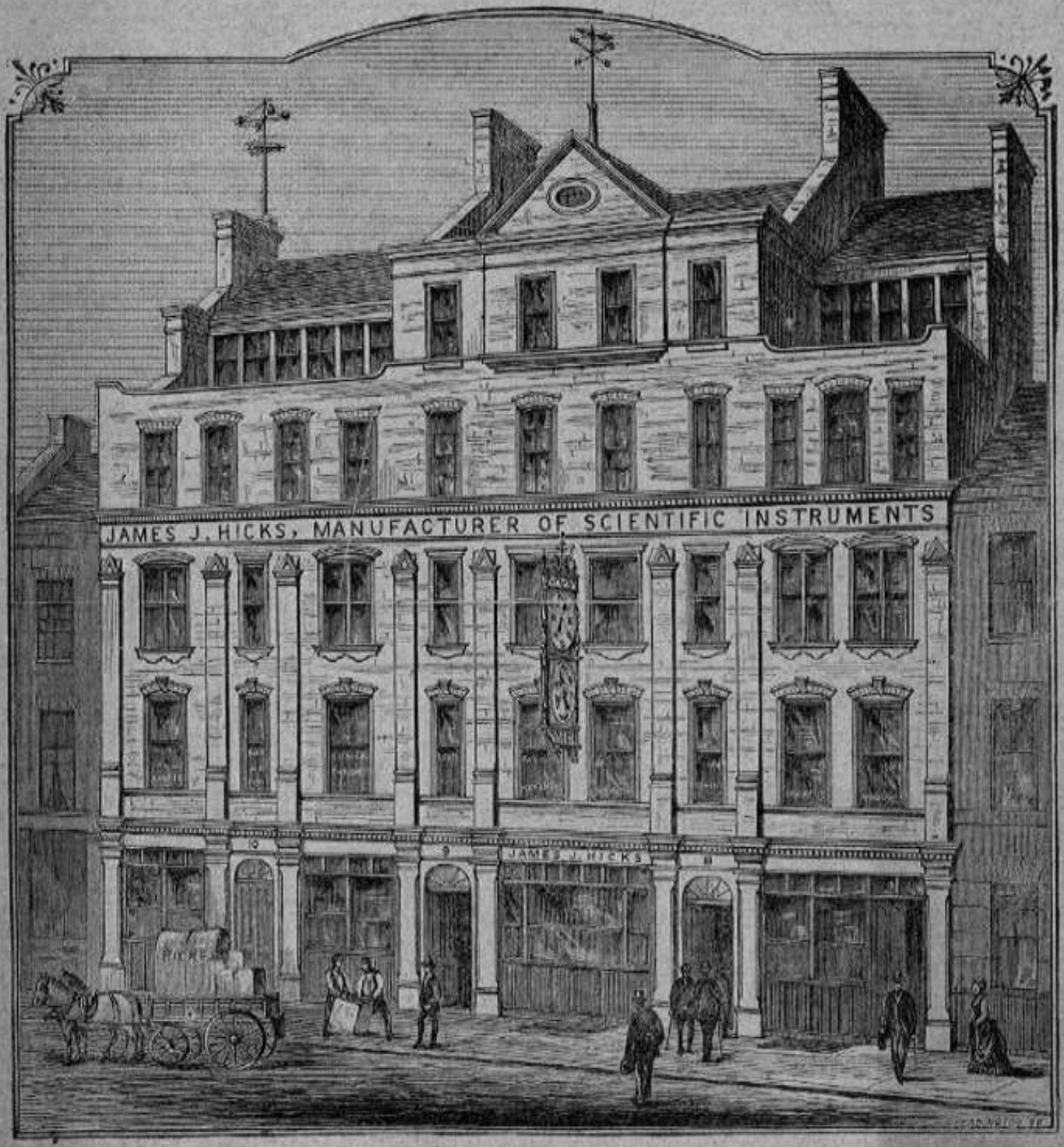
ANEROID BAROMETER

AND

Surveying Instrument Catalogue

BY



8, 9 & 10, HATTON GARDEN, LONDON, E.C.


VR
INTERNATIONAL
INVENTIONS
EXHIBITION
LONDON. 1885
THE EXECUTIVE COUNCIL HAVE
UPON THE RECOMMENDATION OF THE
INTERNATIONAL JURIES AWARDED A
GOLD MEDAL
TO James J. Hicks
FOR Aneroid barometers.

ILLUSTRATED PRICE LIST

OF

ANEROID BAROMETERS.

Sunshine Recorders, Wind Vanes

AND

Surveying Instruments

MANUFACTURED BY

JAMES J. HICKS

Instrument Maker by Appointment to

His Majesty's Home and Indian Governments and

The Board of Inland Revenue.

Also to the Governments of China, Germany, Japan, Turkey and the United States, and the Principal Observatories, Universities and Colleges throughout the World.

8, 9 & 10, HATTON GARDEN

LONDON, E.C.

Awarded NINE MEDALS Paris Exhibition, 1900.

LONDON:
JOHN TAYLOR
24
GRAYS INN ROAD
W.C.

PREFACE.

THE fourth edition of my Special Catalogue of Aneroid Barometers being exhausted, I have taken the opportunity to thoroughly revise and extend the contents. As in previous editions, I have added a number of other useful instruments, the illustrations and particulars of which I am certain will prove of service to Surveyors, Tourists, and others, more particular among which are the Meteorograph by W. H. Dines, Esq., F.R.S., the Radio-Integrator designed by Dr. W. E. Wilson, F.R.S., the Patent Mountain Aneroid Barometer of Col. Watkin, C.B., R.A., and the Patent Altimeter for Kites and Military Balloon Experiments, of which I have been appointed Sole Maker by the inventors. I desire, however, to point out that this list must not be considered a complete catalogue of my business; ***and friends and patrons, therefore, who do not find what they seek in its pages should name what they require, when other lists will be sent them.*** I wish again to announce that any pocket Aneroid can now be made of Aluminium, which renders it much lighter to carry. In fact almost any Scientific Instrument can now be made of this metal, which is a positive boon to those travelling through regions where weight is an important consideration.

It affords me pleasure to record the continued success that has attended the "WATKIN" Aneroid Barometer. The exceedingly open scale, and consequent easy reading, especially for altitudes, has been acknowledged by many of the most eminent Engineers and Scientists of the day. It is also made in watch size, the difficulties which prevented this before having been successfully surmounted. Above all, the price of it has been considerably reduced; a fact due to the increased demand and more experienced method of manufacture. The Testimonials printed with this Catalogue speak for themselves.

I continue to employ a large staff of the very best workmen in the trade, in the careful construction of Aneroid Barometers of all kinds; and the materials used, together with the care and attention bestowed upon their manufacture cannot be surpassed. I therefore confidently solicit a continuance of the patronage, from all parts of the Globe, which it has been my good fortune to enjoy for so many years.

8, 9 & 10, HATTON GARDEN,

LONDON, *April, 1907.*

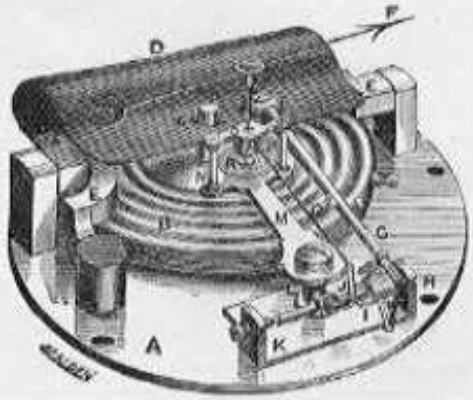
Telegraphic Address—"LENTICULAR, LONDON."

Telephone—6042 CENTRAL.

THE FOLLOWING CHAPTER ON

The Construction of the Aneroid Barometer

WILL PROBABLY BE FOUND OF INTEREST.



Scale about 3-4ths.

THE ANEROID BAROMETER as shown above consists of the vacuum chamber (B), composed of two discs of corrugated German silver firmly soldered together, forming a box, from which the air is exhausted, and to each side of which is attached a brass centre —one with a thread on it to screw the chamber to the base plate (A), the other plain, with a hole drilled across it to receive a knife edge (C), which suspends the vacuum chamber from a powerful spring (D) as seen in the Drawing. On these principally depends the action of the instrument. The base, or foundation plate (A), is of iron or brass, and circular in form; to this the vacuum chamber is attached, while a strong iron carriage (E), fixed across the chamber, supports the mainspring (D), which, acting in direct opposition to the undulations of the vacuum chamber (B), give rise to the variations of the needle (F) on the dial. To the mainspring (D) is attached the main lever (G), a compound bar of iron or brass, which compensates for errors arising from changes of temperature. To the end of this arm is attached a small rod of steel to connect it to the regulator, which is furnished at its centre with a vertical arm of brass by which it communicates with the movement.

The "movement" is furnished with a stout base-plate (K), to the centre of which a short brass pillar is screwed, bearing a projecting arm (M), at the end of which are two smaller brass pillars (N), supporting a thin plate of brass (O), and between these and the flat arm works the arbor (P), on which is fixed the index. A piece of fine chain (Q), as used in the works of watches, is attached to and works round the arbor (P) on the rise or fall of the lever, and a fine hair spring of coiled steel (R) keeps the hand in its proper position.

The regulator (I) supports a vertical brass arm (J), to which is attached the fine chain which works round the arbor.

The connection having been made between those various parts, the entire movement is screwed to the iron foundation-plate (A) and connected with the main lever by means of a fine steel rod at the end, and the communication thus rendered complete between the various parts of the instrument, it is ready for the final adjustment of the dial and hand.

This done, it only remains to graduate the scale, which is effected by placing the instrument under the glass receiver of an air pump with a Standard Mercurial Barometer attached. The air is then exhausted, and, as the mercury falls inch by inch, the Aneroid Scale is pointed off and graduated from 31 inches to any required range.

Many eminent authorities, including the late ADMIRAL FITZROY and MR. GLAISHER, F.R.S., the Aeronaut, have testified to the extreme sensibility and consequent value of the Aneroid, and have placed on record their appreciation of its quickness in showing the variations of atmospheric pressure.

In Observatories, where Mercurial Standard Barometers are in use, the Aneroid is most valuable in its capacity of giving earlier indications of changes than can be obtained from the slower action of the Mercurial column. It being an acknowledged fact that among the almost innumerable descriptions of Meteorological instruments in existence at the present day the Aneroid takes a very high, if not the highest place, in its utility to mankind, it is only necessary in concluding this short chapter to sum up its advantages as follows :—

1.—It is extremely portable and can be carried in any way, or subjected to any motion without the slightest fear of disturbing its action.

2.—It can be made in an almost infinite variety of sizes, and even in its least expensive forms its appearance is elegant and compact.

3.—To the Miner, Surveyor, and Tourist, it indicates differences of altitude with rapid and unerring accuracy.

4.—To the Mariner it is simply indispensable, as from its greater delicacy it enables him to prepare for the coming storm a considerable time before the mercurial Barometer would record its approach—an advantage which may often decide the fate of his ship.

5.—It is not easily broken, and, when treated with ordinary care, not liable to get out of order.

6.—It is produced by me at such a price as to place it within the reach of all.

J. J. HICKS.

8, 9 & 10, HATTON GARDEN,
LONDON, *April, 1907.*

Aneroid Barometers.

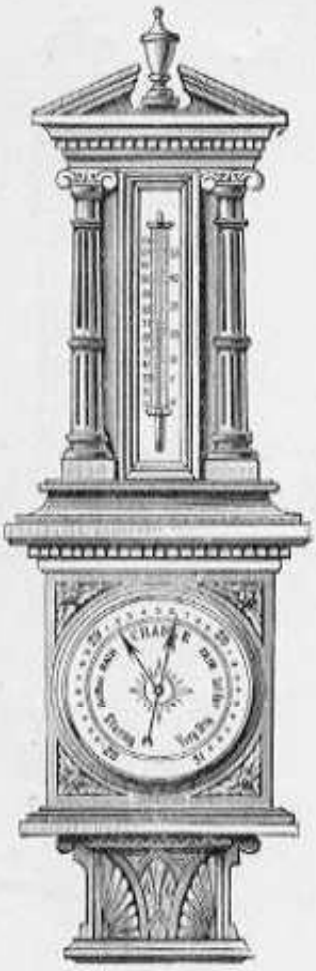


Fig. 1.

Fig. 2.

Fig. 3.

No.		£	s.	d.
1	**EGYPTIAN PATTERN,** Fig. 1, handsomely carved, 8-inch best silvered metal or enamelled glass dial and cylinder bulb thermometer	6	6	0
2	... Do. ... „ Do. 10-inch dial	7	0	0
3	**GOTHIC DESIGN,** Fig. 2, richly ornate, castellated top, 8-inch best silvered metal or enamelled glass dial, and spiral bulb thermometer	8	8	0
4	... Do. ... „ Do. 10-inch dial	9	9	0
5	**IONIC DESIGN,** Fig. 3, richly carved, 8-inch best silvered metal, or enamelled glass dial and spiral bulb thermometer	7	15	0
6	... Do. ... „ Do. 10-inch dial	8	15	0

NOTE.—In any of the pages of the price list where ornamental centres are not shown on the illustrations they can be added, if desired, at an extra charge for 5-inch, 1/6; 6-inch, 2/-; 8 or 10-inch, 2/6. And OPEN DIALS can be made to any barometer at an extra price of 5/-

Aneroid Barometers.

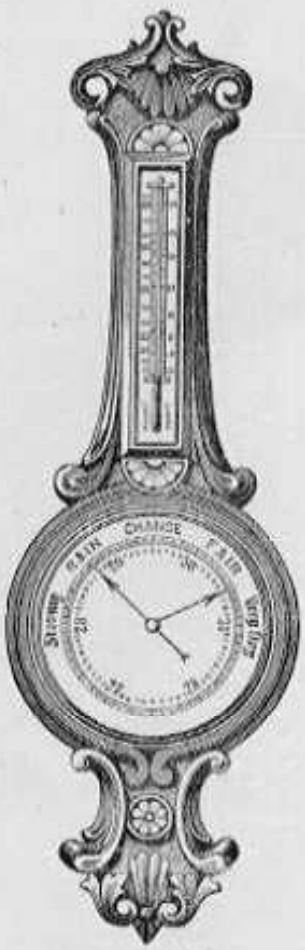


Fig. 4.

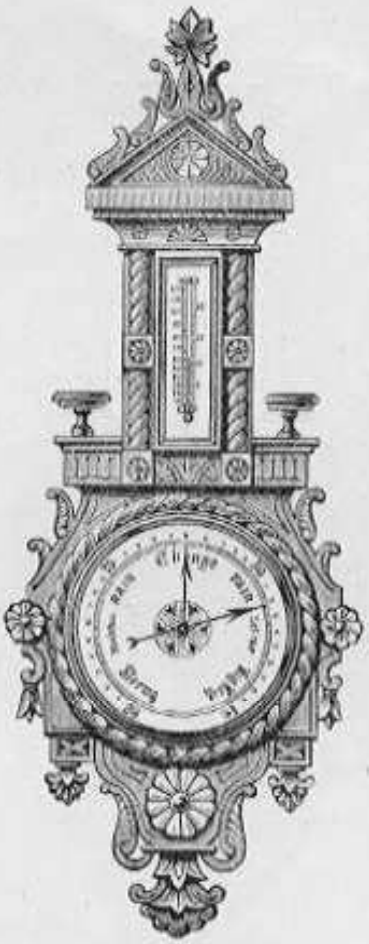


Fig. 5.

Fig. 6.

No.			£	s.	d.
7	**SHELL PATTERN,** Fig. 4, finely carved, with 5-inch card dial and cylinder bulb thermometer		2	0	0
8	... Do. ... „ Do. 6-inch		2	10	0
9	... Do. ... „ Do. 8-inch		3	3	0
10	... Do. ... „ Do. 5-inch, best silvered metal or enamelled glass dial		2	5	0
11	... Do. ... „ Do. 6-inch dial		2	15	0
12	... Do. ... „ Do. 8-inch dial		3	13	0
13	**MODERN FRENCH PATTERN,** Fig. 5, elaborately carved, 8-inch best silvered metal or enamelled glass dial and thermometer		5	10	0
14	... Do. ... „ Do. 10-inch dial		6	10	0
15	**FLORAL DESIGN,** Fig. 6, handsomely ornamented, 8-inch best silvered metal or enamelled glass dial and spiral bulb thermometer		5	0	0
16	... Do. ... „ Do. 10-inch dial		6	0	0

Aneroid Barometers.

Fig. 7.

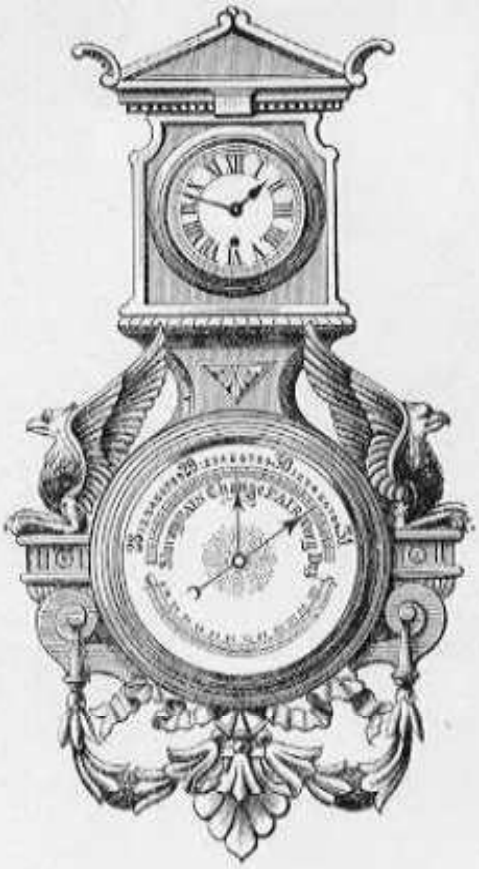


Fig. 8.

Fig. 9.

No.		£	s.	d.
17	**COMBINED LEAF PATTERN,** Fig. 7, richly carved 5-in. best silvered metal or enamelled glass dial, with horizontal clock, and cylinder bulb thermometer	3	3	0
18	Do. do. with lever clock	4	0	0
19	Do. do. 6-in dial with horizontal clock	3	10	0
20	Do. do. „ „ lever clock	4	10	0
21	**COMBINED GRIFFIN PATTERN,** Fig. 8, elaborately carved, 6½-in. best silvered metal or enamelled glass dial, curved thermometer and horizontal clock	7	0	0
22	Do. do. with lever clock	8	5	0
23	Do. do. 8-in. dial and horizontal clock	9	0	0
24	Do. do. „ „ lever clock	9	15	0
25	**EARLY ENGLISH DESIGN,** Fig. 9, 5-in. best silvered metal or enamelled glass open dial and horizontal clock at foot	3	12	0
26	Do. do. lever clock	4	7	0
27	Do. do. 6-in. horizontal clock	4	7	0
28	Do. do. „ lever „	5	2	0

Aneroid Barometers.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

No.					£	s.	d.
29	GOTHIC DESIGN, ...	Fig. 10,	5-in. silvered metal dial and cylinder bulb thermometer in frame ...		2	17	0
30	... Do. ...	„	Do. 6-in. dial		3	5	0
31	... Do. ...	„	5-in. card dial		2	12	0
32	... Do. ...	„	6-in. „		3	0	0
33	RENAISSANCE STYLE,	Fig. 11,	handsomely carved, with 5-in. card dial and cylinder bulb thermometer		2	12	0
34	... Do. ...	„	Do. 6-in.		3	0	0
35	... Do. ...	„	Do. 8-in.		3	10	0
36	... Do. ...	„	with 5-in. silvered metal or enamelled glass dial...		2	17	0
37	... Do. ...	„	Do. 6-in.		3	5	0
38	... Do. ...	„	Do. 8-in.		4	0	0
39	OLD ENGLISH DESIGN,	Fig. 12,	with 5-in. open card dial and cylinder bulb thermometer		2	7	6
40	... Do. ...	„	Do. 6-in.		2	15	0
41	... Do. ...	„	Do. 8-in.		3	5	0
42	... Do. ...	„	with 5-in. open silvered metal or enamelled glass dial		2	12	6
43	... Do. ...	„	Do. 6-in.		3	0	0
44	... Do. ...	„	Do. 8-in.		3	15	0
45	FLORAL DESIGN, ...	Fig. 13,	5-in. silvered metal dial and cylinder bulb thermometer in frame ...		2	17	0
46	... Do. ...	„	Do. 6-in. dial		3	5	0
47	... Do. ...	„	5-in. card dial		2	12	0
48	... Do. ...	„	6-in. „		3	0	0

Aneroid Barometers.

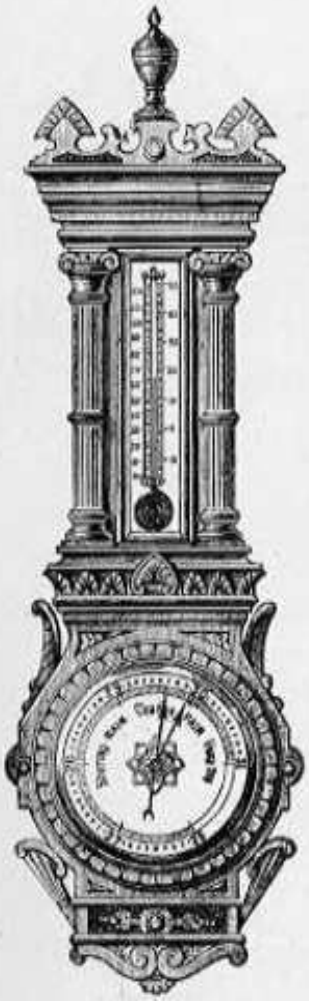


Fig. 13A.

Fig. 13C.

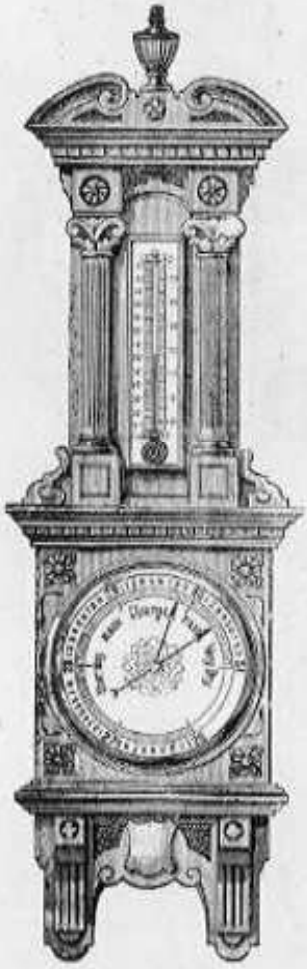


Fig. 13B.

No.		£	s.	d.
48A	**KHEDIVE PATTERN,** Fig. 13A, elaborately carved, with 8-in. metal dial and thermometer	4	7	6
48B	... Do. ... ... with card dial and thermometer ...	4	0	0
48C	**EGYPTIAN DESIGN,** Fig. 13B, handsomely carved, with 8-in. metal dial and thermometer	4	17	6
48D	... Do. ... ... with card dial and thermometer ...	4	10	0
48E	**BEADED "DOTTI" PATTERN,** Fig. 13C, with 10-in. metal dial ...	4	10	0
48F	... Do. ... ... " " " card dial ...	4	2	6

NOTE.—Intending purchasers can have any of the designs of pendant Aneroids in this Catalogue altered or modified to suit their own taste, and frames can be made of either light or dark oak or walnut. Every instrument in this class is made of one quality only, viz., the best. The frames are real works of art, being handsomely and perfectly carved and thoroughly solid and durable, whilst the Aneroid movements are of guaranteed excellence.

Aneroid Barometers.

Fig. 14.

Fig. 15.

Fig. 16.

No.			£	s.	d.
49	**LOUIS XIII. PATTERN,** Fig. 14, finely carved, with 5-in. silvered metal or enamelled glass dial ...		2	17	0
50	... Do. ... ,, Do. 6-in. dial		3	5	0
51	... Do. ... ,, Do. 8-in. ,, ...		4	0	0
52	... Do. ... ,, Do. 5-in. card dial		2	12	0
53	... Do. ... ,, Do. 6-in. ,, ...		3	0	0
54	... Do. ... ,, Do. 8-in. ,, ...		3	10	0
55	... Do. ... Fig. 15, in handsomely carved solid oak frame, with 6-in. best engraved silvered metal or enamelled glass dial and circular thermometer		3	15	0
56	... Do. ... ,, Do. 8-in. dial		4	15	0
57	... Do. ... ,, Do. 10-in. ,, ...		6	0	0
58	**IVY LEAF PATTERN,** Fig. 16, effectively carved, with 5-in. silvered metal or enamelled glass dial		2	17	0
59	... Do. ... ,, Do. 6-in. dial		3	5	0
60	... Do. ... ,, Do. 8-in. ,, ...		4	0	0
61	... Do. ... ,, Do. 5-in. card dial		2	12	0
62	... Do. ... ,, Do. 6-in. ,, ...		3	0	0
63	... Do. ... ,, Do. 8-in. ,, ...		3	10	0

A Thermometer added, if desired, to Figs. 14 and 16 at an extra charge of 5-in. 4/-, 6-in. 5/6, 8-in. 7/6.

Aneroid Barometers.

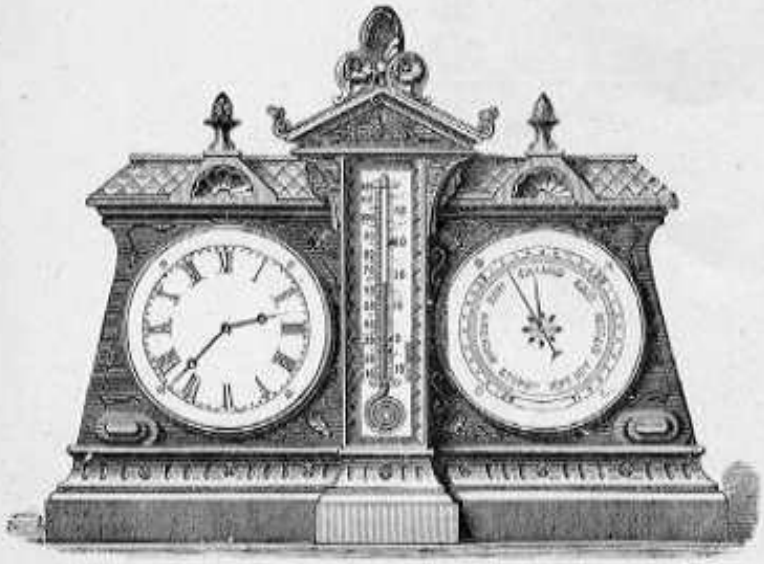
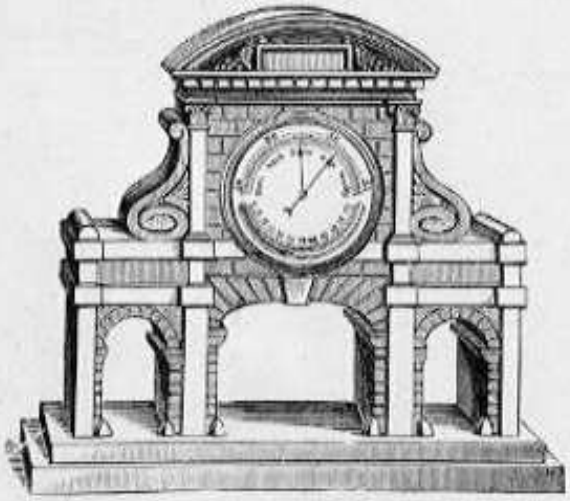


Fig. 17.



Registered Pattern—"Old Temple Bar."
Fig. 18.

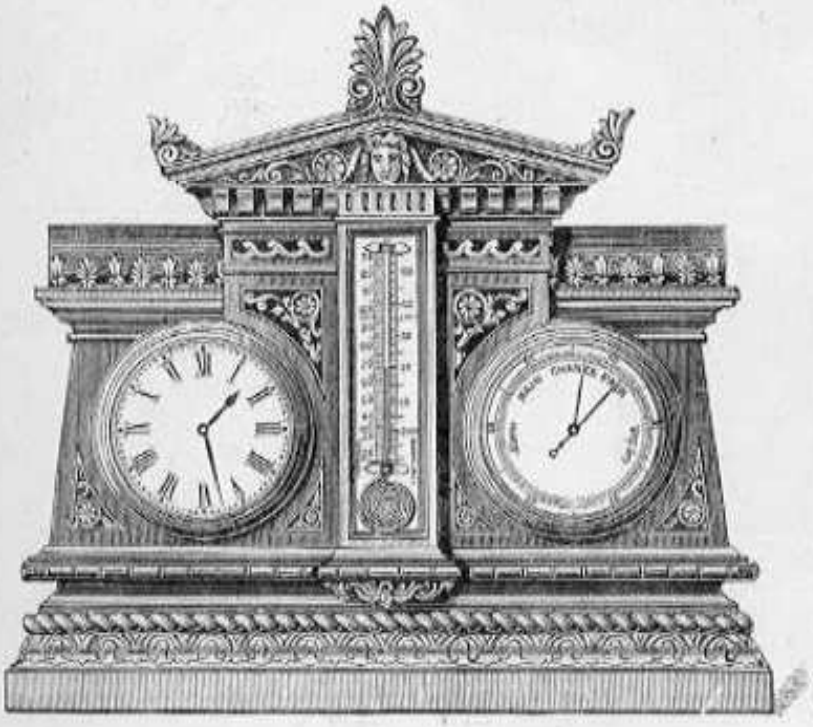


Fig. 19.

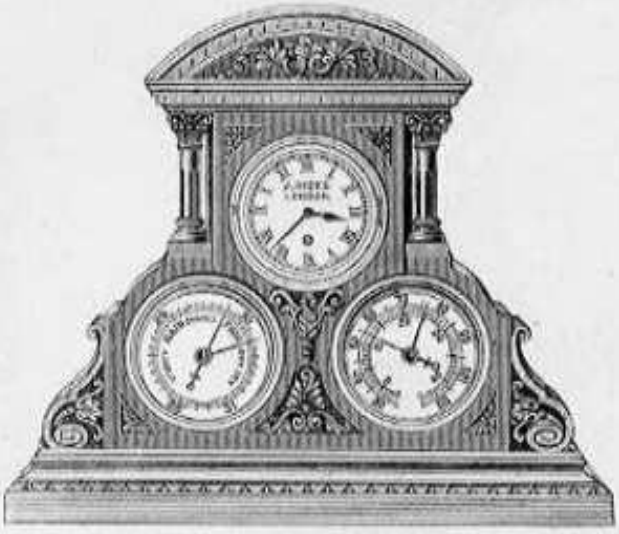


Fig 19A.

