW, consisting of a tube wound round a cylinder revolving obliquely, an ingenious and primitive method of raising water, 15s. 6d. to £1 10 0

2274. APPARATUS to illustrate that more water flows from a vessel through a short pipe than from a mere aperture of equal size £0 10 6

2275. APPARATUS for illustrating the laws by which fluids spout through various jets £2 2 0 and £3 3 0

2276. Tantalus Cup (*fig.* 2276), p. 190, consists of a glass vessel with a carved figure, having a syphon concealed in the body; when water is poured into the vessel, level with the chin of the image, it is immediately emptied by the syphon £0 8 6 to £0 12 0

2277. 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 £0 7 0 to £0 14 0

2278. **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 . . . £4 4 0

2279. Forcing Pump (working model), with glass barrel, exhibiting also the operation of the fire engine £2 2 0

2280. Lifting and Forcing Pumps, together, on high mahogany stand, with cisterns for supplying water £2 2 0

2282. 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 depressing it . . . . . £0 17 6 and £1 10 0

2283. Capillary Attraction, shown by a set of tubes, with bores of different diameters, mounted £0 6 6

2284. **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 . . £0 18 6 to £1 5 0

2285. Mariotti's Tube, on stand, illustrating his admirable law of the compression of elastic fluids . . . . £0 10 6 to £1 5 0

2286. Hydrostatic Balances with steel or brass beams, in neat mahogany cases, with all requisite apparatus for determining the specific gravity of both liquid and solid bodies, £3 3s., £4 14s. 6d., £8 8s., and . . £16 16 0

*** Hydrometers, etc., see specific gravity instruments, pages 212 to 217. Current meter, see p. 71.

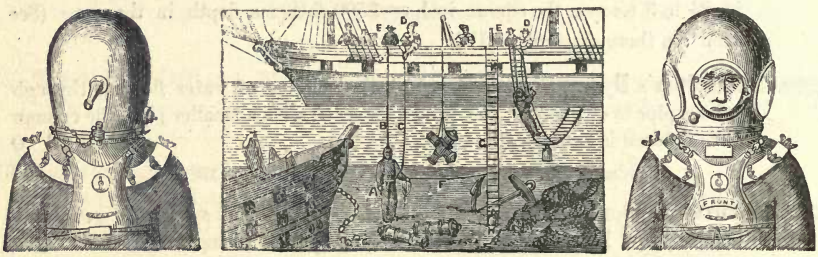


Fig. 2287.

IMPROVED DIVING APPARATUS,

For deep-sea work, pearl or coral fishing, sponge diving, construction of bridges, embankments, breakwaters, etc. The *fig.* 2287 represents an important application of this apparatus employed in recovering the guns from the wreck of the "Royal George,"

and repairing a leak under water. A being diver equipped in dress and helmet, B an air-tight tube for supplying the diver; C signal or life line; D attendants at signal line; E the three barrelled atmospheric air engine; F ladder line for use in thick water; G rope ladder for ascending and descending; H weight to steady the ladder; I diver stopping a leak under the water line; J anchors, guns, and cable to be strung. By means of this improved apparatus, the diver can remain many hours under water, and where the services of a practised diver cannot be had, the instructions which accompany it are so simple as to enable any intelligent labouring man to use it with perfect ease; he can raise himself with it by merely placing his finger on the valve, which rights itself, and without assistance can open his helmet, which is so constructed that the front eye can never become tight or be lost. The indicator constantly shows the depth the diver is at; the condensing box secures a constant stream of air, and it has also a copper cooling cistern for great depths.

This improved apparatus is in constant use at all her Majesty's dockyards, as well as in the construction of the various breakwaters throughout the kingdom; it was also employed day and night at the construction of the numerous new bridges lately built over the river Thames; whilst for pearl and coral fishing, and sponge-diving in Greece, Spain, and Australia it is most popular and in constant use.

2287. THE APPARATUS consists of a treble barrel air engine, with gun metal barrels, 2 fly-wheels with handles, crank, condensing chamber, cooling cistern, dial indicator, with wrenches fitted to all the parts, mounted in mahogany chest with till containing extra gun metal joints for repairs, extra union, crank ends, helmet nuts, bucket leather, etc., etc.; the tinned copper helmet with screws, lead weights, helmet cushion, 100 feet best vulcanized indiarubber tube with gun metal unions, etc., etc., are packed separately and also a seaman's chest with 2 diving dresses, strong boots with lead soles, and all necessary and suitable changes of warm clothing, with signal line, shot belt, ladder, and ample instructions for use, repairs, and keeping in order, etc., etc., complete in strong suitable package, £100, £125, and . . . £200 0 0

SODA WATER AND LEMONADE MACHINES.

Being often applied to for the best machines for manufacturing mineral waters, the following are prices of the latest improved, and such as are found to give the utmost satisfaction; they are admirably adapted for exportation, being securely packed without being taken to pieces, so that soda water, lemonade, etc., may be made from them within an hour after their arrival. Seltzer, Carrara, and other tonic waters, nectar, champagne, cyder, etc., are also made with these machines.

2288. **Direct Action Machines,** as above, producing by hand labour per day 300 dozen £65 0 0

2289. „ „ „ „ „ 200 dozen 60 0 0

2290. „ „ „ „ „ 150 „ 55 0 0

2292. „ „ „ „ „ 100 „ 50 0 0

2293. „ „ „ „ „ 60 „ 45 0 0

The above are hand power machines, but if required for both hand and steam, will be from £4 to £5 extra.

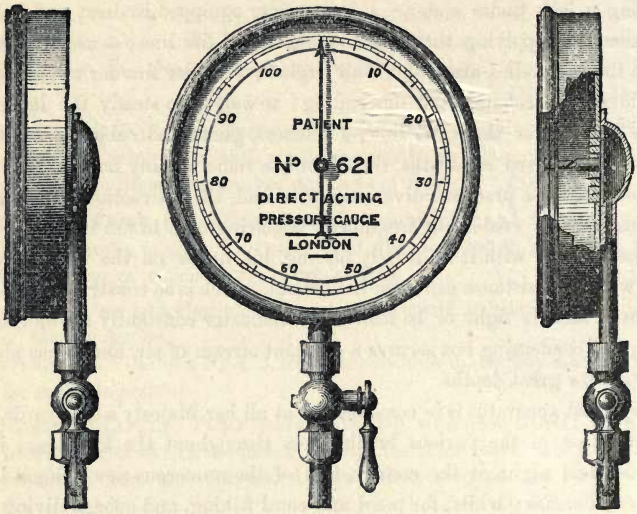


FIG. 2300.

2294. IMPROVED BOTTLING APPARATUS £9 0 0

2295. DIAL PRESSURE INDICATOR 4 0 0

2296. **Improved Acid Tap,** for sulphuric and other acids. In this tap the working parts are composed of stout glass and lead, it is thoroughly efficient, practical, and durable, and indeed free from all the defects known to exist in the various acid taps in use; it supersedes them wherever it is tried . £2 17 6

2297. SMALL GAUGE, for testing the pressure of the waters when bottled, see No. 2308.

2298. WIRE MASK, for protecting the head whilst bottling . . £0 5 6

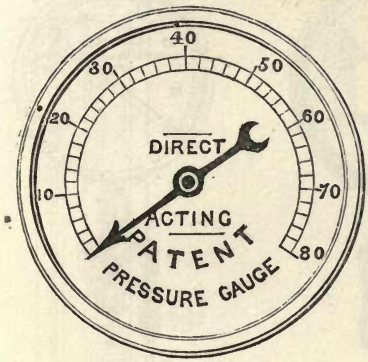
2299. WIRE GAUZE SPECTACLES 0 2 0

STEAM PRESSURE GAUGES.

IMPROVED PATENT DIRECT ACTING PRESSURE AND VACUUM GAUGES.

The great improvement in these gauges consists in the pressure, whether of steam or water, being direct, by means of a small elongated endless screw with intervening diaphragm, pressing upon the spring; in this way the whole circle of the gauge is employed, for whatever pressure (high or low) it is made to indicate, see *fig.* 2300. The metallic spring, etc., in the Bourdons, being dispensed with, they can neither become strained or distorted. They are equally suitable for all positions, stationary or otherwise, and cannot be injured by frost as water does not remain in them; the principle admits of their being made of the small size of *fig.* 2305 for *pocket gauges* with the same precision as if made of the ordinary size without increasing the cost.

2300. **Metallic Pressure Gauge,** as above, in handsome brass frame 3 or 4 inch. (*fig.* 2300) £1 0 0



FULL SIZE.

FIG. 2305.

FIG. 2308.

2301. METALLIC PRESSURE GAUGE, as No. 2300, 5 inch. . . £1 3 0

2302. „ „ „ 6 „ 1 6 0

2303. „ „ „ 7 „ 1 10 0

If with stop-cocks (of best gun metal), 3s. 6d.; with iron syphon, extra 0 1 6

VACUUM GAUGES, same sizes and prices, as above.

2304. **Iron Gauges,** as above, and at same prices, especially adapted for soap and candle manufacturers and chemical works, where caustic potash and its influences are destructive to every other arrangement.

2305. POCKET WATER PRESSURE INDICATOR, for showing any pressure up to a column of 600 feet, much used for testing the strength of mains, and showing the constant actual height or pressure of water (*fig.* 2305) . £1 5 0

2306. FIVE-INCH, ditto 1 0 0

2307. SMALL MODEL POCKET PRESSURE GAUGE, size of *fig.* 2305, for testing model machinery at any pressure up to 300lbs. on the inch. . £1 5 0

2307*. INSPECTORS' PRESSURE GAUGE for the pocket, showing up to 300lbs. or upwards, thickly silvered, with the three different sized connections, in morocco case £2 0 0

2308. BOTTLE TESTING PRESSURE GAUGE, thickly silvered and highly finished, size of No. 2305, with tap and screw complete (*fig.* 2308), in morocco case, for testing the amount of air in soda water and other aërated beverages. To the maker, as well as the purchaser, the value of this test can hardly be over estimated. The tap may also be used separately where a portion only of the beverage is required to be used at the time . . . £2 15 0

Bourdon's Pressure and Vacuum Gauges of usual sizes and best make:

2309. PRESSURE GAUGE, 7 inch. diameter, with central or eccentric hand (*fig.* 2309 or 2309*), p. 198, to indicate any pressure up to 200lbs. on the square inch, and fitted with gun metal cock £1 14 0

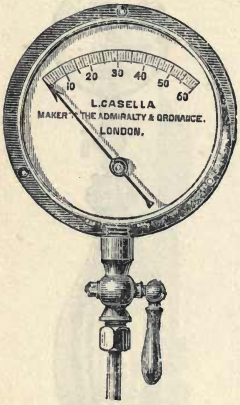


FIG. 2309*.

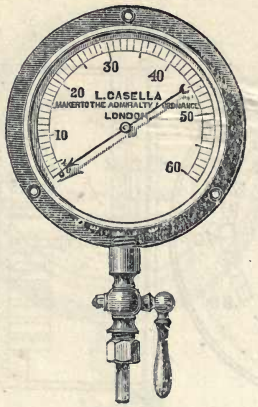


FIG. 2309.

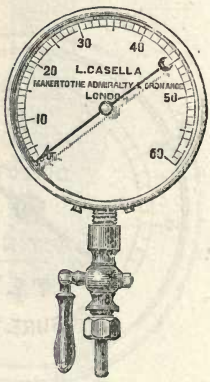


FIG. 2313.

2310. PRESSURE GAUGE, as No. 2309, 6 inch. diameter . . £1 10 0

2311. PRESSURE GAUGE, 6 inch. diameter, with central hand (*fig.* 2309), to indicate any pressure up to 150lbs. on the square inch, and fitted with gun metal cock £1 8 6

2312. PRESSURE GAUGE, 5 inch. diameter (*fig.* 2313), to indicate any pressure up to 120 lbs. on the square inch, and fitted with gun metal cock . £1 4 0

2313. PRESSURE GAUGE, 4 inch. diameter (*fig.* 2313), ditto, . . 1 2 0

2314. PRESSURE GAUGE, 3 inch. diameter (*fig.* 2313), ditto, . . 1 1 0

Vacuum gauges, 4, 5, 6, or 7 inch. diameter, same prices as the above pressure gauges.

*** These gauges, as well as the next following, are guaranteed for two years if properly fixed, and any becoming deranged before that time will be replaced by new instruments.

If the gun metal tap is not required on the Bourdon gauges, 3s. 6d. each is deducted from the price.

*** With orders for any of the above, the pressure to which the gauge is required should be stated, the usual ranges being approximately 50, 100, 150, 200, and 300lbs.

2315. **Hydraulic Pressure Gauges** (carefully tested), in 6 inch. circular brass frames, registering up to 2 tons per square inch . . . £3 0 0

2316. HYDRAULIC PRESSURE GAUGES, as above, to any pressure up to 10 tons per square inch, with maximum pointer £4 2 0

2317. 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 . . . £6 0 0

*** Any of the above gauges repaired, adjusted, or any part renewed.

CASELLA'S MERCURIAL PRESSURE AND VACUUM GAUGES, the action being according to Boyle or Marriot's "Law of Compressed Air." The great attention given by L. CASELLA to the construction of gauges on this principle, renders them in every way, but portability, the safest, most permanent, and accurate gauges in use.

2318. MERCURIAL PRESSURE GAUGE, in polished mahogany frame, 25 inch. long by 5 wide, with strong union joint, to any pressure from 30lbs. to 300lbs. per square inch (*fig.* 2318), p. 199 . . . . £2 0 0

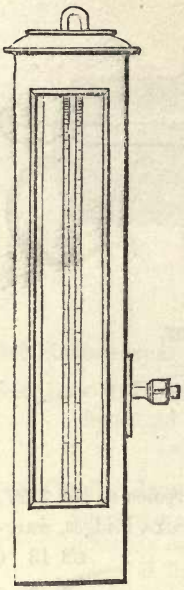


FIG. 2318.

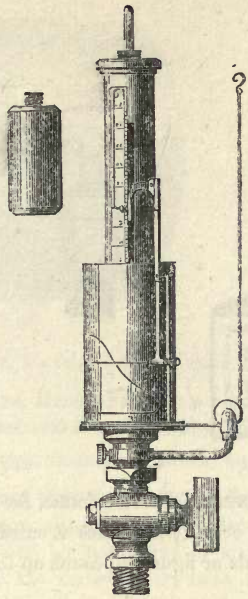


FIG. 2326.

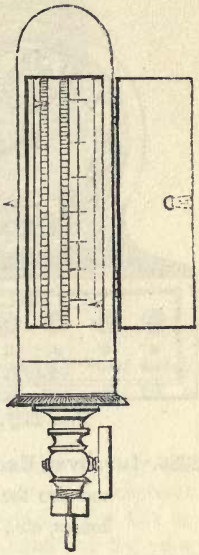


FIG. 2319.

2319. MERCURIAL VACUUM GAUGE, with scale of 21 to 31 inch., in round brass case, with door, stop-cock, etc. (*fig.* 2319) £1 15 0

2320. MERCURIAL VACUUM GAUGE, with scale of 14 to 31 inch . 1 18 0

2321. SYPHON VACUUM GAUGE, with brass nut and screw, for air pumps, etc. £0 4 0

2322. DITTO, DITTO, with glass scale, the gauge enclosed in glass tube with stop-cock (*fig.* 2322), p. 203 . . . . . £0 9 0

2323. **Mercurial Vacuum Gauge,** on mahogany frame, with adjusting scale, divided from 0 to 31 inch., glass cistern, brass tube and union joint, for first-class engine-rooms, connecting with air pump, etc. . . £1 18 0

2324. THERMOMETRIC PRESSURE GAUGE, on which the pressure is shown by the temperature of the steam from 5lbs. to 70lbs., about 10 inch. long, in round brass case for protection £1 15 0

2325. MERCURIAL PRESSURE GAUGE to any length, on painted board, for showing pressure by the height of the mercurial column, arranged so as to prevent overflow of mercury, to 20lbs., £2 5s.; to 30lbs., £2 15s. and upwards, according to pressure.

2326. **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.* 2326) £5 10 0

2327. IMPROVED STEAM ENGINE COUNTER, for registering the number of revolutions or strokes made by an engine, whether stationary or marine, up to 1,000,000, with clock, in handsome brass frame, for the engine-room (*fig.* 2327), p. 200 £15 0 0

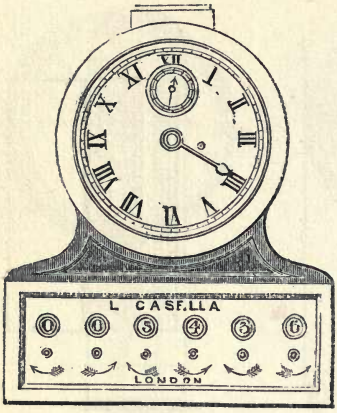


FIG. 2327.