No.		£ s. d.
64	**NEO GREEK DESIGN,** Fig. 17, elegantly carved, with 5-in. best engraved metal dial, eight-day lever clock, and spiral bulb thermometer between	8 0 0
65	**TEMPLE BAR PATTERN,** Fig. 18, representing the once famous London Gateway, with 3½-in. silvered metal dial and thermometer	3 10 0
66	**GREEK DESIGN,** Fig. 19, splendidly carved, with 5-in. best silvered metal dial, eight-day lever clock and spiral bulb thermometer between ...	12 12 0
66A	**NEW DESIGN,** Fig. 19A, consisting of clock, aneroid barometer and thermometer, forming a splendid combination. It is made of highly seasoned wood, and is most elaborately carved. 5-in. dials ...	10 10 0

Aneroid Barometers.

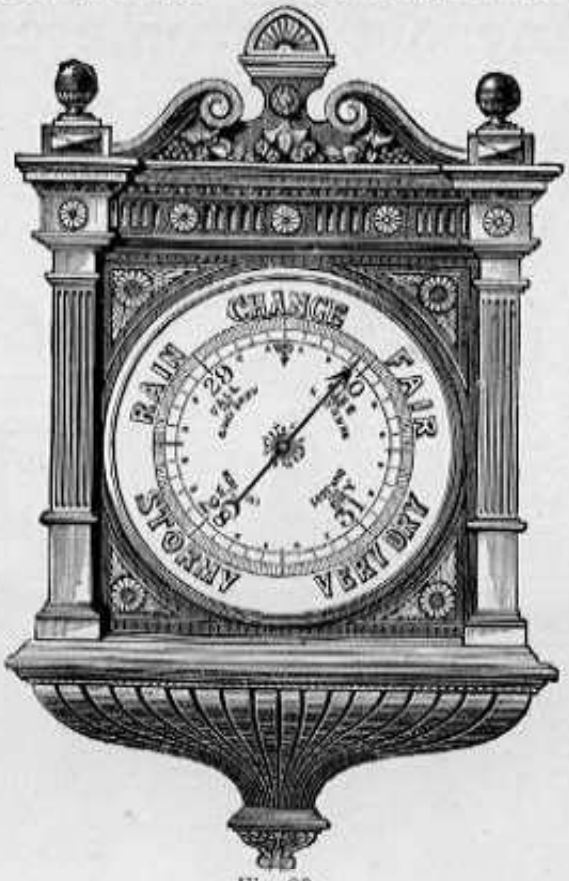


Fig. 20.

Fig. 21.

Fig. 22.

Fig. 23.

No.		£	s.	d.
67	**PALATIAL DORIC DESIGN,** Fig. 20, magnificently carved and polished, (height 5-ft., breadth 2½-ft., diameter of dial 2-ft.), with best enamelled glass dial. Designed expressly for palaces or mansions, and guaranteed absolutely correct	50	0	0

The original of this beautiful Instrument was exhibited at the late International Inventions Exhibition, where it acted throughout in a most satisfactory manner, and proved its perfect accuracy by the marvellously truthful manner in which it foretold the numerous sudden changes in the weather which occurred in London during the summer of 1885.

68	**PALATIAL DORIC DESIGN,** Fig. 20, reduced size, with 8-in. silvered metal or enamelled glass dial	6	15	0
69	... Do. 10-in. dial	7	15	0
70	**CASTELLATED DESIGN,** Fig. 21, admirably suited for Library use, with 5-in. silvered metal dial and curved thermometer, in handsomely carved oak or walnut frame	3	10	0
71	... Do. ... „ Do. 6-in. Dial	3	15	0
72	**PENTHOUSE PATTERN,** Fig. 22, a very neat and popular design, with 4-in. silvered metal dial and curved thermometer	2	5	0
73	... Do. ... „ Do. without thermometer	2	0	0
74	**LOUIS XIV. STYLE,** Fig. 23, elaborately carved, with 5-in. engraved silvered metal dial and curved thermometer in oak or walnut frame ...	3	10	0

Aneroid Barometers.

Fig. 25.

Fig. 24.

Fig. 26.

Fig. 27.

No.				£	s.	d
75	**SHELL AND FRUIT DESIGN,** Fig. 24, handsomely carved, with 6-in. closed silvered metal dial and curved thermometer in oak frame ...			3	10	0
76	Do.	do.	8-in. dial	4	5	0
77	Do.	do.	10-in. „	5	0	0
78	**FLOWER AND FRUIT DESIGN,** Fig. 25, elegantly carved, with 5-in. engraved silvered metal dial and curved thermometer in oak frame			3	10	0
79	Do.	do.	6-in. dial	4	0	0
80	Do.	do.	8-in. „	4	15	0
81	**FRUIT AND SHELL DESIGN,** Fig. 26, effectively carved, with 5-in. engraved silvered metal dial and curved thermometer in oak frame			3	7	6
82	Do.	do.	6-in. dial	3	17	6
83	Do.	do.	8-in. „	4	12	6
84	**LION HEAD PATTERN,** Fig. 27, elaborately carved, with 6-in. closed silvered metal dial and curved thermometer in oak frame ...			3	17	6
85	Do.	do.	8-in. dial	4	12	6
86	Do.	do.	10-in. „	5	7	6

NOTE.—Any of the above made with open dials. See page 1.

Aneroid Barometers.

Fig. 28.

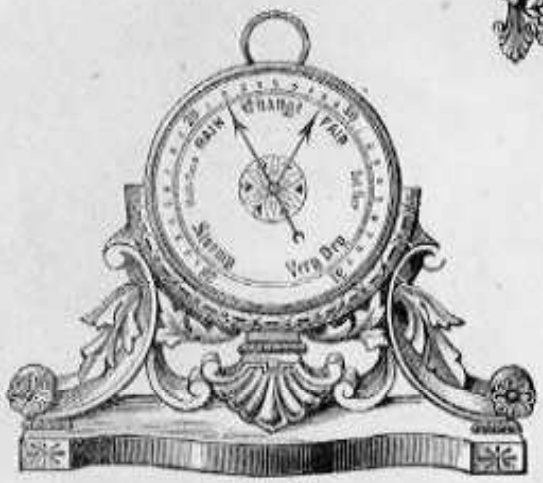


Fig. 29.

Fig. 30.

No.				£	s.	d.
87	**FLORAL DESIGN,** Fig. 28, handsomely carved, with 5-in. silvered metal or enamelled glass dial, in oak or walnut frame			3	10	0
88	Do.	do.	6-in. dial	4	4	0
89	Do.	do.	8-in. „	5	0	0
90	**METAL ANEROID,** Fig. 29, with 5-in. silvered metal dial, and including carved oak stand			3	5	0
91	Do.	do.	6-in. dial	3	13	0
92	Do.	do.	8-in.	4	7	6
93	Do.	do.	5-in. card dial	2	17	0
94	Do.	do.	6-in. „	3	5	0
95	Do.	do.	8-in. „	3	15	0
96	**METAL ANEROID,** Fig. 30, with 5-in. open metal dial, including carved oak stand			3	10	0
97	Do.	do.	6-in. dial	3	18	0
98	Do.	do.	8-in. dial	4	12	6
99	Do.	do.	5-in. card dial	3	2	6
100	Do.	do.	6-in. „	3	10	0
101	Do.	do.	8-in. „	4	0	0

NOTE.—Any of the above made with open dials, 5/- extra. Closed dial to Fig. 30, 5/- less than prices quoted.
Extra charge for adding thermometers to any of the above, 5-in. 4/-, 6-in. 5/6, 8-in. 7/6.
Plain or carved oak stands are supplied according to size and design, from 5/- to 30/-.

101A	**DRUM SHAPE ANEROID,** (not illustrated), with 5-in. metal dial and weather words						2	10	0
101B	Do.	do.	...	...	„	with weather words and thermometer	2	15	0
101C	Do.	do.	...	...	„	with scale of feet only	2	16	6

Stand for Drum Aneroids, 15/-.

Aneroid Barometers.

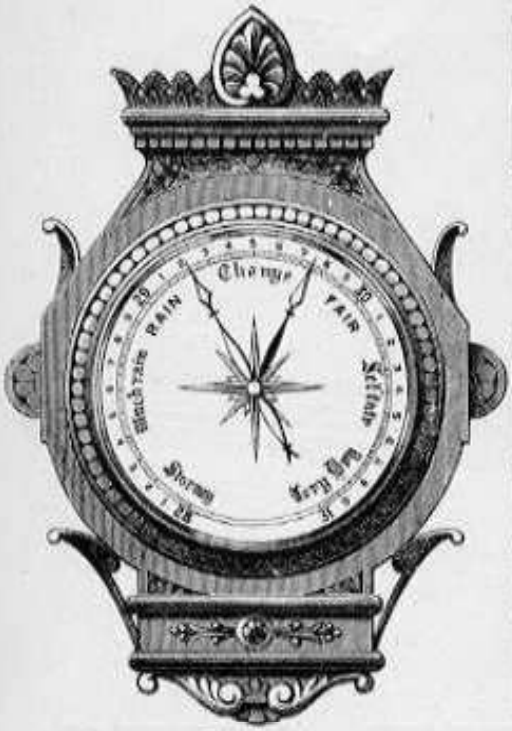


Fig. 31.

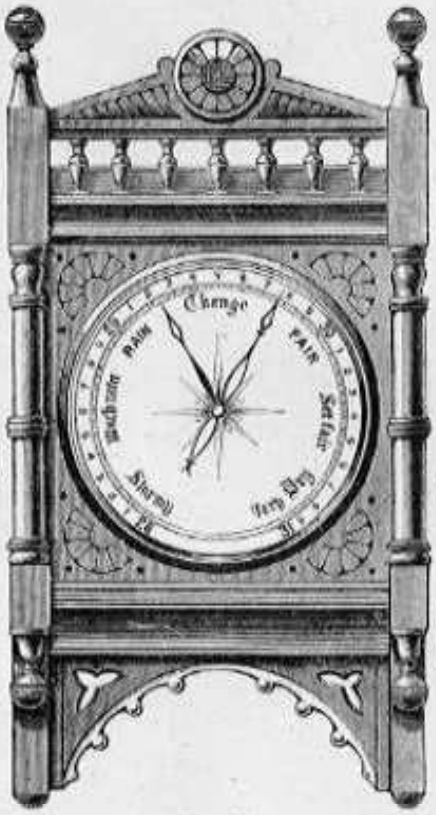


Fig. 32.

Fig. 33.

No.				£	s.	d.
102	**EGYPTIAN DESIGN,** Fig. 31, with 5-in. silvered metal dial and engraved centre			2	10	0
103	...	Do.	„ Do. 6-in. dial	3	0	0
104	...	Do.	„ Do. 8-in. „	3	8	0
105	...	Do.	„ Do. 5-in. card dial	2	6	0
106	...	Do.	„ Do. 6-in. „	2	15	0
107	...	Do.	„ Do. 8 in. „	3	2	0
108	**EARLY ENGLISH PATTERN,** Fig. 32, with 5-in. silvered metal dial and engraved centre ...			2	10	0
109	...	Do.	„ Do. 6-in. dial	3	0	0
110	...	Do.	„ Do. 8-in. „	3	8	0
111	...	Do.	„ Do. 5-in. card dial	2	6	0
112	...	Do.	„ Do. 6-in. „	2	15	0
113	...	Do.	„ Do. 8-in. „	3	2	0
114	**GRIFFIN PATTERN,** Fig. 33, elaborately carved with 6-in. silvered metal or enamelled glass dial in oak frame			5	15	0
115	...	Do.	„ Do. 8-in. dial	6	6	0
116	...	Do.	„ Do. 10-in. „	7	7	0

Extra charge for adding Thermometers to any of above, 5-in. 4/-, 6-in. 5/6, 8-in. 7/6.

Recording Aneroid Barometers.

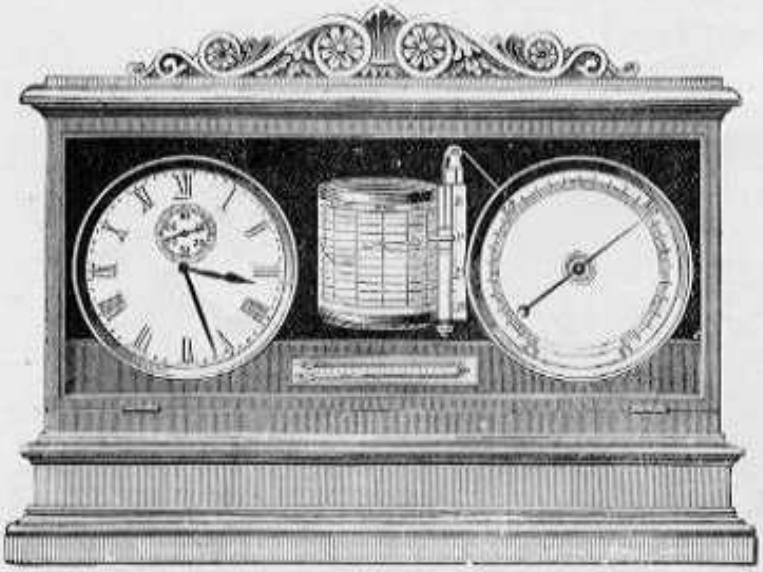


Fig. 34.

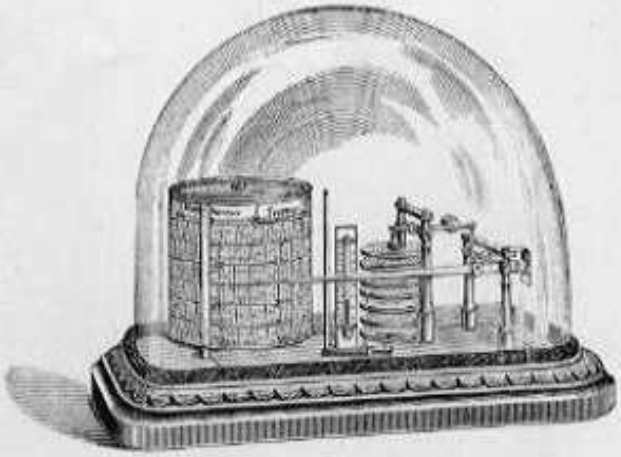


Fig. 35A.

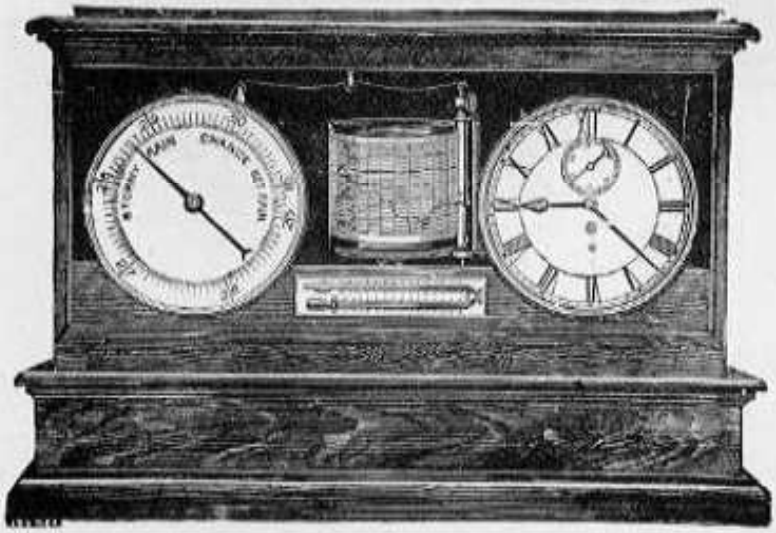


Fig. 35.

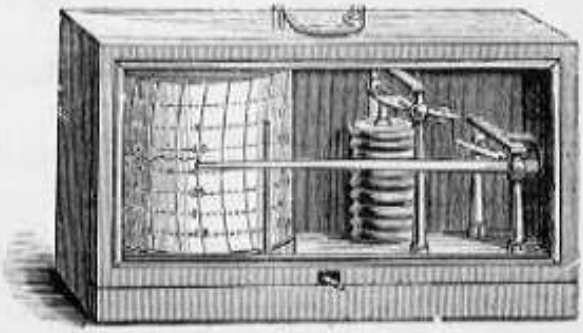


Fig. 36.

No.		£	s.	d.
117	**SELF-RECORDING ANEROID BAROMETER,** Fig. 34, in French polished walnut case, ornamental top, glass door, superior eight-day clock, self-registering maximum and minimum Dimenuon Thermometer, and scale of inches on the recording-pencil guide	25	0	0
118	Do. Fig. 35, plain top, solid French polished walnut case with plate glass hinged front, open scale to Barometer, minute circle to clock, Dimenuon Thermometer, with magnet for adjusting indices	24	0	0
118A	Do. Fig. 35A, under glass shade (similar to Fig. 36), very handsome ...	5	15	0
118B	Do. Fig. 36, most simply constructed and noted for the accuracy with which it keeps the barometric record. It is enclosed in a polished mahogany case with glass front, and requires winding but once a week, a fresh chart being placed on the drum every eighth day	5	10	0
118C	Do. In polished oak case with glass sides and top	5	0	0
118D	Do. As 118C but with drawer in front to hold used and unused charts ...	5	10	0
	CHARTS for Figs. 34 and 35—One year, 7/6; Two years, 14/-; Four years	1	7	6
	Do „ 35A and 36— „ 4/6; „ 8/6; „	0	16	0

Recording Aneroid Barometers.

Fig. 36A.

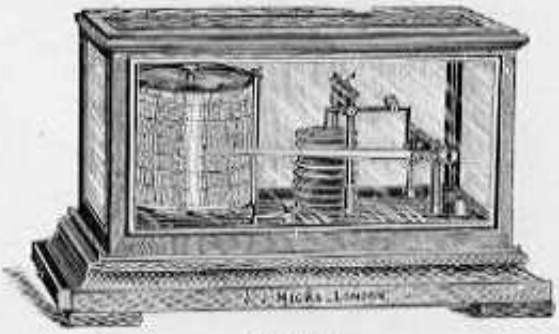


Fig. 36B.

Fig. 36C.

No.				£ s. d.
118E	**SELF-RECORDING ANEROID BAROMETER** in oak, mahogany, or walnut case, with silvered mirror at back, sides and front of bevelled plate glass with drawer beneath for storing charts, works either nickelled or gilt			6 15 0
118F	Do.	do.	with lacquered works	6 6 0
118G	Do.	Fig. 36A, in oak, mahogany, or walnut case, with bevelled plate glass top and sides, and drawer for charts, nickelled or gilt works		6 10 0
118H	Do.	do.	with lacquered works	6 0 0
118J	Do.	Fig. 36B, in oak, mahogany, or walnut case, with bevelled edges and with bevelled plate glass top and sides, nickelled or gilt works		6 6 0
118K	Do.	do.	with lacquered works	5 15 0
118L	Do.	Fig. 36C, same as 36B but with solid wood top, nickelled or gilt works		6 6 0
118M	Do.	do.	with lacquered works	5 15 0

Charts for any of above, one year, 4/6; two years, 8/6; four years, 16/-.

Recording Aneroid Barometers.

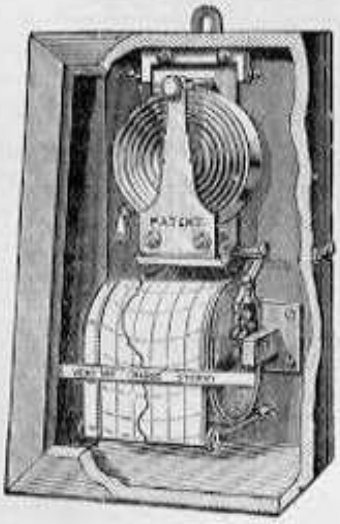


Fig. 36D.

FITTED WITH EIGHT-DAY CLOCKS.

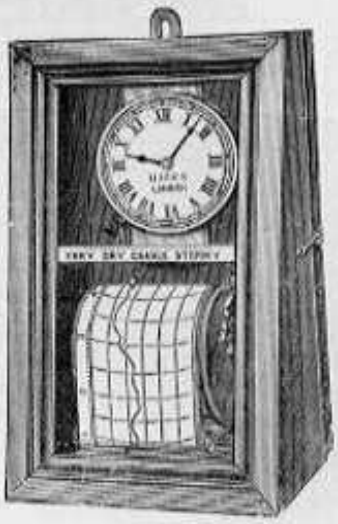


Fig. 36E.

No.		£	s.	d.
119	**THE NEW SELF-RECORDING BAROMETER** (Patented), Fig. 36D. This is the very latest improvement in **Recording Barometers** and is a highly sensitive and compact Instrument. It is made to hang up, as shown above, its dimension being only 10-inches by 6-inches, and fits into a neat mahogany case with glass front. It is also suitable for standing on a table or shelf, without fear of toppling over, as the base is much larger than the top. It differs from other Barometers, not only in appearance, but, on account of the record or tracing being made in dotted lines instead of a continuous line, the advantage being that it **does not drag or rub on the paper,** but remains at a convenient distance from it. Every twenty minutes the spring which carries the pen drops down, on account of the fall of the hammer on top of it, and the pen marks a dot. The whole of the dot constitutes the dot of the atmospheric pressure. A small button at the side of the cylinder serves to regulate the dotting; by turning it to the right the dots become thicker, and to the left thinner. The movement must be wound up every week, and the paper changed. The records are made on paper scales. The small brass cylinder, mounted between two spring wires, serves to tighten the paper on the large cylinder; by simply turning the cylinder with the hand, the chart or scale is "set" at any particular day, and the pen is moved either right or left by turning the button on top of the vacuum box. The movement can be raised up by unbolting the small bolt on the left and lifting up the vacuum box. This operation is necessary when changing the chart or cleaning the pen. The pen can be occasionally cleaned by washing with water, and a small pipette is provided with which to re-fill it. NOTE.—To start the clock, wind it up at the right hand side of the cylinder, and remove the two rubber bands holding the levers. (These bands are merely placed on to ensure safety in travelling.) It will be observed that the Barometer, though of simple construction, is as suitable for Scientific observations or private use as many Instruments of more elaborate pretensions, and is particularly adapted for Travellers. **Its exceedingly low price commends it to all. Accuracy guaranteed.** Price, including small bottle of Ink and 55 Charts	4	0	0
119A	Do. ... do. ... with extra lever clock (as shewn in Fig. 36E), enclosed in handsome gilt metal frame, instead of mahogany case	8	8	0

Aneroid Barometers.

Fig. 37.

(Registered Pattern.)

Fig. 38.

Fig. 39.

No.				£	s.	d.
120	**ROPE PATTERN,** Fig. 37, in finely carved oak frame, with 5-in. engraved silvered metal dial and thermometer			2	5	0
121	Do.	Fig. 37	Do. 6-in. dial	2	10	0
122	Do.	„	Do. 8-in. „	2	15	0
123	Do.	„	Do. 5-in. card dial	2	1	0
124	Do.	„	Do. 6-in. „	2	5	0
125	Do.	„	Do. 8-in. „	2	10	0
126	**HORSE-SHOE PATTERN,** Fig. 38, drum nickel Aneroid suspended in handsome oak or walnut horse-shoe stand with nickel plated mounts, with 5-in. best engraved silvered metal dial and thermometer			3	12	6
127	Do.	Fig. 38	Do. 6-in. dial	4	4	0
128	Do.	„	Do. 8-in. „	5	7	6
129	**IVY-LEAF PATTERN,** Fig. 39, in handsomely carved oak frame, with 5-in. silvered metal dial and thermometer...			2	9	0
130	Do.	Fig. 39	Do. 6-in. dial	2	15	0
131	Do.	„	Do. 8-in. „	3	2	6
132	Do.	„	Do. 5-in. card dial	2	5	0
133	Do.	„	Do. 6-in. „	2	10	0
134	Do.	„	Do. 8-in. „	2	16	0
134A	**OPEN SCALE BAROMETER** (not illustrated), divided right round the circle from 28 to 31-ins., with 10-in. metal dial in round polished frame ...			3	10	0
134B	Do.	do.	in round metal frame	3	3	0

Aneroid Barometers.

Fig. 40

Fig. 39A.

Fig. 41.

Fig. 42.

No.		3½-in.	5-in.	6-in.	8-in.
135	**BRONZED METAL FRAME,** Fig. 40, enamel card dial and thermometer	—	36/-	42/6	55/-
136	Do. silvered metal dial and thermometer ...	35/-	40/-	47/6	60/-
137	**HORIZONTAL 8-day CLOCK to match,** fitted with back plates and wound in front	35/-	40/-	47/6	—
138	**LEVER CLOCK** do	50/-	55/-	62/6	—
139	**TURNED WOOD PATTERN,** Fig. 41, enamel card dial and thermometer	—	37/6	40/-	45/-
140	Do. silvered metal dial and thermometer ...	—	41/-	45/-	50/-
141	**FISHERMAN'S ANEROID,** 5-in. printed dial, in bronzed metal case or strong teak wood frame, Fitzroy words ...	—	50/-	—	—
141A	**YACHT ANEROID,** Fig. 39A, best engraved metal dial and curved thermometer in bright brass case with three lugs, as supplied to the Imperial Ottoman Government	—	—	66/-	—

No.		£	s.	d.
141B	**HORIZONTAL 8-day CLOCK,** to match above	2	7	6
141C	**LEVER** do do	3	3	0
142	**STEERING WHEEL DESIGN,** Fig. 42, 3-in. silvered metal dial, plate glass front highly electro gilt with enamelled blue and white rings ...	10	0	0
143	Do. with cornelian handles	9	0	0

Aneroid Barometers.

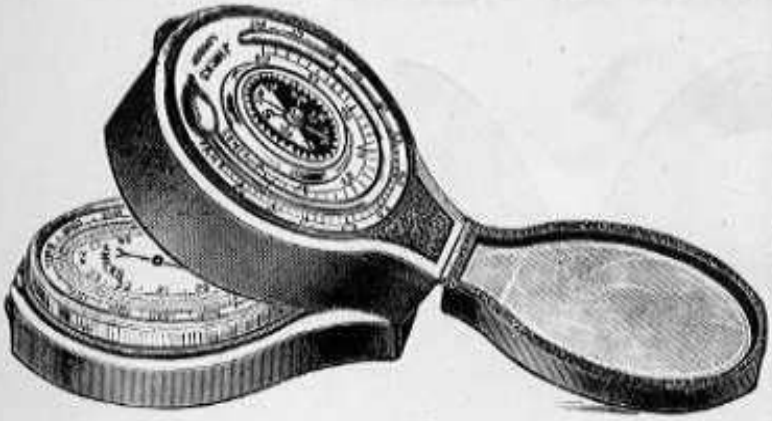


Fig. 43.

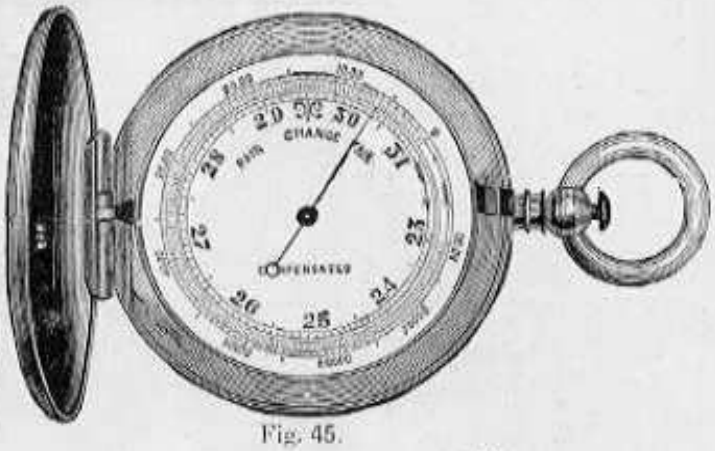


Fig. 45.

Fig. 45A.

Fig. 44.

Fig. 45B.

No.					£	s.	d.
144	WATCH-SIZE ANEROID,			Fig. 43. Altitude scale, with Compass and double scale thermometer on ivory in lid of morocco case, compensated ...	3	10	0
145	...	Do.	...	Fig. 43. Do. 2nd quality	3	0	0
146	...	Do.	...	Fig. 44. Raised dial altitude scale and thermometer, with large stop Singer's compass at back of Aneroid, in double opening morocco case	4	7	6
146A	...	Do.	...	Fig. 44. Do. do. without thermometer...	4	4	0
147	...	Do.	...	Do. 2nd quality, no raised dial or thermometer	4	0	0
148	...	Do.	...	Fig. 44. With fixed or revolving altitude scale and best pebble compass, lens through lid of morocco case	3	10	0
149	...	Do.	...	Fig. 44. With glass cover on one side of morocco case, having compass in centre	3	10	0
150	...	Do.	...	Fig. 44. With raised dial, altitude scale and thermometer, with gilt pebble compass at back showing through bottom of morocco case	3	16	6
151	...	Do.	...	Do. 2nd quality, no raised dial or thermometer	3	9	0
152	...	Do.	...	Fig. 45. With fixed or revolving altitude scale in nickel hunter's case ...	2	15	0
153	...	Do.	...	Fig. 45. In silver hunter's case	4	5	0
153A	...	Do.	...	Figs. 45A & 45B. With raised dial and thermometer, keyless motion, large bar needle compass at back, and two feet, so that it can be stood upright on table or mantelpiece, with gilt case	5	5	0
153B	...	Do.	...	Do. do. with silver case	7	10	0

Aneroid Barometer Sets.

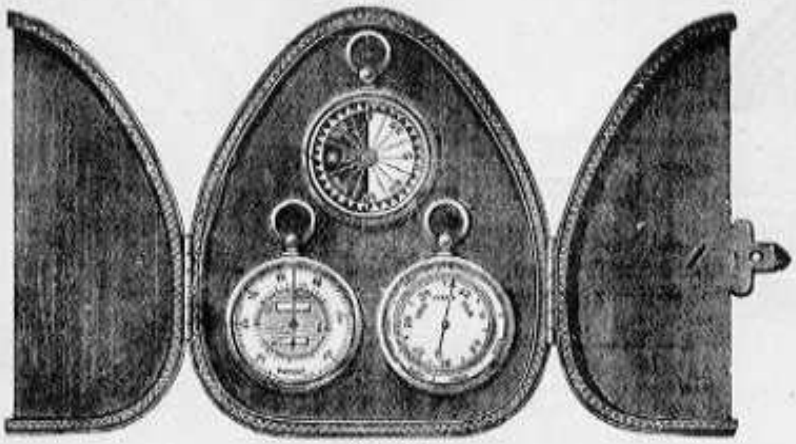


Fig. 48.