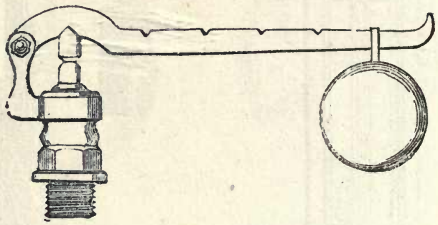


FIG. 2337.

2328. IMPROVED ENGINE COUNTER, in metal frame, for same purposes as No. 2327, and also for counting or tally machines at entrances of docks, bridges, warehouses, etc., with 4 dials or figures to count up to 10,000 . £2 13 6

2329. DITTO 5 „ „ „ 100,000 . 3 0 0

2330. „ 6 „ „ „ 1,000,000 3 7 6

2332. „ 7 „ „ „ 10,000,000 3 15 0

2333. **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

2334. TROCHEAMETER, for registering the revolutions of machinery or carriage wheels of any size, showing the distance travelled from place to place, etc. (*fig.* 2334), p. 201. See also No. 517 . . . £2 10 0

2335. WATER GAUGE, ¾-inch, of best gun metal, with screw-bottom taps, and centre guard £1 15 0

2336. DITTO, DITTO, ½-inch 1 12 0

2337. IMPROVED SMALL SAFETY VALVE, with wrought-iron lever and weight, by which it may be adjusted to 10lbs., 20lbs., 30lbs., 40lbs., or 50lbs. on the inch (*fig.* 2337), p. 200, with ½-inch way, 9s. 6d.; ¾-inch, 11s.; 1-inch, 13s.; 1¼-inch, 15s.; 1½-inch £1 0 0

2338. **Railway or Engine Whistles,** of best make, 1¼-inch, brass, 12s. 6d.; 1½-inch £0 14 0

2339. RAILWAY OR ENGINE WHISTLE, gun metal, 2-inch . . 0 18 6

2340. BREAK WHISTLES, gun metal 1 12 0

2342. „ „ extra large 2 8 0

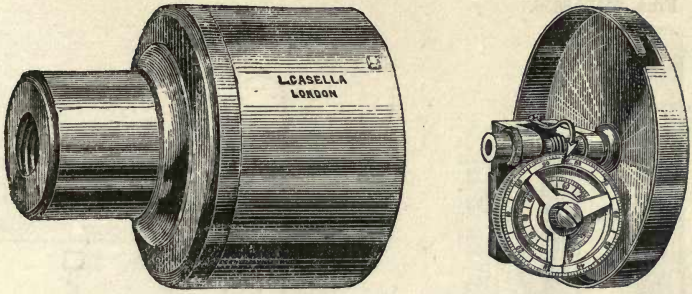


FIG. 2334.

2343. LUBRICATORS with caps, 3s. 6d.; 5s. 6d.; and . . £0 6 0

2344. 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.

2345. **Casella's Improved Gauge Glasses for Steam Boilers,** warranted to bear any temperature or pressure either in or out-of-doors, irrespective of whatever vibration may be caused by locomotive or stationary engines. The tint or colour is light green, the material very hard as well as light, and the price considerably below that of the ordinary glass in use. There is nothing which L. CASELLA has more confidence in recommending than these gauge glasses:

PRICE LIST.

Inches. Diameter [outside].			Per doz.			Inches. Diameter [outside].			Per doz.			Inches. Diameter [outside].			Per doz.		
10	×	½	£0	4	2	10	×	11/16	£0	5	4	10	×	7/8	£0	7	6
12	×		0	4	8	12	×		0	5	6	12	×		0	8	6
14	×		0	5	3	14	×		0	6	6	14	×		0	9	10
16	×		0	5	10	16	×		0	7	6	16	×		0	11	2
18	×		0	6	5	18	×		0	8	6	18	×		0	12	6
20	×		0	7	0	20	×		0	9	8	20	×		0	13	8
22	×		0	7	7	22	×		0	10	10	22	×		0	14	10
24	×		0	8	2	24	×		0	12	0	24	×		0	16	0
10	×	9/16	0	4	9	10	×	¾	0	5	6	10	×	15/16	0	9	0
12	×		0	5	0	12	×		0	6	0	12	×		0	10	0
14	×		0	5	8	14	×		0	7	2	14	×		0	11	4
16	×		0	6	4	16	×		0	8	4	16	×		0	12	8
18	×		0	7	0	18	×		0	9	6	18	×		0	14	0
20	×		0	7	8	20	×		0	10	6	20	×		0	15	8
22	×		0	8	4	22	×		0	11	6	22	×		0	17	4
24	×		0	9	0	24	×		0	12	6	24	×		0	19	0
10	×	5/8	0	4	6	10	×	13/16	0	7	0	10	×	1	0	9	6
12	×		0	5	0	12	×		0	7	6	12	×		0	10	6
14	×		0	6	0	14	×		0	8	8	14	×		0	12	2
16	×		0	7	0	16	×		0	9	10	16	×		0	13	10
18	×		0	8	0	18	×		0	11	0	18	×		0	15	6
20	×		0	9	0	20	×		0	12	4	20	×		0	17	4
22	×		0	10	0	22	×		0	13	8	22	×		0	19	2
24	×		0	11	0	24	×		0	15	0	24	×		0	21	0

FIGS. 2355, 2356.

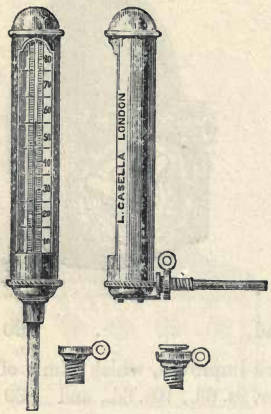


FIG. 2357.

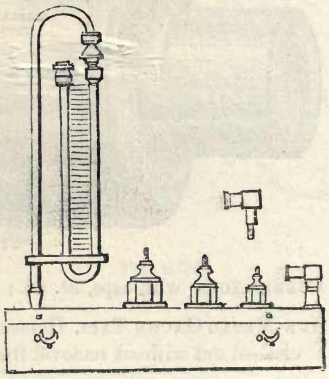


FIG. 2352.

GAS GAUGES AND APPARATUS.

2346. **Glass Tube Pressure Gauges,** with union joint and brass bend with socket (*fig.* 2346), p. 203:

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.

2347. PRESSURE GAUGES, viz., stout glass tube about ½ inch. bore, with brass cap, union and boxwood scale on polished mahogany:

12-inch. scales . . .	£0 14 6	20-inch. scales . . .	£1 5 0
14 „ „ . . .	0 16 6	24 „ „ . . .	1 8 6
16 „ „ . . .	0 18 6	30 „ „ . . .	1 14 0
18 „ „ . . .	1 1 0	36 „ „ . . .	1 17 6

2348. GAS PRESSURE GAUGES, of stout glass tube, about ½ inch. bore without bend, on mahogany boards with boxwood scale, connected brass cap and union at top, and brass socket and plug below to admit of cleaning without unfixing the gauge:

12-inch. scale . . .	£1 1 0	24-inch. scale . . .	£1 17 0
18 „ „ . . .	1 8 6	36 „ „ . . .	2 6 0

2349. **Gas Gauges,** in brass frames, for protecting the tubes in exposed situations:

6-inch. ivory scales . .	£0 10 0	10-inch. ivory scales . .	£0 14 6
8 „ „ „ . .	0 12 0	12 „ „ „ . .	0 18 0
6 „ boxwood scales .	0 8 6	12 „ boxwood scales .	0 15 0
8 „ „ „ .	0 9 6	24 „ „ „ .	2 2 0
10 „ „ „ .	0 12 0	30 „ „ „ .	2 11 9

GAS PRESSURE GAUGES on CASELLA'S improved porcelain scales, with clear black indelible figures and divisions, sizes and forms of No. 2348, at a slight extra cost.

2350. INSPECTORS' POCKET GAUGE, 3-inch. scale, with the 2 usual adapters, elbow, and pliers with burner brooch, in maroon case, complete . £1 5 0

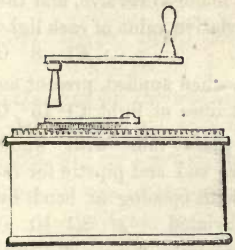


FIG. 2366.

FIG. 2322.

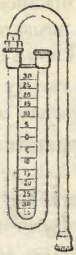


FIG. 2346.

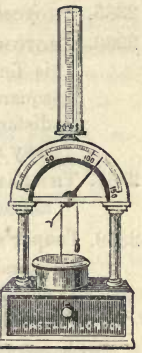


FIG. 2364.

2352. LARGE SIZE INSPECTORS' GAUGE, with bent brass work, ground elbow and socket with 3 adapters and extra elbow adapter, much used by the London Gas Company, complete (*fig.* 2352), p. 202 . . . £1 12 6

2353. DITTO, DITTO, with small tap and burner . . . 1 15 6

2354. **King's Pedestal Pressure Gauges,** in form of small time-piece with circular dial, in which the whole circle of each gauge is employed, in neat ornamental forms; for 3 inch. pressure, £1 15s.; for 6 and 12 inch. pressure, £2 10s.; for 24 inch. pressure, £3 3s.; 36 inch. pressure . . . £4 4 0

2355. GAS THERMOMETER, 8-inch. scale, in brass case, straight for horizontal pipes, with ground socket and screw plug (*fig.* 2355), p. 202 . £1 1 0

2356. DITTO, DITTO, bent, for perpendicular pipe, with socket and plug, as above (*fig.* 2356), p. 202 . . . . . £1 2 0

2357. EXTRA SOCKETS AND PLUGS (*fig.* 2357), p. 202, each . . 0 2 0

2358. SENSITIVE THERMOMETER, small size, on neat ivory scale, $4\frac{1}{4}$ inch. extreme with projecting bulb for taking the temperature of gas in pipes, etc. £0 4 6

2359. DITTO, DITTO, with ground socket and screw plug . . 0 8 6

2360. SEPARATE GROUND SOCKETS with screw plugs, each . . 0 4 0

2362. **Specific Gravity Apparatus,** consisting of light balloon of 1 cubic foot capacity, proof scales, with grain weights, each grain being equal to the weight of 1·728 cubic inches of air, in case complete . . . £2 5 0

With this apparatus the difficulties of taking the specific gravity of coal gas are removed, and reduced to a simple operation of a few minutes.

2363. EXPERIMENTAL METER AND PILLAR, the pillar having micrometer adjustment, and pressure gauges affixed, with 2 regulating cocks, and large tube pressure gauge £5 14 0

2364. **Inferential or Jet Photometer** (LOWES'), for measuring the illuminating power of gas. In this arrangement the length of the gas flame from the photometer is constantly measured by the graduations on the attached glass chimney, and the uniformity of pressure shown by the index on the graduated circle (*fig.* 2364). This gauge is a decided favourite with the managers and practical men of the various gas works around London £3 15 0

2365. PHOTOMETER as No. 2364, in polished mahogany case with glazed front £5 5 0

2366. 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.* 2366), p. 203 . . £1 8 0

2367. 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

2368. **Cooper's Tube Apparatus,** consisting of graduated glass tube with water cylinder, water dish or pan, flexible tube with glass end and pipette for reagents, the tube being of Mann's improved form, with opening at bend, by which the difficulty in using these tubes is entirely obviated £1 10 0

By means of this apparatus an expeditious and inexpensive analysis of gas sufficiently correct for all practical purposes may be readily obtained.

2369. COOPER'S TUBE, as above, improved by Mr. Mann, engineer of the City of London Gas Works £0 7 6

2370. SULPHUR TEST (LETHEBY'S), viz., glass condensing cylinder and combustion tube, long outlet tube, glass funnel with metal end-piece and ammonia bottle, complete on polished wood stand £2 10 0

2372. MANN'S IMPROVED THOMPSON'S APPARATUS for testing the heating power of fuel. This ingenious and practical apparatus consists of a combination cylinder with movable weighted base, small copper furnace with tube and tap, and 5 spare taps, 2 short glass water tubes, graduated to 29,010 grains, small sensitive thermometer in copper case, 3 Mann's protective diaphragms, scales with grain weights, small iron pestle and mortar, hair sieve and canister with oxygen mixture, in polished mahogany case with drawer, lock, and key £5 5 0

2373. **Testing Gas Holder,** of best make, to hold 2 cubic feet, with copper bell and double divided scale, balance wheel on friction rollers, cycloid and weights, gun metal inlet and outlet cocks, and pressure gauge complete, handsomely japanned, suitable for a laboratory £18 10 0

2374. TESTING GAS HOLDER, for testing meters, as above, to hold 5 cubic feet, with cast-iron tank, bell with scale, double divided to 5ths and 1-100ths, cycloid and weight, balance weights, 3 tube pressure gauge, etc., warranted to give the same continuous pressure, handsomely painted and accurately adjusted £28 0 0

2375. TESTING GAS HOLDER, as above, to hold 10 cubic feet, very perfect and complete £38 0 0

GAS APPARATUS, GAS TUBING, AND APPLIANCES, in every variety, on the best terms.

MECHANICAL AND DYNAMICAL APPARATUS, GEOMETRICAL FORMS, ETC.

The models, etc., quoted in this section include only such as will be found of value to the teacher and student of the laws and science of motion and mechanics, besides their use in these studies, the solids form excellent drawing models, owing to the symmetry of their shape and the variety of shadows which each object affords.

2376. **Model Apparatus for Exhibiting the Mechanical Powers,** viz., levers, simple and compound, pulleys of various kinds, inclined plane, wheel and axle, screws of various sizes and pitch, capstan, wedges, etc., in mahogany and boxwood; in case, with weights, £1 1s., £3, and . . . £5 0 0

2377. DITTO, DITTO, more highly finished, and complete with brass pulleys, etc. £10 7s. to £15 10 0

2378. SET OF LEVERS, mahogany, of the first, second, and third orders and bent form, on stand, with friction rollers and graduated scales, £1 1s. to £1 10 0

2379. SET OF LEVERS, in brass, £4 and 4 10 0

2380. A SET of three-toothed wheels and pinions, for showing the relation of power to weight £1 16 0

2382. SET OF COMPOUND LEVERS, in wood, with stand, £1; ditto, in brass 4 10 0

2383. SETS OF PULLEYS, for making different combinations, 3s. to . 0 10 0

2384. **A Set of Three Brass Pulleys,** in frame, of the first, second, and third orders £1 18 0

2385. A PAIR OF THREE-INCH WHITE'S PULLEYS, £1 16s.; ditto, of 6-inch 2 12 6

2386. INCLINED PLANE, 24-inch., with locomotive, and graduated arc of 90 degrees, to explain the law of gradients, and showing that an angle of 10 degrees increases the resistance of the load nine times £3 15 0

2387. INCLINED PLANE, mahogany, with graduated arc and roller, for increasing or reducing the angle, 10s. 6d. to £1 10 0

2388. **Models,** to show the principle of the screw and nut, to illustrate the action of screws of different degrees of inclination, the compound and endless screw, 15s. to £1 5 0

2389. FERGUSON'S COMPOUND ENGINE, in which all the simple mechanical powers move together £4 10 0

2390. A SET OF SIX BRASS VALVES, highly finished, on 4-inch. mahogany blocks, showing the flat, clack, conic, ball, throttle, and side valves . £2 2 0

2392. DITTO, DITTO, of 5, viz., the butterfly valve, bellows valve, round spring valve, conical valve, and oil-silk valve, in stained hard wood, each 6 inches in diameter, the set £0 10 6

2393. **Whirling Table,** improved form, as adopted in the military schools, for demonstrating the laws of planetary motion and central forces, including the Keplerian law, etc. £13 10 0

2394. WHIRLING RINGS, for proving the oblate figure of the earth . 1 1 0

2395. APPARATUS to illustrate the centre of gravity, consisting of 2 equal parallelopipeds of a rhomboidal form. They stand firmly on end when separate, but fall when placed on one another £0 2 0

2396. LEANING TOWER OR OBLIQUE CYLINDER, in 2 pieces. They stand firmly on end when separate, but fall when placed on each other . £0 2 0

2397. AN IRREGULAR BOARD, with 2 strings attached, with lines drawn to show how the centre of gravity of an irregular surface may be found . £0 1 6

2398. SEMICIRCLE of brass, weighted at the two ends, supported on a brass stand, with a knife edge, to show the centre of gravity . . . £0 3 6

2399. Double Cone and Inclined Plane, to show the descent of the centre of gravity, though the cone apparently moves upwards . £0 5 6

2400. Apparatus for demonstrating the parallelogram of forces, with weights and board complete, 18s. 6d. to £1 5 0

2402. **Attwood's Fall Machine,** with large pendulum, in finely polished wood, carefully graduated £10 10 0

2403. Apparatus to show that a body in rotating, if free, always selects the shortest axis £2 2 0

2404. Small Ground Brass Plates to illustrate the attraction of cohesion 0 12 6

2405. Cometarium, for showing the elliptical orbit of a comet, laid off to explain the law of equal areas in equal times £2 15 0

2406. Geometrical Solids, in case, with book and illustrated text for stereometry and stereography £0 8 6

2407. Trinomial Cube Dissected, for showing the relation between geometry and algebra; large, 7s. 6d.; small £0 5 0

2408. The Gyroscope, a modification of Bohnenberger's machine, by M. Foucault, arranged to illustrate the following principles:—That inertia is a property of matter in motion, as well as when at rest; that axial and orbital motion are closely related, and that the speed of one may affect or regulate the other; that the unstable state of equilibrium retained by various bodies is explained by the fact of their rotation; that bodies in motion endeavour to maintain their original plane of rotation; that the power of overcoming the force of gravity possessed by shots when fired from Armstrong's gun is due to the gyratory motion given to them by the internal formation of the gun. It also illustrates beautifully the precession of the equinox. Price of the simple form, on stand £1 1 0

2409. Ditto, compound or most complete form in cabinet . . 2 10 0

A very interesting illustrated paper on the gyroscope and experiments performed with it by M. Foucault accompanies each instrument.

Working models of steam engines, see pages 208 to 211.

MODELS OF CRYSTALS,

Of very accurate construction, designed with the utmost care.

2410. **Glass Models,** to illustrate the six systems of crystallography. The set of six, uniform with the 2 or the 3-inch. cube, £3 3s.; uniform with the 4-inch. cube £5 5 0

1.—The Cube, containing the Tetrahedron, Octahedron, Intersecting Cube, and Rhombic Dodecahedron.

2.—The Square Prism, containing the Acute and Obtuse Octahedrons, and Long and Short Square Prisms.

3.—The Rectangular Prism, containing the Rhombic Octahedron and Prism.

4.—The Oblique Prism, containing the Oblique Rhombic Octahedron and Prism.

5.—The Doubly Oblique Prism, containing the Doubly Oblique Octahedron and Prism.

6.—The Hexagonal Prism, containing the Obtuse Rhombohedron, and Scalenohedron of Carbonate of Lime.

2412. The Crystal Cube, containing the Octahedron and two Intersecting Tetrahedrons, 3-inch., with an explanation £0 7 6

2413. The Cube, containing the Octahedron, Intersecting Cube, two Intersecting Tetrahedrons, and Cube-octahedron, with the Macles's Section, 3-inch. £0 10 6

2414. The Cube, containing the Octahedron, Intersecting Cube, Rhombic Dodecahedron, Trapezohedron, and Tetrahexahedron, 3-inch. . . £0 15 0

2415. **Models in Wood,** illustrating "Dana's Manual of Mineralogy," ¾-inch, 12s.; 1½-inch. £1 1 0

The small sizes are in white wood, and the larger in mahogany.

2416. Models in Wood, to illustrate the section on Crystallography and Mineralogy in Orr's "Circle of the Sciences," 1-inch, 10s. 6d.; 1½-inch . £0 18 0

2417. Models in Wood, to illustrate Ansted's "Elementary Course of Mineralogy," ¾-inch, 10s. 6d.; 1½-inch £1 1 0

1.—Regular:—Cube-octahedron, Octahedron, Cube, Rhombic Dodecahedron, Tetrahexahedron, Pentagonal Dodecahedron, Tetrahedron, Ex-octahedron, Ex-cube, Fluor Spar Native Copper, Grey Copper.

2.—Square Prismatic:—Short Square Octahedron, Long Square Octahedron, Tin Ore, Zircon, Zircon, Idocrase, Zircon.

3.—Hexagonal:—Hexagonal Dodecahedron, Rhombohedron, Quartz, Calc Spar, Hexagonal Prism.

4.—Rhombic:—Long Rhombic Octahedron, Sulphur, Topaz, Heavy Spar, Prehnite, Sulphuret of Antimony.

5.—Oblique:—Oblique Rhombic Octahedron, Malachite, Gypsum, Pyroxene.

6.—Doubly Oblique:—Doubly Oblique Rhombic Octahedron, Sulphate of Copper, Axinite.

Twin Crystals or Macles:—Staurotide, Gypsum.

2418. **Models in Wood,** to illustrate Dr. Pereira's "Materia Medica," 1-inch, 15s.; 1½-inch. £1 10 0

2419. Models in Wood, to illustrate Fownes's "Elementary Chemistry," 1-inch, 6s.; 1½-inch. £0 10 6

2420. Models of Diamonds, in glass, the Koh-i-noor or Mountain of Light, Star of the South, Nassuck or Indian, Pitt or Orleans, Maximilian or Austrian (yellow), Great Russian, George the Fourth or Blue Diamond, etc., each £0 8 0

2422. Wire Models. The six prisms with their contained forms, in wire, uniform with the 8-inch. cube £5 5 0

2423. The Six Prisms, in wire, with their axes, uniform with the 6-inch. cube 1 1 0

2424. Ditto, with movable Octahedrons, etc., in wood, coloured . 2 2 0

2425. **Models in Wood.** Geometrical solids. The Platonic or five regular solids. The Tetrahedron, Cube, Octahedron, Dodecahedron, and Icosahedron, with a description, 1-inch, 1s. 6d.; 1½-inch., 2s. 6d. The same forms in wire, 4-inch., 7s. 6d. Short set, 1-inch, 6s.; 1½-inch., 10s. 6d. Complete set, 1-inch, 10s. 6.; 1½-inch. £0 18 0

Complete Set.—Tetrahedron, Hexahedron or Cube, Octahedron, Rhomboidal Dodecahedron, Trapezohedron, Tetrahexahedron, Excube, Cuboctahedron, Exoctahedron, Triexoctahedron, Pentahedron, Dodecahedron, Icosahedron, Tricacontahedron, Hexacontahedron, Exdodecahedron, Icosadodecahedron, Exicosahedron, Acute Rhombohedron, Obtuse Rhombohedron, Scalene Dodecahedron, Bipyramidal Dodecahedron, Tetradodecahedron, Pentagonal Dodecahedron, Trapezoidal Dodecahedron, Triangular Prism, Triangular Pyramid, Quadrangular Pyramid, Hexagonal Prism, Hexagonal Pyramid, Cone, Sphere, Cylinder.

DISSECTED CONES, PAINTED BLACK.

2426. CONE, containing the ellipse, parabola, and hyperbola, 3-inch. base £0 3 0

2427. „ „ „ „ „ 5 „ 0 6 0

2428. „ „ „ „ „ triangle and circle, 8-inch. base £1 1 0

2429. GONIOMETER, PEPYS'S, for measuring the angles of crystals, in case, for the pocket £1 1 0

2430. GONIOMETER, for measuring the angles of crystals . . 3 15 0

2431. GONIOMETER, WOLLASTON'S, reflecting 5 5 0

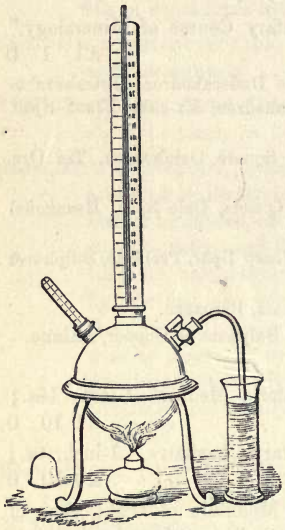


FIG. 2432.

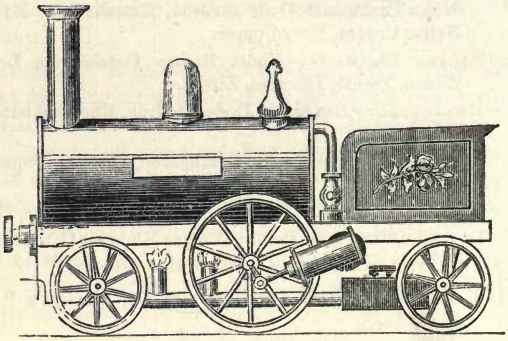


FIG. 2443.

WORKING MODELS OF STEAM ENGINES, STEAMBOATS, ETC.

The following list includes only such models as are carefully tested, and the fullest confidence may be placed in their working with perfect efficiency. The marine engines named (or larger sizes) can be applied to suitable working model ships if required.

2432. **Marcet's Steam Apparatus,** with barometer, thermometer, stop-cock, etc., for illustrating the principal experiments connected with high or low pressure steam and latent heat (*fig.* 2432) . . £4 0 0 and £4 10 0

2433. **Locomotive Engine,** 18 inches long, boiler heated by charcoal or spirit lamp, with fixed cylinders, slide valves, tubular boiler, steam cocks, for high and low water-marks, water gauge, steam whistle, safety valve, lamp, spring buffers, etc., best make £30 0 0

2434. DITTO, DITTO, as above, with reversing gear . . . 36 0 0

2434*. TENDER for the above, with spring buffers . . . 4 0 0

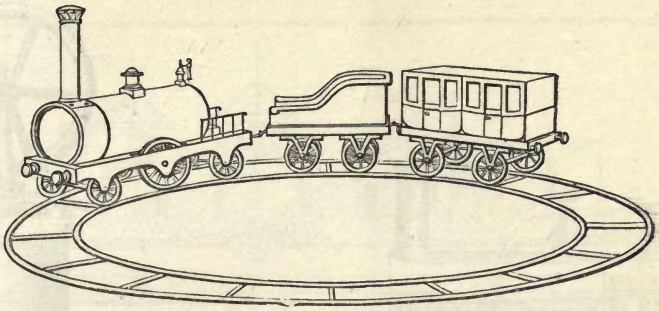


FIG. 2448.

2436. LOCOMOTIVE ENGINE, 16 inches long, with oscillating cylinders inside framing, double crank, steam chest, safety valve, steam cock, two cocks for high and low water marks, whistle, spring buffers, and spirit lamp, highly finished £14 0 0

2436*. TENDER for ditto 1 8 0

2437. **Locomotive Engine,** 8½ inches long, with oscillating cylinders inside framework, whistle, steam cock, buffers, and safety valve, £4; or to run straight £3 15 0

2438. LOCOMOTIVE ENGINE, 9 inches long, with 4 wheels, cylinders, outside framework, steam cock, safety valve and spirit lamp . . £3 3 0

2439. TENDER for ditto 0 11 6

2440. SMALL BRASS LOCOMOTIVE ENGINE, 6½ inches long, with outside cylinders, steam cock, safety valve, and spirit lamp . . . £1 18 6

2442. TENDER for ditto 0 8 0

2443. **Locomotive Engine and Tender** in one (*fig.* 2443), p. 208, 10 inches long, with polished brass boiler, and brass frame, oscillating cylinders outside frame, steam cock, safety valve, buffers, and spirit lamp . . £2 5 0

2444. Same as the above, with japanned tin boiler . . . 2 2 0

2445. DITTO, DITTO, the same as No. 2443, with 4 wheels, and without tender 2 2 0

2446. DITTO, DITTO, same as above, but with japanned tin boiler . 1 12 0

2447. SMALL CHEAP LOCOMOTIVE (*fig.* 2447), p. 210, 7 inches, with one cylinder, bright brass frame, japanned tin boiler, buffers, and spirit lamp; works well £1 0 0

2448. **Locomotive Engine,** of brass, highly finished, with cylinders inside frame, double crank, steam cock, whistle, buffers, and safety valve, japanned tender, carriage, and brass circular railway, 3 feet 9 inches diameter (*fig.* 2448) £9 10 0

2449. LOCOMOTIVE ENGINE, as No. 2436, with tender and brass railway, 5 feet diameter £20 0 0

2450. TURN TABLES, models of, for turning and shifting locomotives and carriages on railroads £6 6 0

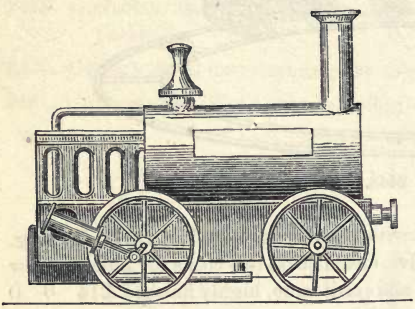


Fig. 2447.

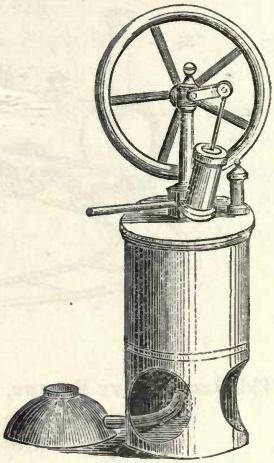


Fig. 2456.

STATIONARY STEAM ENGINE MODELS.

2452. **Horizontal Steam Engine,** with polished brass boiler, cylinder, steam cock, safety valve, lamp and fly-wheel, on japanned stand, 7 inches long £0 18 0

2453. Ditto, same as above, working a small lathe fixed on bed plate, with polished mahogany stand, best finish £1 13 0

2454. Horizontal Steam Engine, with fixed cylinder, slide valve, boiler, steam cock, safety valve, fly-wheel 5 inches diameter fixed on bed plate 7 inches long, with polished mahogany stand £3 5 0

2455. High Pressure Beam Engine, with fixed cylinders, slide valve, parallel motion, cocks, governors, boiler, etc. . . . £5 0 0

2456. Vertical Steam Engine, on brass boiler, with cylinder, fly-wheel, steam pipe, spirit lamp, etc. (*fig.* 2456) £0 15 6

2457. Oscillating Engine, with detached boiler, steam cock, etc., on French polished mahogany stand, 7 by 5 inches £1 18 0

2458. **Steam Saw Oscillating Engine,** with 5-inch. fly-wheel, circular saw in bed plate, and separate boiler, supported by 4 brass pillars, on mahogany stand £3 15 0

2459. High Pressure Beam Engine, with slide valve, fly-wheel 5¼ inches diameter, and brass boiler £9 10 0

MARINE STEAM ENGINES.

2460. **Pair of Marine Steam Engines,** with paddle wheels 3½ inches diameter, oscillating cylinders, double crank, steam cock, copper boiler, safety valve and lamp; to drive a boat 3 feet 6 inches or 4 feet long . £4 0 0

2462. Ditto, of larger size, with 5-inch. wheels and reversing gear, to drive a boat of 4 to 5 feet £4 10 0

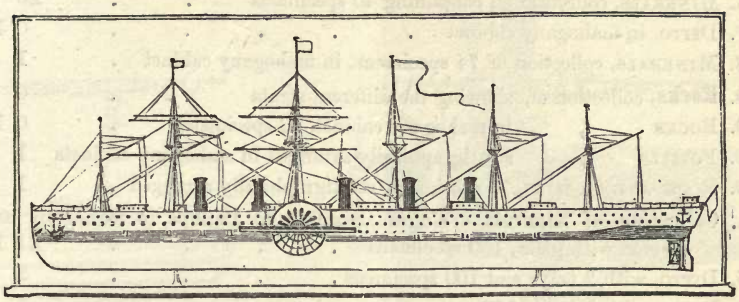


FIG. 2473.

2463. **Pair of Marine Engines,** of superior make and extra power, with 4-inch. wheels, reversing gear, copper boiler, cocks, safety valve . £5 5 0

2464. DITTO, same construction as above, with 6-inch. paddle wheels, to drive 5 to 6 feet boat . . . . . £9 0 0 to £12 0 0

2465. DITTO, with 7-inch. wheels, to drive 7 to 8 feet boat 13 0 0 to 18 0 0

Larger sizes made to order.