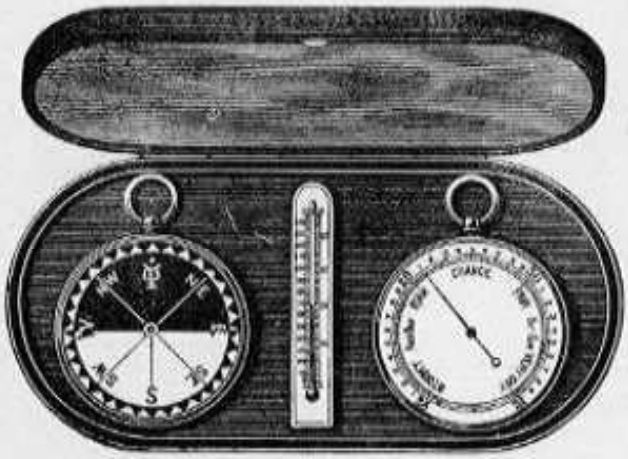


Fig. 46.

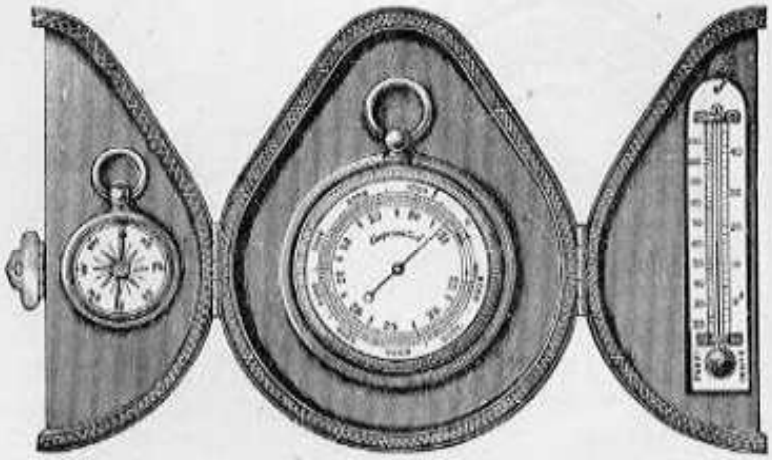


Fig. 47.

No.			£	s.	d.
154	**TRAVELLERS' SET,** Fig. 46. Containing best quality watch Aneroid with Singer's pearl dial compass to match, and ivory scale thermometer in centre of snap morocco case, in gilt, nickel or silver plated		4	10	0
155	... Do. ... in silver		5	15	0
156	**TOURISTS' SET,** Fig. 47. Containing best quality watch Aneroid with altitude scale, compensated, ivory scale thermometer, and bar needle compass, in folding morocco case, in gilt, nickel or silver plated		4	5	0
157	... Do. ... in silver		5	10	0
158	**HICKS'S POCKET COMPANION,** Fig. 48. Best quality miniature Aneroid, pearl Singer's compass and metallic thermometer, all in nickel, and enclosed in morocco case		4	5	0
159	... Do. ... in silver		5	5	0
160	... Do. ... in gold		10	10	0

Aneroid Barometers.

WATCH SIZE.

Fig. 49.

Fig. 50.

Fig. 52.

Fig. 51.

No.					£ s. d.
161	**WATCH SIZE ANEROID,**			1¾-in. hard enamel dial, with ordinary range scale and movement, no thermometer	1 8 0
162	Do.		do.	metal dial do.	1 10 0
163	Do.		do.	hard enamel dial, do. with thermometer	1 10 0
164	Do.		do.	metal dial do. do.	1 15 0
165	Do.		do.	hard enamel dial, with fixed altitude scale, from 6,000 to 7,000 ft.	1 10 0
166	Do.	Fig. 50.	do.	metal dial, 5,000 to 10,000 ft.	2 0 0
167	Do.		do.	raised metal dial, do. and thermometer	2 5 0
168	Do.		do.	1¾-in. silvered metal dial, best movement, with ordinary range scale	2 7 6
169	Do.		do.	do., with thermometer	2 15 0
169A	Do.		do.	1¾-in. silvered metal dial, best movement to 10,000 ft.	3 5 0
169B	Do.		do.	1¾-in. do. do. in morocco case, with large pebble compass in lid	4 0 0
170	Do.	Fig. 51,	do.	1¾-in., with open face	2 17 0
171	Do.		do.	do. do. with fixed or revolving altitude scale from 5,000 to 10,000 ft.	3 7 6
171A	Do.		do.	closed dial, weather words, revolving rim, milled edges, to 10,000 ft. (best flat)	3 3 0
172	Do.	Fig. 49.	do.	keyless motion, do. (also in 1⅝ size)	3 11 6
173	Do.		do.	raised dial, do., and thermometer	3 7 6
174	Do.		do.	raised dial and keyless motion	3 17 6
175	Do.	Fig. 52.	do.	for military surveying, reading 1,000 up, and 1,000 down	3 0 0
176	Do.		do.	for do. 1,000 down, and 4,000 up, reading to 10 ft.	3 10 0
177	Do.	Fig. 54. (*on next page*)	do.	raised dial with barometer scale on sunk part of dial, and scale of feet on raised part to facilitate the reading, which is rendered even more distinct by a revolving magnifier	3 17 6
177A	Do.	Fig. 55. (*on next page*)	do.	raised dial and barometer scale on upper part (This instrument has also a revolving magnifier to assist the reading.)	3 15 0
178	Do.		do.	with altitude scale from 5,000 to 10,000 ft. and small Singer's compass at back in double opening morocco case	4 0 0
179	Do.		do.	do., Singer's compass and thermometer at back	4 7 6

NOTE.—The best quality instruments (Nos. 168 to 179) are all compensated for temperature, fitted with best movements, and have a fixed or revolving scale of feet. Any of the 2nd quality (Nos. 161 to 167) which have ordinary movements and fixed scales, can be compensated for 5/- extra, and a revolving scale added for 3/- extra.

SILVER CASES to any of the best quality, 20/- extra, or according to weight, and any Aneroid made in Ladies' size, if desired.

GOLD ANEROIDS from charm to watch size, according to weight, prices ranging from £2 to £10.

ALUMINIUM CASES can be supplied to any Watch or Pocket Aneroid, if desired. Special quotations given.

ALL ANEROIDS with Altitude Scales are priced in this list to 10,000 feet; above that every 5,000 feet will be charged 7/6 extra.

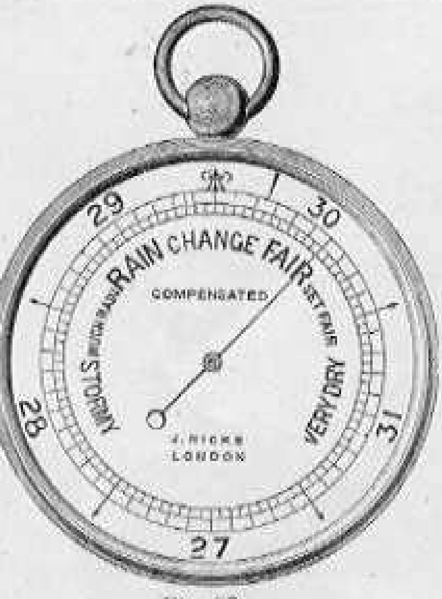


Fig. 53.

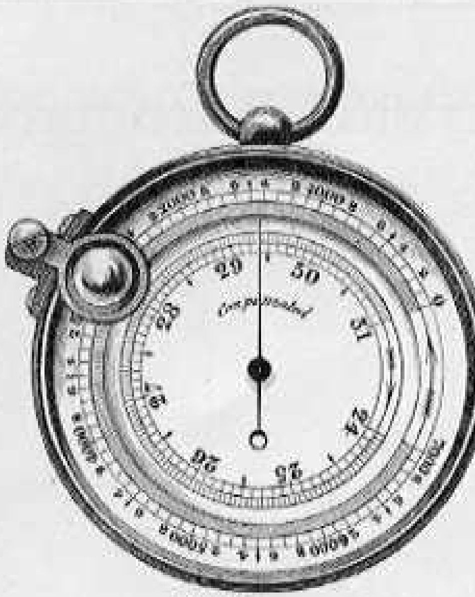


Fig. 54.

Fig. 55.


Fig. 55A.

No.		Best quality in Morocco Cases. £	s.	d.
180	**POCKET SIZE ANEROID,** ordinary range, 2½ or 3-in. dial	2	7	6
181	Do. do. with thermometer ... ... do. do. ...	2	12	6
181A	Do. do. Fig 53, block letters and weather words very distinct, 27 to 31 ins., 3-in dial	2	10	0
182	Do. do. raised dial, with thermometer and engraved weather words, 2½ or 3-in. dial	3	0	0
183	Do. flat dial, altitude scale 5,000 to 10,000 feet, 2½ or 3-in. dial	2	15	0
184	Do. do. with full sized compass at back, 2½-in. dial...	4	4	0
185	Do. do. divided to 40ths and 50ths, reading to 20 & 25 ft. and small figures, 2½ or 3-in. dial	3	7	6
186	Do. do. Fig. 55A, with raised dial thermometer and weather words, 2½ or 3-in. dial ...	3	17	6
187	Do. for miners and surveyors, raised dial, scale of feet from 2,000 below sea level to 6,000 above, and thermometer, 3-in. dial	3	10	0
188	Do. Fig. 52, for military surveying, reading 1,000 up and 1,000 down, 2½-in. dial ...	3	0	0
189	Do. do. do. reading 1,000 down and 4,000 up, to 10 ft.	3	10	0
190	Do. altitude scale, raised dial with barometer scale on sunk part of dial, and scale of feet on raised part to facilitate reading, and magnifier, Fig. 54, 3-in dial ...	4	7	6
191	Do. for geological purposes, very sensitive, flat dial, altitude scale to 6,000 feet, reading to 10 ft., 3-in. dial	3	15	0
192	Do. do. with compass and thermometer at back, 3-in. dial	4	15	0

No.		Best Qual. 4 & 4½ in.	2nd Qual. 4½ in.
193	**CYLINDRICAL ANEROIDS,** no scale of feet, but engraved weather words		2 10 0
194	Do. do. with thermometer		2 15 0
195	Do. do. raised dial divided all round, weather words and thermometer		3 3 0
196	Do. altitude scale 5,000 to 10,000 ft.	4 4 0	
197	Do. do. and revolving by rack work	5 5 0	
198	Do. altitude sale to 10,000 ft., raised dial and thermometer	4 10 0	
199	Do. do. with magnifier, no thermometer	4 5 0	
200	Do. same description as No. 191	4 4 0	
201	Do. do. No. 190	4 12 6	
202	Do. for surveyors and engineers, altitude scale 10,000 ft. graduated to 50ths and reading to 20 ft.	4 0 0	
203	Do. do. with Vernier reading to 10 ft., no altitude scale	4 10 0	

All the above are compensated, and have fixed or revolving scales, except Nos 193, 4 and 5. which can be compensated for 5/- extra, and revolving scale added for 3/- extra. SLING LEATHER CASES extra: 2-in. 3/-, 3-in. 5/-, 4½-in. 6/6.

The well-known mountaineering expert, Mr. EDWARD WHYMPER, *writes*:—

St. Martin's House,
29, Ludgate Hill, London, E.C.,
September, 8th, 1904.

Dear Sir,—You will be glad to hear that the behaviour of Five Aneroids of your make which I took to the Rocky Mountains this year was **unusually good,** and I was pleased accordingly.

Very truly yours,
EDWARD WHYMPER.

To Mr. Jas. J. Hicks.

October 20th, 1905.

Dear Sir,—I have been using this year, in the Rocky Mountains of Canada, the 7½-in. diameter Aneroid which you made for me last winter, and am glad to be able to tell you that it has answered my purposes perfectly. It weighs only 3½ lbs., and is strong enough to be used without a case. It is beautifully divided, and can be read easily with precision; and after having been carried over 12,000 miles (sometimes having been unavoidably subjected to rather rough treatment) it has returned to London with a scarcely appreciable error.

Very truly yours,
EDWARD WHYMPER.

Mr. J. J. Hicks,

*** Attention is directed to the following list of specially **CHEAP ANEROIDS IN METAL CASES:**—

204	WATCH SIZE with hard enamel dial	23/-	do. ... ...with metal dial	25/6
205	Do. do. do. and thermometer	25/-	do. ... ... do.	27/6
206	Do. do. do. altitude scale to 7,000 ft. ...	24/-	do. to 10,000 ft. do.	26/6
207	POCKET SIZE with 2½-in. metal		... ...	33/-
208	Do. do. do. and thermometer		... ...	35/-
209	Do. do. do altitude to 10,000 ft. ...		... ...	34/-

210	With card dial	4½-in.—12/-	5-in.—17/6	6-in.—30/-	8-in.—37/6
211	Do and thermometer	,, 14/6	,, 20/-	,, 33/-	,, 41/-

OPEN DIALS TO ANY OF THIS CHEAP CLASS, 3/- EXTRA.

THE CELEBRATED (PATENT)

"Watkin" Aneroid Barometers.

Fig. 56.

Fig. 57.

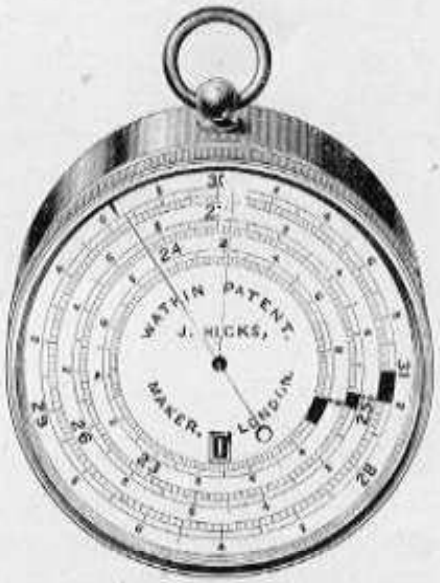


Fig. 58.

THE sole right of manufacture of this wonderful Instrument (the invention of the late Colonel H. S. Watkin, the inventor of the famous Range Finder and many other instruments adopted by our War Office) has been entrusted to Mr. Hicks, the maker also of the Watkin Range Finder, etc. It is well known that Aneroids have been made of all sizes from three feet to ½-inch in diameter; the length of the divisions on the scale, representing inches on the mercurial barometer, have also been varied to suit different purposes. But inasmuch as there was only one circle of figures, either the number of inches, and therefore the extreme height at which the instrument was available had to be restricted, or the dimensions of the scale contracted in order to obtain a longer range. Colonel Watkin's patent index gets over this difficulty, and an open scale can now be obtained combined with great length of range. Thus in the 4-inch Patent Aneroid one inch on the mercurial barometer can be made to represent from 4 to 10 inches.

In the illustrations it will be noticed that instead of the usual *one* circle of figures, the scale consists of THREE complete turns. The Aneroid (Fig. 56) being put under an air pump or taken up a mountain, the index, or registering point, in moving back, is gradually drawn *towards* the centre, so that it faithfully follows the *decreasing* spiral scale; but when the index moves in the opposite direction, the point moves *away* from the centre, thus following the *increasing* spiral. This is effected by the index or registering point being made to slide in or out so that one end may advance or recede from the centre, and thus follow a spiral or other form of scale. Attached to the spindle is a crosspiece in which the index slides, and a hollow drum fixed to the dial plate has a flexible chain or cord wound round it, the ends being fastened to projecting pins rivetted to the index. It follows from this construction, that if the spindle and the piece attached to it is

revolved, one portion of the chain or cord unwraps off the drum, the other being wound on to the same extent, and the index is caused to slide through the crosspiece, the direction of motion being controlled by the direction in which the spindle is revolved.

Below Fig. 56, a clear view is afforded of the sliding index which is drawn beneath the Barometer, and some idea can be formed of its wonderful construction.

In Fig. 58, the Aneroid is represented with three concentric circles of scales, with a hand or pointer sufficiently long to extend across them all. In order to show clearly which circle of scales should be read, there is an indicator attached to the movement of the Instrument which causes a series of figures (I., II., III., corresponding with the three circles), to be exhibited through an aperture in the dial. For instance, when the Instrument is in its normal state the hand will point to the first or outer circle, and the figure I. will appear and remain in the aperture until the Barometer falls to 27·8, where the break takes place in the circle, as will be seen in the illustration. The hand then takes up the reading on the second circle (where the break appears at 27·8), and figure II. replaces figure I. in the aperture, remaining there until the Barometer falls to 25, when the reading is transferred to the third circle, and figure III. appears in the aperture.

The marvellous construction of this new Aneroid has been admitted by every scientific man who has seen it; and its accuracy has not only been submitted to various tests, in which it has worked perfectly, but it is also *guaranteed* by the maker. It is made either with or without an altitude scale and is so delicate that a reading can easily be taken to *one foot in height*. Its very open scale renders it particularly suitable for delicate weather observations; and scientists, surveyors and tourists will find it of immense value.

The "WATKIN" ANEROID is supplied in Brass Cases at the following prices:

	Size.	With an Altitude Scale to—			
		5,000 feet.	10,000 feet.	15,000 feet.	20,000 feet.
No. 212, Fig. 56	3½, 4, or 4½-in.	£5 10 0	£6 0 0	£6 10 0	£7 7 0
„ 213, „ 57	2 or 3-in.	5 0 0	5 7 6	5 15 0	6 6 0
„ 214, „ 58	3½, 4, or 4½-in.	5 5 0	5 12 6	6 0 0	6 12 6

NOTE.—Sling leather cases extra, for 2-in. size, 3/6; 3 and 3½-in., 5/-; 4 and 4½-in., 6/6.

Any of these Aneroids can be supplied in *Aluminium* instead of *Brass* cases. Aluminium is, of course, very much lighter, and those who have to carry their Instruments long distances, or for several hours a day, will find it a decided advantage.

An additional charge for Aluminium (over above prices) will be made of 5/-

The 2-in. size is made with only *two* circles of scales.

The "WATKIN" ANEROID can also be supplied in carved oak or walnut frame, with 6-in. dial and gilt ring. Price £7 10s.

Testimonials

RECEIVED

In connection with the "WATKIN" ANEROID BAROMETERS.

THE OBSERVATORY, MELBOURNE, 10*th October*, 1888.

The "Watkin" Aneroid only reached me three weeks ago. I am very much pleased with it, and have given it a pretty severe trial with very satisfactory results.

ROBT. J. ELLERY.

EDINBURGH, 31*st May*, 1889.

I have just returned from a six weeks' stay at the Ben Nevis Observatory, and while there had an opportunity of testing the admirable qualities of your new "Watkin" Aneroid. The result has been most satisfactory, the extreme error noted being only about one-hundredth of an inch. During my stay at the Observatory, the Aneroid was frequently tested by taking it down a couple of thousand feet and then comparing it with the standard on my return. The results obtained speak volumes for the high-class workmanship and great accuracy you have attained in the manufacture of this instrument.

R. C. MOSSMAN, F.R.M.S.,
Observer, Scott. Met. Socy.

SCIENCE SCHOOL, NORTHAMPTON, 30*th May*, 1890.

I have had several opportunities of testing the Aneroid, and am well pleased with the results.

BEEBY THOMPSON.

MADRID, *July* 24*th*, 1890.

In November last you supplied me with a 3-inch "Watkin" Aneroid Barometer, and I have great pleasure in testifying to my great satisfaction with the instrument, which I have found very sensitive and exceedingly accurate. I have used it to a small extent for surveying, and have found on returning over the same points a second time, in settled weather, a very close correspondence with the former observations of altitude. In some cases, indeed I have had an absolute agreement.

I have also, while travelling by railway, compared it with the Ordnance Branch marks, which are fixed at nearly all the stations in this country, and the weather being settled, have found a remarkable agreement with the differences of level. I have often, in fact, found for long distances, and with considerable variations of altitude, agreements to as near as one metre, which is as close as it is possible to read the scale.

T. A. GREENHILL,
Mining Engineer, etc.

THE "TIMES," PRINTING HOUSE SQUARE, *July* 25*th*, 1890.

I have pleasure in saying that I am perfectly satisfied with the "Watkin" Aneroid, with which you supplied me two or three years ago.

A. F. WALTER.

4, BISHOPSGATE STREET WITHIN, E.C., 28*th July*, 1890.

I have much pleasure in saying that the "Watkin" Patent Aneroid Barometer, which you supplied me in February of last year, has given me very great satisfaction.

I have made use of it in many instances where I have had an opportunity of testing its accuracy by subsequent surveys, and the results have always been remarkably good.

I can, therefore, thoroughly recommend the instrument.

PERCY JNO. OGLE,
Engineer.

ROYAL COURTS OF JUSTICE, *July* 28*th*, 1890.

I have not compared the readings of my "Watkin" Aneroid with those of a Standard Barometer, but I know enough of the instrument to be entirely satisfied with its sensitiveness and general behavior.

T. W. ERLE.

Testimonials—*continued.*

CATHEDINE, BURLEY-IN-WHARFDALE, *Aug*, 13*th*, 1890.

I can offer no scientific opinion upon the "Watkin" Aneroid I bought from you, but it is an unfailing source of interest to me at home, and I always keep it before me on long railway journeys, observing the gradients. It seems to me a very sensitive instrument.

E. P. ARNOLD FOSTER.

THE OWENS COLLEGE, MANCHESTER, 23*rd Sept.*, 1890.

During a recent trip to Switzerland I have used one of your "Watkin" Barometers, and found it a great improvement on previous Aneroids. Although it is graduated up to 15,000 feet it shows a rise and fall of 10 feet throughout its range.

It has been subjected to pretty severe trials, as after carrying it several times up a height of 4,000 feet or more, I could not detect any change on my return. After ascending Piz Languard from Pintresina, the "Watkin" Barometer showed a difference of 4 900 feet, while in reality Piz Languard is 4,800 feet above Pintresina. It followed that either the indications of the Barometer were wrong by 100 feet or that the Barometer had fallen through a range of the twelfth part of an inch. On my return I found that the Barometer had actually fallen while I was going up the mountain, but unfortunately I could not ascertain the exact amount.

If the "Watkin" Aneroid fulfils on further trials its promise, a very distinct advantage would be gained.

ARTHUR SCHUSTER, F.R.S.
Professor of Physics.

12, QUEEN'S ARCADE, BELFAST, 22*nd Oct.*, 1890.

I put the "Watkin" Aneroid I got from you to a severe test in ascending and descending a mountain side 1,200 feet, with the best results.

P. F. GULBRANSEN.

THE KEW OBSERVATORY, 27*th Oct.* 1890.

I have to report that the "Watkin" Aneroid No. 274, with scale ranging from 31 ins. to 25·6 ins., and corresponding altitude scale graduated up to a height of 5,200 feet above mean sea level, has been duly examined and tested at the Observatory throughout its whole range, both with pressure diminishing and increasing. We find its errors nowhere amount to the twentieth of an inch, or forty feet in altitude, whilst its open scale, of which a change of pressure of one inch is indicated by a movement of the index over about five inches linear, or a variation in height of 100 feet in level is shown by similar changes over 0·6, renders observations of minute alteration of level and pressure visible to the unassisted eyesight of the observer with facility.

The Aneroid is in every way equal in its performance to that of the ordinary form of instrument, whilst the "Watkin" patent indicating arrangement must commend itself most forcibly to observers whose keenness of vision is at all defective or on the wane.

The effect of temperature upon the instrument has been examined through a range of 50°—from 40° to 90° Fahrenheit—and the compensation has been found to be perfect.

G. M. WHIPPLE,
Superintendent.

TAGNITY, RUSSIA, *February*, 1892.

I am very well pleased with the "Watkin" Aneroid Barometer you made for me. I have tested it in the Meteorological Observatory, St. Petersburg. It has been used with good effect to find the differences of level between two rivers which were to be united by a channel.

COUNT BERG.

66, VICTORIA STREET, S.W., 1*st. March*, 1892.

The large "Watkin" Aneroid Barometer you sold me is perfect. By taking 3 or 4 readings I can measure the height of a mantel-piece,—*i.e.*, I can swear to its being about half way between one-third and half of 10 feet—the mantelpiece being 4 feet.

J. M. GORHAM.

Testimonials—*continued.*

97, South Mall, Cork, Ireland, *July 4th*, 1893.

Dear Sir,—It is with very great pleasure that I inform you of the extreme accuracy of the "Watkin" Aneroid No. 426, which you made for me last year. I have compared it daily since with the Cork Station of the Meteorological Office at Roche's Point, the height above the sea level being practically the same, and its accuracy is very remarkable indeed. You will be pleased to have this unsolicited testimony. A more trustworthy instrument could not apparently be made, and I value it highly.

MARY KELLY.

Australian Agricultural Company, Newcastle, *Feb. 3rd*, 1894.

Dear Sir,—Your letter of advice and the Aneroid reached me quite safely. I ought to have acknowledged their receipt earlier, but waited for an opportunity of doing some practical work with the instrument so that I might be able to tell you the result.

When I had the leisure for this, the weather was unsatisfactory until yesterday, when I got perfect readings (upon known points) of each 25 feet interval from sea level up to 320 feet, which was as high as I had time to go. The result was very pleasing, though indeed I felt certain what it would be from the great care and pains which you have taken to put the Aneroid in perfect order. I am especially obliged to you for the record of comparison with standard instrument at Kew Observatory.

I am satisfied that I now have an instrument at least equal to any of its kind in Australia.

I am, dear sir, yours truly,

CHAS. W. RANCLAND,
Major 4th Regt., N.S.W.V.I.

390, Ontario Street, Chicago, *Oct. 22nd*, 1894.

The two-in. "Watkin" Aneroid which you made for me about four years ago has proved a most satisfactory instrument. I have crossed the Atlantic with it four times and find that it never fails to foretell coming storms—sometimes twenty-four hours in advance. I have also carried it with me many times over our Rocky Mountains and Sierra ranges of mountains, and find that the readings correspond very closely with the altitudes as established by the government engineers. In fact, 'tis my constant companion at home or abroad, and if I could have but one, I hardly know which I would choose, my watch or my "Watkin" Aneroid.

C. W. BOYNTON.

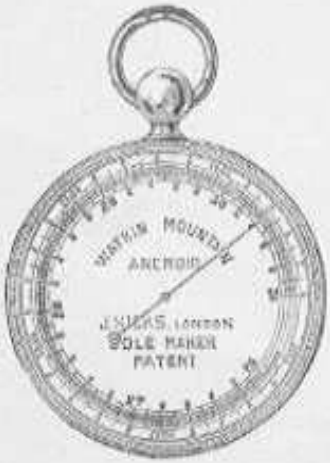
10, Blacket Place, Edinburgh, *6th May*, 1896.

Dear Sir,—It may interest you to know that the "Watkin" Aneroid purchased more than eight years ago still continues to give every satisfaction. During this time its qualities have been severely tested in numerous hill-climbing expeditions, for which the open scale of the instrument is particularly adapted; enabling the height of the mountain to be read off within a few feet. Numerous comparative readings have been made from time to time with the standard barometer at the Ben Nevis Observatory during visits to the hill top. Broadly speaking, the differences of pressure indicated by the two barometers when hung side by side, may virtually be regarded as a negligible quantity, averaging only 0·025 inch.

Yours very truly,

R. C. MOSSMAN,
F.R.S.E., F.R., Met. Soc.

Watkin's New Patent Mountain Aneroid Barometers.



This marvellous instrument, of which both a front and back view is shown above, is the invention of Colonel H. S. Watkin, the author of the famous Barometer described on the five pages immediately preceding this. It is the only Aneroid that can be put in and out of action as required, and which when out of action is absolutely impervious to the influence of variations in atmospheric pressure. Travellers, Explorers and Surveyors will now be able to ascertain *correct* altitudes owing to its unerring accuracy. It supplies a want which has long been felt by the Alpine world, and is, beyond a doubt, certain to be speedily adopted as the *standard* instrument for the determination of altitudes.

It is made in Aluminium for lightness, either 3-inch or 4½-inch size, with its scale divided in either English or French measurement, and supplied in a Sling Leather Case, at the undermentioned prices :—

	£	s.	d.
For altitude of 5,000 feet	5	15	0
,, 10,000 ,, ...	6	2	6
,, 15,000 ,, ...	6	10	0
,, 20,000 ,, ...	6	17	6

The following extracts from a letter written by Mr. Edward Whymper, the world renowned Alpine explorer to the *Times* newspaper, dated 9th December, 1898, will be read with interest in connection with

"WATKIN'S" NEW MOUNTAIN ANEROID BAROMETER:—

In introducing it, Col. Watkin said in effect, though not in these words, "You point out that all aneroids lose upon the mercurial barometer when submitted to a diminution of pressure; that this loss is large when pressure is much diminished; and that the loss continued to augment for several weeks. It is, you say, apparent that the *extent* of the loss which will occur in any aneroid upon the mercurial barometer on being submitted to a diminution in pressure depends (1) Upon the duration of time it may be submitted to diminished pressure, and (2) upon the amount of the diminution in pressure; and that it follows that the errors which will be manifested by any particular aneroid will be greatest when it is submitted to very low pressures for long periods. Accepting this as a correct statement of facts, I propose to construct an Aneroid Barometer that can be put in action when required, and 'put out of gear' or 'thrown out of action' when it is not wanted for use; and I propose to construct it in such a way that it shall not be exposed to the influence of variations in atmospheric pressure when it is *out* of action, in short, that no variations in atmospheric pressure, however large they may be, shall produce any effect upon it except at the time when it is put in action for the purpose of taking a reading." The following description, supplied by Col. Watkin, explains the manner in which this is done:—

"In order to relieve the strain on the mechanism of the Aneroid, and only permit of its being put into action when a reading is required, the lower portion of the vacuum-box instead of being a fixture (as in the case with ordinary instruments) is allowed to rise. Without entering into details of construction, this is effected generally by attaching to the lower portion of the vacuum-box a screw arrangement, actuated by a fly nut on the outside of the case. Under ordinary conditions this screw is released, and the vacuum-box put out of strain. When a reading is required, the fly nut is screwed up as far as it will go, thus bringing the instrument into the normal condition in which it was graduated."

At first mention this idea did not appear promising, as it seemed that, however quickly an observation might be made, the aneroid would be losing upon the mercurial all this time that the reading was being taken; that when the aneroid should be thrown out of action, this loss would be shut up; and that when readings should be taken on succeeding occasions the loss which would occur during them would accumulate; and that this would go on until at length the error would become almost or quite as serious as in an ordinary aneroid. I was, however, very urgently required to give the instrument a fair trial in the field; and after satisfying myself that, when thrown out of action, it was not affected by variations in atmospheric pressure (amongst other ways by keeping it for six weeks under a receiver in which pressure was maintained constantly at 17 inches), I commenced to compare it against the mercurial barometer in Switzerland in last

September, having intentionally refrained from taking a reading for six weeks further, after it was released from the air-pump, in order to obtain confirmation of the opinion that it was, when thrown out of action, actually impervious to the influence of variations in atmospheric pressure.

The following table shows the comparisons:—

A Place of Observation.	B Date. 1898.	C Altitude.	D Merc. Bar. reduced to 32° F.	E Watkin's Mountain Aneroid.	F Number of Obs'rvations.	G Mean error of Aneroid.
			Inches.	Inches.		Inch.
Zermatt	Sept. 3-8	5315 ft.	25'006	25'096	21	+0'090
Top of Gugel	„ 9	8882 „	21'963	22'020	1	+0'057
Riffelhaus	„ „	8429 „	22'319	22'360	1	+0'041
Top of Gornergrat ...	„ „	10289 „	20'872?	20'820	1	—0'052?
Zermatt	„ 10-13	5315 „	24'912	24'980	8	+0'068
Top of Gornergrat ...	„ 13	10289 „	20'729	20'717	3	—0'012
Zermatt	„ 13-14	5315 „	24'917	24'947	2	+0'030
Randa	„ 15-17	4741 „	25'687	25'687	6	0'000
St. Nicholas	„ 17-22	3678 „	26'443	26'424	5	—0'019
Visp	„ 23-29	2165 „	27'726	27'720	3	—0'006
Zermatt	„ 30	5315 „	24'475	24'492	2	+0'017
Visp	Oct. 4-7	2165 „	27'890	27'907	5	+0'017
Sierre	„ 9-12	1765 „	28'131	28'121	5	—0'010
Geneva	„ 13-17	1227 „	28'332	28'302	2	—0'030

If the eye is run down the column G and neglects the hundredths and thousandths of an inch, it will be seen that it reads 0'0 from first to last! Better results might have been attained, and I believe would have been attained, if the readings had been taken with greater rapidity. Attention must be paid to two points when employing this instrument. The first is to keep it constantly shut off from the influence of the atmosphere, except at the times when readings are to be taken: and the second is to take the readings as quickly as possible.

Finally, I feel confident that, in the hand of those who will give the requisite attention, extraordinary results may be obtained from Watkin's Mountain Aneroid in observations made for altitude, and in determining differences of level.

The comparisons were made against a Mountain Mercurial Barometer, Fortin principle, which was graduated to read on the vernier to $\frac{1}{500}$ of an inch, and by estimation could be read to $\frac{1}{1000}$. Before starting in July, this Barometer was compared against its maker's Standard and it was found that it had not taken in any air.

The Aneroid which was observed was 4½ inches in diameter, and was divided to 0'05 of an inch. Its scale ranged from 31 to 17 inches, and it weighed when in its leather sling case 2½ lbs.

Dines' Self-Recording Mercurial Barometer

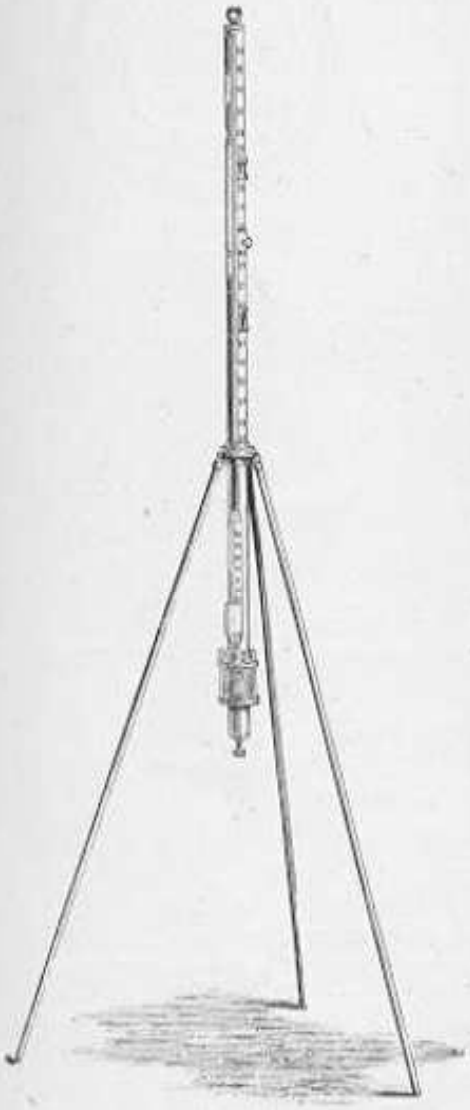


Fig. 58B.

Fig. 58A.

Fig. 58C.

THE DINES' SELF-RECORDING MERCURIAL BAROMETER (Fig. 58A.) has been designed by W. H. Dines, Esq., F.R.S., to give a trace from which the height at any time may be determined to ·005 inches. This end is attained by arranging the details of construction so that the friction of all the moving parts, and more particularly that between the pen and the paper, may be very small, and also by an automatic temperature correction. The pen is actuated by a float in the lower cistern, the motion being multiplied by a lever so that a length of 1¼ inches on the paper may correspond to a change of 1-in. in the height of the barometer. The float is in the form of a hollow cylinder sealed at the top and floating mouth downwards in the mercury. A rise of temperature lowers the level of the mercury in the lower cistern, but at the same time it expands the air in the float, and makes it swim higher in the mercury. The volume of air is so adjusted that there may be a complete compensation. There is an additional pen fixed to the frame, which draws a line of reference on each sheet of paper while it is on the clock drum, and for accurate measurement this line is taken as the zero line, since by this means the error that might be caused by placing the chart unequally on the drum, or by an incorrect printing of the charts, is avoided. The price, complete in glass case with lock and key, including supply of charts and ink is £30

MERCURIAL MOUNTAIN BAROMETER (Fig. 58B) on FORTIN'S principle, ivory pointer in cistern, attached Thermometer, graduated on stem. Barometer tube enclosed in metal body, portable brass tripod stand and gimbals to revolve, packed in leather sling case, metal lined, for travelling (Fig. 58C.) £8 8 0

Hicks's Patent Altitude Meter.

Fig. A.

There has been a universal demand for years among all classes of tourists for an accurate and inexpensive instrument to determine the altitude of hills and other eminences occurring on their line of route, yet sufficiently simple in its indication to be understood by anyone.

To meet this very popular enquiry, I have recently devised the instrument illustrated elsewhere, which, by merely turning the zero, or O, of the revolving dial round to where the indicating hand may happen to be at the time, one may in a few moments learn whether one is ascending or descending, and to what extent, even though it may be only a few feet. To everyone this information would at all times be interesting, but to the Motorist, who may be uncertain if his storage of motive force is sufficient to finish his journey, it should be exceptionally welcome. One other feature has been maintained by the manufacturer, and that is an exceptionally low price for what will prove a very useful instrument, the object being to bring it within the reach of everybody, whether indulging in pedestrianism, cycling, or motor driving.

Fig. B.

PRICES.

Fig. A.	Divided 2,500 ft. up and 2,500 ft. down, with revolving dial	30/-
,,	,, ,, ,, ,, keyless action	36/-
Fig. B.	Divided 5,000 ft. up and 5,000 ft. down, with revolving dial	32/-
,,	,, ,, ,, ,, keyless action	40/-

The above are in Chamois Cases, but if Morocco Cases are required the extra cost would be 2/- each.

When the day's work is over one can also, by setting the Zero over the indicating hand, see what the weather is likely to prove before setting out again on the morrow—an obvious advantage.

Self Registering Altimeter.

NEWTON & CO.'S PATENT. J. J. HICKS, SOLE MAKER.

The Altimeter has been made to supply a want that has been felt amongst kite fliers and military balloonists, *i.e.*, a simple and yet effective way to ascertain the height to which a kite or balloon rises. One must of course see that the kite or balloon will carry the weight; the full size instrument in an aluminium case weighs about seven ounces. It is also very useful for hill climbing by motor or cycle. The scale is divided to 5 ft. reading to 5,000 ft., on a 2½-in. face; so the scale is very open and easy to read.

TO ADJUST THE INSTRUMENT.

Turn the instrument upside down, slide the small plate down to uncover the hole at the side, which will allow a pin to project; push this in a little so as to release the detent, and the hand of the barometer will read the mean atmospheric pressure. Next hold the instrument upright and turn the altitude scale zero opposite the hand. The instrument is now in adjustment ready to send up. As the machine rises the hand goes down, and is held in check by a mechanical arrangement inside which does not allow the hand to return, it working only in one direction, so that when the aerial machine has attained its greatest height it stops action. The difference between zero and the hand will be the height. The hand will be found pointing to the highest altitude attained by the kite, so that no calculation or deduction has to be made.

To reset the instrument, adjust as before described.

When the above is used as a Weather Instrument it must be kept perfectly flat.

The Altimeter noted above is the outcome of a great deal of experimental work to arrive at an accurate and at the same time a very simple means of ascertaining the maximum height a kite reaches.

Price, in Leather Case, £5 5s. Wire Cage, with springs to prevent concussion, 12s. 6d.

Aneroid Barometers.

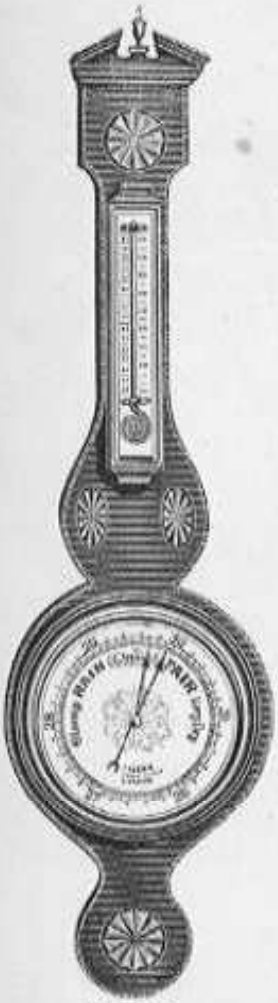


Fig. 58D.

Fig. 58E.

Fig. 58F.

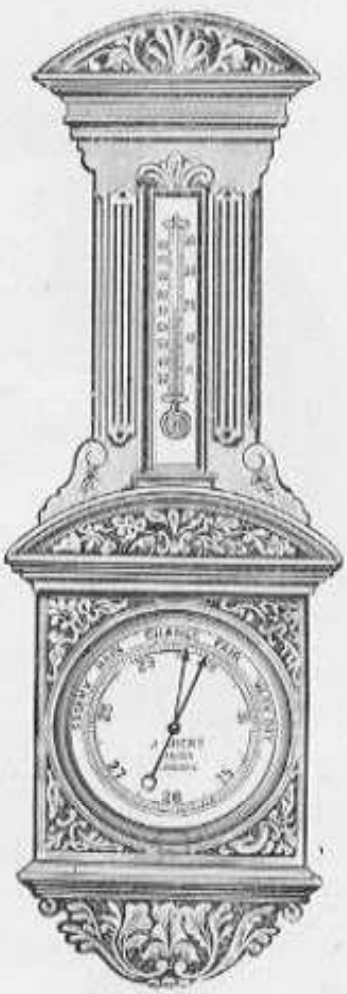


Fig. 58G.

No.			£	s.	d.
214A	Fig. 58D.	Inlaid mahogany frame, with best movement, spiral bulb thermometer, and 8 in. engraved metal dial	4	0	0
214B	Fig. 58E.	Finely carved oak or walnut frame, with 8 in. engraved metal dial	7	0	0
214C	Fig. 58F.	Do. do. do. do.	6	10	0
214D	Fig. 58G.	Do. do. do. do.	6	0	0

Self-Recording Thermometers.

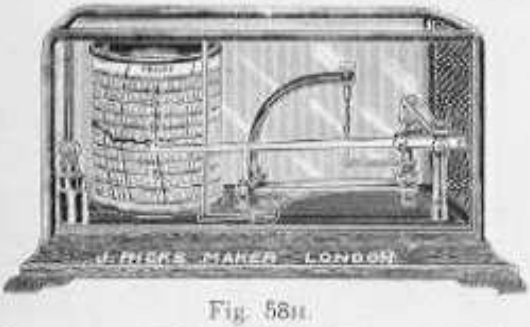


Fig. 58H.

		£	s.	d.
	Self-Recording Thermometer, in oak, mahogany, or walnut case, with glass sides, complete with ink and supply of charts for one year ...	5	15	0
Do.	do. with drawer, having separate compartments for used and unused charts	6	10	0
Do.	do. in copper case, for use in refrigerating chamber, and ranging from Zero to 100° Fahrenheit, complete with supply of charts for one year and bottle of ink	7	0	0

Aneroid Barometers.

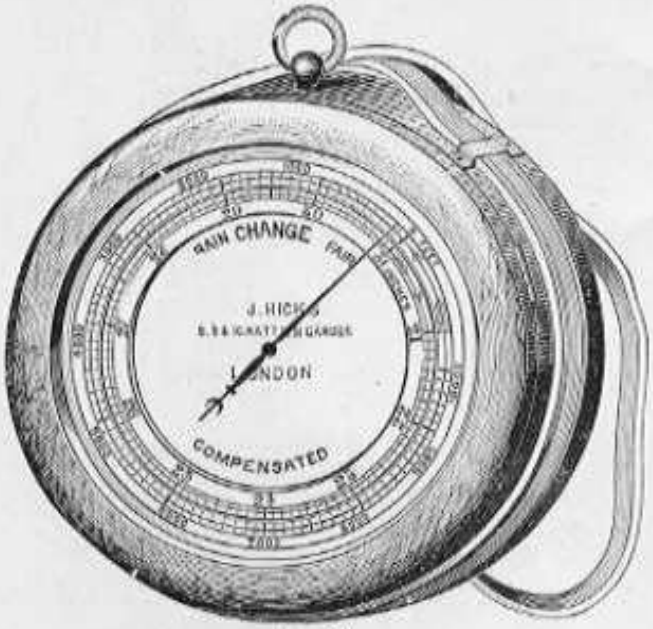


Fig. 59.

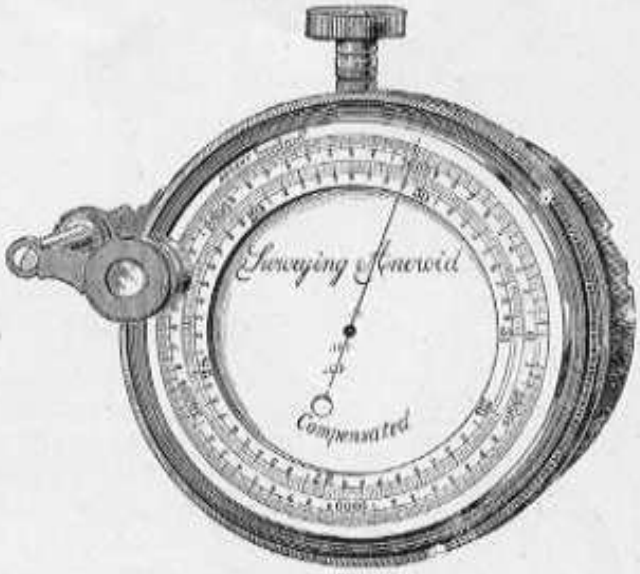


Fig. 60.

215 **GEOLOGICAL ANEROID,** Fig. 59. As specially made by Mr. Hicks for the survey of Pennsylvania. With 5-inch silvered metal dial enclosed in a mahogany case with leather strap and altitude scale from 3,000 to 5,000-ft., £6 6s. 0d., 5,000 to 10,000-ft., £6 10s. 0d., from 15,000 to 20,000-ft., £6 15s. 0d.

216 Do. do. similar to above, but in aluminium case for lightness, as made by Mr. Hicks for Professor Fraser of Philadelphia, with a scale of feet from 3,000 to 5,000, £8 10s. 0d., to 10,000, £8 15s. 0d., to 15,000, £9 9s. 0d., to 20,000, £10 10s. 0d.

217 **SPECIAL SURVEYING & MINING ANEROID,** Fig. 60. In this Instrument, which is made in either 4½ or 5-in. size, there is a special altitude scale graduated to hundredths and subdivided so as to be read with a vernier to single feet. The entire circle of the dial is divided from 26 to 33 inches, enabling the Instrument to register 4,000 ft. above and 2,000 ft. below sea level. There is a rack-work adjustment attached to the Vernier Scale and a rotating magnifier for taking minute readings. The Instrument is extremely sensitive, and is highly recommended for the use of Miners and Surveyors. Where desired, the Instrument can be made with a scale from 25 to 31 ins. Price in sling leather case, with altitude scale from 5,000 to 10,000 ft. ... £7 10s. 0d.

Fig. 60A

217A **GEOLOGICAL ANEROID,** Fig. 60A. Very sensitive, 3-inch dial, revolving scale to 5,000 feet, keyless motion, aluminium case (a similar Instrument made for use on one of the Polar expeditions) ... ... £5 0s. 0d.

Anemometers.

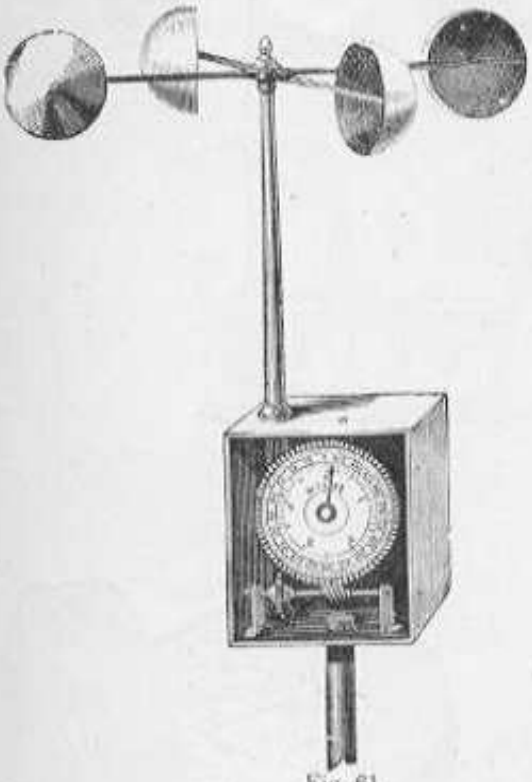


Fig. 61.

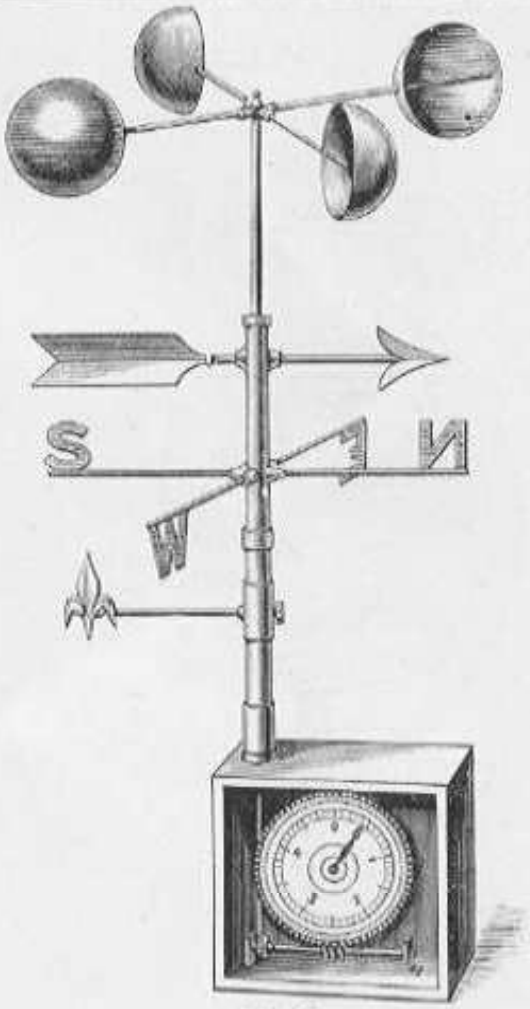


Fig. 62.

No.		£ s. d.
218	**BECKLEY'S IMPROVED,** Fig. 61. As the illustration shows, this is a simpler form of Robinson's Anemometer. The cups are retained, but the index portion of the Instrument consists of two graduated circles divided respectively into 10ths and 100ths. There is a fixed index at the top of the dial, which, as the toothed wheel revolves, marks on the inner dial the miles and 10ths of miles the wind has travelled, while a moveable index indicates on the outer dial the passage of every five miles	No case. 4 0 0 In case. 4 7 6
219	Do. do. with wind vane and letter points	No case, £5 5s. 0d. In case 5 15 6
220	**IMPROVED ANEMOSCOPE or WIND VANE,** Fig. 62. Designed by the late G. M. WHIPPLE, Esq., B.Sc., Superintendent of the Kew Observatory. The object of this Instrument is to prevent the errors which sometimes observers make, arising from the foreshortening of the common wind vane when it stands nearly in the line of sight. This is effected by making the vane turn the ordinary letters, N. E. S. W., and by fixing rigidly at right angles to the line of sight, a pointer; so that it then only becomes necessary to notice what letter or letters are nearest to the pointer in order to read off the direction. The vane is mounted on the tube of the ordinary Counting Robinson Anemometer which is lengthened for the purpose. ...	6 6 0
220A	Do. do. larger size	8 8 0

Mr. Hicks is sole maker of this Instrument.

In fixing the Anemoscope the base of the instrument should be firmly secured, with its dial facing the position most suitable to the observer. When this is done, the pointer at the bottom of the pillar of the instrument should be moved round to where the observer can see it most distinctly, and then secured to the pillar by its clamping screw. The vane or arrow head should then be unclamped from the tube carrying the letters N, S, E, W, and the pointer of the vane turned and *held* to the North: the lower portion carrying the letters should now be turned round until the letter N is directly over the lower pointer. The vane must now be secured by the clamp screw to the tube carrying the letters, and when this is done the Anemoscope is ready for observation. In taking an observation one has only to observe which letter is above the fixed pointer, this being the direction the wind is blowing at the time.

NOTE.—See also Wind Indicator, illustrated and described on back of cover.

Anemometers.

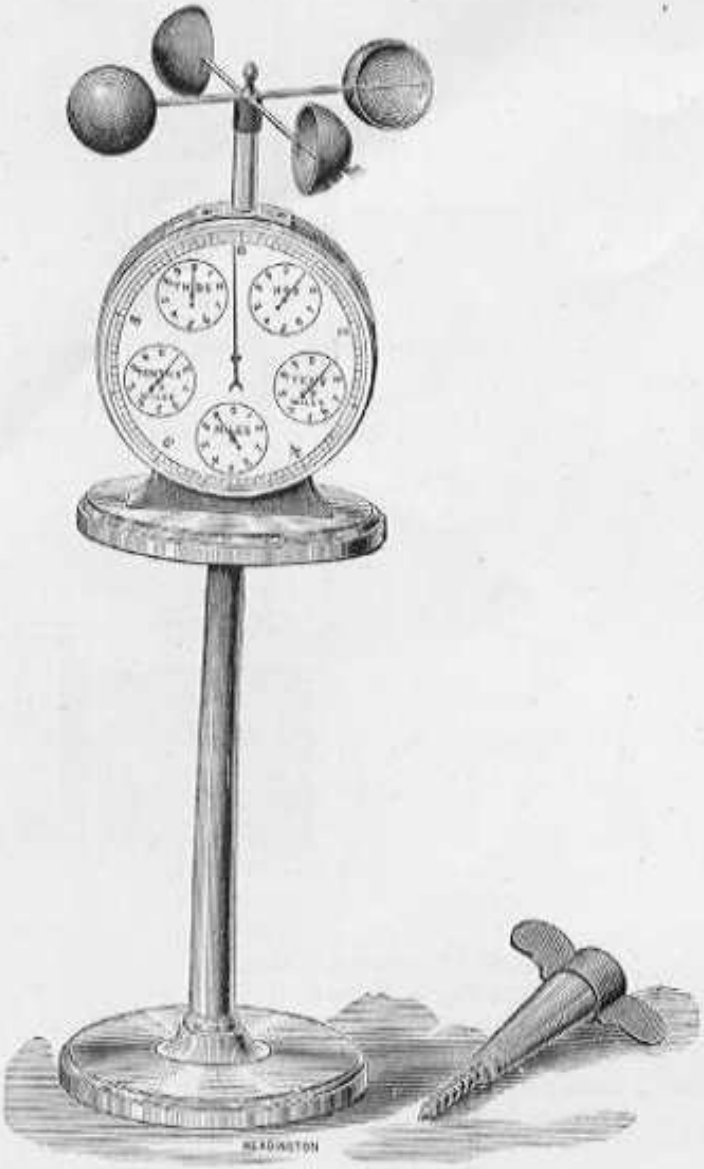


Fig. 63.

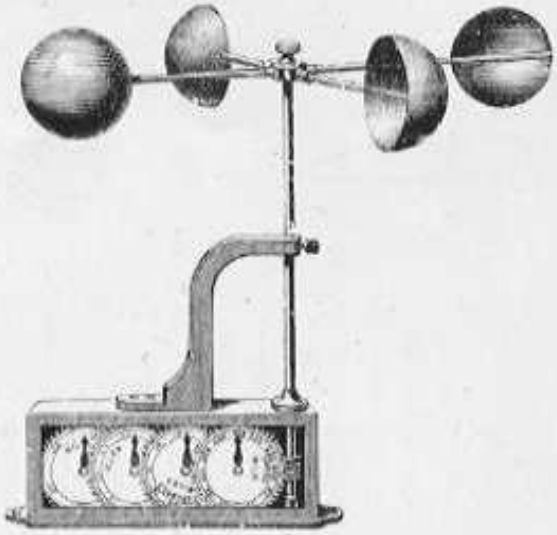


Fig. 64.

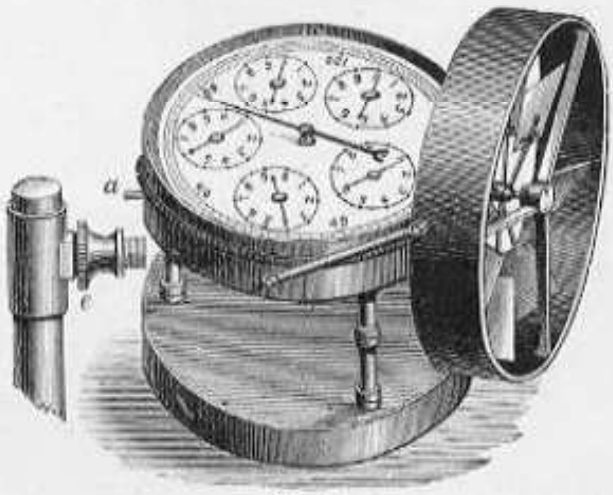


Fig. 65.

No.		£ s. d.
221	**PEDESTAL ANEMOMETER,** Fig. 63. The face of this ingenious instrument closely resembles that of the 5 dial Air Meter, and is similarly constructed, with the exception of the fan wheel being replaced by four hemispherical cups placed at the top. The instrument is attached to a brass stand, in which form it will be found particularly convenient in many places. It is quite portable and is packed in a small mahogany case, the stand being unscrewed ...	4 10 0
222	**ROBINSON'S ANEMOMETER,** Fig. 64. Invented in 1850 by Dr. Robinson, of Armagh. It has attained just celebrity, being a highly accurate and reliable instrument for taking the velocity of the wind. Its value has been much appreciated by the Government and the chief Meteorological Offices of this country	3 10 0
223	**PORTABLE AIR METER,** Fig. 65. For measuring air currents in sewers, mines, hospitals, etc., the face is similar to Fig. 63, but a fan wheel is here used which acts first on the long hand, which records on the larger or outer dial, and then successively by a train of wheels on the indices of 5 small dials. It is an excellent pocket companion and guide for Tourists, and records the velocity up to 10,000,000 feet, or 1,839 miles	2 6 0
224	Do. do. with two small dials recording to 1,000 feet	2 3 0

Sand timers to Nos. 223 and 224, 6/6 extra.

Anemometer, Spirometer, etc.

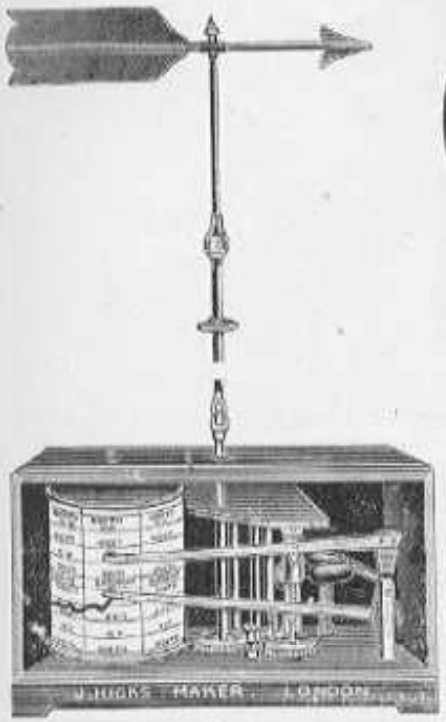


Fig. 65A.

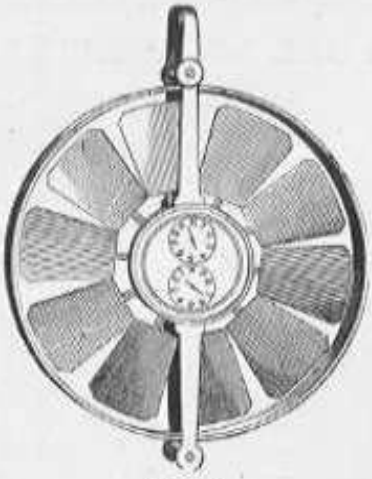


Fig. 66.

Fig. 67.

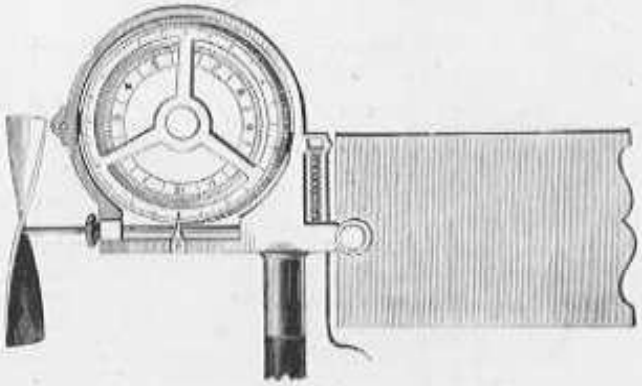
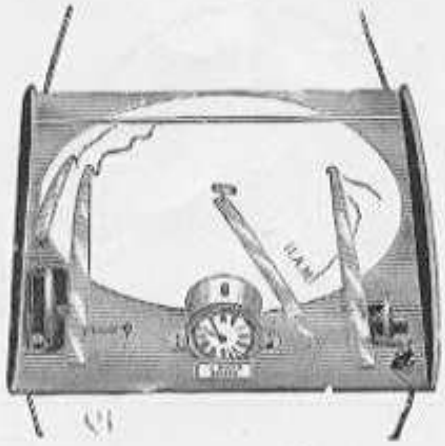


Fig. 68.