2466. WOOLLASTON'S APPARATUS, showing the action of the atmosphere, or condensing engine . . . . . £0 7 6 and £0 10 0

2467. **Paddle Wheel Steamboats,** suitable for marine engine No. 2460, with rigging, etc., complete, 4 feet long, £8 10s.; 3 feet 6 inches long . £7 0 0

2468. DITTO, DITTO, extra finished, 4 feet long, £11; 3 feet 6 inches 9 10 0

2469. SCREW STEAMBOATS, suitable for marine engine No. 2460, rigged, etc., complete, 4 feet long, £7 15s.; 3 feet 6 inches long . . . £5 10 0

2470. DITTO, DITTO, extra finished, 4 feet, £10 10s.; 3 feet 6 inches long 9 0 0

2472. **Models of Paddle and Screw Steamers** (not working), including the "Irena," "Trinity Yacht," "Cosmopolitan," etc., 2 feet long, each . £3 10 0

2473. 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.* 2473), £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.

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; all are named, carefully labelled, and accompanied with brief descriptions of their uses in the manufactures and arts.

2474. **Minerals,** small collection, 24 specimens, 2s.; ditto, larger specimens £0 5 0

2475. MINERALS „ 40 „ 5s.; „ „ 0 10 0

2476. MINERALS, collection of, containing 40 specimens . . £0 7 6
2477. DITTO, in mahogany cabinet 0 10 0
2478. MINERALS, collection of 74 specimens, in mahogany cabinet . 1 0 0
2479. **Rocks,** collection of, showing the different strata . . 0 5 0
2480. ROCKS „ in mahogany cabinet, 40 specimens . 0 10 0
2482. FOSSILS „ stratigraphically arranged in mahogany cabinets 1 0 0
2483. ROCK AND FOSSILS, 74 specimens, stratigraphically arranged . 1 0 0
2484. **Collection of Minerals,** arranged according to Phillips, in mahogany cabinet covered with glass, 100 specimens £1 10 0
2485. DITTO, with 2 trays and 100 specimens 2 0 0
2486. DITTO, with 3 trays, 150 „ 4 0 0
2487. COLLECTION OF ROCKS, stratigraphically arranged according to Lyall, with the characteristic fossils, in mahogany cabinet, with 2 trays and glass covers, 100 specimens £2 0 0
2488. DITTO, DITTO, larger and more select, with 3 trays, 150 specimens 4 0 0
2489. SHELLS, a collection of, arranged according to Woodward in mahogany cabinet, 50 specimens £1 0 0
2490. DITTO, more select, illustrative of the different genera, in mahogany, with 3 trays, covered with glass, 100 specimens . . . £3 0 0

*** LARGER COLLECTIONS FOR MUSEUMS, INSTITUTIONS, etc., etc., arranged to any extent.

SINGLE SPECIMENS OF MINERALS, ROCKS, AND SHELLS FOR THE CABINET.

2492. TRANSPARENT GLASS-CAPPED BOXES, the same as used in the York, Liverpool, and other museums, for preserving minerals, fossils, shells, eggs, etc., per dozen, from £0 1 0

SPECIFIC GRAVITY INSTRUMENTS.

The increasing use of these instruments in the arts and manufactures is intended to be met in the following list, in which economy, as well as precision, has been studied alike in those for manufacturing purposes, as well as 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 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 he has made them."—*Report of the Kew Observatory Committee to the British Association,* 1854-5.

HYDROMETERS, SACCHAROMETERS, ETC.

2493. **Sykes's Hydrometer,** Excise pattern, best make and strongly gilt, with comparative and reducing rule, ivory thermometer, book of tables, trial glass and instructions, complete £4 4 0
2494. DITTO, DITTO, without rules 3 18 0
2495. DITTO, DITTO, plain, slightly gilt, as used by most distillers . 3 3 0

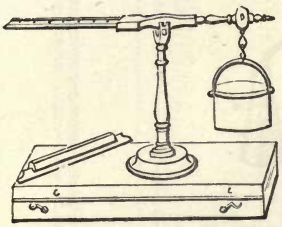


FIG. 2508.

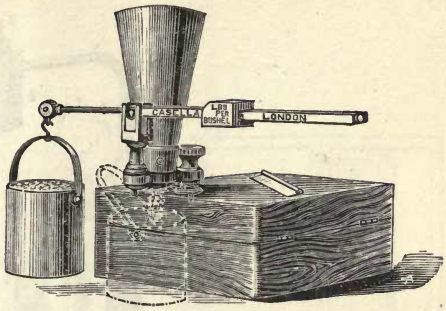


FIG. 2509.

2496. SMALL POCKET SYKES'S HYDROMETER, best double gilt, with ivory thermometer, enamelled tube, book of table, and trial glass, complete £3 15 0

N.B.—When either of the above are required for warm climates, the book of tables is made up to 100° of temperature, and the thermometer to proportionate higher range at 7s. 6d. extra.

2497. 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.

2498. **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

2499. DITTO, the same, with tables of heat up to 100° for hot climates 0 6 0

2500. BREWER'S SACCHAROMETER, best electro-gilt, with one weight, showing to 52lbs. per barrel, with rule, tables, instructions. Thermometer, etc., in case, with lock and key £4 4 0

2502. DITTO, DITTO, electro-gilt, of plainer make, without rule . 3 3 0

2503. RICHARDSON'S ditto, ditto, to 60lbs. 3 10 0

2504. **Allen's Saccharometer,** best gilt, chiefly used in Scotch breweries, with slide rule, trial jar, etc., in case complete £4 10 0

2505. SACCHAROMETER, glass, for brewers, with thermometer, in mahogany case, also glass jar, improved tables of gravity, and temperature, etc. (*fig.* 2505), p. 215 £1 1 0

2506. SACCHAROMETER, glass, in round case, with tables of heat, as above 0 5 6

2507. SACCHAROMETER, glass, for British wine making, as described in Robert's "Wine Maker's Guide" £0 5 0

Corndrometer or Corn Balance. A portable and convenient instrument for showing the real weight per bushel, etc., of corn, as wheat, oats, barley, etc., from the weight of a small quantity, thus, the measure A being filled with corn and attached to the beam B, the sliding weight is passed along till the corn is balanced, and the exact weight or value is thus shown. The sizes quoted are imperial English measures, but foreign ones can be made, if preferred, at a slight extra cost.

2508. CORNDROMETER, in mahogany case, complete (*fig.* 2508), 1 pint, £3 5s.; ½ pint, £2 15s.; ¼ pint, £2 5s.; ⅛ pint £2 2 0

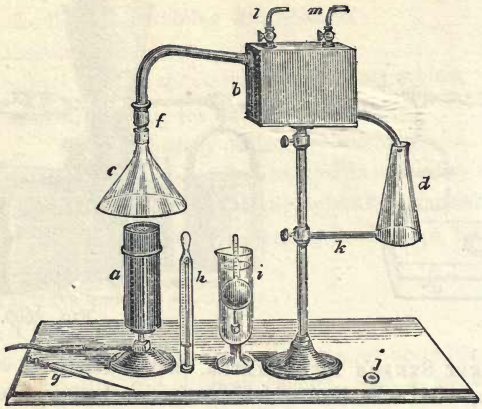


FIG. 2513.

2509. **Corndrometer,** complete as No. 2508, with attached funnel (*fig.* 2509), p. 213, 1 pint, £5 ; ½ pint, £4; ¼ pint, £3 10s. ; ⅛ pint . . £3 3 0

The advantage obtained by this arrangement is uniformity in filling the measure; the funnel is placed in a projecting position, over the end of the box, beneath which, at a fixed distance, the bucket is placed to receive the corn; the funnel is then filled with the sample to be tried, and a slide being removed the corn passes gradually into the measure at a uniform rate, when the top is levelled off with a small accompanying straight edge.

2510. ALCOHOLMETER, for brewers, Field's patent improved, for 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

2512. 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

2513. **Alcoholic or Wine Test,** as used in the laboratories of her Majesty's Board of Customs for the estimation of proof spirits in wine, liquors, etc. (*fig.* 2513), and including 12 flexible washers, 1 each measure, bottle, trial jar, 12 feet flexible tube, stirring thermometer, and plain strong case . £5 0 0

2514. SPARE FLASKS, with screw collar to fit the still, each . . 0 2 6

2515. SPARE STANDARD MEASURE GLASSES, each . . . 0 1 6

The heating lamp may be for gas or spirit, as under:—

2516. IMPROVED GAS LAMP 0 8 6

2517. OR ARGAND SPIRIT LAMP, to slide on telescope stand . 0 15 0

The strength of the alcohol obtained by this apparatus is then shown by any of the hydrometers in the usual way, see Nos. 2493 to 2497.

2518. WINE TEST, small and portable, for testing the amount of alcohol contained in small samples of wine, with glass hydrometer and thermometer, complete, in case £1 6 0

2519. **Salinometer** (patent), of stout cast metal, for attaching to the boilers of steam vessels, with hydrometer, thermometer, and best metal cock and valves, for showing at any time the gravity of the water by the amount of salt contained in the boiler £8 15 0

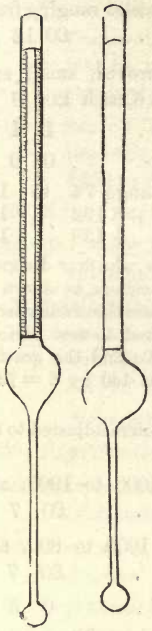


Fig. 2538.

Fig. 2526.

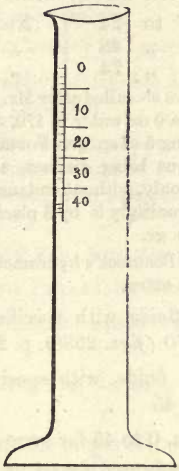


Fig. 2527.

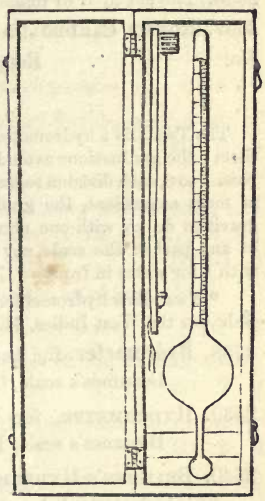


Fig. 2505.

2520. **Salinometer Hydrometer,** best glass, adjusted to 200° Fahrenheit (or Centigrade or Reamur), 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 £0 4 0

2522. Ditto, Ditto, of gilt metal, in tin case . . . 0 18 6

2523. Ditto, Ditto, in mahogany case, with thermometer . . 1 6 0

2524. Thermometer, protected, etc., for ditto . . . 0 4 0

2525. Engine Counters or Meters for steam vessels, see steam gauges, Nos. 2327 to 2334.

2526. **Milk Test or Lactometer,** for detecting adulteration, and showing the relative value of milk from different cows (*fig.* 2526) . . £0 3 6

2527. Cream Test, for showing the difference in quantity of cream between one cow and another, with instructions also for the lactometer (*fig.* 2527) £0 3 6

No one using these appliances would ever again be without them.

2528. Acetometer, for vinegar and other light acids 0 5 0

2529. Barktrometer, with open graduations, for tanning . . 0 6 0

2530. Oleometer, for testing the quality of oils, in round case . 0 4 6

2532. Ditto, with thermometer and glass jar, in mahogany case . 0 16 0

2533. **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

2534. HYDROMETERS, a pair of, as No. 2533, in mahogany case, the scales ranging from 0 to 20, and from 20 to 40 . . . . . £0 12 6

2535. **Twaddle's Hydrometer** (glass), pear shaped, CASELLA'S improved, small and strong, with ivory scales, No. 1 to 3, 2s. 6d. each; No. 3 to 6, each £0 3 0

2536. The set of 6 in mahogany case 1 1 0

2537. ROUND CARDBOARD OR TIN CASES, each . . . 0 0 3

No. 1 . .	Range 0 to 24	No. 4 . .	Range 74 to 102
„ 2 . .	„ 24 „ 48	„ 5 . .	„ 102 „ 138
„ 3 . .	„ 48 „ 74	„ 6 . .	„ 138 „ 170

The Twaddle's hydrometers*, are so called after Mr. Twaddle of Glasgow, who first designed them; the graduations extend from 0 or water to 170, on 6 separate hydrometers, as shown in Nos. 1 to 6, each division representing 5 of sp. gr. For manufacturing purposes the arrangement is most convenient, the graduations being distinct, and workmen required to test various gravities do so with one number only, without endangering the whole. To find the gravity of any part of the scale, say 140, multiply it by 5 placing 1 in front, thus 140 by 5 = 700, with 1 for water in front = 1700 sp. gr.

* Twaddle's hydrometers, and Beaumes's hydrometers and saccharometers adjusted to 84° Fah., for the West Indies, 6d. each extra.

2538. **Hydrometer,** for heavy fluids, with specific gravity scale, 1000 to 1900, and Beaumes's scale, 0 to 70 *(figs.* 2538), p. 215 . . £0 7 6

2539. HYDROMETER, for light fluids, with specific gravity scale 1000 to 800, and Beaumes's scale, 10 to 45 . . . . . £0 7 6

2540. BEAUMES'S HYDROMETER, 0 to 45 for syrups, soap, leys, etc. . 0 5 6

This hydrometer being extensively used abroad, as well as in connection with chemicals imported into this country, the following short comparative tables will be found convenient.

SPECIFIC GRAVITIES CORRESPONDING TO DEGREES OF BEAUMES'S HYDROMETER FOR LIQUIDS HEAVIER THAN WATER.

Degrees.	Sp. Gr.	Degrees.	Sp. Gr.	Degrees.	Sp. Gr.
1	1·007	15	1·109	29	1·235
3	1·020	17	1·126	31	1·256
5	1·034	19	1·143	33	1·277
7	1·048	21	1·160	35	1·299
9	1·063	23	1·178	37	1·321
11	1·078	25	1·197	39	1·345
13	1·094	27	1·216	41	1·369
				43	1·395
				50	1·490
				60	1·652
				70	1·854

FOR LIQUIDS LIGHTER THAN WATER.

Degrees.	Sp. Gr.	Degrees.	Sp. Gr.	Degrees.	Sp. Gr.
12	0·986	27	0·896	42	0·820
15	0·967	30	0·880	45	0·807
18	0·948	33	0·864	48	0·794
21	0·930	36	0·849	51	0·781
24	0·913	39	0·834	54	0·768

2542. SACCHAROMETER, for sugar-boiling, Beaumes's scale 0 to 40, of stout brass gilt, in tin case £1 8 0

2543. **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 precision, £1 10s., or in one case . . . £1 14 6

2544. A SET OF THREE HYDROMETERS for heavy fluids, by L. CASELLA, of standard precision, as above: No. 1, 1000 to 1300; No. 2, 1300 to 1600; No. 3, 1600 to 1900, £1 6s., or in one case £1 10 0

2545. HYDROMETER for spirits, with Cartier's and specific gravity scales 0 5 0

2546. 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

2547. **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 12, 5s. 6d.; of 18, 8s.; of 24 . . . . . £0 10 6

* Spirit bubbles adjusted to 84° Fah., ditto, ditto, without extra charge.

2548. PARTING GLASSES OR SINKING PHIALS, for East India, per dozen 0 7 0

2549. SALT-WATER BEADS OR BUBBLES, for aquariums, in pairs (Lloyd's arrangement) with instructions £0 2 0

2550. AQUARIUM HYDROMETER (LLOYD'S), for adjusting the salt-water to its proper density £0 2 6

2552. **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

2553. PHOTOGRAPHIC HYDROMETER, for showing grains per ounce of nitrate of silver in solution £0 4 6

2554. HYDROMETERS, SACCHAROMETERS, and ALCOHOLMETERS, according to Beaume, Tralles, Richter, Gay-Lussac, etc., for showing the strength and gravity of fluids both heavier and lighter than water; from 1s. 6d. to 2s. 6d. each, in every variety.

2555. SPECIFIC GRAVITY BOTTLES, of 1000 grains capacity, with counterpoise, in tin case, japanned, 10s. 6d.; ditto to 500 grains, 8s. 6d.; ditto to 250 grains, 6s. 6d.; ditto to 100 grains, 5s. 6d.; ditto to 1 cubic inch. . £0 5 6

2556. SPECIFIC GRAVITY BOTTLES, of stout glass, with solid stoppers, with a slit down the side, at the same price.

2557. **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

2558. 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

URINOMETERS; the great care taken by L. CASELLA in the design, as well as precision of these instruments, obtains for them a decided preference wherever they are tried.