No.			£ s. d.
224A	**DALES'S PATENT SELF-RECORDING ANEMOGRAPH.** This is simple in construction, not liable to get out of order, and records the direction of the wind at all points throughout the day. The vane is mounted on the roof, or some similarly elevated position, and suitably connected to the recorder placed in the hall or elsewhere. Price exclusive of fixing		10 10 0
225	**BIRAM'S ANEMOMETER,** Fig. 66. A clever and trustworthy "tell-tale" instrument for registering currents of air in mines, and thus showing if the proper amount of ventilation is being maintained. In heavy gun or rifle practice the pocket size of this instrument affords most useful information. It is well but simply made, and full directions for use are supplied with each instrument. Of 12-in. diameter reading to 10,000,000 feet, in wood case		4 10 0
226	Do. 6-in. " " 1,000 " "		2 5 0
227	Do. 4-in. " " " " "		2 0 0
228	Do. 2-in. " " " " special watch form ...		3 0 0
229	Do. 6-in. " " 10,000,000 " in wood case		2 15 0
	Disconnectors, 3/6 extra.		
230	**PORTABLE MEDICAL SPIROMETER (Patent),** Fig. 67. The measurement of the vital capacity is obtained by measuring the velocity of the expired current during the time of expiration, and the instrument is arranged so as to reduce the velocity of the current to cubic measure. ...		5 5 0
231	**CURRENT METER,** Fig. 68. Constructed specially for use in small rivers and streams to show the rate of flow of tide. Suitable also for reservoirs...		5 10 0

Dines' Meteorograph.

FOR USE WITH KITES.



Instruments for recording the climatological conditions of the upper air have hitherto been found so expensive that anything like a general interest in the science has been rendered almost impossible.

W. H. Dines, Esq., F.R.S., however, has designed the combination of instruments illustrated above, and the question of ultimate cost having been carefully considered by the Manufacturer, it is hoped that the subject may be more generally taken up.

Description of Meteorograph.

The pens write on a disc of paper 11 inches in diameter instead of on a drum. The paper lies flat on a piece of thin wood, and turns about a pin passing through its centre. It is driven by contact near its circumference with a small milled wheel which is driven in its turn by a clock. A roller mounted on a spring on the other side presses the paper against the milled wheel, and ensures sufficient friction. The pens describe arcs of circles on the paper disc, the chords of the arcs being roughly coincident with radii of the disc. It will thus be seen that the time scale being angular is not uniform, but depends on the position of the pen.

The barograph pen is actuated by an aneroid box made of thin metal, and sealed with some air at atmospheric pressure inside. The corrugated face of the box is very yielding, and hence the volume of the enclosed air is dependent chiefly on the external pressure and on its own temperature. The arrangement necessitates a large correction for temperature, but the result has proved satisfactory, since independent observations of the height of the kite have mostly agreed with the heights given by the Meteorograph within 2½ per cent., instead of the 5 per cent. previously given by the exhausted boxes.

The hygrograph depends on the extension of a bundle of human hairs, protected from rain and spray, 6 ins. (15 cm.) long multiplied eightfold by a lever. Although the scale is short it is probable that this arrangement enables the relative humidity to be determined to about 5 or 10 per cent.

The thermograph depends on the expansion of spirit enclosed in a thin brass tube, ¼in. diameter and 20 ins. long (6 mm. diameter, 50 cm. long); this communicates with a small aneroid box also full of spirit, and its expansion and contraction actuates the pen. The scale is obtained by direct comparison with a mercurial thermometer, and is about 40° to one inch (1° C. to 1·2 mm.) The arrangement gives a powerful control over the pen so that blurring due to the shaking of the Meteorograph seldom occurs.

The pens write on discs of paper, and the traces are tabulated by placing the paper discs under a celluloid transparency on which the scales are engraved. The certainty of synchronous readings is ensured in the following manner:—On each trace while the paper is on the meteorograph nicks are made simultaneously by hand by the pens. On placing the celluloid transparency on the paper, with a pin through the centres of both, by turning it round it should be possible to make each nick on the trace coincide exactly with the corresponding arc engraved on the celluloid. If this can be done the points on the traces of the barograph, hygrograph, and thermograph, which lie under the corresponding arcs on the celluloid, must be simultaneous points on the traces, and if not allowance can be made. If preferred, printed paper discs can be supplied.

These instruments can also be used as an ordinary thermograph and hygrograph either in a room or in the open.

Price of Meteorograph, without Engraved Celluloid Scale, as illustrated, with all the latest improvements £4 15 0

Charts, extra per 100, £3, or 7/6 per dozen.

Each instrument is tested and verified by W. H. Dines, Esq., F.R.S.

Sunshine Recorders.

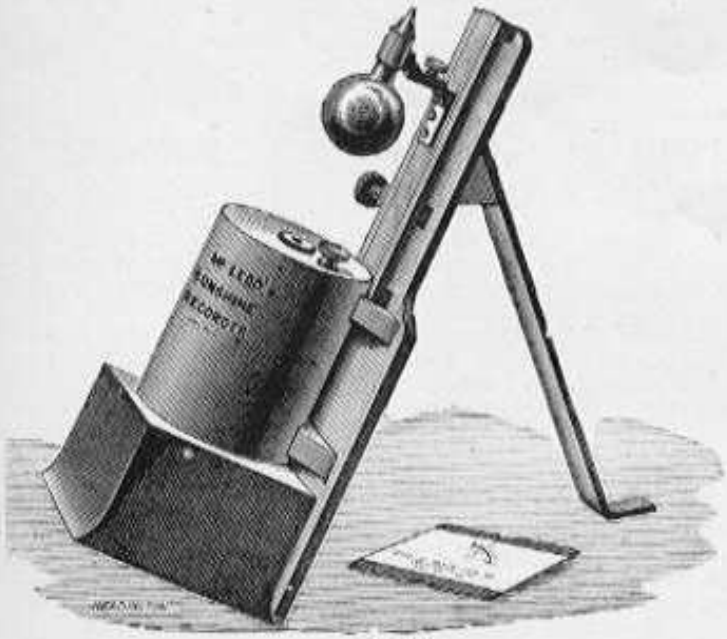


Fig 69.

Fig. 70.

No. £ s. d.

232 **McLEOD'S SUNSHINE RECORDER,** Fig. 69. The ingenious instrument, which is the invention of the well-known Professor McLeod, of Cooper's Hill College, Staines, consists of a cylindrical metallic camera, opposite to the lens of which is a thin glass sphere silvered inside. The sphere is mounted on a slide provided with rack and pinion for focussing the image of the sun on the sensitised paper placed in the base.

When in use the axis of the instrument has to be fixed parallel to the axis of the earth, that is to say, the instrument must be placed with its vertical plane in the meridian and inclined with the sphere upwards so that the axis of the camera makes an angle with the horizontal equal to the latitude of the place at which it is set up. The support of the instrument is constructed by the maker to suit the latitude; the observer has merely to place the instrument in the meridian. Further information supplied by J. J. H., who is the sole maker 6 15 0

Sensitised paper for one year 0 15 0

233 **IMPROVED CAMPBELL-STOKES' SUNSHINE RECORDER,** Fig. 70. Designed by R. H. Curtis, Esq., F.R. Met. Soc., with adjustments for both lens and bowl.

In the original pattern of the Campbell-Stokes' Burning Sunshine Recorder no arrangement was made for readily centering the lens in the bowl, or for adjusting the bowl for the latitude of the place at which it was to be used; and these omissions have not only proved themselves a source of much trouble to observers using this form of instrument, but they have in some instances resulted in the instrument becoming unjustly discredited as a recorder of sunshine.

In several instances which could be mentioned, an obviously too small record of sunshine has been regarded as an essential fault of this type of instrument, whereas it was simply due to the fact that the lens had not been properly placed in the bowl.

Purchasers of these Recorders, finding the pedestal on which the lens is placed permanently fixed, and unprovided with any means of adjustment, have assumed, as they were entitled to do, that the adjustments had been properly ensured by the makers before they left their hands, and any fault in this respect, which with a lens of such short focus as is used need be but a very small one to sensibly affect the record, has in some cases not been discovered until the instrument had been in use for some time.

Until now no satisfactory attempt has been made to remove this serious defect, and the adjustable pedestal now introduced has been designed to meet the want, and get rid of a difficulty which has not seldom been a source of much error and annoyance.

To render observations of bright sunshine strictly comparable *inter se*, it is desirable that all Recorders should be essentially similar, and to this end the Meteorological Office and the Royal Meteorological Society have adopted the specification, as to size of lens and bowl, suggested by Mr. R. H. Curtis, F.R.Met.Soc., in the Quarterly Journal of R. Met. Soc., vol. xxiv., Jan., 1898.

The adjustable pedestal now introduced by Mr. Curtis renders it quite easy to ensure that the lens shall be so adjusted in the bowl that the sun's image shall be properly focussed upon the strip of card whenever in the day the sun is shining, and thus yield the full amount of record.

At the same time an improved adjustment for latitude is provided, by means of which the instrument can be accurately set for the latitude of the station without recourse to the clumsy and very unsatisfactory plan of tilting the base, as has to be done in instruments of the old pattern.

In planning these adjustments care has been taken to ensure rigidity and stability. The movable parts can be readily secured, and are then neither able to slip nor liable to become weakened by exposure to weather.

The adjustable bowl has been supplied to the Meteorological Office as its standard pattern.

INSTRUCTIONS FOR ADJUSTING AND USING THE IMPROVED SUNSHINE RECORDER.

The Improved Sunshine Recorder consists of a metal bowl, firmly fixed by means of a brass bracket to a slate base; in front of the bowl is a movable pedestal, upon the curved top of which rests a glass ball, and the inside of the bowl is fitted with a series of grooves for holding the strips of card upon which the record is scored. The ball and bowl are both of the standard dimensions adopted by the Meteorological Office.

The instrument when placed in position faces the south; and when the sun is shining the focussed rays char a slip of card previously placed in the instrument. As the sun travels from east to west the burn gradually moves along the card, which is thus scored during sunshine and left untouched when the sun is hidden.

Choice of Position.—If possible, a position should be chosen for the instrument in which it will have a clear horizon from north-east through south to north-west. Trees or other objects likely to intercept the sun's rays, especially towards the times of sunrise and sunset, should be avoided as far as possible.

The support for the instrument should be of brick or stone; or if wood must be used it should be protected from the effect of the weather, so that the adjustment of the Recorder may not be affected by the wood becoming warped.

Concentricity of the Lens in the Bowl.—This adjustment is made before the instrument is sent out, but before putting it in its place it should be verified. The easiest way of doing this is to cut from a piece of thin card a circle, the diameter of which is that of the lens plus twice its focal length, say 5·75 inches. From the centre of this circle cut out another 4 inches in diameter, and put the ring which will be thus formed over the lens so that it shall divide it exactly in half. Put one of the straight cards in the bowl, and set the ball upon the pedestal and turn it so that the edge of the ring shall fall upon the white line which runs along the middle of the card. If the adjustment is correct these will coincide right round the bowl, and if they do not thus coincide the pedestal must be released by using the capstan pin supplied for the purpose, and moved as required until the edge of the ring falls upon the white line on the card all the way round the bowl. The nuts on the pedestal must then be securely tightened up again.

Placing the Instrument in Position.—In doing this there are three points to which attention must be paid:—

1. The polar axis of the bowl must be inclined to the horizon at an angle equal to the latitude of the place.
2. The bowl must be level in an east and west direction.
3. A plane passing through the axis of the bowl and the noon line marked on its inside must coincide with the plane of the meridian.

The first of these conditions is at once secured by releasing with the capstan pin the nut at the back of the bowl, and then moving the bowl up or down until the arrowpoint indicates on the engraved scale the latitude of the place, when the bowl is to be reclamped as before.

The second point will be obtained by levelling the top of the support upon which the Recorder is to be placed.

The third adjustment may be made by the aid of an azimuth compass. But a better plan is to correct the clock time (Greenwich or Dublin *mean* time) for the longitude of the place and for the equation of time, so as to get the local *apparent* time of the station.* Then place a card in the bowl, taking care that the noon line corresponds exactly with the noon mark engraved in its centre, and turn the instrument to face the south as nearly as possible. Now when the sun is shining, preferably near mid-day, note the position of the spot of light thrown upon the card, and turn the base of the Recorder to the right or left as required until the spot indicates exactly the local apparent time, and when this has been correctly done the instrument will be in proper adjustment.

The burn made by the instrument should be clean and sharp, not too broad, but going right through the card whenever the sun shines brightly, and fading off gradually towards sunrise and sunset if the atmosphere is clear. A too wide burn, or a failure to get any record early or late in the day, should suggest that the lens is not properly placed in the bowl. If each of the three points mentioned has been secured the burn will be practically parallel to the nearest edge of the card.

Cards to be Used.—Three patterns of cards are employed in the course of the year; a straight card for the equinoxes, and curved cards for the summer and winter, the winter card being smaller than that used in summer.

The *straight* cards are to be used from the 1st of March to the 12th of April, and again from the 1st of September to the 12th of October, inclusive. The *long curved* cards are to be used from the 13th of April to the 31st of August, and the *small curved* cards from the 13th of October to the end of February.

The cards are to be inserted with the hour figures erect, and are to be slid along the grooves until the noon line coincides with the noon mark engraved in the centre of the bowl.

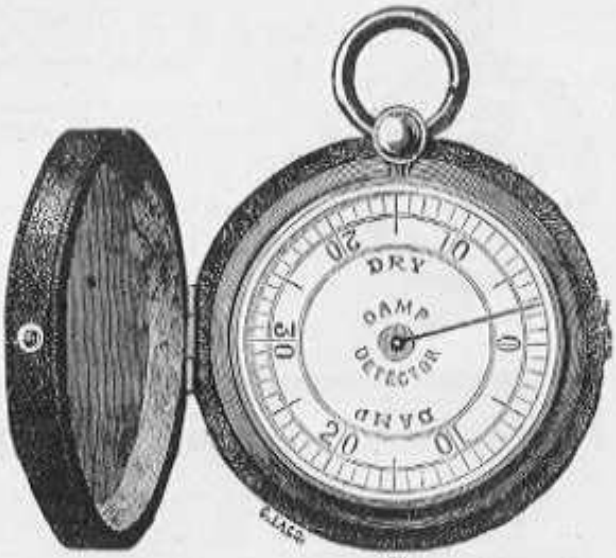
It is recommended that the cards be changed each day at sunset.

* *Apparent* noon is when the sun is on the meridian, or due south. The corrections for longitude is made by adding to or subtracting from clock time, according as the place is east or west of Greenwich, at the rate of four minutes to each degree. The equation of time will be found in Whitaker's or any similar Almanack.

	£	s.	d.
Price of Sunshine Recorder	9	10	0
,, Stand only	5	0	0
,, Brass Ring to adjust the lens in the bowl	0	10	6
,, 1 Year's Charts	1	10	0

Pedometers, Trocheameters, etc.

Fig. 73.



73A.

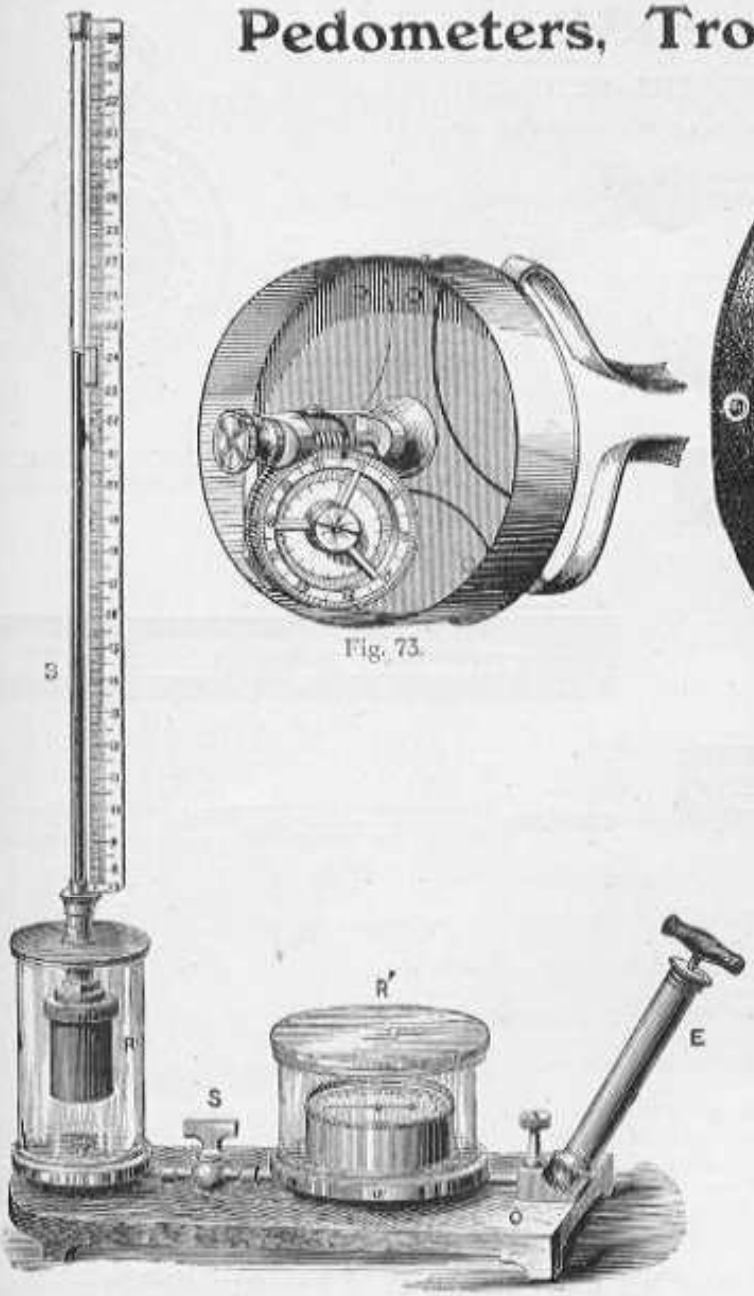


Fig. 71.

FRONT VIEW.
Fig. 72.

No.		£ s. d.
234	**APPARATUS FOR TESTING ANEROIDS,** Fig. 71. This consists of a Standard Mercurial Barometer (B) with engine-divided metal scale, each inch of which is compensated for capacity; the cistern being enclosed in the receiver (R), which communicates by the tube and Stop-cock (S) with the larger receiver (R) containing the Aneroid, while undergoing the process of testing. It will thus be seen, that the two receivers virtually form one chamber, the compartments of which are simultaneously exhausted of air by the powerful exhausting syringe (E). The base-board (O) and the circular plates (AA) are the same as in an ordinary air-pump. In using the apparatus, all joints should be made absolutely air-tight in the usual manner by the application of a little lard;—the Aneroid, to be tested, is placed in the receiver (R') and the exhaustion commenced. If the scale of the Aneroid be rightly divided and the works in accord with those divisions, the pressure in inches which they indicate should coincide tenth for tenth with the divisions on the mercurial scale as the mercury falls or rises	12 0 0
235	**PEDOMETER,** Fig. 72. In size and appearance this instrument closely resembles a watch, and enables the wearer to measure the distance he has walked. It is simply constructed, can be adjusted with ease to suit the full length of step, and is very accurate. Full directions are supplied with each instrument, which is particularly suitable to Athletes and Tourists. In German Silver or Nickel Case, 15/- ... ... In Silver	1 10 0
236	**TROCHEAMETER,** Fig. 73. This instrument is used for registering the revolutions, up to 10,000, of carriage or machinery wheels. It is simply but strongly constructed and contained in a stout copper case fitted with a leather strap to attach it to the wheel. It will be found a very correct indicator of the distance travelled by a coach or carriage	3 3 0
237	Do. with 3 wheels, reading to 50,000 revolutions	5 0 0
237A	**DAMP DETECTOR,** Fig. 73A. In Nickel Case with outer Morocco Case	0 6 0

Hicks's Clinical Thermometers

ARE THE BEST.

Known and Used all over the World.

Fig. 74.

The undermentioned are but a few of the many kinds of my clinical Thermometers. I keep a stock of over **Half-a-Million,** and those who wish a complete illustrated trade price list of them can have same on application.

Fig 75.

Fig. 76.

Fig. 79.

Fig. 77.

Fig 80.

Fig. 78.

Fig. 81.

No.		£	s.	d.
238	**Patent Metallic Thermometer,** Figs. 74 and 75. Very sensitive, and not liable to break or get out of order. In Gold £2 10s. 0d. In silver ... ... each	1	1	0
239	**Hicks's Patent "Climax" Clinical Thermometer,** Fig. 76. Scale enclosed in body. No dirt or infection. Price, in cases, per doz.	3	0	0
240	**Hicks's Patent One Minute and "Half Minute" Clinical Thermometers.** Magnifying. Very rapid action and very popular. Fig. 77. Price in cases, per doz.	3	12	0
241	**Hick's Patent Opaque Lens Clinical Thermometer,** Fig. 78. Very beautiful and distinct scale. Price, in cases, per doz.	3	0	0
242	**Hicks's Patent "Duplex Bulb" Clinical Thermometer,** Fig. 79. Very sensitive and exceedingly strong. Magnifying. Price, in cases, per doz.	4	10	0
243	**Hicks's Patent "Non Plus Ultra" Clinical Thermometer,** Fig. 80. Magnifying. The scale is very clear, as figures are placed near the bulb. Price, in cases, per doz.	3	18	0
244	**Hicks's Patent "Hospital" Clinical Thermometer,** Fig. 81. Very popular with Hospital Doctors and Nurses. Price, in cases, per doz.	1	1	0

Hicks's Tourists' Maximum and Minimum Thermometers.

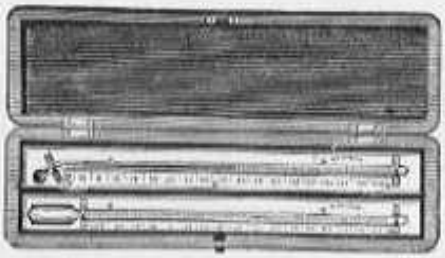


Fig. 82.
Scale about 1.

Fig. 83.
Scale about 1-4th.

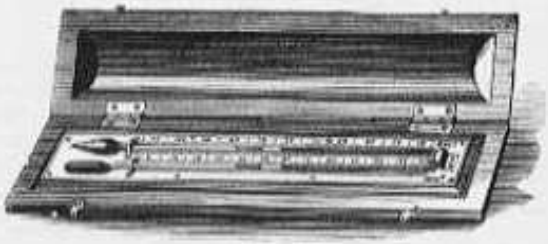


Fig. 84.

245	**Livingstone's Maximum and Minimum Thermometers,** Fig. 82. divided on stem, on ivory or metal scales, in mahogany or morocco case ... ...£1 5s. to	1	10	0
246	**Maximum and Minimum Thermometers,** Fig. 83. For Alpine Tourists, 6-in. enamel tubes, engine divided on stem, figured on raised German silver scale, on boxwood, in mahogany snap case	1	10	0
247	**Dimenuon Self-Registering Thermometer,** Fig. 84. For tourists, silvered metal scale on mahogany backs, in solid mahogany case, 8-in., 25/-; 6-in., 23/-; 5-in.	1	1	0
248	**Dimenuon Self-Registering Thermometer,** same as preceding, ivory scales, in morocco case with snap, 8-in., 17/6; 6-in., 14/6; 5-in.	0	12	6

Hygrometers & Boiling-Point Thermometers for Tourists.

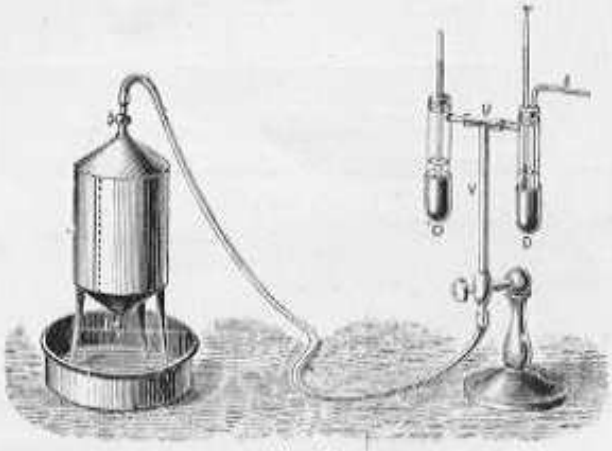


Fig. 86.

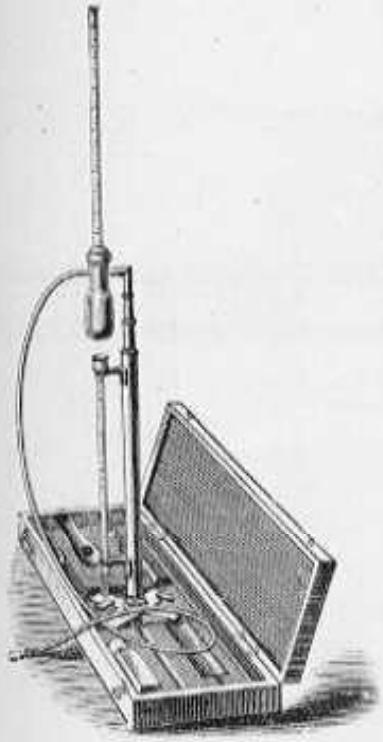


Fig. 85.

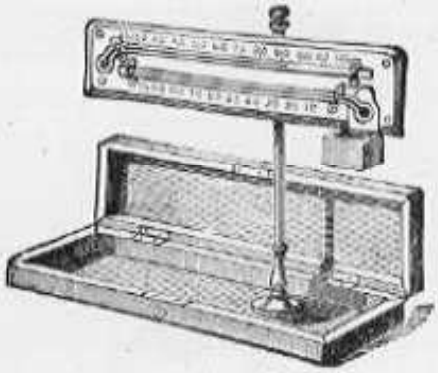


Fig. 87.

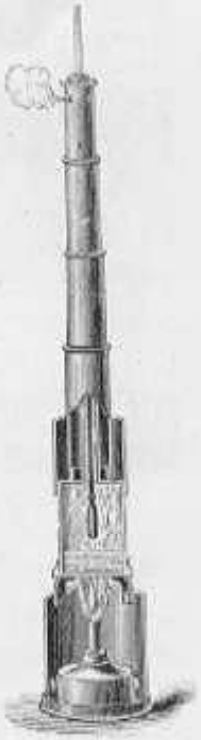


Fig. 88.

No.		£ s. d.
249	**REGNAULT'S HYGROMETER,** Fig. 85, acts like Daniell's, by the condensation of moisture on its external surface, and possesses some important advantages over the former instrument. It consists of a very thin and highly polished silver tube or bottle, into the neck of which is inserted a very delicate Thermometer. The bottle has a lateral tubular opening, to which is attached a flexible tube with an ivory mouth-piece. Ether is poured into the silver tube in sufficient quantity to cover the bulb of the Thermometer. The ether is then agitated by breathing through the flexible tube until, by the rapid evaporation thus produced, a condensation of moisture takes place, readily observable on the bright polished silver surface, and the temperature indicated by the Thermometer at that moment is the dew point. Complete in case	3 10 0
250	**REGNAULT'S HYGROMETER with ASPIRATOR,** Fig. 86. An exceedingly thin silver cup (D), highly polished on the outside, is cemented to a tube of glass (M), the mouth of which is closed by a cork having three openings. The central opening receives the stem of a Thermometer (T), while one of the side openings is filled by the tube (b) communicating with the outer air. In the third opening, a tube (V) is adapted, connected by a caoutchouc tube with the aspirator (A), which is full of water and placed at some distance from the Hygrometer; this tube (V) only just enters the tube, while the tube (b) passes	7 7 0
251	**MASON'S HYGROMETER,** enamel tubes, engine divided on stem, figured on German Silver scales, very compact, with stand and water cistern, in mahogany case, Fig. 87	1 15 0
252	**POCKET HYPSOMETRICAL APARATUS.** This is a more portable form of the Wollaston Boiling-Point Thermometer, and on account of its simplicity, much used by Alpine Travellers; it is cheap and efficient, and forms a trustworthy check on the Aneroid Barometer. The illustration, Fig. 88, shows the instrument with the Telescope portion drawn out for use. The lamp is protected from wind by a perforated metal case covered with wire gauze. With one Thermometer divided to 1-5th of degrees	2 10 0
253	**Extra Thermometers,** in metal case, each	0 15 0

Hicks's Five Guinea Set of Meteorological Instruments.

Suitable for Educational Purposes, or for private use at home; consisting of:—

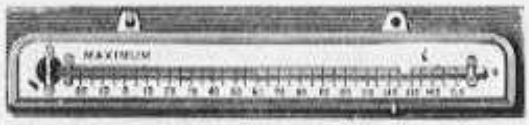


Fig. 91.

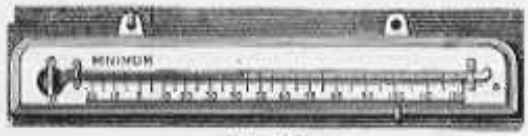


Fig. 92.

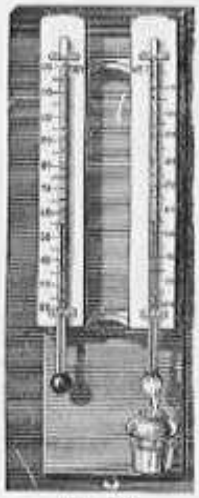


Fig. 90.

Fig. 89.

Fig. 93

No.				£	s.	d.
254	...	1 Mercurial Barometer, with attached Thermometer	Fig. 89 ...	1	14	6
255	...	1 Wet and Dry Bulb Hygrometer, on oak board	„ 90 ...	1	1	0
256	...	1 Registering Maximum Thermometer, in oak frame	„ 91 ...	0	15	6
257	...	1 Registering Minimum Thermometer, in oak frame	„ 92 ...	0	15	6
258	...	1 Symons' Copper Rain Gauge and graduated measures	„ 93 ...	0	18	6
				£5	5	0

(Kew Certificates Extra.)

N.B.—This List can be modified or extended as desired. Every instrument is guaranteed of standard excellence.

Hicks's Special Set of Meteorological Instruments

SUITABLE FOR OBSERVATORIES, &c.

(*For Prices and Description see page 50.*)

Fig. 94.