2560. URINOMETER (PROUT'S) for ascertaining the specific gravity of urine, strong and very sensitive, in sheath case £0 3 6

2562. URINOMETER (PROUT'S), in round case, with 2 oz. graduated glass jar £0 6 6

2563. **Urinometer,** with graduated jar, delicate thermometer and test papers, in maroon case £0 11 6

2564. DITTO, DITTO, very handsome, with thermometer, 2 oz. graduated jar, spirit lamp, 2 acid bottles, 9 test tubes, test papers, and dropping tube £1 6 0

2565. 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

2566. **Urinary Cabinet,** as selected by Dr. Lionel Beale, consisting of urinometer in case, graduated 2 oz. measure, pipette, stirring rod, microscopic slides, and thin watch glasses, washing bottle for precipitates, tube holder, test tube, forceps, blow pipe, platinum foil and wire, spirit lamp with ring, test papers, and 7 Highley's dropping bottles for nitric acid, acetic acid, ammonia, potash, nitrate of bysitas, nitrate of silver, and oxilate of ammonia . £2 10 0

2567. METAL URINOMETER, gilt or electro-plate, in round sheath case 0 11 0

2568. CODDINGTON LENS in German silver, 4s. 6d. to 7s. 6d.; Stanhope ditto, 3s. 6d. to £0 5 6

SURGICAL AND MEDICAL INSTRUMENTS AND APPARATUS.

The following brief list enumerates a few of the medical appliances mostly required from L. CASELLA, all other varieties, however, of the most approved and useful kinds are forwarded to order, on the lowest terms.

2569. **Ear Illuminator** (JORDAN'S) £1 2 0

2570. AURISCOPE (BRUNTON'S) much improved . . . 1 8 0

2571. TOYNBEES, set of silver tubular specula of 3 sizes, round or oval, with handle £0 17 6

The clear bright light, natural or artificial, thrown into the ear by these instruments is most efficient; they are also used as auxiliaries to the speculum.

2572. EAR SYRINGE (indiarubber syphon) for self use (*fig.* 2572), p. 219 £0 3 6

2573. „ „ flexible (*fig.* 2573), p. 219, best, 1 oz., 1s. 9d.; 2 oz. 0 2 0

2574. „ „ brass, 3s. 6d., 4s. 6d., and . . . 0 5 0

2575. „ „ „ with set of three pipes, in morocco case . 0 12 6

2576. STETHESCOPES, in every variety, each . . £0 2 6 to 0 6 6

2577. **Lancets** for bleeding, for the gums, for vaccine, abcess lancets, etc., per dozen £0 3 6 and £0 5 6

2578. SILVER, MOROCCO, AND TORTOISE-SHELL LANCET CASES 0 0 6 to 0 15 0

2579. KNIVES AND CORN FILES, for chiropodists, the set 0 7 6 „ 0 15 6

2580. DITTO, DITTO, mounted in ivory, with nail nippers, scissors, spring forceps, and double tantaculum, in neat pocket case . . . £1 10 6

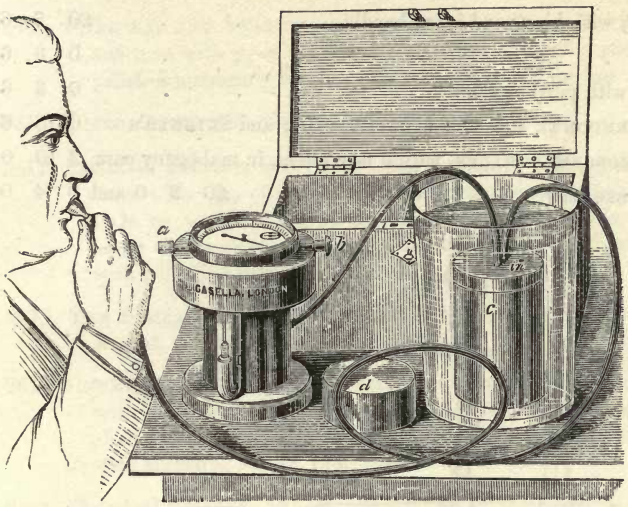


FIG. 2589.

FIG. 2573.

FIG. 2572.

2582. **Eye-lid Retractors** (BOWMAN'S, CRITCHETT'S, PELLIER'S, and ADAMS'S), each £0 3 3 to £0 6 0

2583. HEARING TRUMPETS, bronze and electro-plated, the latest improved, 3s., 6s., 9s., each, and upwards to £2 10 0

2584. EAR CORNETS, each . . . . £0 2 0 to 0 10 6

2585. CONVERSATION TUBES, covered with silk, plain and taper, in ivory and ebony mountings . . . . . £0 16 0 to £1 1 0

2586. OPTHALMOSCOPE, of much importance, for viewing the interior and back surface of the eye . . . . . £0 15 6 to £1 5 0

2587. SPIROMETER (Dr. HUTCHINSON'S), for measuring the vital capacity of the lungs, with tables and instructions, complete . . . £4 4 0

2588. **Weighing and Measuring Machine,** to be used in conjunction with the above £7 10 0

2589. IMPROVED PORTABLE SPIROMETER, for measuring the capacity and power of respiration of the chest and lungs (*fig.* 2589). The principle of this new and very beautiful instrument is that of the sensitive air meter No. 75, with a special arrangement for directing the action of the breath direct upon the fan, so that no portion of it is lost, the indications being thus rendered absolutely uniform and correct. With this really portable instrument the profession can with ease and certainty test the chest and lungs of their out-door patients, whilst in many instances it is believed they will direct it to be used by the patients themselves. In neat mahogany case, 6 inches by 4 inches £4 10 0

2590. STETHOMETER (Dr. QUAIN'S), for determining the expansion of the chest, in watch case, for the pocket £1 8 0

2592. **Laryngoscope** (Dr. JOHNSON'S), in pocket case, may also be used as an excellent ophthalmoscope £1 12 0

2593. DITTO (MACKENZIE'S) 1 12 0

2594. **Mouth Mirror,** with hinge and ivory handle . . . £0 5 6

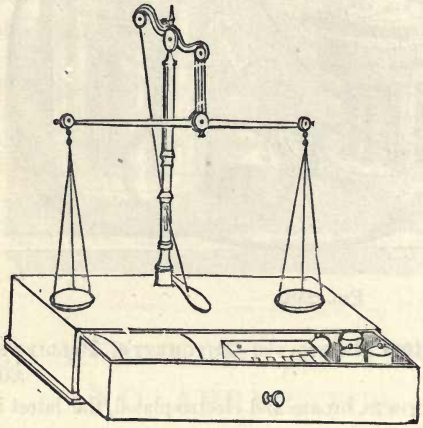
2595. PLAIN DITTO 0 3 6

2596. DITTO, DITTO, with pearl or shell 0 3 6

2597. INHALERS (CLENDON'S), 10s. 6d.; MURPHY'S, 6s.; and SKINNER'S 0 15 6

2598. SNOW'S CHLOROFORM INHALER, with 3 face pieces, in mahogany case 2 10 0

2599. INHALING TUBES, each . . . . £0 3 0 and 0 4 0



CHEMICAL AND ASSAY BALANCES,

Including those at low price, as well as others for strict scientific investigations; in each case the utmost precision and care may be relied on.

2600. **Plain Balance,** with 6-inch. beam, brass pans and weights from ½ grain to ¼ ounce, in oak case, 3s. 6d.; 7-inch., 4s. 6d.; 8-inch. . . £0 5 6

2600*. If with glass pans, to 1 ounce, per pair extra . £0 1 0 and 0 1 6

2602. DITTO, with glass pans and box-end beam, in mahogany case, 10s. 6d., 12s. 6d., and £0 15 6

2603. DISPENSING SCALES (fine grain), for surgeons and chemists, with glass pans, 8-inch. box beam, handsome brass fittings, with raising pulley, apothecary and grain weights from ¼ to 200 grains, in 10-inch. French polished mahogany box £1 8 0

2604. APOTHECARIES' WEIGHTS, in sets of 6 from 2 drams to ½ scruple, per set 0 0 9

2605. GRAIN WEIGHTS, as ordered by British Pharmacopœia, in sets of 6 weights from 200 to 10 grains, per set £0 1 0

2606. GRAIN WEIGHTS, in sets of 7 weights from 10 to ½ grain, per set 0 0 6

2607. **Chemical Balance,** with fine box-end beam on slide pillar, weights 1000 grains to $\frac{1}{10}$, tweezers, etc., complete, in polished mahogany box . £3 3 0

2608. SEPARATE WEIGHTS, for analytical purposes, in mahogany box, with tweezers, 1000 grains to $\frac{1}{10}$, 12s. 6d.; 1000 grains to $\frac{1}{100}$ . . £0 17 6

2609. CHEMICAL AND ANALYTICAL BALANCE, with 12-inch. beam, to carry 800 grains, and turn with $\frac{1}{50}$ of a grain, with divided beam, for slide weight, in French polished mahogany box, on which also it stands for use . £4 5 0

2610. DITTO, the same, in glass case, with adjusting screws . . 6 6 0

2612. **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 agate planes, fixed apparatus to move slide weight, with short pan for specific gravities, etc., in glass case, with adjusting screws £8 10

2613. THE SAME, in glass case, on 3 feet, without draw or apparatus to move slide weight, particularly suitable for pupils in the laboratory . £6 6 0

2614. CHEMICAL BALANCE, with 14-inch. beam for 1500 grains, turning when loaded with $\frac{1}{1000}$ grain, knife edges, agate centre and agate planes, divided beam, slide moving apparatus, short pan for taking specific gravities, in glass case, with adjusting screws, complete £15 0 0

2615. **Chemical Balance,** 16-inch. divided beam, to weigh 1½lbs. to 2lbs., turning when loaded with $\frac{1}{100}$ of a grain, slide moving apparatus, in glass case, with adjusting screws, £14; or with agate edges . . . £15 10 0

2616. THE SAME, for general use in the laboratory, weighing to 2lbs., and turning to $\frac{1}{10}$ grain, in glass case £8 10 0

2617. ASSAY BALANCE, with 8-inch. beam, to carry 50 grains in each pan, and turn to $\frac{1}{200}$ of a grain £5 10 0

2618. ASSAY BALANCE, with 10-inch. beam to carry 500 grains in each pan, turning distinctly with $\frac{1}{1000}$ of a grain, in glass case, with adjusting screws £12 12 0

2619. ASSAY BALANCE, with 8-inch. beam, to carry 200 grains in each pan, turning distinctly with $\frac{1}{1000}$ of a grain; the beam is constructed with 3 edges of agate, and the pans are supported by agate planes, with apparatus for moving the sliding weight £18 10 0

2620. **Bullion Balances,** to weigh 300, 1000, to 2000 ozs. at £30, £50, and 70 0 0

2622. 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

2623. 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.

2624. **Set of Troy Weights,** from 10 ozs. down to $\frac{1}{100}$ of an ounce, in box £3 3 0

2625. SET OF WEIGHTS, of 100, 50, 40, 30, 20 ozs. . . . 5 5 0

2626. SINGLE WEIGHT of 200 ozs. £2 2 0 | 2628. SINGLE WEIGHT of 400 ozs. 4 4 0
2627. „ „ 300 „ 3 3 0 | 2629. „ „ 500 „ 5 5 0

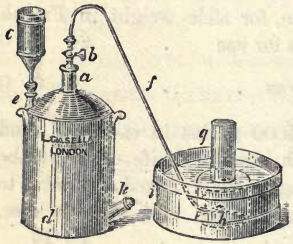


FIG. 2659.

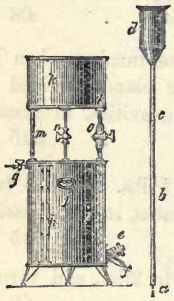


FIG. 2656.

FIG. 2674.

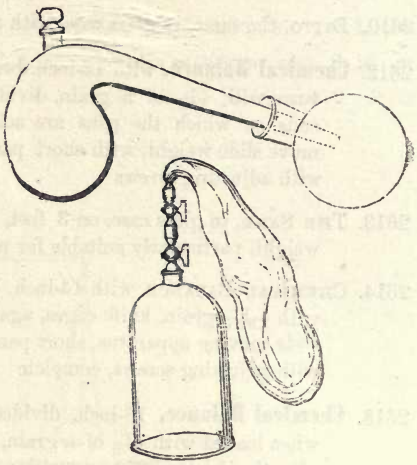


FIG. 2636.

CHEMICAL APPARATUS.

APPARATUS FOR EXPERIMENTS WITH GASES.

2630. **Gas Jars,** cylindrical, with ground ends, so that they may be closed with a plate of glass, for collecting and preserving gases, a set of 7, size from 6 to 50 oz. 10s. 6d.; or separately from 9d. to 2s. 6d. each.

DEFLAGRATING JARS, bell-shaped, stoppered, with ground base, for collecting and preserving gases:

2632. 1¼ pint size . . £0 2 0 | 2634. 6 pint size . . £0 4 0
2633. 3 „ „ . . 0 3 0 | 2635. 10 „ „ . . 0 5 6

Gas or Transfer Jars, with brass caps:

	Without Stop-cock.		With two Stop-cocks. Union Ferule bladder, etc. (Fig. 2636).	
Cubical Contents.	Plain.	Graduated.	Plain.	Graduated.
2636. 100 inches	3s. 6d.	6s. 6d.	13s. 0d.	16s. 0d.
2637. 150 „	4 0	7 0	13 6	16 6
2638. 200 „	4 6	7 6	14 0	17 0
2639. 250 „	5 0	8 6	14 6	18 0

2640. GLASS PLATES, for covering air jars, funnels, etc., each, 2d. to 9d.

2642. 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

2643. **Mercurial Pneumatic Trough,** porcelain . £0 2 6 to 0 3 6

2644. PNEUMATIC TROUGH, japanned tin, with movable shelf and tray, 3s. 6d.; 22 inches by 16 inches £0 12 6

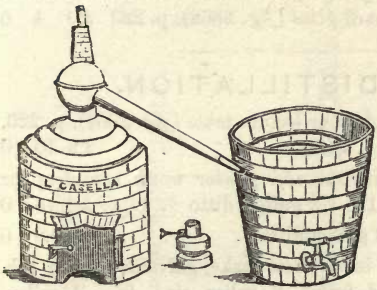


Fig. 2669.

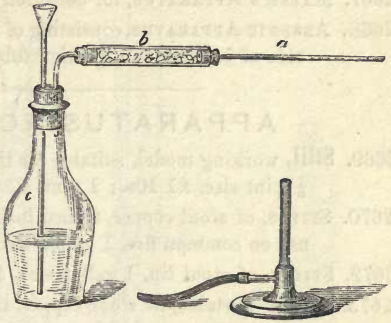


Fig. 2668.

2645. Bladders, prepared for containing gases, with brass ferule and stop-cock £0 5 0

2646. **Vertical Pneumatic Troughs,** jars with expanded mouths, 8-inch. high, 1s. 3d.; 12-inch. by 2-inch., 1s. 6d.; 16-inch. by 2½-inch., 2s. and £0 2 6

2647. Woulff's Bottles, best make, the necks carefully rounded for the cork, with 2 necks, ½ pint, 1s.; 1 pint, 1s. 3d.; 1 quart, 1s. 6d.; 3 pint, 2s. With 3 necks, ½ pint, 1s. 8d.; 1 pint, 1s. 10d.; 1 quart, 2s. 4d.; 3 pint . £0 2 9

2648. Safety Funnels, for gas bottles, with round or long bulbs, each 0 1 0

2649. Crum's Tube, for the collection of nitric oxide in the analysis of nitrates; thoroughly annealed £0 5 0

2650. **Stop-cocks,** glass in the middle of straight tubes £0 2 6 to 0 7 6

2652. Stop-cocks, brass, with male screw at each end, or with male and female screw, or with straight tube at each end for connection . . £0 3 0

2653. Pinch-cocks (Mohr's) 0 0 6

2654. „ (Bunsen's lever) 0 1 4

2655. Improved Acid Tap, see No. 2296.

2656. **Gas Holders** (Pepys's) (*fig.* 2656), p. 222, of japanned zinc, receiver 16 inch. by 12 inch., with three brass stop-cocks . . . £2 10 0

2657. Same size, copper 5 0 0

2658. Gas Holders, glass, about 6 gallons, with brass cap and stop-cock 2 10 0

2659. Gas Holders, stoneware, with japanned funnel, brass stop-cock (*fig.* 2659), p. 222, 1½ gallon £0 10 0

2660. Ditto, 3 gallons 0 15 0

2662. Gas Holder, Glass (Bunsen's), for mercury, complete . 0 7 6

2663. **Apparatus for the Electrolysis of Water,** Smee's cells, platinized silver and zinc plates, about 5 inch. by 4 inch., each . . . £0 7 0

2664. Groves's Cells, platinum and zinc plates, from . . 0 5 6

2665. Pair of Tubes, for collecting the H and O produced by decomposition of water £0 7 6

2666. Bunsen's Apparatus, for preparing pure detonating gas for analytical purposes £0 10 6

2667. MARSH'S APPARATUS, for detection of arsenic; tube with 2 bulbs, etc. £0 6 0

2668. ARSENIC APPARATUS, consisting of hydrogen-generator, fitted with tube for chloride of calcium and ignition tube of hard glass (*fig.* 2668), p. 223 £0 4 6

APPARATUS FOR DISTILLATION.

2669. **Still,** working model, suitable for the student or lecture table (*fig.* 2669), p. 223, ½ pint size, £1 10s.; 1 pint, £1 18s.; 1 quart . . £2 10 0

2670. 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

2672. STILLS, of stout tin, 1 gallon size, £1; 2 gallon ditto . . 1 8 0

2673. 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

2674. **Retorts,** of thin hard German glass (*fig.* 2674), p. 222, per dozen:

Size:	2-oz.	4-oz.	6-oz.	8-oz.	12-oz.	16-oz.	24-oz.	36-oz.	50-oz.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Plain	3 0	3 0	4 0	5 0	7 0	8 0	10 0	11 0	15 0
Tubulated and Stoppered	7 0	8 0	8 6	9 0	12 0	14 0	17 0	20 0	23 0

2675. RECEIVERS, plain, tubulated and stoppered, about same capacity and price as retorts.

2676. RETORT STANDS, small, on iron foot, with 2 rings £0 1 9 and £0 2 6

2677. RETORT STANDS, 13 inches high, with 3 rings . . . 0 3 4

2678. DITTO, DITTO, more massive, 16 inches, 4s.; 20 inches, 5s.; and 24 inches high, with larger rings £0 10 6

2679. **Gay Lussac Holder,** or vice for fixing retorts, iron or brass (*fig.* 2679), p. 228, £0 3 6 to £0 5 0

2680. TUBE HOLDER to affix to the retort stand, brass . . 0 2 6

2682. ALEMBICS of hard German glass, 2 oz. size, with movable heads 0 2 0

2683. „ of glass, large size (*fig.* 2683), p. 225, 5s., 6s. 6d., 7s. 6d., and 0 10 0

2684. TUBE ALEMBICS, for fractionizing small quantities of liquids . 0 1 6

2685. ADAPTERS, straight or bent glass; width of neck, 1 inch., 8d.; 2 inch., 1s.; 3 inch. £0 1 6

2686. LIEBIG'S CONDENSERS; glass tube in japanned tin, 30 inch., 7s. 6d.; 40 inch. £0 9 0

2687. SUPPORT for the same, with universal joint . . . 0 6 6

2688. „ mahogany polished 0 10 0

2689. **Liebig's Condenser,** entirely of glass, fitted complete, the condensing tube 36 inch. long £0 5 6

2690. TUBES for Liebig's condensers, 1s. 6d., 2s., and . . . 0 2 6

GRADUATED GLASS APPARATUS—ALKALIMETERS.

2692. **Bink's Alkalimeter,** for Centigrade testing (*fig.* 2692), p. 225, graduated into 100 divisions, equal to 100 decimillems, 700 or 1000 grains of water, or 50 cubic centimetres, 5s.; or upon glass stand (*fig.* 2692*), p. 225 £0 5 6

FIG. 2697.

FIG. 2692.

FIG. 2692*.

FIG. 2693.

FIG. 2700.

2693. **Gay Lussacs's Alkalimeter,** divided as No. 2692 (*fig.* 2693) £0 5 0

2694. SCHUSTER'S ALKALIMETER, 9d.; Clarke's tube retort and receiver 0 1 0

2695. MOHR'S BURETTE, with pinch-cock and caoutchouc tube (*fig.* 2697):

In cubic centimetres.		In decems. = 10 grains.	
10 c.c. in $\frac{1}{10}$ . .	£0 3 0	50 dec. in $\frac{1}{5}$ths. . .	£0 4 6
25 c.c. in $\frac{1}{5}$ . .	0 3 0	50 dec. in $\frac{1}{10}$th . .	0 5 0
25 c.c. in $\frac{1}{10}$ . .	0 4 0	100 dec. in $\frac{1}{1}$th . .	0 5 0
55 c.c. in $\frac{1}{2}$ . .	0 4 9		
60 c.c. in $\frac{1}{10}$ . .	0 6 0		
100 c.c. in $\frac{1}{1}$ . .	0 6 0		
100 c.c. in $\frac{1}{2}$ . .	0 6 6		
100 c.c. in $\frac{1}{5}$ . .	0 8 0		

This is the most generally useful form.

FIG. 2683.

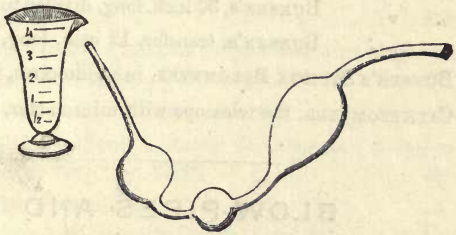


FIG. 2703. FIG. 2780.

2696. MOHR'S BURETTE, with glass stop-cock instead of pinch-cock, from 1s. to 1s. 6d. more.

2697. **Wooden Screw Clamps** for holding burettes (*fig.* 2697), blackened wood, 4s.; mahogany £0 5 0

2697*. ERDMANN'S FLOAT £0 1 6

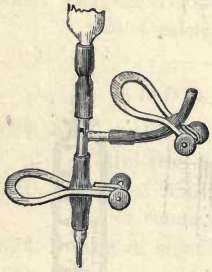


FIG. 2704.

FIG. 2706.

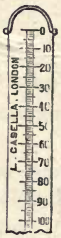


FIG. 2708.

FIG. 2717.

2698. PIPETTES, with mark on the neck, 5 c.c., 8d.; 10 c.c., 10d.; 25 c.c. £0 1 3

2699. FLASKS for measuring, with mark on the neck, 250 c.c., 1s. 6d.; 500 c.c., 2s.; ½ pint, 1s. 6d.; 1 pint, 2s. 3d.; 1 litre . . . £0 3 0

2700. STOPPERED TEST MIXERS (*fig.* 2700), p. 225, 1 litre in 100 divisions 0 9 0

2702. CYLINDERS, graduated: 1 deci-gallon in 100 divisions, 5s.; ½ litre ditto, 5s.; 1 litre ditto £0 8 0

2703. GLASS MEASURES (*fig.* 2703), p. 225, conical or cylindrical, accurately graduated:

1 drachm . . .	£0	1	0	5 oz. in ¼ oz. . . .	£0	1	3
2 „ . . .	0	1	3	10 „ in ½ oz. . . .	0	1	6
1 oz. in ½ drms. . .	0	0	9	20 „ in 1 oz. . . .	0	2	6
2 oz. in drms. . .	0	1	0	40 „ in 1 oz. . . .	0	3	6

2704. ⊤ TUBE for filling Mohr's burette from below by means of a syphon, 9d.; or with I R tube and extra pinch-cock (*fig.* 2704) . . £0 1 6

Eudiometers, for the analysis of gases:

2705. EUDIOMETER, MITSCHERLICH'S, graduated to $\frac{1}{100}$ of a cubic inch. 1 0 0

2706. „ URE'S (*fig.* 2706) 0 7 0

2707. „ VOLTA'S (*fig.* 2707), p. 228, about 50 c.c. to show $\frac{1}{10}$ c.c. 0 4 6

2708. „ BUNSEN'S, 30 inch. long, divided to millimetres (*fig.* 2708) 0 10 0

2709. „ BUNSEN'S, transfer, 12 inch. long, divided as above 0 5 6

2710. BUNSEN'S SYPHON BAROMETER, in millimetres, with stand and plummet 1 5 0

2712. CATHETOMETER, the telescope with micrometer, on stand . 3 10 0

BLOW-PIPES AND LAMPS.

2713. BLOW-PIPE, plain brass, 6d.; Black's japanned body . . £0 0 8

2714. BLACK'S JAPANNED DITTO, with ivory mouth-piece, 1s. 9d.; ditto, ditto, brass . £0 2 0

2715. CRONSTED'S BLOW-PIPE, with condensing bulb, 2s.; ditto, with ivory mouth-piece and two jets, 3s.; Wollaston's pocket portable blow-pipe £0 3 6

2716. PEPYS'S DITTO, with ivory mouth-piece and two jets . . 0 3 0

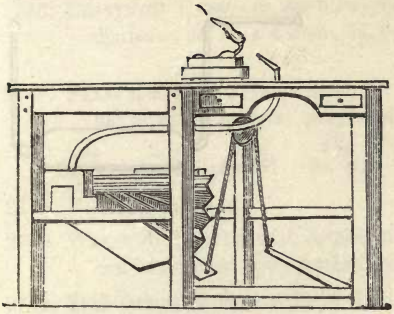


Fig. 2735.

Fig. 2730.

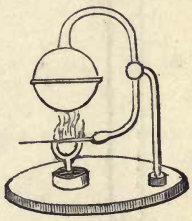


Fig. 2724.

2717. **Spirit Lamps,** with brass wick holders and ground glass caps (*fig.* 2717), p. 226, 2 oz. size, 1s. 6d.; 3 and 4 oz., each, 2s.; 5 to 7 oz., each £0 2 6

2718. Argand Lamp, chemical, with supports, cotton and adapter complete 0 7 0

2719. „ „ larger size, 5s. 6d.; ditto, with double concentric wick 0 14 6

2720. Spirit Lamp, on stand, with concentric wick and double current of air, embracing the improvements of Faraday, Rose, Liebig, etc. . £0 18 0

2722. **Gas Lamp or Burner,** with 4 inch. brass cylinder and gauze, for burning common gas mixed with air, giving intense heat without smoke, very useful in laboratories, for boiling, distilling, etc. £0 6 0

2723. Hofmann's Gas Lamp, with Argand burner, jet for blow-pipe, wire gauze and three-way stop-cock; by turning which it is adapted for a large flame or the blow-pipe £0 10 6

2724. Spirit Lamp or Blow-pipe, self-acting, on the Russian principle, with copper ball (*fig.* 2724) £0 7 6

2725. Davy's Safety Lamp, for coal-mines, etc. . . . 0 8 0

2726. Ditto, ditto, with lamp to lock 0 10 0

2727. Davy's Lamp (Dr. Clanny's Improved) with glass cover to show the flame, without disturbing the gauze cover £2 0 0

2728. **Bunsen's Gas Burners,** for burning a mixture of gas and air; single jet, brass tube, 1s. 6d.; ditto, with rose cap, 2s.; ditto, larger, 4s. 6d. and £0 6 0

2729. Water Oven, copper; outside measure, 9 inch. square . 2 2 0

2730. Hot Air Bath (Taylor's), the body 9 inches diameter and 5 inches high, japanned iron, with movable tray (*fig.* 2730) . . £0 15 0

2732. Ditto, with copper body, tinned inside 1 10 0

2733. Hot Oil Oven, of stout copper, rivetted, 7 inch. square by 6 inch. high 2 5 0

2734. Ditto, ditto, 9 inch. square by 8 inch. high . . . 2 12 6

2735. **Glass Blowers' Bellows,** best double action (full size), with table, brass mountings, lamp, improved jet holder, three jets and scissors (*fig.* 2735) £2 18 6

The above bellows, with screw-joints for exportation, 10s. 6d. extra.

2736. Glass Blowers' Bellows, circular, in round pedestal, with square table top, lamp, jet, etc., as above, much used in laboratories . . £4 4 0

Fig. 2707.

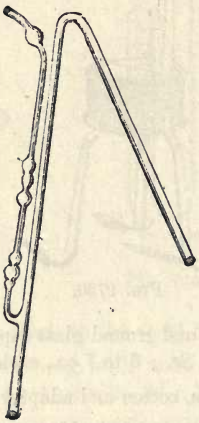


Fig. 2779.

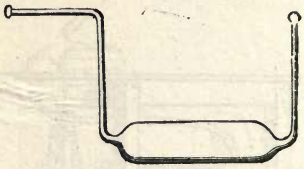


Fig. 2802.

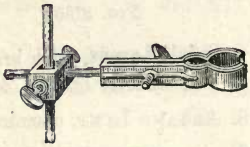


Fig. 2679.

2737. Hofmann's Combustion Furnace, with 5 rows of burners, £7; ditto, with 3 rows of burners £5 5 0

2738. Clay Burners for the above, per doz., 2s.; fire-clay tiles, per doz. . 0 2 0

APPARATUS FOR SOLUTION, EVAPORATION, AND FILTRATION.

2739. Beaker Glasses (best German), of uniform substance and annealed, sold only in sets:

No.	Contents.	Height.	Diameter.	No.	Contents.	Height.	Diameter.
1	2½ ozs.	2½ inches	1½ inches	7	36 ozs.	6¼ 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 „

2740. Nests of the above, No. 1 to 12, 12s.; No. 1 to 8, 5s.; No. 1 to 5, 2s. 6d.; No. 1 to 3 . . . . . £0 1 6

2742. Evaporating Capsules, Berlin porcelain, round bottoms; 2¾ inch. diameter, 4d.; 3¼ inch., 5d.; 3½ inch., 7d.; 3¾ inch., 7d.; 4 inch., 10d.; 4½ inch., 1s.; 4¾ inch., 1s. 3d.; 6 inch., 1s. 7d.; 7¼ inch., 2s.; 8½ inch., 2s. 8d.; 10 inch., 4s.; 12 inch., 6s. 6d.; 14 inch., 7s. 6d.; 15½ inch. (holding about 18 pints) £1 4 0

2743. Evaporating Capsules, Berlin semi-porcelain, shallow, round bottoms; 3½ inch. diameter, 5d.; 4¼ inch., 5d.; 5¼ inch., 6d.; 6½ inch., 8d.; 8 inch., 1s.; 9 inch., 1s. 4d.; 10½ inch., 2s.; 11¼ inch., 2s. 9d.; 12 inch., 3s. 6d.; 12½ inch., 4s. 6d.; 13¼ inch., 5s. 3d.; 14¼ inch., 6s.; 16 inch., 7s. 6d.; 18 inch. £0 12 6

2744. **Evaporating Capsules,** of glazed porcelain with handles, without spout, 1½ ozs. to 18 ozs., each . . £0 0 6 to £0 2 0

2745. Capsules, small and extra thin, for weighing the results of analysis ⅛ to 1½ ozs., each . . . . . £0 0 4 to £0 1 0

2746. Platinum Capsules, for blow-pipe experiments, approximate prices, ¼ inch. diameter, 1s. 3d.; ⅜ inch., 1s. 9d.; ½ inch., 2s. 6d.; ¾ inch., 4s.; 1 inch. £0 4 0

2747. Flasks, of hard German glass, for resisting varying and extreme temperatures, flat or round bottoms, per dozen:

Size:	2-oz.	4-oz.	6-oz.	8-oz.	12-oz.	16-oz.	20-oz.	30-oz.	40-oz.
	2s. 0d.	3s. 0d.	3s. 0d.	3s. 6d.	4s. 6d.	5s. 0d.	6s. 0d.	8s. 0d.	10s. 0d.