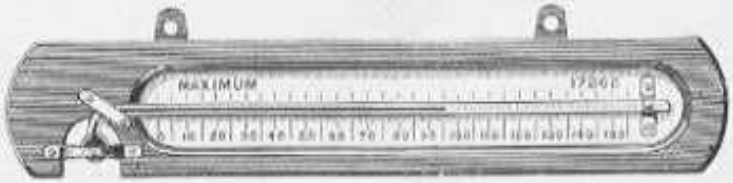


Fig. 95.

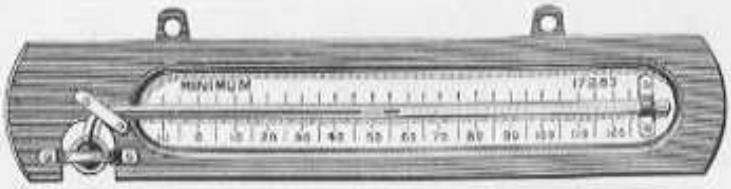


Fig. 96.

Fig. 97.

Fig. 98.

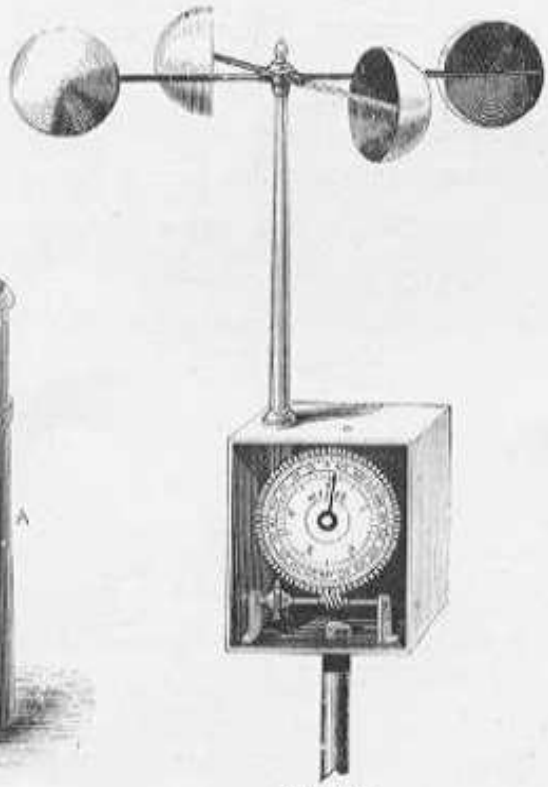


Fig. 102.

Fig. 101.

Fig. 103.

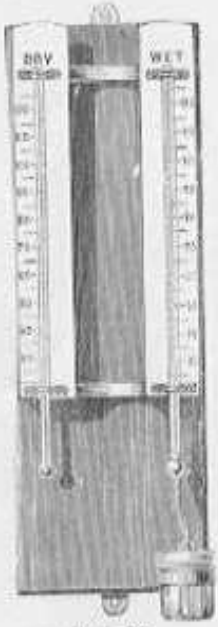


Fig. 99.

Fig. 100.

HICKS'S SPECIAL SET OF

Meteorological Instruments.

SUITABLE FOR OBSERVATORIES (*illustrated on page 49.*)

No.			£	s.	d.
259	1 Standard Barometer, diameter of tube 0·5 in. mounted on mahogany board, Fig. 94		8	8	0
260	1 Maximum Standard Thermometer, in oak frame ... ... „ 95		0	18	6
261	1 „ „ „ black bulb, in vacuo on stand ... „ 98		1	10	0
262	1 Minimum „ „ in oak frame ... ... „ 96		0	18	6
263	1 „ „ „ terrestrial, on stand ... ... „ 97		1	1	0
264	1 Wet and Dry bulb Hygrometer, on oak board ... ... „ 99		1	1	0
265	1 Glaisher's Copper Rain Gauge, with Standard measure ... ... „ 101		1	10	0
266	Beckley's Improved Anemometer, on 3-feet iron pedestal frame ... „ 102		7	10	0
267	1 Standard Earth Thermometer, in frame with pointed brass end ... „ 100		1	3	0
268	1 Stephenson's Thermometer Screen ... ... „ 103		2	0	0
	(Kew Certificates extra).				
		£26	0	0	

N.B.—These Instruments are of Standard quality both as regards manufacture and accuracy. Purchasers may extend or modify the list according to their requirements.

Hicks's Patent Alarm Thermometer.

Fig. 104.

Fig. 105.

This ingenious Thermometer is the most perfect Alarm ever brought out in the country. The old kinds have the tube open at the top, but in this form it is closed for cleanliness, a very great advantage. Further, it has movable indices, which remain to register the temperature after the alarm is given. The system of contact is as perfect as it is novel.

Fig. 106.

No.		£	s.	d.
269	This Thermometer, Fig. 104, registers both heat and cold	1	1	0
270	„ „ Fig. 105, registers cold only (invaluable for cold rooms and stores)	0	15	0
271	„ „ Fig. 106, registers heat only (suitable for Bakeries, Breweries, Kitchens, &c.)	0	15	0

NOTE.—A complete descriptive circular of these Alarm Thermometers can be had on application.

Fig. 107.

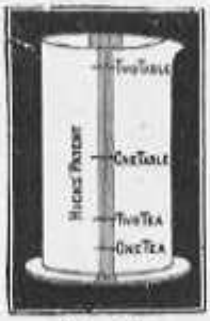


Fig. 108.

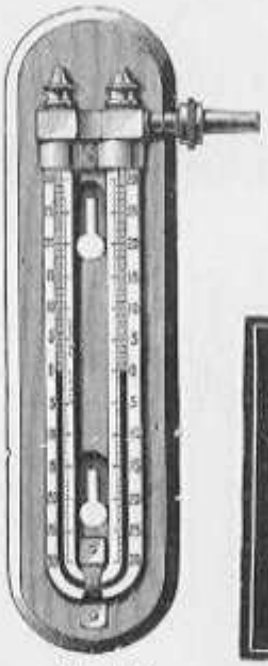


Fig. 109.

Fig. 110.

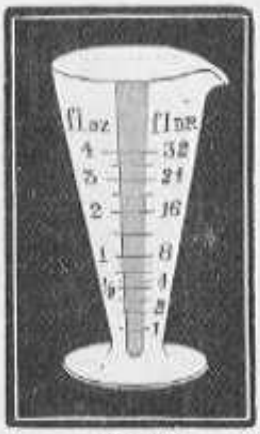


Fig. 111.

272 **HICKS'S PATENT OPAQUE MEDICAL AND OTHER MEASURES.** The advantages of these Measures over those of plain glass consists in their being made of pure white enamel tubing, with a narrow opening of clear glass back and front through which to read the liquid, and the divisions and figures being written in black and fired on the enamel are indelible, and can be read with the greatest ease in almost any light. They will be found an inestimable boon by persons of weak sight, as well as by all other users of such Measures, to whom this distinct advance in medical and philosophical appurtenances means a saving of time and money. The prices are as follows :—

No.		Per Doz.
1	60 Minim, on wine-glass foot ... conical ...	17/-
2	120 „ „ „ ... „ ...	19/-
3	2 oz. „ „ cylindrical ...	20/-
4	60 Minim „ „ ... „ ...	16/-
5	120 „ ... ... „ ...	12/-
6	30 „ on wine-glass foot ... „ ...	13/-
7	1 oz. „ „ cylindrical ...	18/-
8	60 drops ... ... „ ...	10/-
9	½oz. ... on wine glass foot ... conical ...	19/-
10	120 Minim „ „ cylindrical ...	16/-
11	4 tea spoons ... ... „ ...	11/-
12	2 table „ ... ... „ ...	12/-
13	1 oz., on wine glass foot, conical	22/-
14	100 c. c. Burette, with Pinchcock ...	90/-
15	1000 grain Alkalimeter, cylindrical on hook	90/-
16	1000 grain Measure	72/-
17	50 c. c. Gay Lussac's Burette	86/-
18	60 Minim Large Drop Syringe, glass plunger	19/-
19	60 „ „ „ „ metal „	15/-
20	4oz. ... cylindrical on wine glass foot ...	34/-
21	½oz. ... „ „ „ ...	17/-
22	6 cubic inch Jar cylindrical...	17/-
23	2 oz. Urinometer Jar	17/-
24	15 Minim Pipette	12/-
25	20 „ „	14/-
26	30 „ „	15/-
27	60 „ „	16/-
28	100 c. c. Measure cylindrical on foot ...	68/-
29	1 oz. cup shape	21/-
30	2 oz.	26/-

No.		Per Doz.
31	4 oz. cup shape	30/-
32	6 oz. „	34/-
33	8 oz. „	38/-
34	10 oz. „ ... Fig. 107 ...	45/-
35	12 oz. „	48/-
36	16 oz. „	50/-
37	20 oz. „	55/-
38	40 oz. „	94/-
39	60 Minim ... ... cylindrical ...	22/-
40	120 „ ... ... „ ...	24/-
41	½ oz. „ ... ... „ ...	26/-
42	Tumbler ... ... Fig. 110 ...	22/-
43	1 drachm, 60 Minim ... conical ...	20/-
44	2 „ 120 „ ... „ ...	21/-
44a	4 „ 240 „ ... „ ...	24/-
44b	½ oz. ... ... „ ...	19/-
45	1 oz. ... ... „ ...	25/-
46	2 oz. ... ... „ ...	28/-
47	4 oz. ... ... Fig. 111 ...	32/-
48	6 oz. ... ... „ ...	36/-
49	8 oz. ... ... „ ...	42/-
50	10 oz. ... ... „ ...	50/-
51	20 oz. ... ... „ ...	55/-
52	Tumbler 60 drop, in leather case	38/-
53	Leather cases for No. 8	4/-
54	„ „ „ 11	5/-
55	„ „ „ 12	7/-
56	„ „ „ 42	8/-
57	„ „ tumbler and minim combined	10/-
	N.B. 1 & 2 oz. Measures divided also in drops, extra.	7/-

273 **HICKS'S PATENT OPAQUE GAS GAUGES,** Fig. 109. These gauges are made of the same glass and are divided in the same manner as the above. They entirely do away with the necessity for metal, boxwood, or porcelain scales, as the divisions and figures are so beautifully distinct on the gauge itself. Prices :—3 in. 8/-; 4 in. 8/6; 6 in. 8/9; 8 in. 9/-; 10 in. 10/6; 12 in. 11/6; 15 in. 13/6; 18 in. 15/-

For price lists of Clinical and other Thermometers, Mercurial Barometers, Chemical and all other Philosophical and Meteorological Instruments and apparatus (an immense stock of all of which is kept by Mr. Hicks) special application must be made.

Drawing Instruments.

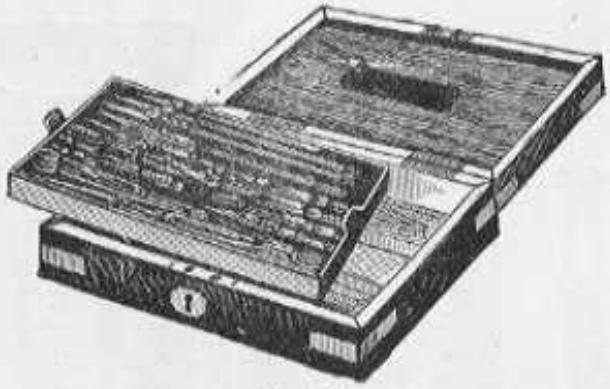


Fig. 112.

Fig. 113.

No.		£	s.	d.
274	7-inch **MAHOGANY CASE,** with tray and lock, brass instruments, 6 inch sector joint compasses, lengthening bar, pen and pencil points, pen and pencil bows, steel pen, 6 inch ebony parallel and box protractor (pattern 1255)	1	5	0
275	Do. do. do. with divider and jointed pen (pattern 1256)	1	12	6
276	Do. do. do. of German silver, with ivory protractor (,, 1257)	2	5	0
277	7-inch **WALNUT WOOD CASE,** Fig. 112. With lock, best German silver instruments, 6 inch double-jointed compasses, lengthening bar, pen and pencil points, double-jointed pen and pencil bows, hair divider, set of three spring bows, jointed and steel pens, pricker, knife key, ivory sector, protractor and parallel rule ... ... (pattern 1260)	5	10	0
278	Do. do. do. with addition of fully divided proportional compass (pattern 1262)	7	15	0
279	13-inch **ROSEWOOD CASE,** with lock, containing German silver instruments, 6 in. sector joint compass, with pen and pencil points and bar, pen and pencil bows, set of spring bows, hair divider beam compass with adjustment, 3 drawing pens, pricker, 6 boxwood, chain, or architect's scales, and ebony rolling parallel rule ... ... (pattern 1263)	7	7	0
280	**RUSSIA LEATHER CASE,** Fig. 113. With silver plate, containing the following extra quality electrum instruments:—4½ in. compass with improved needle points, ink and pencil points and 2 lengthening bars, improved hair divider, ink and pencil bows with improved needle points, set of 3 needle spring bows, 2 drawing pens, pricker, ivory protractor and architect's scale ... ... (pattern 1270)	8	10	0
281	**MOROCCO CASE,** containing the following electrum instruments:—4½ in. long joint compass with ink and pencil points, ink and pencil bows, drawing pen and protractor ... ... (pattern 1276)	1	11	0
282	Do. do. do. in brass ... ... (pattern 1277)	1	5	0

Opera and Field Glasses and Telescopes.

Fig. 118.

Fig. 114.

Fig. 115.

Fig. 116.

Fig. 117.

No.		£	s.	d.
283	**Marine Glass,** 24 lines, 6 glass, covered and japanned, bending in black leather case ... ... (101)	3	3	0
284	Do. Aluminium, 24 lines, 6 glass, covered Russia and bright, not bending (102)	7	12	6
285	Do. Aluminium, bending, 24 lines, 6 glass, covered do. ... ... (103)	8	15	0
286	**Aluminium Field Glass** 21 lines, 6 glass, patent draw to facilitate focussing, covered vulcanite, bending, in leather sling case ... ... (107)	6	15	0
287	**Binocular Aluminium Glass,** Fig. 114. 10 lines, bending, 2 draws covered Russia and bright (or dull), in brown leather case ... ... (110)	9	2	6
288	**Army Regulation Field Glass,** 26 lines, 12 glass, covered and bronzed (116)	2	10	0
289	**Aluminium Opera Glass,** pearl and bright, 17 lines, 6 glass, deep eye-piece, in collapsing case ... ... (118)	3	3	0
290	**Opera Glass,** pearl and gilt, 15 lines, 6 glass, collapsing case ... (120)	2	12	6
291	Do. Fig. 116. 15 lines, 6 glass, oxidized body, gilt draws, in collapsing case (124)	2	4	0
292	**Aluminium Three Change Glass,** Fig. 115. Theatre, field and marine, black mounts, 24 lines ... ... (187s)	7	10	0
293	Do. do. do. not aluminium	2	15	0
294	**Tourist Glass,** 13 lines, 6 glass, covered chocolate and gilt, in collapsing case...	2	2	0
295	**Opera Glass,** 17 lines, 6 glass, covered dull, black collapsing case ... (127)	1	15	0
296	**Tourist Telescope,** Fig. 118. 22 lines, 3 draw, leather body, caps and sling, brass mounts ... ... (208s)	2	15	0
297	**Double Telescope,** Fig. 117. 19 lines, aluminium, in case ... (P)	13	10	0
298	**Telescope,** as used in Army Signalling, with caps ... ... (54H)	2	0	0
299	**Coast Guard Telescope,** with caps and sling, as used in the Navy and Coast-guard Stations ... ... (55H)	3	10	0
300	**Astronomical Telescopes,** of all kinds, prices ranging from £4 to £50, according to size, diameter and quality of the object glasses.			

N.B.—Special quotations for Telescopes, &c. sent on application.

All kinds of Repairs done. In addition to above, a special assortment of very cheap but good glasses is always kept in stock. Price List FREE on application.

Fig. 119.

Callendar's Patent Long-Distance Thermometer,

AND

Moor's Self-Locking Retort Stand.

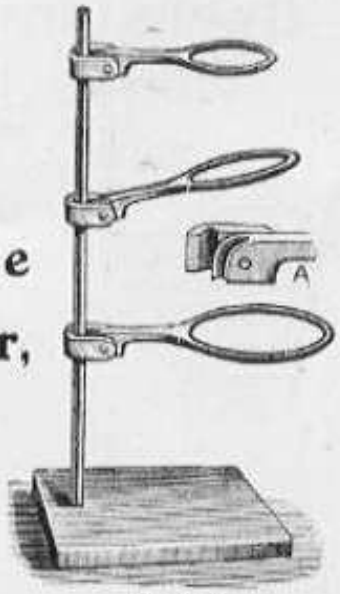


Fig. 120.

THESE instruments are constructed so as to read directly and continuously on a straight scale, by means of an index column of liquid, in the same way as an ordinary spirit or mercury thermometer.

The bulb marked A in the cut is exposed to the temperature to be measured. It is connected to the indicator B by means of flexible tubes. The temperature of the bulb A is shown by the height of the column of liquid on the scale C D.

The whole instrument is hermetically sealed up, so that it remains unaffected by changes in the barometric pressure.

The effect of changes of temperature in the connecting tubes is compensated by the method described by MR. CALLENDAR in a paper published in the *Proceedings of the Royal Society* for December, 1891. The connecting tubes can, therefore, be made of any convenient length.

The Instruments are also compensated, as described in the same paper, in such a way that their readings are unaffected by changes of temperature in the surrounding air.

No. 301. The Instrument shown in Fig. 119 is a Long-distance Thermometer. It has a range, from 80° to 180° Fahr., and will indicate the temperature correctly to a-tenth of a degree at a distance of 100 yards or more. It is specially adapted for Brewers, Maltsters, etc., the end of the flexible tubes in illustration being in a tun or vat. The idea is to have the thermometer fitted up in a room or office with the flexible tubes leading to any boiler or vat 100 yards or more away, so that the correct temperature of the vat can be ascertained without leaving the room, as the indicator is shown on the scale of the thermometer. Price on application.

No. 302. **MOOR'S SELF-LOCKING RETORT STAND,** Fig. 120. Can be instantly adjusted to any height necessary by raising the ring slightly and then sliding up or down as required. On the ring being pressed down, it will automatically lock and remain perfectly steady. This arrangement possesses the following advantages over the ordinary form:—

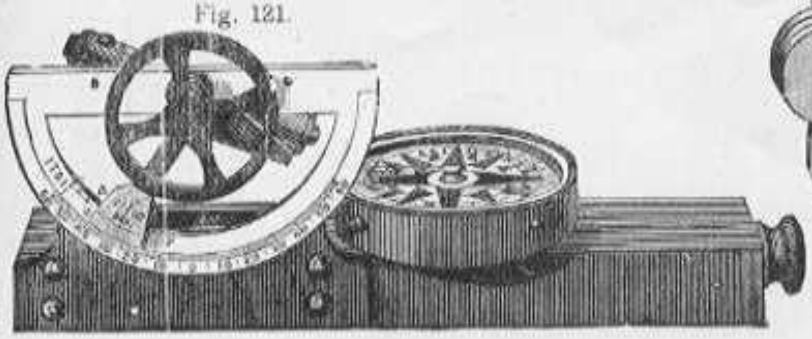
(1). When hot, the rings are easily moved by lifting them with the end of a file, etc.

(2). In the old form, if made of brass, the thread of the screw is liable to wear out and "slide"; whereas, if the set screw is made of iron, the acid vapours of the laboratory will soon rust the thread, and make it difficult or impossible to use.

The rings in this instrument being made of cast iron, and carefully annealed by a new process, are very strong, and being of considerable thickness, no fear of burning away the metal need be entertained, as a Bunsen flame may be directed on them for any length of time without the slightest action. Price, each, 8/6.

Clinometer Rule and Abney Level.

Fig. 121.



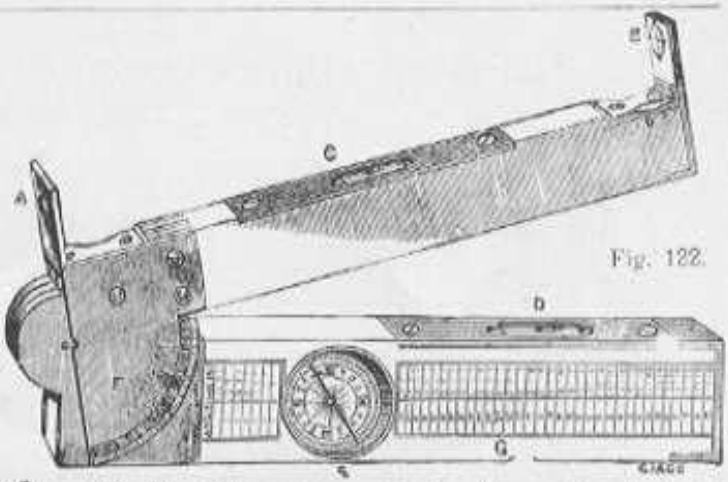


Fig. 122.

Fig 121. This instrument is used for getting the height of buildings, trees, hills, &c., and also for fixing the slopes or gradients of rails and railways, the rise and fall for drainage purposes, and all operations where angular distance or inclination of surface is wanted.

No.		£	s.	d.
303	Abney Level, with float or edge bar needle Compass, Fig 121.	2	5	0
304	,, without Compass	2	0	0

Full directions for use supplied with each instrument.

305	Clinometer Rule with arc, level and Compass, with jewelled cap, complete in morocco case, Rule when folded, 6-in., each	1	10	0
306	,, ,, with two levels and pair of sights, Fig. 122	2	0	0
306A	,, ,, with full size stop bar needle compass and best flush vernier arc, with rise in inches per yard, each	3	0	0
306B	,, ,, with swing Compass	3	6	0

Rhumkorff Coils and Battery Hydrometers.

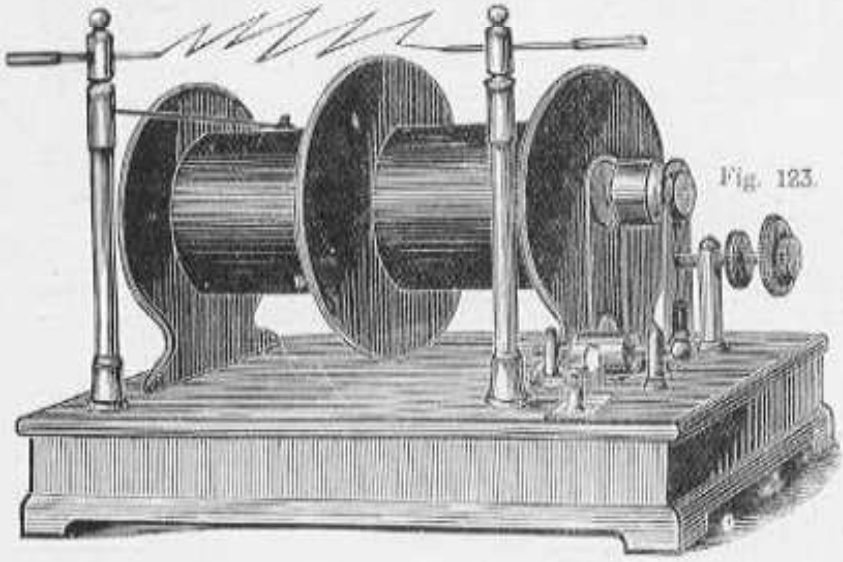


Fig. 123.

307	RHUMKORFF COILS. English make. Giving 2-in. spark. Fig. 123	7	0	0
308	,, 3-in. ,,	9	0	0
309	,, 4-in. ,,	14	0	0
310	,, 5-in. ,,	17	0	0
311	,, 6-in. ,,	20	0	0
312	,, 7-in. ,,	24	0	0
313	,, 8-in. ,,	27	0	0
314	,, 9-in. ,,	30	0	0
315	,, 10-in. ,,	36	0	0

HICKS' PATENT BATTERY HYDROMETERS.

No.		£	s.	d.
316	Fig. 124 has four different coloured beads, indicating different gravities, and the correct gravity is shown on the bead which floats nearest the centre of the tube. It has a hooked top, so that it may hang inside the accumulator, and is excessively simple and absolutely reliable .. .. each	0	4	6
317	Fig. 125 is loaded with shot at one end, and has the scale clearly marked in its stem. It is made to float in the battery, and is in extensive use by Electric Companies	0	2	0
318	Fig. 126. This beautiful Instrument (designed by Mr. Kesting), has a pure white enamel glass stem, which is open at the top, and there is a hole at the bottom of the stem through which the fluid enters as it sinks in the test jar. It therefore differs materially from all other Hydrometers, and gives such a splendid *open scale* that reading is rendered exceptionally easy and distinct	0	4	6

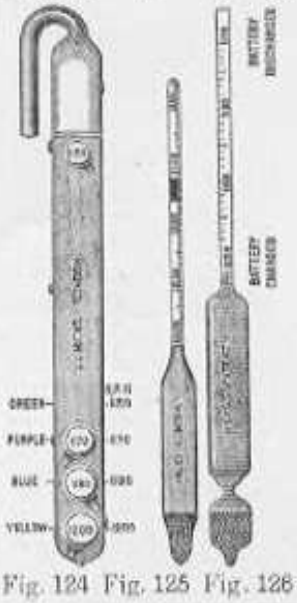


Fig. 124 Fig. 125 Fig. 126

Self-Registering Maximum and Minimum Thermometers.

SHOWING THE GREATEST HEAT AND COLD.

Fig. 127.

Fig. 128.

Fig. 129.

Fig. 130.

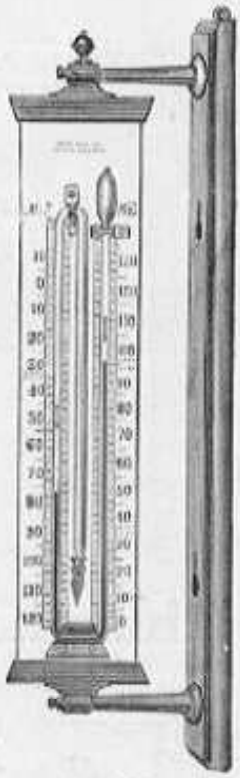


Fig. 131.

No.		Inches	With Ordinary Enamel Tubes. 8	10	12	14	16	20	With magnifying Tubes, like Fig. 130. 8	10	12	14	16	20
319	Round Top Boxwood Scale		4/6	5/6	7/9	10/3	—	—	6/-	7/6	9/6	11/9	—	—
319A	Fig. 128 Boxwood Scale, in black japan case		4/9	6/-	9/6	11/3	—	—	6/3	7/9	11/6	12/9	—	—
320	Porcelain do. in white do.		10/-	12/3	15/3	16/9	—	—	11/-	13/9	15/6	17/-	—	—
321	Trans. Glass do. in white do.		10/6	12/9	16/-	17/3	—	—	11/3	14/3	16/3	17/9	—	—
322	Fig. 131. Porcelain or Transparent Glass on Oak Boards with Brackets to revolve		—	18/9	21/3	24/6	26/9	33/3	—	19/6	23/6	25/6	27/3	37/6
323	Zinc Scale, in white japan case		5/-	7/3	10/6	12/-	—	—	6/6	8/9	11/-	13/-	—	—
324	Trans. Glass Scale on Polished Oak or Mahogany back		15/-	17/-	19/-	21/-	—	—	16/6	18/6	21/-	24/-	—	—
325	Poreclain Scale, with back plates top and bottom		—	—	—	—	—	30/-	—	—	—	—	—	35/-
326	Fig. 127. Double Registering, showing the temperture yesterday and to-day, glass scale		11/3	14/3	16/3	17/9	—	—	14/-	16/6	19/9	21/3	—	—
327	Do. do. boxwood scale		6/3	7/9	11/6	12/9	—	—	7/9	10/6	13/9	15/-	—	—
328	Fig. 129. Double Registering, with bulb reversed so as to render the Thermometer less liable to get out of order during transit, with boxwood scale, 8-in., 11/-; 10-in., 15/-; 12-in., 19/-; and 14-in.												1 3 0	
328A	,, Do. do. with glass scale, 8-in., 13/-; 10-in., 17/-; 12-in., 21/- and 14-in.												1 5 0	

Garden, Window and Porcelain Thermometers.

Fig. 133.

Fig. 132.

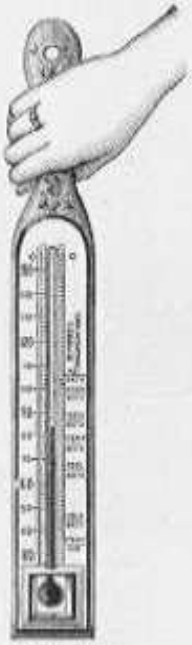


Fig. 134.

Fig. 135.

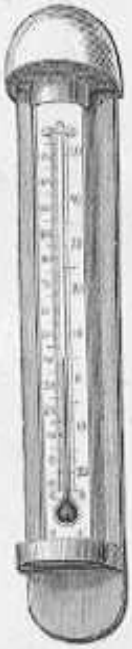


Fig. 136.

Fig. 137.

No.			£	s.	d.
329	Fig. 132.	**HOT-BED THERMOMETER,** 30-inch, with ordinary enamel tube, in mahogany frame, enclosed in brass tube, and extra thermometer on door for air temperature	1	7	6
330	... ...	Do. ... ... do. ... with two patent magnifying tubes	1	12	6
331	... ...	Do. ... ... do. ... 30-inch, porcelain scale, with ordinary enamel tubes, in copper case, with brass tube	0	15	0
332	... ...	Do. ... ... do. ... ... with patent magnifying tube	0	18	6
333	Fig. 133.	**GARDEN MINIMUM THERMOMETER,** solid zinc scale, enamel spirit tube, raised figures and divisions	0	3	0
334	... ...	Do. ... do. 8-inch polished boxwood scale, enamel spirit tube	0	2	0
335	... ...	Do. ... do. 10-inch ... do. ... ... do. ...	0	3	0
336	Fig. 134.	**BATH THERMOMETER,** pink or blue porcelain scale and enamel tube, with Dr. Forbes' specification for the Bath legibly printed on	0	3	0
337	Fig. 135.	**PORCELAIN THERMOMETER,** with metal guard, enamel tube and double scale, 8-inch, 7/6; 10-inch, 8/6; 12-inch, 10/6; 14-inch, 11/6; 16-inch, 17/6; 20-inch	1	5	0
338	Fig. 136.	**WINDOW THERMOMETER,** with ivory scale and ordinary enamel tube enclosed in glass tube, on mahogany frame, with copper roof, 8-inch, 18/6; 10-inch	1	1	0
339	... ...	Do. ... with patent magnifying tube, 8 inch, 20/-; 10 inch ...	1	3	0
340	Fig. 137.	**PORCELAIN THERMOMETER,** with very legible scale and every thirty degrees indicated by larger figures and broader lines moulded sides, metal guard, and bold enamel tube, 20 inch ...	1	3	0

House Thermometers and Hygrometers.