2748. Florence Flasks £0 0 3

2749. Washing Bottle, with double tubes, by which a continuous stream of water can be directed upon precipitates, etc., pint size . . £0 1 6

2750. **Test Tubes,** of the best hard German glass:

Diameter.	Length.	Per dozen.	Diameter.	Length.	Per dozen.
¼ inch	2 to 2½ inch. .	£0 0 4	¾ inch	6 inch. . .	£0 1 2
½ „	3 inch. . .	0 0 6	¾ „	7 „ . .	0 1 4
½ „	6 „ . .	0 1 0	1 „	7 „ . .	0 1 9
⅝ „	6 „ . .	0 1 1	1¼ „	8 „ . .	0 2 6

2752. Test Tube Stand, to hold 6 test tubes, 6d.; ditto, 12 ditto . 0 1 4

2753. Ditto, ditto, with 8 holes and pegs for drainage, 1s. 2d.; ditto, with 12 ditto £0 1 9

2754. Test Tube Stand, of polished mahogany, for 24, 5s.; for 36 0 6 0

2755. Test Glasses, for the lecture table, each, 6d., 9d., 1s., and . 0 1 6

2756. **Glass Jars,** on foot, for hydrometers, cold solutions, etc. (*fig.* 2756), p. 231:

Height.	Diameter.	Each.	Height.	Diameter.	Each.
8 inch.	1½ inch. .	£0 0 8	12 inch.	2 inch. .	£0 1 2
9 „	1¾ „ .	0 0 9	13 „	2⅓ „ .	0 1 6
10 „	1¾ „ .	0 0 10	14 „	2½ „ .	0 1 6

2757. 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. 6d.	5s. 6d.	8 ounce	£0 13 0	£0 14 0
2 „	8 0	8 0	16 „	0 15 0	0 16 0
3 „	9 0	9 0	1 quart	1 1 0	1 4 0
4 „	9 6	10 0	3 pint	1 8 0	1 13 0
6 „	11 0	12 0			

2758. Bottles, capped and stoppered, for acids and volatile fluids, 1 and 2 ozs., 1s. 6d.; 4 ozs., 2s.; 8 ozs. £0 3 0

2759. Bottles, of gutta-percha, for containing fluoric acid, 1 oz., 6d.; 2 ozs., 7d.; 4 ozs., 9d.; 6 ozs. £0 1 4

2760. **Pestles and Mortars,** of best Berlin porcelain, biscuit or glazed, of 2 inch. (inside) diameter, 9d.; 3½ inch., 2s.; 4½ inch., 2s. 6d.; 5 inch. £0 3 3

2762. Pestles and Mortars, best quality, to resist acids:

Diameter:	2¼-in.	2½-in.	3-in.	3¼-in.	3½-in.	4¾-in.	6¼-in.
In Wedgewood	0s. 10d.	1s. 0d.	1s. 0d.	1s. 2d.	1s. 4d.	1s. 10d.	4s. 3d.
In Stout Glass	1 0	1 6	2 0	2 0	3 0	3 6	4 6

2763. Pestles and Mortars, agate, the prices of which are approximate, and vary according to size and soundness of material employed; 1⅛ inch. diameter, 5s.; 1¾ inch., 5s. 6d.; 1⅞ inch., 6s. 6d.; 2 inch., 7s.; 2¼ inch., 8s. 6d.; 2½ inch.; 12s.; 2¾ inch., 15s.; 3 inch. 18s.; 3½ inch., £1 8s.; 4 inch. £2 12 0

2764. DIGESTERS, best porcelain, with handle and ground lid, 8 ozs., 2s.; 16 ozs., 2s. 6d.; 20 ozs. £0 3 0

2765. **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 .	0s. 2½d.	0s. 3d.		0s. 4d.		0s. 6d.	0s. 9d.	1s. 6d.
Wedgewood	0 5	0 7	0 8	0 10	1 0	1 3	1 9	

2766. FUNNELS, glass, small size, with long necks for filling retorts, etc., 4d. to £0 1 6

2767. FUNNEL, separating, with stop-cock, 3 inch., 4s. 6d.; 4 inch., 5s.; 5 inch., 5s. 6d.; 6-inch. £0 6 0

2768. FUNNEL STANDS, similar in form to retort stands, with ring; small, for 1 funnel, black wood, 1s.; ditto for two funnels, ditto . . . £0 2 0

The same in mahogany, 1s. 6d. and 3s.

2769. LARGER DITTO, for 1 funnel, black wood, 3s. 6d.; ditto, 2 funnels £0 4 6

The same in mahogany, 5s. and 6s.

2770. FILTERING PAPER, best white, per quire . . . 0 1 6

2772. „ „ Swedish, „ . . . 0 3 0

2773. FILTERS, circular, ready cut, in packets of 100 each, various, per packet, from £0 0 4 to 0 2 6

MISCELLANEOUS.

2774. **Arsenic Tubes,** of hard German glass, for the reduction of compounds containing arsenic, Berzelius's, Rose's, Clarke's, or Liebig's pattern, per dozen £0 1 0

2775. WATER HAMMER . . . . . £0 3 0 to 0 5 6

2776. FLINT GLASS TUBING, soft and easily worked, 18 to 36 inches, or longer, per lb. £0 1 6

2777. FLINT GLASS TUBING, best, assorted bore for thermometers, sealed when drawn, 4s. 6d. per lb.; enamelled ditto, per lb. . . . £0 7 0

2778. GERMAN GLASS TUBING, without lead, ¼ inch and under, 2s. 6d.; ½ to ¼ inch., 2s. 3d.; ¾ to ½ inch., per lb. £0 2 0

2779. SYPHON, plain, 6d. to 1s. 6d.; ditto, with improved suction tube (*fig.* 2779), p. 228 £0 2 6

2780. **Nitrogen Bulb** (HORSFORD'S), improved (*fig.* 2780), p. 225 . 0 0 8

2782. POTASH APPARATUS (MITSCHERLICH'S) (*fig.* 2782), p. 231 . 0 1 6

2783. POTASH APPARATUS (LIEBIG'S) (*fig.* 2783), p. 231 . . 0 1 6

2784. CORK BORERS, of polished brass, set of 6, 3s. 6d.; set of 12 . 0 5 6

2785. CUFF'S SCALE OF CHEMICAL EQUIVALENTS, with slide rule . 0 6 6

2786. GLAZIERS' DIAMONDS, very superior . . £0 15 6 and 0 18 6

2787. DIAMONDS, mounted, for writing on glass . 0 5 0 „ 0 8 0

2788. FILES FOR CUTTING GLASS, 9d.; rasps for corks 0 0 9 „ 0 1 0

2789. **Carbonic Acid Apparatus** (FRESENIUS and WILLS), for analysing carbonates of potash, soda, lime, etc. (*fig.* 2789), p. 231 . . . £0 1 6

2790. CARBONATES (PARNELL'S) testing apparatus (*fig.* 2790), p. 231 0 1 3

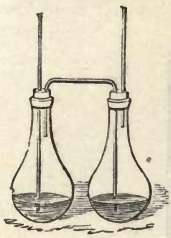


FIG. 2789.


FIG. 2783.

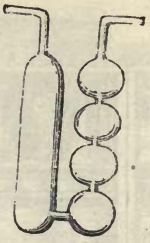


FIG. 2782.

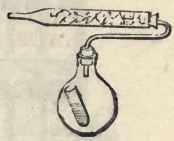


FIG. 2790.

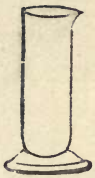


FIG. 2756.

2792. CHLORIDE OF CALCIUM TUBES, for drying gases, straight with 1 bulb £0 0 8

2793. „ „ „ V shape, with 2 bulbs . 0 1 0

2794. TEST PAPERS, (litmus, turmeric, starch or lead), in books, per dozen 0 1 6

2795. CRUCIBLES AND COVERS, best glazed porcelain £0 0 4 to 0 1 6

2796. DITTO, Hessian triangular, in nests of 3 to 8, per nest 0 0 5 „ 0 2 6

2797. DITTO, fire clay, best London make, 3 to 9 inch., per dozen 0 1 6 „ 0 13 6

Covers for above, at the same prices as the crucibles.

2798. CRUCIBLES, black lead, 20 sizes, 2½d. to 21s.; covers about two-thirds extra.

2799. CRUCIBLE TONGS, black iron, straight or bent, 18 inch., 1s. 9d.; 25 inch. £0 2 6

2800. CRUCIBLE TONGS, small; iron, 1s. 2d. and 1s. 6d.; brass, 1s. 9d. and £0 2 6

2802. DRYING TUBE (*fig.* 2802), p. 228 . . . . 0 1 0

PLATINUM BOILERS AND OTHER APPARATUS. Gold, silver, platinum, palladium, iridium, osmium, rhodium, ruthenium, aluminium, indium, magnesium, etc., etc., pure and chemically pure, in their various varieties.

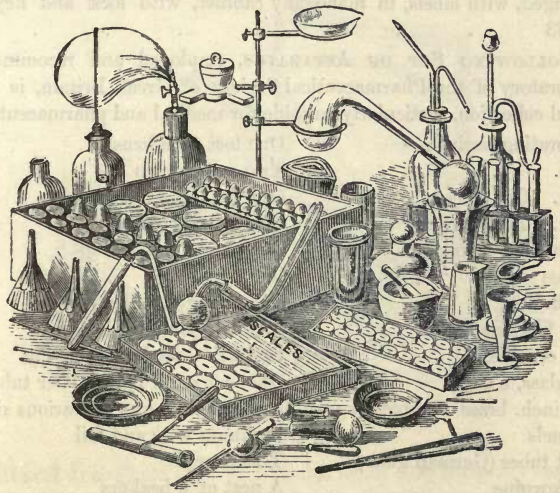


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FIG. 2803.

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 fully meet the wants of the lecturer, farmer, agricultural gentleman, and occasional experimentalist. As an article for exportation it presents the most practical arrangement and compact form in which chemical apparatus has yet been offered.

2803. **Youth's Chemical Cabinet** (*fig.* 2803), containing upwards of 60 chemicals, tests, and apparatus, without strong acids or other 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

2804. STUDENT'S 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.* 2804), p. 233 . . . . . £1 1 0

2805. THE FOLLOWING SET OF APPARATUS, employed and recommended in the Laboratory of the Pharmaceutical Society of Great Britain, is a practically useful collection, particularly suitable for medical and pharmaceutical students:

A set of evaporating basins:—
- One 6½ inch.
- One 8½ inch. One 4 inch.
- One 7¼ inch. Two 3 inch.

One retort stand and 3 rings
Two test glasses
One half-pint flask
One half-quire filter paper
Two porcelain crucibles
One measure glass, 5 ozs.
One pair of 8-inch. brass crucible tongs
Two glass funnels
One dozen test tubes (German glass)
One Black's blowpipe
One test tube brush
Two soup plates
One flat plate
Two spatula knives
One pair of scissors
One round file
One triangular file
One half-pound glass rod
One half-pound glass tubing
One foot small indiarubber tubing
Three dozen corks of various sizes
Platinum wire and foil
Test papers
A nest of 3 beakers

Packed in a neat case £1 5 0

2806. STUDENT'S CABINET, No. 3, in neat mahogany case, with 70 chemicals and same apparatus as No. 1, with stoppered bottles and turned wood boxes £2 2 0

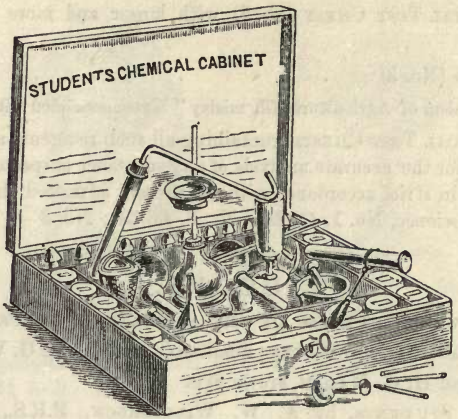

FIG. 2804.

2807. **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.* 2807) £3 3 0

2808. 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, Fresenius, Liebig, Galloway, etc., a great acquisition to naval or military officers, carefully packed for abroad £8 8 0

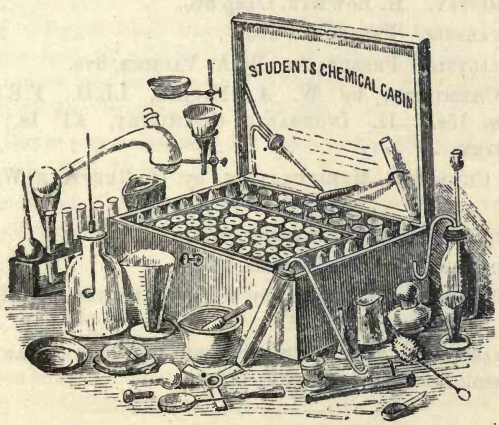

FIG. 2807.

2809. **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

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2811. DITTO DITTO (No. 3) 8 8 0

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2814. GLOBES in fancy cardboard boxes (*fig.* 2814), p. 235, with and without glass tops, 3½ inch., 3s.; 2½ inch., ter. only, 2s.; 1¾ inch., ter. only £0 1 0

FIG. 2819.

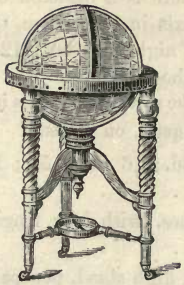

FIG. 2824.

FIG. 2825.

FIG. 2813.

FIG. 2814.

2815. GLOBES on pedestals, mahogany, 12 inch., £1 5s.; 10 inch., £1 1s.; 6 inch., 7s. 6d.; 4½ inch., 4s. 6d.; 3½ inch., 3s. 6d.; 3 inch., 3s. 6d.; 2½ inch., ter. only, 2s. 6d.; 1¾ inch., ter. only £0 1 6

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2817. SLATE GLOBES, with parallels of latitude and longitude marked. These globes may be drawn on with an ordinary slate pencil; on 3-legged black frame, 16 inch., £2 10s.; 12 inch., £1 10s.; on pedestal, 12 inch., £1 5s.; 10 inch. £1 1 0

2818. GLOBES for suspension to the ceilings of rooms, with rack and pulley, 18 inch., with bronzed iron meridian, £2 7s. 6d.; 16 inch., ditto, £1 17s. 6d.; 12 inch., ditto £1 1 0

These globes can be used at any desired height, and drawn up to the ceiling when no longer required.

2819. **Globes** in 3-legged black frame *(fig.* 2819), with bronzed iron meridian, 18 inch., per pair, £7; 16 inch., £5; 12 inch., £3; the single terrestial or celestial globe may be had at about half price; in mahogany frame, 18 inch., per pair, £9 9s.; 16 inch., £7 7s.; 12 inch. . . . £4 10 0

2820. COMPASS BOXES may be had with the above globes, at per globe, 18 inch., 6s. 6d.; 16 inch., 5s. 6d.; 12 inch. £0 4 6

2822. GLOBES in relief, with elevations, showing the mountains, twelve inches in diameter, on wooden pedestal, or for suspension, £1 10s.; in metal frame, with marble stand £2 10 0

2823. GLOBES in mahogany frame, 18 inch., per pair, £9; 16 inch., £7; 12 inch., £4 4s.; 10 inch., £3 3s.; 6 inch., £2 2s.; in black frame, 18 inch., per pair, £8 10s.; 16 inch., £6 10s.; 12 inch., £3 18s.; 10 inch. . £3 0 0

The single terres trial or celestial globe may be had at about half the price of the pair. Compasses in mahogany cases, may be had to fit on the horizon of these globes, see Nos. 457 to 469.

2824. GLOBES in handsome carved mahogany tripod frame *(fig.* 2824), 18 inch., per pair, £16 16s.; 16 inch., £13; 12 inch. . . . £7 10 0

The single terrestial or celestial globe may be had at about half the price of the pair.

2825. GLOBES in carved mahogany, pillar and claw frame (*fig.* 2825), 18 inch., per pair, £13 13s.; 16 inch., £10 10s.; 12 inch., . . £6 10 0

The single terres tial or celestial globe may be had at about half the price of the pair.

2826. **Armillary Spheres.** The armillary sphere is a skeleton of the celestial globe. It contains the earth, fixed on its axis in the centre, the sun and the moon. It serves to explain the phenomena of night and day; 12 inch., on high mahogany stand, £6 6s.; ditto, on low mahogany frame . . £5 5 0

The globe in the centre representing the earth is 3½ inches in diameter.

2827. A MODEL OF THE MOON, 4 inch. in diameter, on pedestal . 0 4 0

2828. **Quadrants of Altitude,** 18 inch., 6s. 6d.; 16 inch., 5s.; 12 inch., 3s. 6d.; 10 inch., 3s.; 6 inch. £0 2 0

2829. QUADRANTS for the cheap school globes, with iron rings, 16 inch., 4s. 6d.; 12 inch. £0 2 6

2830. LEATHER CLOTH COVERS FOR GLOBES, high stand, per pair, 18 inch., £1 10s.; 16 inch. £1 7s. 6d.; 12 inch., 17s. 6d.; low stand, per pair, 18 inch., £1 1s.; 16 inch., £1 1s.; 12 inch. £0 15 0

Brown Holland covers at lower prices than the above.

2832. **Orrery,** complete, 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 £10 10 0

2833. PLANETARIUM, 17½ inch., the earth, moon, and two planets only having rack motion £5 5 0

2834. DITTO, DITTO, as above, the movements being without rack . 3 13 6

2835. 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 £4 10 0

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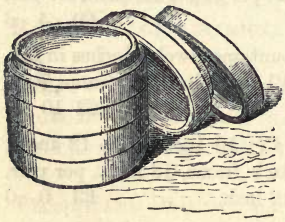

FIG. 2892.