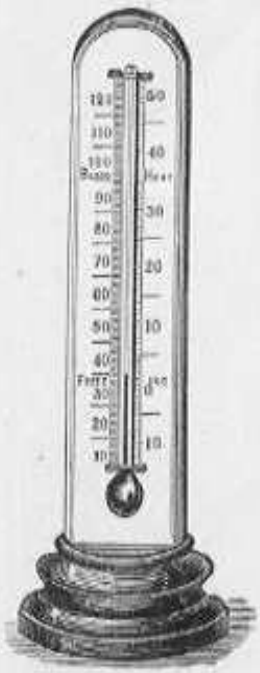


Fig. 138.

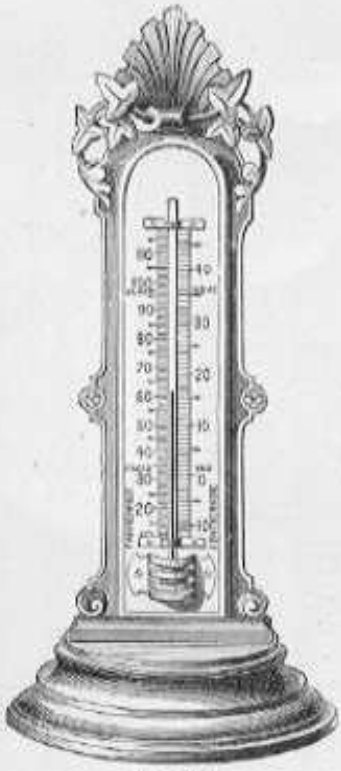


Fig. 139.

Fig. 140.

Fig. 141.

No.			£	s.	d.
341	Fig. 138.	PEDESTAL THERMOMETER, with ivory scale on ebony base	0	13	6
342	... ...	Do. ... do. with patent magnifying tube	0	15	6
343	Fig. 139 ...	Do. ... ... with opal glass scale and ordinary enamel tube, on carved oak or walnut stand	0	18	6
344	... ...	Do. ... do. with patent magnifying tube	1	1	0
345	Fig. 140 ...	Do. ... carved ivory, with ordinary enamel tube	3	0	0
346	... ...	Do. ... do. with patent magnifying tube	3	3	0
347	DRAWING ROOM THERMOMETERS, opal glass scales, ordinary enamel tubes, on ebony or boxwood backs, 8-in., 8/3; 10-in., 10/-; 12-in.		0	13	6
348	Do. do.	with patent magnifying tube, 8-in., 10/-; 10-in., 12/-; 12-in.	0	15	6
349	THERMOMETERS FOR EARTH TEMPERATURES, Symons' Pattern, for lowering into an iron pipe to any depth. Designed expressly to obviate all the difficulties found in obtaining ground temperatures. Thermometer Engine divided on the glass tube, and figured on round polished boxwood scale, attached to copper cap fitting over top of pointed iron pipe to be driven into the ground. For indicating temperatures six inches below the surface		1	0	0
350	Do. do.	1 foot	1	0	0
351	Do. do.	2 feet	1	4	0
352	Do. do.	4 feet	1	8	6
353	Fig. 141. HYGROMETER, as used in factories and warehouses to determine amount of moisture; very strong and legible, and well protected from damage, in copper case	10 in. 16/6, 12 in. 22/6			
354	... ... Do. ... do.	do in japanned tin case „ 15/- „ 19/6			
355	... ... Do.	better quality, mounted on oak or mahogany back, tubes, divided on stem and figured on the scales ... large size, each 31/6			
356	... ... Do. ... do. ... do.	... medium size, „ 27/-			
357	... ... Do. ... do. ... do.	... small size, „ 21/-			

Standard, and Bartrum's Barometers,

etc.

Fig. 141A.

Fig. 142.

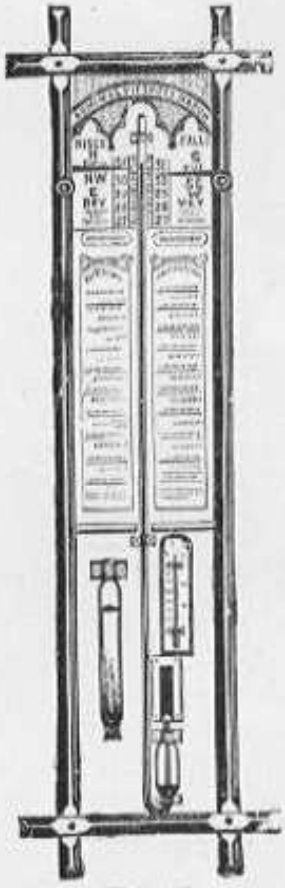


Fig. 143.

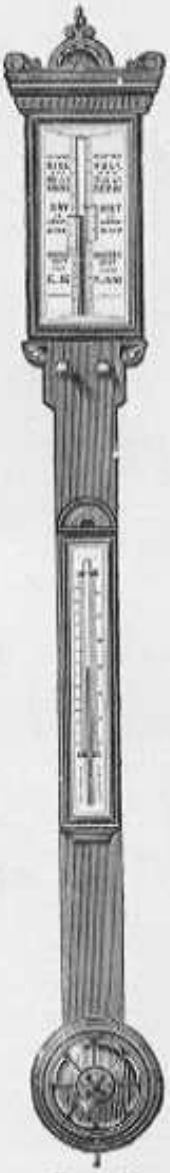


Fig. 144.

Fig. 145.

No.			£ s. d.
357A	Fig. 141A.	THE DEMONSTRATOR'S STANDARD BAROMETER, specially suitable for College use. Diameter of column '25 inch. Affords bold, well-defined readings	3 15 0
358	Fig. 142.	ROUND TOP PEDIMENT BAROMETER, in oak or walnut frame	4 15 0
359	Fig. 144.	CARVED TOP ... do. smaller size	3 3 0
360	Fig. 143.	FITZROY BAROMETER, in strong Oxford frame, a really good reliable and serviceable instrument, with bold mercurial tube, storm glass and thermometer. It always looks well, and is not easily put out of order	0 18 0
361	Fig. 145.	BARTRUM'S BAROMETER is without doubt one of the most beautiful instruments of its kind ever introduced to the public. It is not only extremely sensitive and accurate, but simple and distinct. The coloured fluid in the tube and the very legible porcelain scale behind it can be seen and read with the greatest ease. Owing to the extremely open range of the barometer (over 8ins. to an in. of mercury) no vernier is required, and a reading can easily be taken to 1-1000th of an inch	8 8 0
362	Do.	... do. ... More highly finished, with Rackwork ...	10 10 0

Galvanometers.

In most cases these are really current Detectors or Galvanoscopes, as the Graduations on the Dial indicate the comparative, and not the actual E.M.F. of a Battery or other sources of Electricity.

The Tangent and Sine Galvanometers can be, and are, used to measure the actual current by certain mathematical formulæ, and in their case the designation is correct.

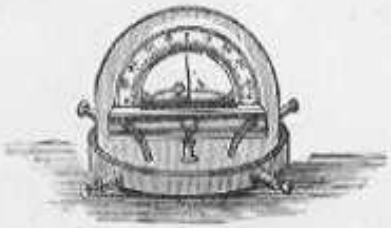


Fig. 146.

Fig. 147.

No.		£ s. d
363	**Galvanometer,** horizontal, with terminals, simple form	0 6 0
364	**Horizontal Galvanometer.** Fig. 146, on a round walnut base, polished 4 in. diameter, with a 2½ in. dial divided to 90 deg. It has a brass bezil with silvered ring and a glass to protect the needle, 2 terminals and a controlling magnet to bring the needle to 0 or thereabout, and although cheap is a useful galvanometer	0 8 0
365	**Galvanometer,** with graduated arc and vertical pointer, double coils of coarse and fine wire, under glass shade	0 18 0
366	**Lineman's Detector Galvanometer,** in a french polished mahogany case, with brass bezil silvered ring and a thick bevelled edge glass. It is wound with thin wire for intensity, and is very sensitive	2 0 0
367	Ditto, wound for intensity and quantity, with three terminals	2 10 0
368	Ditto, with 2 dry cells in same case, making a complete and compact testing instrument, very useful for testing purposes	3 15 0
369	**Astatic Galvanometer,** as above, of large size and highest quality, wound for either high or low resistance, with graduated silvered dial	4 10 0
370	**Astatic Galvanometer,** portable, with jewelled centre, high resistance, in leather case, suitable for use with Wheatstone bridge, for line testing ...	6 0 0
371	**Testing Galvanometer,** with suspended needle, on stand, with levelling screws, suitable for use with resistance coils	7 0 0
372	**Sine Galvanometer,** with 10 ohms resistance, agate centre to needle and aluminium pointer	3 15 0
373	**Tangent Galvanometer,** of accurate construction, plain form, 12-inch ring ...	5 10 0
374	**Detector Galvanometer,** Government pattern, with 3 coils round the needle, 2, 10, and 1,000 ohms respectively, connected to brass blocks and plug in top of instrument	6 0 0
375	**Reflecting Galvanometer,** wound with resistance to 1,000 ohms, with controlling magnet	4 0 0

Galvanometer Lamp and Scale.

(PATENTED.)

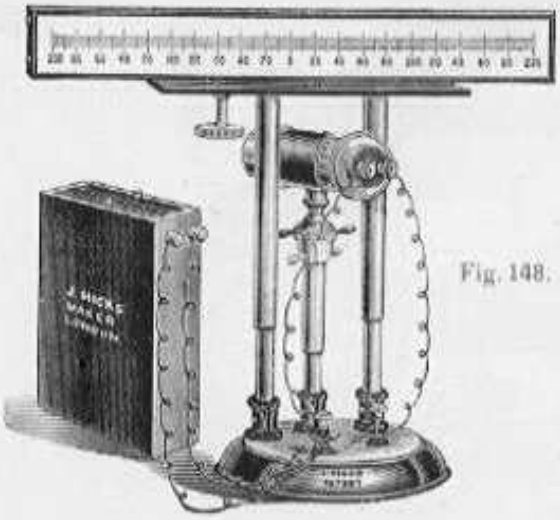


Fig. 148.

This Scale and Lamp have been designed so as to be portable, rapidly adjusted, and to work in the open daylight. The focussing tube is carried on a ball joint, and by means of a sliding tube can be set at any required height; when the spot of light has been thrown on the mirror, both these joints are sufficiently stiff, so that focussing can be done without fear of the spot being shifted off the mirror.

The scale is divided by milimetres on ground glass and is capable of adjustment both vertically and horizontally, the latter adjustment being by means of a rack and pinion.

The source of light is a small glow lamp worked by two storage batteries. A fine line is etched on the object glass and this line is focussed on the scale.

By means of hinged joints the lamp and scale can be folded into a very small compass, by no means a small consideration for portable work.

Experience has shown this form of scale and lamp to be very convenient in the laboratory and testing room, while for use with the Potentiometer and other portable testing apparatus it is far superior to any existing form.

PRICES.

		£	s.	d.
No. 376.	**Patent Galvanometer Lamp,** Fig. 148, with folding pillars in leather case ...	6	15	0
„ 377.	**Two-Cell Accumulator,** in case with strap handle and terminals complete	3	5	0
„ 378.	**Extra Incandescent Lamp** in mount with terminals (if required)	0	7	6

Galvanometer Mirrors.

Attention is particularly invited to these Mirrors, which are absolutely the best in the market.

No.						£	s.	d.
379	**Galvanometer Mirrors.**	$\frac{2}{10}$	in. dia.	... ...	per doz.	1	0	0
380	Do.	do.	$\frac{3}{8}$	„	„	1	3	0
381	Do.	do.	$\frac{1}{2}$	„	„	1	6	0
382	Do.	do.	$\frac{3}{4}$	„	„	1	10	0
383	Do.	do.	1	„	„	2	0	0

Focus 36 to 40 in. or any focus to order.

384 **Small Reading Telescopes for Electricians** of every description made to order. Prices according to size and requirements.

Patentees and others having new ideas or improvements of Electrical Apparatus, are invited to communicate with Mr. Hicks.

Entire Levels.

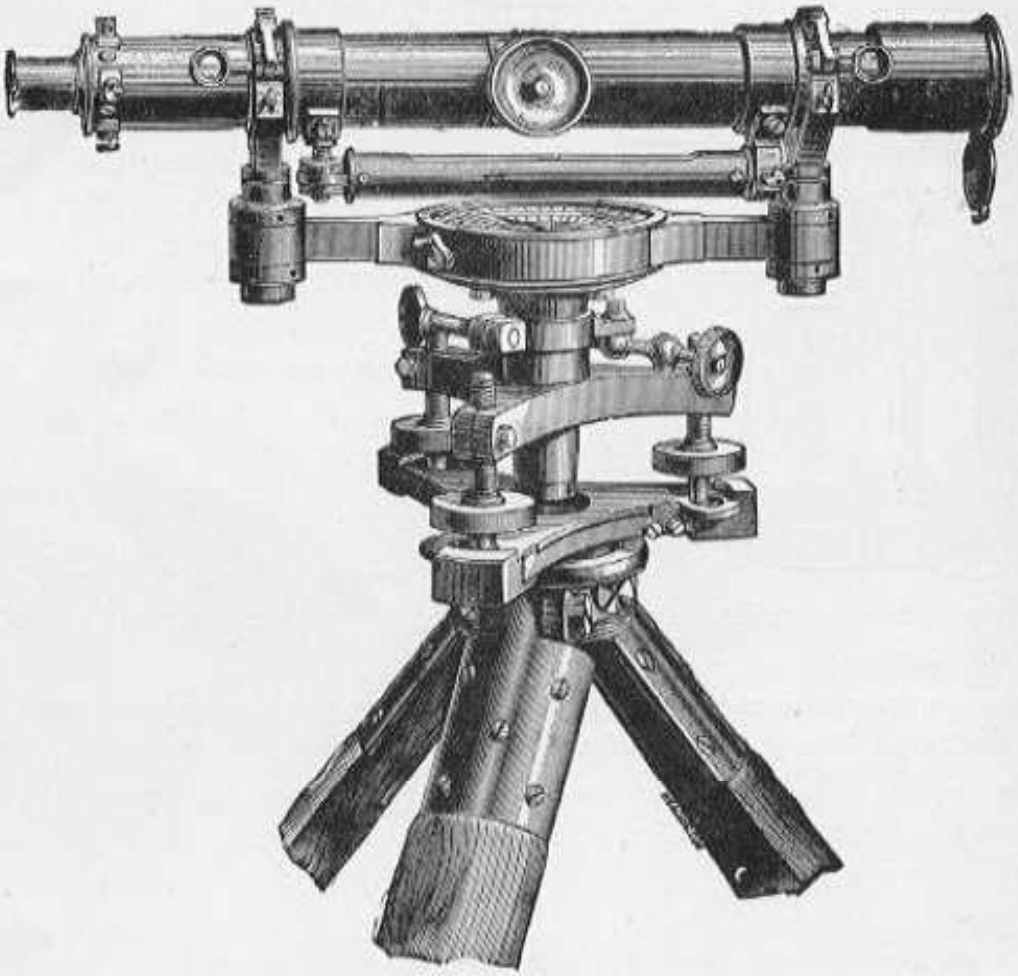


Fig. 149

No.		£	s.	d.
385	**ENTIRE LEVEL of Improved Form,** Fig. 149, with telescope body 10 in. long, Object Glass, 1⅝ in. dia., with shade, extra large parallel plates, socket to adjusting screws, increased length of centre, packed in mahogany case with extra deep eye-piece, capstan pin and screwdriver, round tripod stand ...	15	0	0
	The above fitted with a triangle centre plate and improved locking plates to screw on the round tripod stand	16	16	0
	If fitted with an open lath mahogany stand, with locking plates attached, instead of the round tripod stand	18	0	0
	Clamp and tangent screw adjustment to either of the above locking plates extra	1	4	0
	If fitted with a compass, having aluminium ring 3¼ in. dia. ... extra	2	0	0
	Leather knapsack case ... ... extra	2	2	0
	Shoulder straps and loops to case ... ... extra	0	10	0
386	**A LEVEL,** fitted similar to 385, but with telescope body 12 in. long, Object Glass 1¾ in. dia.	17	0	0
	If fitted with a triangle centre plate and improved locking plates to screw on the round tripod stand	19	0	0
	Fitted with an open lath mahogany stand, with locking plates attached, instead of the round tripod stand	20	0	0

Entire and Y Levels.

No.		£	s.	d.
387	**A LEVEL,** fitted similar to Fig. 149, but with a telescope body 14 in. long, Object Glass 1⅝ in. dia., etc.	19	0	0
	If fitted with a triangular centre plate and improved locking plates to screw on the round tripod stand	21	0	0
	Fitted with an open lath mahogany stand, with locking plates attached, instead of the round tripod stand	22	10	0
	Clamp and tangent screw adjustment to either of the above locking plates extra	1	10	0
	If fitted with a compass, having aluminium ring 3¾ in. dia. ... extra	2	0	0
	Shoulder straps and loops to case ... ... extra	0	10	0
	Leather knapsack case ... ... extra	2	10	0
388	**A LEVEL,** fitted similar to Fig. 149, but with telescope body 16 in. long, Object Glass 2 in. dia.	22	0	0
	Fitted with a triangle centre plate and improved locking plates to screw on the round tripod stand	25	0	0
	Fitted with an open lath mahogany stand, with locking plates attached, instead of a round tripod stand	27	10	0
	Clamp and tangent screw adjustment to either of the above locking plates extra	2	0	0
	If fitted with a compass, having aluminium ring 4 in. dia. ... ... extra	2	0	0
	Shoulder strap and loops to case ... ... extra	0	12	0
	Leather knapsack case ... ... extra	2	15	0
389	**A LEVEL,** similar to Fig. 149, but with telescope body 18 in. long, Object Glass 2⅜ in. dia.	27	0	0
	Fitted with triangle centre plate and improved locking plates to screw on the round tripod stand	31	0	0
	Fitted with an open lath mahogany stand, with locking plates attached instead of the round tripod stand	33	10	0
	Clamp and tangent screw adjustment to either of the above locking plates extra	2	0	0
	If fitted with a compass, having aluminium ring 4½ in. dia. ... extra	2	0	0
	Shoulder straps and loops to case ... ... extra	0	15	0
	Leather knapsack case ... ... extra	3	10	0
	Erect eye-draws fitted to Nos. 385, 386, 387, 388 and 389 ... each extra	0	15	0
390	**Y LEVEL,** similar to Fig. 150, but with telescope body 12 in. long, Object Glass 1½ in. diameter	19	0	0
	Fitted with triangle centre plate and improved locking plates to screw on the round stand	20	10	0
	Fitted with open lath mahogany stand with locking plates attached in the place of the round stand	21	10	0
	Silvered dial compass, with edge bar needle, 3 in. long ... ... extra	2	0	0
	Body straps and loops to case ... ... extra	0	10	0
	Leather knapsack case ... ... extra	2	10	0
391	**Y LEVEL,** fitted similar to Fig. 150, but with telescope body 14 in. long, Object Glass 1⅜ in. dia.	21	0	0
	Triangle centre plate and improved locking plates	23	0	0
	Open lath mahogany stand, with locking plates attached	24	0	0
	Silvered dial compass, with edge bar needle, 3 in. long ... ... extra	2	0	0
	Body strap and loops to case ... ... extra	0	12	0
	Leather knapsack case ... ... extra	2	10	0

NOTE.—Levelling Staves and Surveying Poles of every description made to instructions.

Repairs of all kinds undertaken.

Y Levels.

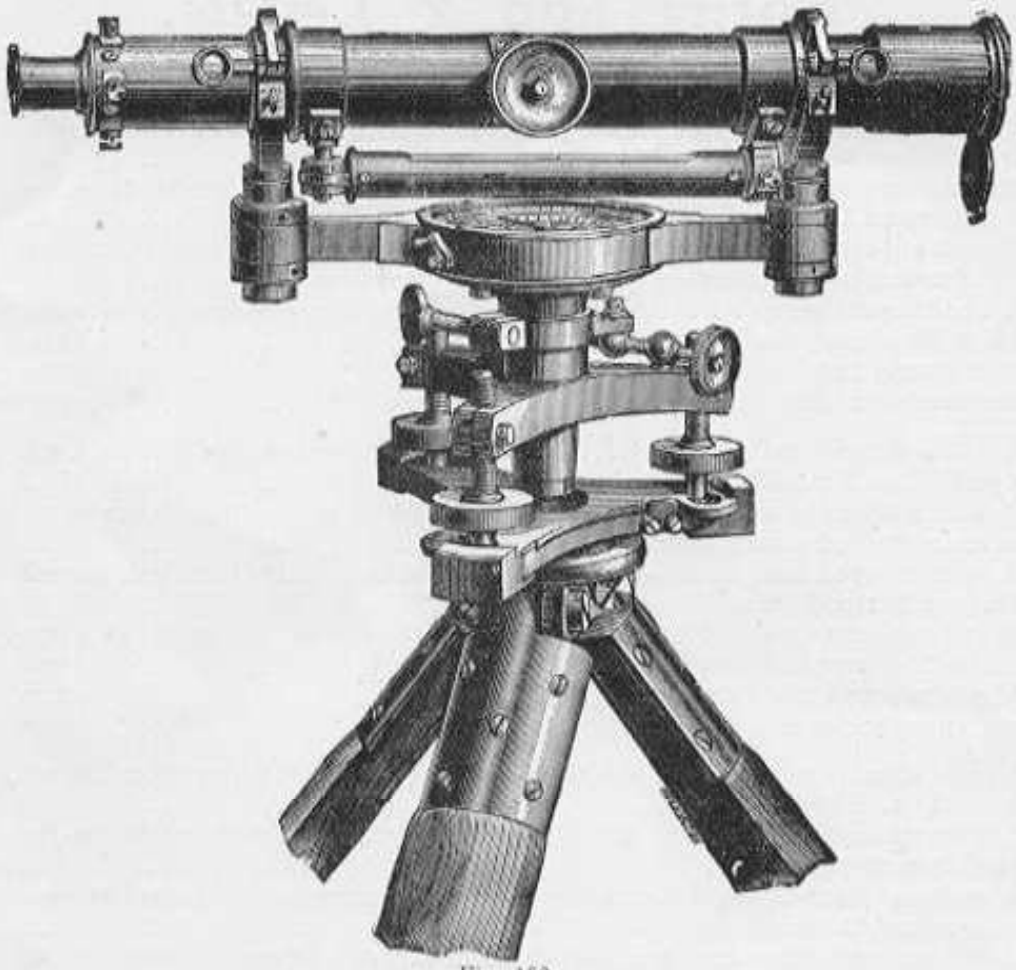


Fig. 150.

No.			£	s.	d.
392	**Y LEVEL** of improved form, Fig. 150, with telescope body 10 in. long, Object Glass 1¼ in. diameter, sockets to parallel plate screws, clamp and tangent screw adjustment to the centre, packed in mahogany case with extra deep eye-piece, screwdriver, capstan pin, and round tripod stand		17	0	0
	This instrument fitted with triangle centre plate and improved locking plates to screw on the round stand		18	10	0
	If fitted with an open lath mahogany stand, with locking plates attached in place of the round stand		19	10	0
	Fitted with silvered dial compass, having edge bar needle, 2⅞ in. long	extra	1	0	0
	Body strap and loops to case	extra	0	10	0
	Leather knapsack case	extra	2	2	0
393	**Y LEVEL,** fitted similar to Fig. 150, but with telescope body 16 in. long, Object Glass 1¼ in. dia.		23	0	0
	Triangle centre plate, with improved locking plate		25	0	0
	Open lath mahogany stand, with locking plates attached		26	0	0
	Silvered dial compass, with edge bar needle 3¼ in. long	extra	2	0	0
	Body strap and loops to case	extra	0	15	0
	Leather knapsack case	extra	2	15	0
394	**Y LEVEL,** similar to Fig. 150, but with telescope body 18 in. long, Object Glass 1¾ in. dia.		25	0	0
	Triangle centre plate, with improved locking plates		28	0	0
	Open lath mahogany stand, with locking plates attached		29	0	0
	Silvered dial compass, with edge bar needle 3¼ in. long	extra	2	0	0
	Body strap and loops to case	extra	0	15	0
	Leather knapsack case	extra	3	10	0

The Gradient-Telemeter Level.

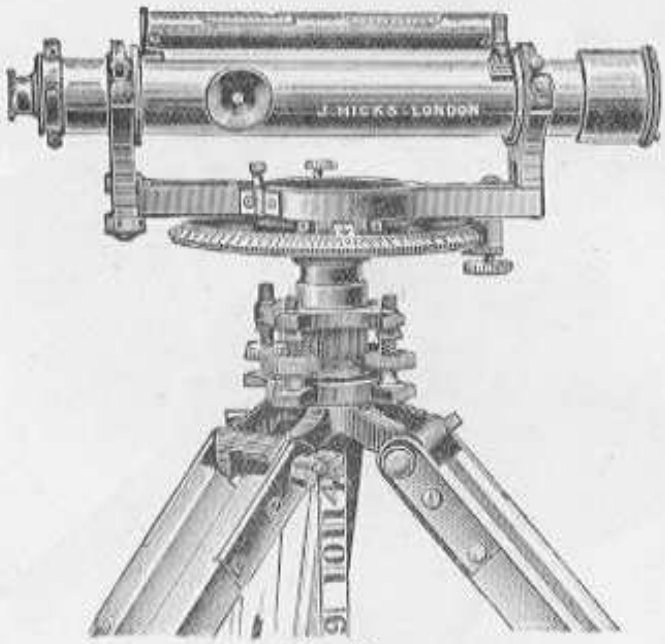


Fig. 151.

This instrument, an illustration of which is shown above, is constructed for getting linear distance, gradients, and difference in level of objects, all of which it does by one and the same observation, and does away with the necessity for using the land chain, or tape. It performs these operations with singular accuracy and ease to the observer, enabling a *much greater* quantity of work to be got through in the same space of time compared with the usual methods employed by Engineers and Surveyors. The linear distances can be obtained far more accurately than with the land chain, and this regardless of rough or broken ground or the existence of a stream, or other water, between the observer's station and the distant object.

Description of the Instrument.

This GRADIENT-TELEMETER LEVEL is generally in its construction as the Dumpy or **V** Level familiar to Engineers and Surveyors, but, with the addition of a *Horizontal* limb or circle, on which are marked the gradients from 1,200 to 10, or any other series of gradients determined on. The gradient marks or points are such a distance apart on the horizontal limb that they can be easily read at the index without the aid of a reading microscope, and being read by an index point—*not* a vernier—the gradient of the distant object is seen at a glance, without the trouble of any calculation; this, together with the fact that the same observation which gives the gradient also gives the *distance* of the observer's station from the object, enables accurate levelling work being done in a singularly short space of time.

The telescope of this GRADIENT-TELEMETER LEVEL has an objective $1\frac{7}{10}$-in. aperture, with erect and inverting eye-pieces as may be preferred for different work; the index is fixed to and moves with the telescope, and by the *special* construction of the instrument the horizontal motion of the telescope is converted into vertical dip, or elevation, so that the gradient and distance of objects are obtained by the readings on the horizontal limb, as stated above.

A light and strong open framework tripod stand is provided with the level, enabling it to be set up on the ground in a very firm manner. A short tape is suspended from the bottom of the instrument giving the exact height of the centre of the telescope from the ground.

PRICES.

Gradient-Telemeter Level, 14-in., with compass, locking plate, 3 screws, graduated to gradient 1 in 10, in case complete, with open framework stand ...	22	0	0
Do. do. 16-in. size	25	0	0
Do. do. 12-in. size	21	0	0
Extras.—If provided with Theodolite limb divided, on silver, with 2 verniers and readers for 14-in., £11 10s.; 16-in. £13; 12-in.	9	15	0
Shifting base plate for centering the instrument accurately over a given point ...	3	10	0

Theodolites.

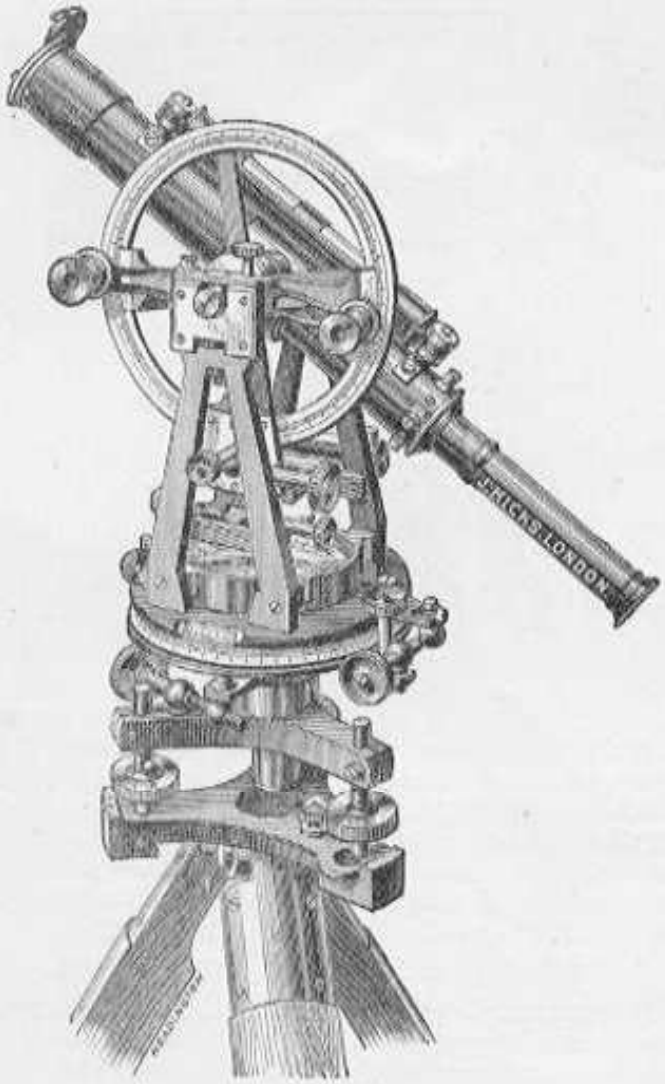


Fig. 152.