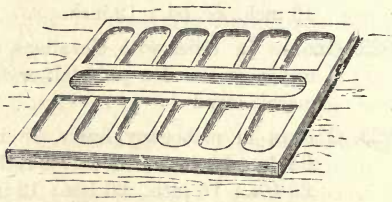

FIG. 2889.

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Royal	24 „ 19 „	0 4 6
Medium	22 „ 17 „	0 3 4
Demy	20 „ 15 „	0 2 6
Foolscap	17 „ 13½ „	0 1 10
Double thick imperial, per quire		0 16 6
Ditto, ditto, double elephant		1 10 0

* When not otherwise ordered it is sent hot-pressed.

2839. **Whatman's Machine Made Drawing Paper,** Turkey mill, nearly equal in strength and finish to the best hand made papers, the quality and finish, being as suitable in every respect for highly finished drawings:

	Size.	Price, per quire.
Double elephant	40 by 27 inches	£0 10 6
Imperial	30 „ 22 „	0 6 0
Royal	24 „ 19 „	0 3 6
Medium	22 „ 17 „	0 2 9
Demy	20 „ 15 „	0 2 0
Foolscap	17 „ 13½ „	0 1 6

The above, of 2nd quality, about 20 per cent. less.

2840. Best Drawing Cartridge: double elephant, 40 by 27 inch., 12s. 6d. per quire; imperial, 30 by 22 inch., per quire £0 7 6

2842. Ditto, ditto, machine made, 10 sizes, about 30 per cent. less.

2843. **Continuous Drawing Cartridge Paper,** to any required length without a join, takes ink and colour well, and will be found most useful for cartoons or diagrams for lectures: first quality, 54 inch. wide 1s. per yard; second quality, 54 inch. wide, 10d.; 60 inch. wide, 1s.; third quality, 54 inch. wide, 7d.; 60 inch. wide £0 0 9

2844. Mounted Drawing Papers, antiquarian on brown holland, per square foot £0 0 9

2845. Ditto, ditto, on union cloth 0 0 7

2846. Best Continuous Drawing Cartridge, on brown holland, of any length, 54 inch. wide, per yard £0 5 8

2847. Ditto, ditto, on union cloth 0 4 6

2848. **The Best Hand Made Drawing Paper** (double elephant), mounted on brown holland and on union cloth, of the following widths always in stock: 26 inch. at per yard run, brown holland, 2s. 9d.; union, 2s. 2d. 39 inch., brown holland, 4s.; union, 3s. 3s. 52 inch., brown holland 5s. 6d.; union £0 4 4

TRACING PAPERS.

		Inches.	Per quire.
2849.	No. 1. TRANSPARENT TRACING PAPER, double crown	30 by 20	£0 3 0
2850.	DITTO, double double crown . .	40 „ 30	0 6 0
2852.	No. 2. BEST DITTO, double crown . . .	30 „ 20	0 4 0
2853.	DITTO, DITTO, double double crown . .	40 „ 30	0 8 0
2854.	DITTO, DITTO, triple double crown . .	60 „ 40	0 16 0
2855.	GLAZED TRACING PAPER . . .	30 „ 20	0 4 0
2856.	DITTO, DITTO, finest	30 „ 20	0 6 0

2857. **Best French Tracing Papers,** of the most delicate and transparent texture. These papers are greatly esteemed on the Continent, and have obtained the highest approval of the engineers of this country, by whom they are in constant use: finest thin, about 30 by 40 inch., 7s. per quire, or £6 per ream; thick, about 30 by 40 inch., 10s. per quire, or per ream . £9 0 0

2858. CONTINUOUS TRACING PAPER, in rolls of 21½ yards by 43 inches wide: thin, finest quality, 15s. per piece; thick ditto, 17s.; thin, second quality £0 10 0

2859. CARBONIC OR TRANSFER PAPER, black 1 side, 4s. 6d.; black both sides 0 6 6

2860. DITTO, DITTO, blue, red, or white 1 side, 5s. 6d.; black lead, per quire 0 4 6

2862. OILED ROYAL, for copying machines, per quire . . 0 6 6

Superfine French vegetable papers in all sizes, parchment, and other tracing paper.

2863. **Patent Vellum Tracing Cloth or Linen,** the texture of which is remarkably fine and transparent; it is manufactured in pieces of about 24 yards each, and will be found very valuable for tracing, letter-press and copper-plate printing, and as a substitute for paper for all purposes where durability and strength are required:

No.	Width.	Quantity in each piece.	Price.	No.	Width.	Quantity in each piece.	Price.
4	18 inch.	24 yards	£0 15 0	8	38 inch.	24 yards	£1 16 0
5	30 „	24 „	1 6 0	10	41 „	24 „	1 18 0
6	36 „	24 „	1 10 0				

The above widths are approximate only. The vellum cloth should be kept in a dry place, and not subjected to pressure.

2864. **Black Lead Pencils,** of pure Cumberland lead and of finest quality, all lettered as to hardness, etc., per dozen £0 5 0

2865. STUDENTS' DRAWING PENCILS, assorted and lettered, much recommended for schools, per dozen £0 3 0

2866. BLACK LEAD POINTS, to fit compasses, bows, etc., very best, per dozen 0 1 3

2867. WOLFF'S CRETA LÆVIS PENCILS, in flat leather cases, assorted tints: case containing 12 tints, 7s.; ditto, 18 tints, 10s.; ditto, 24 tints 14s.; ditto, 36 tints £1 1 0

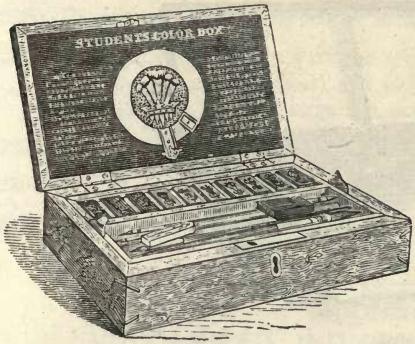

FIG. 2876.

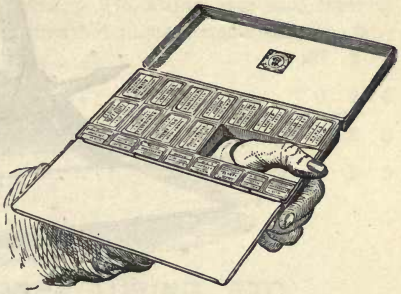

FIG. 2883.

2868. **Best Steel Pens,** carefully selected, in boxes, with all the latest improvements, per gross . . . . . £0 1 6 to £0 5 0

2869. BEST STEEL PENS, for drawing, mapping, and lithographic printing, per gross, 6s., 8s., 10s., and £0 12 0

PENHOLDERS, plain, silver, ebony, etc., etc. Quills and quill pens in small boxes, or in large quantities for exportation.

ARTISTS' MATERIALS,

Of superior manufacture, for the use of artists, architects, and engineers, including:

2870. **Superfine Water Colours,** in cakes, per dozen, from £0 7 6 to £1 10 0

2872. CARMINE, French blue, pink madder, malachite green, etc., per cake 0 3 0

2873. **Superior Oil Colours** in patent collapsible tubes, per doz. £0 6 0 to 1 4 0

2874. POLISHED MAHOGANY SLIDING BOXES, with cakes of colours or cups of moist colours, brushes, pencils, saucers, and 6 whole colours, 7s.; 12 ditto, 12s.; 18 ditto, 18s.; 24 ditto £1 4 0

2875. Or half colours 6 cakes, etc., as above, 4s. 6d.; 12 ditto, 7s.; 18 ditto, 10s. 6d.; 24 ditto £0 14 0

2876. STUDENT'S COLOUR BOX, of polished mahogany, with lock and tray, best selected colours, camels' hair brushes, pencil slab, etc. *(fig.* 2876) £0 16 0

2877. DITTO, DITTO, as above, with 12, 18, and 24 whole colours, set of best camels' hair brushes, slabs, pencil, etc., each, £1, £1 8s., and . £1 15 0

2878. Or with half cakes, 10s. 6d., 15s., and 1 0 0

2879. ENGINEERS' AND ARCHITECTS' MAHOGANY COLOUR BOXES, with lock, tray, and slabs, 12 selected colours, sable and camels' hair brushes, etc. £1 1 0

2880. SUPERIOR BOXES, with ink slab, water glass, Indian ink, indiarubber, chalk stumps, porte crayon, brush rests, brushes, pencils, and slope tiles, 12 cakes, £1 1s.; 18 cakes £1 10 0

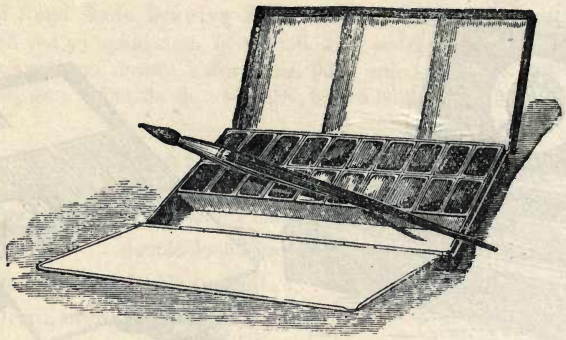

FIG. 2882.

2881. SUPERIOR BOXES, with 24 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.

2882. **Best Japanned Sketching Boxes,** with folding pallet, lid, and space for brushes containing 3 to 30 cups or half cups of the improved moist water colours, selected, for figure, landscape and miniature painting, with sable or camels' hair brushes, washing brushes, etc. (*fig.* 2882):

	With colours and Camel Hair Brushes.				With Colours and Sable Hair Brushes.			
	Whole.		Half.		Whole.		Half.	
	£ s. d.		£ s. d.		£ s. d.		£ s. d.	
Box containing 8 cups	0 16 0		0 9 6		1 0 0		0 12 6	
„ „ 12 „	1 2 0		0 13 6		1 8 6		0 17 0	
„ „ 16 „	1 13 6		0 19 0		2 0 0		1 3 6	
„ „ 20 „	2 2 0		1 3 6		2 7 6		1 9 0	
„ „ 30 „	3 3 0		1 13 0		3 10 0		2 0 0	

2883. JAPANNED THUMB HOLE BOXES (*fig.* 2883), p. 239, with 20 whole and half cups, the best and most useful selection for figure and landscape (recommended) £1 15 0

2883*. JAPANNED THUMB HOLE BOXES, all half cups . . 1 0 0

2884. SUPERFINE CAMELS' HAIR BRUSHES (gold and silk bound like sables), with best handles, per dozen, 1s. 6d., 2s., 3s., and 4s.; swans' quills, each, 6d., 9d., 1s., and £0 1 6

2885. SKY AND WASHING BRUSHES, wire bound, with best handles, each, 1s., 1s. 6d., and £0 2 6

2886. SUPERFINE SABLE BRUSHES (silk and gold bound), with best handles, each, 6d., 9d., 1s., and 1s. 6d.; swan and eagle quills, each, 2s. 6d., 3s., 4s., and 0 5 0

Every description of brushes for oil and water colour paintings.

2887. **Best Block Drawing Books,** half-bound, of all sizes with leather backs and corners, for loose sketches or drawings, each, from £0 1 6 to £0 17 0

2888. SLABS, PALLETS, ETC., for artists' use.

2889. SLANT TILES (*fig.* 2889) p. 236, with 3 deep spaces, 4 by 2½, 6d.; ditto, 6 deep spaces, 7¾ by 3⅛, 1s. 3d.; ditto, 12 deep spaces, 7⅝ by 6, with centre well £0 2 0

If extra deep, 6d. each additional.

2890. PALLETS, oblong or oval, 6 to 10 inches wide, each £0 0 9 to £0 1 6

2892. CABINET NEST OF SIX SAUCERS (*fig.* 2892), p. 236, fitting over each other to keep the colours moist and clean when not in use: small size, 1s. 3d.; middle size, 1s. 6d.; large size, per set . . . £0 2 0

2893. Or, in round leather case, each, 2s. 9d., 3s, and . . . 0 3 6

2894. CIRCULAR TILE CUP OR BASIN, for sponge . . . 0 3 0

2895. COLOUR SAUCERS, per dozen, from . . £0 1 0 to 0 1 6

VULCANIZED INDIARUBBER TUBING, ETC.

2896. **Best Elastic Tubing,** of pure indiarubber, the most flexible that is made.

Internal diameter.	⅛-in.	¼-in.	⅜-in.	½-in.	⅝-in.	¾-in.	1-in.	1¼-in.
Price, per foot .	3½d.	4½d.	5½d.	7½d.	11d.	1s. 1d.	1s. 7d.	2s. 3d.

2897. 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 price as without.

2898. **Glazed Gas Tubing,** for portable gas lamps, surgical purposes, etc.:

External diameter.	¼-in.	⅜-in.	½-in.	⅝-in	¾-in.	⅞-in.	1-in.
Price per ft.	4½d.	4½d.	6½d.	9d.	1s.	1s. 4d.	1s. 7d.

2899. WASHERS, best quality, for glass gauges, steam boilers, etc., flat form, 8s.; round ditto, 10s. per lb.

2900. VULCANIZED INDIARUBBER, in sheets, 2s. to 6s. 6d. per lb. according to thickness and quality.

2902. WASHERS, BUFFERS, BEARING AND CHECK SPRINGS, VALVES, etc., in any size or quantity, on the best terms.

Indiarubber Cushions, Pillows, and Swimming Belts, circular and square.

2904. AIR-TIGHT CUSHIONS, for railway travelling, each £0 6 6 to £0 10 6

2905. SWIMMING BELTS, of best make . . 0 7 6 „ 0 10 6

ADDENDA.

2905*. **Disinfecting Thermometer,** self-registering, for showing the exact heat or registering part temperature in any part of disinfecting apparatus, 15s. 6d.

2906. **Dynes' Hygrometer,** with which the *exact* dew-point is more readily and distinctly shown than by any other means. The fluid employed is iced water, by which the dew is made to deposit on a flat surface of black glass, thus combining the neat delicacy of Daniell's or Regnault's, giving at once a perfectly plain indication, without the difficulty of obtaining highly rectified spirit £1 10 0

HYDROSTATIC WEIGHING MACHINES, for any weight from 1 ton up to 100 tons, or for showing the force exerted in ploughing, etc. The action of these machines is to weigh goods by suspension as in the ordinary circular balance, so that the mere act of lifting them by crane for shipment, etc., shows the weight at the same time. Attached at the end of the chain or pulley with which the objects as hogsheads, cannon, timber, plate armour for ships, etc., are slung or lifted, their value can hardly be over-estimated.

SIZES, PRICES, AND WEIGHTS OF THE MACHINES.

2908. Three ton machine, of about 50lbs. weight . . . £14 10 0

2909. Five „ „ „ „ 60 „ „ . . . 18 10 0

2910. Ten „ „ „ „ 90 „ „ . . . 20 0 0

2912. Twenty ton „ „ „ 180 „ „ . . . 28 10 0

2913. Thirty „ „ „ „ 250 „ „ . . . 36 0 0

2914. Fifty „ „ „ „ 350 „ „ . . . 50 0 0

The system admits of no limit in power, and machines may be made to order up to any capacity. Those of 10, 20, 30, 40, and 50 cwt. capacity, same price as three ton machines.

2915. MAP METRE (Improved), with scale divided to 176, each division being equal to 5 yards, to correspond with the Ordnance Survey of 6 inches to the mile £0 14 6

2916. **Sounding and Dredging Apparatus,** as used by the Admiralty for measuring great depths in the sea, or bringing specimens from the bottom. Price according to size and depth for which it is required £2 2 0 to £10 10 0

2917. TELESCOPES for tourists, in **aluminium,** very light, viz., about one-third the weight of the usual kinds, with caps and straps, as *figs.* 1354, 1374, and 1375,

4 draw with $1\frac{1}{8}$-inch. object glass, £4 4 0 | 4 draw with $1\frac{7}{10}$-in. object glass £6 6 0
„ „ $1\frac{4}{10}$-inch. „ „ 5 15 0 | „ „ 2-inch. „ „ 7 16 0

2918. TELESCOPES, marine, in **aluminium,** of light weight, as above:

1 draw, with $1\frac{4}{10}$-in. object glass £5 8 0 | 1 draw, with 2-in. object glass £7 15 0
„ „ $1\frac{7}{10}$-in. „ „ 6 0 0 | „ „ $2\frac{1}{4}$-in. „ „ 8 12 6

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TO

L. CASELLA'S CATALOGUE.

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