No		£	s.	d.
395	5 in. **TRANSIT THEODOLITE,** Fig. 152, divided reading to 1' Telescope 9½ in.long, object glass 1½ in. dia.	34	0	0
	Locking plates to screw on round stand	35	10	0
	Open lath stand with locking plates attached	36	10	0
	Leather knapsack case ... ... extra	2	10	0
396	6 in. **TRANSIT THEODOLITE,** divided reading to 20", Telescope 10¾ in. long, Object Glass 1¼ in. dia.	38	0	0
	Locking plates to screw on round stand	40	0	0
	Open lath stand with locking plates attached	41	10	0
	Leather knapsack case ... ... extra	3	0	0
397	4 in. **Y THEODOLITE,** with silvered dial compass, divided on silver reading with microscopes to 1' with telescope 7½ in. long. Object Glass ⅝ in. dia., parallel plates, clamps and tangent screw adjustments, packed in a mahogany case complete with capstan pin, screwdriver, plummet, with erect and inverted eye-pieces and mahogany tripod stand	28	0	0
	This instrument fitted with improved locking plates to screw on the round stand	29	10	0
	If fitted with an open lath mahogany stand with locking plates attached in place of the round stand	30	10	0
	Leather knapsack case ... ... extra	2	2	0

Theodolites.

No.		£	s.	d.
398	5-in. **Y THEODOLITE,** reading to 1', Telescope 9½-in long, Object Glass 1 3/16-in. dia.	30	0	0
	If fitted with improved locking plates	31	10	0
	Open lath mahogany stand and locking plates	32	10	0
	Leather knapsack case ... ... extra	2	10	0
399	6-in. **Y THEODOLITE,** reading to 20", Telescope 11¾-in. long, Object Glass 1¼-in. dia.	34	0	0
	Improved locking plates to the round stand	36	0	0
	Open lath mahogany stand with locking plates attached	37	10	0
	Leather knapsack case ... ... extra	3	10	0
400	4-in. **TRANSIT THEODOLITE,** with silvered dial compass, divided on silver reading, with Microscopes to 1', Telescope 7½-in. long, Object Glass ⅞-in. dia., parallel plates, clamp and tangent screw adjustments with erect and inverted eye-pieces, packed in a mahogany case complete with capstan pin, screwdriver and plummet, and round tripod stand	30	0	0
	If fitted with improved locking plates to screw on the round stand	31	10	0
	Open lath mahogany stand with locking plates attached	32	10	0
	Leather knapsack case ... ... extra	2	2	0

Chemical Thermometers.

Fig. 153.

No					8-in.	10-in.	12-in.	14-in.	16-in.	18-in.
401	Enamel tube, divided and figured on stem, in round wooden case			0 to 220° Fahr. each	5/-	5/3	5/6	5/9	6/-	8/9
402	Do.	do.	do.	0 to 400° „ „	5/3	5/6	5/9	6/-	6/9	9/3
403	Do.	do.	do.	0 to 650° „ „	5/6	5/9	6/-	6/9	7/9	10/-
404	Enamel tube, divided and figured on hinged boxwood scale ...			0 to 220° „ „	5/3	6/9	7/3	7/9	8/9	10/9
405	Do.	do.	do.	0 to 400° „ „	6/9	7/9	8/9	10/-	10/-	12/-
406	Do.	do.	do.	0 to 650° „ „	7/3	8/9	10/-	10/3	10/9	13/3

407	**STANDARD THERMOMETER,** Enamel tube, scale engine-divided, on silvered metal raised piece, 0 to 220° Fahr., enclosed in hinged morocco case, 18-in. long ... ... each			37/6
408	Do.	do.	COMPARATIVE, enamel tube engine-divided, mounted on silvered metal or porcelain scale, attached to mahogany or oak back ... ... each	28/-
409	Do.	do.	divided and figured on stem to one-fifth of a degree, from 0 to 220° Fahr., 18-in. long, in metal case, lined with rubber ... ... each	37/6
409A	Do.	do.	divided and figured on stem to one-twentieth of a degree, very open range, say any 20 or 30 degrees that may be required ... ... each	52/6
409B	Do.	do.	divided on stem and figured on boxwood, scale 0 to 120° Fahr., 12-in. long ... ... each	18/9
409C	Do.	do.	do. do. 0 to 220° Fahr., each	21/9
410	**HICKS'S MERCURIAL THERMOMETER** to 900° Fahr., Guaranteed, 18-in. long, divided and figured on its stem, beautifully distinct ... ... each			25/-

Self-Recording Rain Gauge.

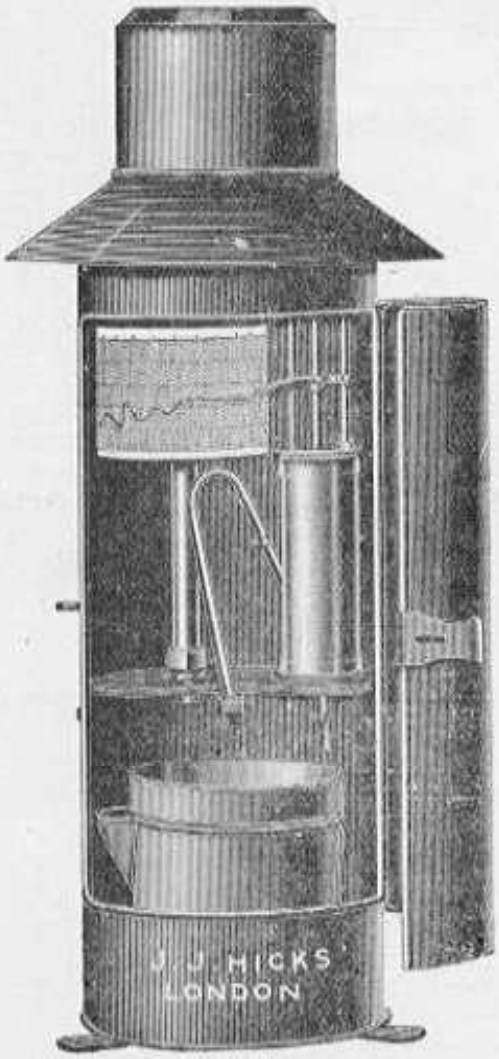


Fig. 154.

THIS SELF-RECORDING RAIN GAUGE has a receiving surface 6 inches in diameter, from which the collected rain flows through a metal pipe into a cylindrical receptacle underneath. This is furnished with a float with rod attached which, passing through the lid, is held in position by an upper guide arm supported by a pillar fixed to the lid. Attached to the float rod is an arm carrying the recording pen. When the chamber has received half an inch of rainfall the pen will be found at the top of the chart, the attached syphon coming into action and emptying the chamber, causing the pen to descend to the zero line, when the rain gauge is again ready to record. The chart is drawn to show half an inch of rain and divided to hundredths of an inch—it should be changed daily. The clock should be wound once a week. In changing the chart turn the lid carrying the pen arm to the right until it nearly touches the outer metal case, when the drum can be easily lifted from its spindle. Price, complete with charts £16 15 0

The Wilson Patent Radio-Integrator.

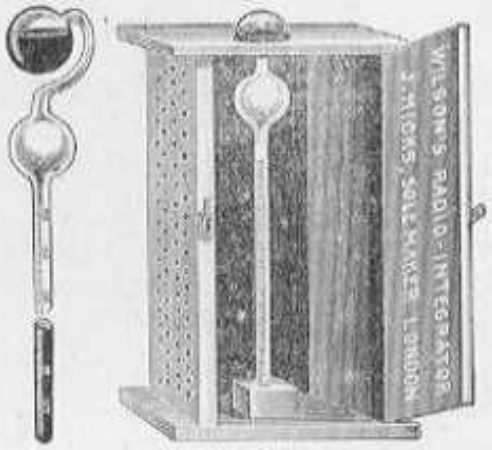


Fig. 155.

This simple instrument consists of a glass bulb partially filled with alcohol, the rest of the interior space being vacuous, and joined by a bend to a lower bulb and graduated tube. It has been designed by Dr. W. E. Wilson, F.R.S., to record the *total* amount of solar radiation received daily by the ground. Based on the fact that the latent heat of vaporisation of alcohol is constant at all ordinary air temperatures, the amount of alcohol which distils from the upper bulb into the lower bulb and graduated stem is directly proportional to the amount of solar radiation. Every cubic cm. that distils over into the stem is equal to 179 gram calories received by the surface of the alcohol. When set up for observation the instrument is arranged vertically, as illustrated above, thus exposing the surface of the alcohol to the solar rays. The tube, on the other hand, is protected from direct radiation by being enclosed in a screen with perforated sides. It will be seen that as the alcohol distils off under the action of the solar radiation it condenses into the graduated tube below, which is divided to read to ½ cc. from zero to 60 c.cm., and is kept at the shade temperature by the protecting screen.

The radio-integrator is so constructed that where necessary it can easily be fitted into the ordinary Stephenson's thermometer screen.

DIRECTIONS FOR USE.

See that all of the fluid is in the top bulb at starting, and that nothing is left in the divided tube. A little heat, from the hand clasping the empty bulb, will send all the fluid down into the top bulb. Hold it for half a minute or so that it may drain itself, after which it may be placed in the screen again for the next observation.

Price, complete with screen, as illustrated. £3. Price without screen, £1 17s. 6d.

Sphygmometers.

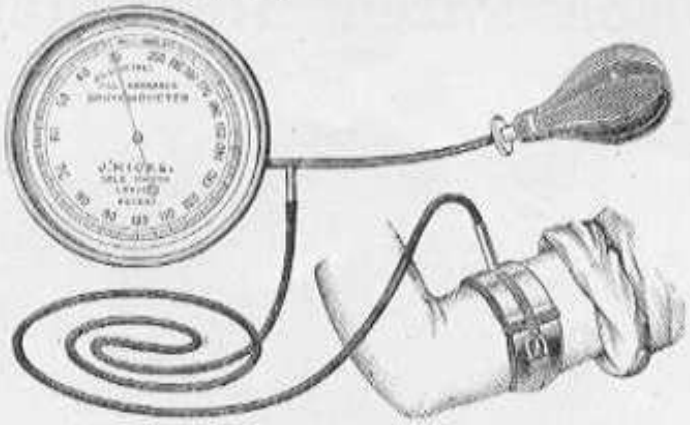


Fig. 156.

The above instrument is a simple and accurate form of Sphygmometer or Arterial Pressure Gauge, contrived for Clinical use by LEONARD HILL, F.R.S., M.B., and HAROLD BARNARD, M.S., F.R.C.S. It consists of:—

(1) A broad armlet, which is strapped round the upper arm. The armlet is formed of a flexible leather or steel band, on the inside of which there is fastened a bag of thin india-rubber. The rubber bag is connected by a **Y** tube with (2) a rubber compressor and (3) a pressure gauge.

The pressure gauge is of special construction. Roughly, it consists of a metal tambour the expansion of which is exhibited in a highly magnified form by means of an index, or pointer, which travels round a dial. This dial is graduated in milimetres of mercury. The armlet compressor and pressure gauge, when not in use, fit conveniently into a leather case.

DIRECTIONS FOR USE.

1. Remove the instrument from morocco case, connect the compressor or syringe bulb and the tube of armlet to instrument as shown in illustrations—now fasten armlet close and firmly round the right arm just above the elbow. The Sphygmometer is now ready for use.

2. Force up the pressure rapidly till pulsation appears.

3. Continue to force up the pressure till pulsation disappears, or obviously becomes lessened.

4. As the pressure rises and falls note where the pulsation becomes maximal. The maximal pulsation indicates the mean arterial pressure. If the pulsation be maximal over a certain area, for example between 104 and 110 mm. Hg., take the mean of these figures—106 mm. Hg.—as the mean arterial pressure.

5. Let the air out entirely and empty the arm of venous blood, either by elevation of the limb or friction.

6. Repeat the operation and take another reading.

The armlet is bound firmly round the arm so that the rubber bag may be but slightly distended when the pressure is raised within up to the arterial tension. If the bag were greatly distended the elasticity of the bag would come into play, and from this an error in the readings would arise. To avoid this error the rubber bag is made thin and flaccid.

By raising the pressure within the bag the venous outlets are blocked. This, if continued for long, produces a great congestion of the arm and discomfort. For this reason readings must be taken rapidly. The pressure is never to be maintained on the arm for more than a minute or so. By following the above plan no pain or discomfort will arise.

In studying the effect of varying conditions successive readings must be taken in the above manner. Owing to the effect of position on the circulation, the readings must be taken uniformly with the arm placed by the side and on the same level as the heart. When taking the readings the arm of the patient must be maintained in an absolutely passive condition. The patient should place the arm in a partially extended position. The arm should rest on a table or on the bed. The instrument can be placed on the arm over a thin dress or shirt. This will not affect the accuracy of the readings.

From the right arm the greater pulsation is obtained. In children, the armlet can be fitted to the thigh, and the pressure is then taken in the femoral artery.

NOTE CAREFULLY.—The index must on no account be driven up beyond the limit of the scale; if this is done the instrument is strained and the scale rendered inaccurate.

Price, complete in morocco case with handle, £5. Spare Rubber Bag and Tube, 5/- extra.

THE NEW

Hill and Barnard Pocket Sphygmometer

FOR DETERMINING THE SYSTOLIC PRESSURE AND MAXIMAL PULSATION.

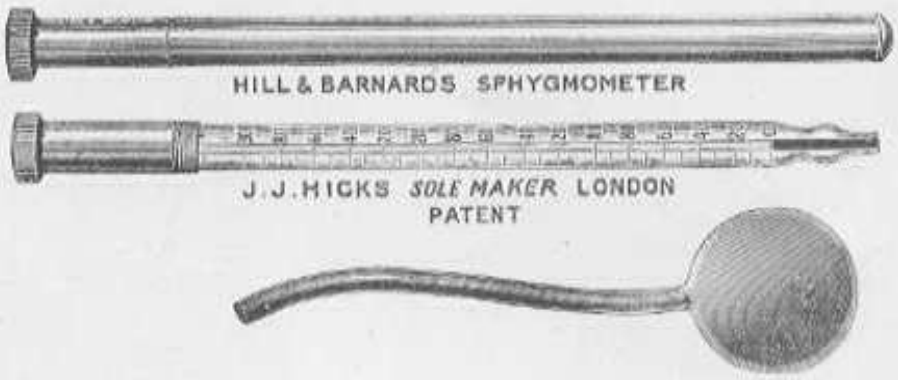


Fig. 157.

The instrument consists of a gauge and of a flaccid rubber ball contained in a silk bag and fitted with a few inches of rubber tubing. The gauge consists of a straight glass tube which is carried, when not in use, in a metal case like that of a clinical thermometer. The glass tube is closed at one end by a metal cap in which a hole is pierced, this hole is closed by a screw and can be opened or shut at will. The screw is provided with a leather washer which is moistened with glycerine to ensure an air-tight closure. A fluid meniscus is introduced within the gauge by placing its open end in water and opening the screw tap. So soon as the meniscus reaches the zero mark on the gauge the screw tap is closed. The flaccid rubber ball (which is about 1¾ inches in diameter) is distended with air and connected to the gauge. The ball is covered by the palm of one hand and pressed down upon the radial artery of the patient, whose arm must be supported in a suitable position, while the radial pulse is felt by the fingers of the other hand placed peripherally to the rubber ball. The pressure indicated by the gauge is read when the radial pulse is obliterated. The gauge is empirically graduated in millimetres of mercury. The fluid meniscus either can be jerked out after use or left in and re-adjusted to the zero mark before re-use by opening the screw tap and gently jerking the gauge till the meniscus reaches the zero. The maximal pulsation may be obtained by enclosing the ball with the palm of the hand and pressing it down upon the radial artery.

With this same gauge the Hill-Barnard armlet and syringe bulb can be used in place of the rubber ball, and the maximal pulsation pressure obtained by this means as well as the systolic pressure. The accuracy of the rubber ball method is shown by the fact that the same systolic pressure is obtained with it as with the armlet method.

The Venous and capillary pressures can also be determined with this gauge, using the method of von Recklinghausen. A small flaccid and flat rubber bag is taken with a circular hole punched through it; the bag is moistened with glycerine, placed over a vein, and covered with a glass slide which is held in position. The skin, slide, and glycerine together convert the bag into an air-tight cavity; the bag is connected by a tube to the gauge and to the syringe bulb; the pressure is noted which obliterates the vein. The vein is observed through the glass slide which covers the hole in the bag. To obtain the capillary pressure, von Recklinghausen reads the pressure respectively when a skin area blanches on raising, and when it begins to flush again on lowering the pressure. This capillary index, however, is not a sharp one.

The advantages of this instrument are:—

(1) Simplicity and accuracy.
The gauge cannot alter or go wrong, the fluid meniscus is easily set at zero.
The silk cover prevents over expansion of the rubber ball.
Experiment shows that the pressure required to flatten the walls of even a degenerate artery is negligeable.

(2) Convenience in use. The instrument is applied to the wrist and the patient's arm need not be stripped; the slight discomfort of the armlet is also avoided.

(3) Portability. The gauge and rubber ball can go into a waistcoat pocket.

Price, complete in case, with rubber ball and tubing ... 14/6

Petroleum Test Apparatus.

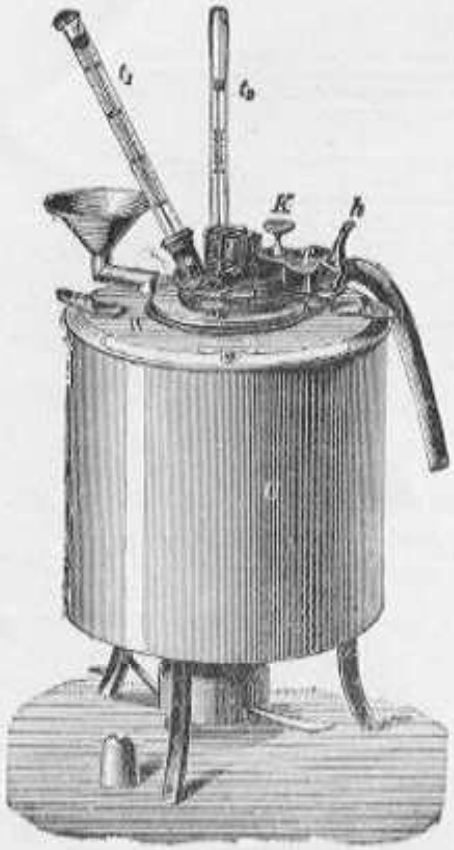


Fig. 158.

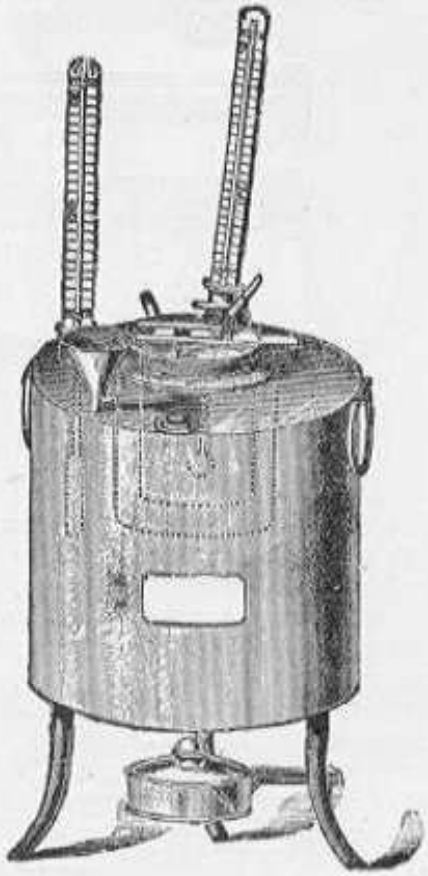


Fig. 159.

No.		£ s. d.
411	PETROLEUM TESTING APPARATUS, Fig. 158, with clockwork motion to open cover and depress the test flame, as required by the Government, and two thermometers, divided and figured on stem, 50° to 220° Fahr., and two divided 50° to 150°; also bronzed frame Aneroid Barometer with flange. The whole packed in polished pine case, with lock and key, and heavy strap overlid	14 0 0
412	Do. ... do., Fig. 159, as recommended by the Board of Trade. *See copy Petroleum Act, 1879.* Complete in case with fittings ...	5 5 0
	Board of Trade Fee for Stamping No. 412	0 5 0

Plane Tables and Pocket Sextant.

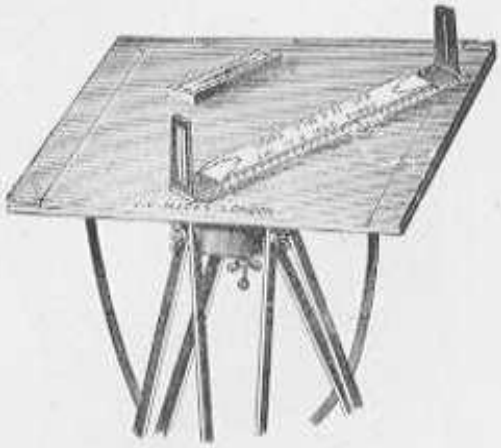


Fig. 160

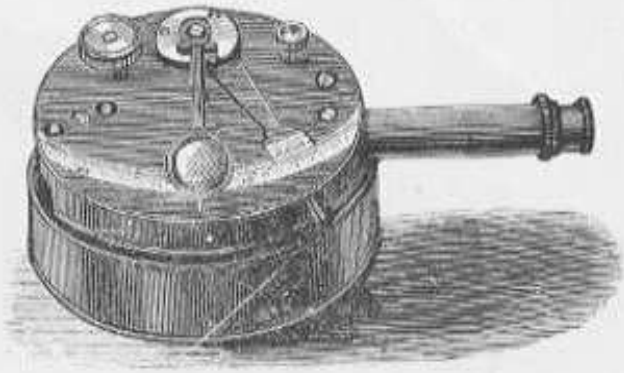


Fig. 161.

No.			£	s.	d
413		**PLANE TABLE**, Fig. 160, 16-ins. × 13-ins., mounted on tripod, with sighted Alidade and trough compass	4	0	0
414	Do.	16-ins. × 12-ins., with metal frame round edges for holding paper and drawing space of 14-ins. × 10-ins., same as supplied by Mr. Hicks to the Royal Military Academy and Royal Military College, complete with rule, legs, straps, &c.	3	10	0
415	Do.	23-ins. × 16ins., with movable panel board for paper, adjustable stand, Alidade, trough compass and best level	10	0	0
416	Do.	do. with telescope and divided arc...	15	0	0
417	Do.	Captain Cunningham's Patent, fitted with the following Aluminium instruments neatly inserted into the board:—Aneroid barometer, clinometer, compass, and sights, also pencil holders, bow pen, dividers, ivory protractor, T square and set square, forming a most complete and portable apparatus, splendidly adapted for explorers in Africa and elsewhere	21	0	0
418		**POCKET SEXTANT**, best finish, in bronze case, 3-ins. diameter, divided on silver arc, with telescope and shade, complete in sling leather case ...	4	10	0
419	Do.	... do. ... without telescope	4	0	0
420	Do.	Fig. 161 do. with telescope and shade and extra arc	6	0	0

Hicks' New Patent Ships' Clinometers.

Fig. 162.

Fig. 164.

INVALUABLE FOR ALL KINDS OF SAILING VESSELS, STEAMERS, YACHTS, &c.

No Ship should be without one.

"A Perfect Clinometer."

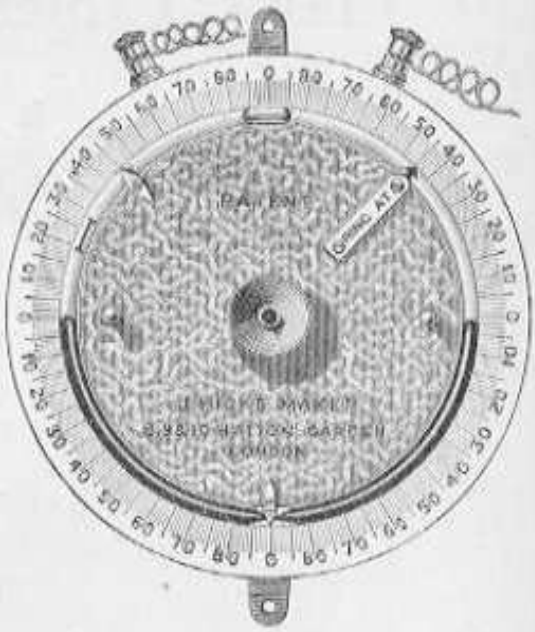


Fig. 163.

These Instruments have been designed to register the exact roll of a vessel at sea or when listing to port or starboard. They are extremely sensitive and perfectly unerring in their indications, so cannot fail to commend themselves to all navigators and ship owners, to whom the advantage of knowing the actual roll of the vessel, and also whether the rolls are increasing, is of the greatest importance.

Ship's Clinometer.—Fig. 162 consists of a circular tube containing mercury with a contraction in the lower part to avoid undue oscillation. The tube is sunk into a strong oak or mahogany board, which is bordered by a plainly divided metal scale showing 360 degrees (in 4 90's). The mercury at all times finds its own level so that when the Clinometer is fixed perfectly upright both sides will read O; then the slightest movement to either side will cause the mercury to move and the extent of the movement or roll will be shown by the index remaining at the degree on the scale to which the mercury pushes it. Of course, should successive rolls be greater this index will be driven further away and will remain to indicate the greatest roll. The reading is taken at the bottom of the index; thus the illustration shows it to be at 18.

In order to "set" or bring back the indexes again to the O it is merely necessary to attract them again to the surface of the mercury by means of the magnet issued with the instrument. If desired, the Clinometer can be supplied without any index, in which case the greatest roll of the vessel is ascertained by watching the instrument and noting the highest point reached by the mercury. This clinometer will be found invaluable for trimming a ship in harbour or in all places where it is essential to keep the vessel as level as possible, as the slightest movement or list to either side would be instantly indicated on the dial plate.

It is the greatest improvement on all Clinometers hitherto made for this purpose.

Ship's Clinometer.—Fig. 163 is made entirely of metal and is fitted with electric connection so as to record any particular roll of the ship in the captain's cabin or other place. For instance, if the captain desired to be warned should the vessel roll as much as 45° he would place the small metal pointer marked RING AT with arrow attached opposite that point, as shown in the illustration. This is done by slightly releasing the milled screw head in the centre by giving it a few turns to the left and then turning the pointer gently by the aid of the brass pins until the plate RING AT is opposite the 45° or other desired point, clamping the disc again by turning the milled head to the right. Should the vessel ever roll sufficiently to cause the mercury to reach this point contact is instantly made and a loud warning bell would be rung. The bell can be placed at any desired distance away from the Clinometer. This instrument has also an index to record the greatest roll. To re-set the index proceed as described above. If it is desired not to cause the bell to ring when the index is being set, break contact by removing one electric wire from the terminal, replacing it after the index has been pushed round.

During a recent voyage to Australia and back one of these Clinometers proved a very great source of interest to the passengers and they used to hazard opinions as to the extent of the ship's roll each day, in the same manner as it has long been customary for them to amuse themselves by guessing the length of the daily run.

NOTE.—The small quantity of fluid shown on top of the Mercury is Creosote, which is placed there for the purpose of always keeping the Mercury pure and bright.

THE ROYAL TOUR.

Prior to the departure of H.M.S. "Ophir," Mr. Hicks furnished the boat with two of his Marine Clinometers Figures 162 and 163, and in a letter dated Melbourne, May 8th, the Commander,

Commodore Winsloe, writes:— "The Ship Clinometers you fitted up have both worked very satisfactorily.

This emphatically endorses the opinion of several of our leading shipowners and the Mercantile Marine generally.

PRICES.—No. 421. Fig. 162. With Double Indices as shown in the illustration, **£2 15s.** No. 422. Fig. 162. Without Index, **£2 2s.** No. 423. Fig. 163. With Index, Electrical Contacts, Bell, Battery and 50 feet of Wire, **£5 10s.**; Extra Wire, per 100 feet, **4s.**; Spare Batteries, each **5s.**

Ship's Clinometer.—Fig. 164 (200 of them used by the United States' war vessels during the late Spanish war). It shows the exact movement of the vessel when rolling in a seaway or when listing to port or starboard. The advantage of such an Instrument, which is so simple in construction and yet so unerring in its indications, will commend itself to all navigators. For trimming a ship in harbour or at all times or places where it is essential that the vessel should be kept as level as possible, it will be found invaluable, as the slightest movement to either side will be immediately shown on the dial plate.

PRICES:—No. 424. Fig. 164. With 5-inch dial, **£2 5s.**; No. 425. Fig. 164. With 6-inch dial, **£2 12s. 6d.**; No. 426. Fig. 164. With 8-inch dial, **£3.**

Marine Clinometers, Sight Compasses, &c.

Fig. 165.

SINGLE SIGHT.


Fig. 166.

DOUBLE SIGHT.

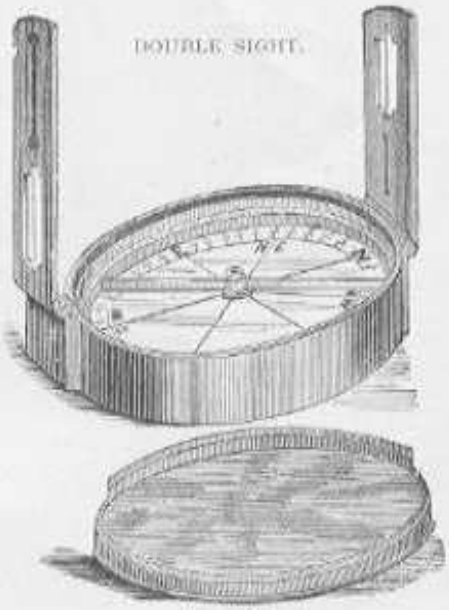


Fig. 167.

No.		£	s.	d.
427	**HICKS'S MARINE CLINOMETER,** as shown in Fig. 165. It is specially designed and admirably adapted for ship's use. It cannot get out of order, and is set by simply turning the collet head on the glass. Price with 6-in. dial, £3 10 0 ... ... 7-in. dial	2	18	0
428	**BRASS BRONZED SIGHT COMPASS,** single sights, Fig. 166, with cover, card dial, bar needle, agate cap and stop ... ... Diam. of box 2½ inch	0	15	0
429	Ditto ditto ditto ditto ... ... " " 2¾ "	0	17	0
430	Ditto ditto ditto ditto ... ... " " 3 "	1	0	0
431	Ditto ditto ditto ditto ... ... " " 3½ "	1	5	0
432	Ditto ditto ditto ditto ... ... " " 4 "	1	10	0

Engraved metal silvered dial to any, from 5/- to 7/6 each extra according to size.

Sling leather cases, 5/- to 6/- each extra.

No.		£	s.	d.
433	**BEST BRASS BRONZED SIGHT COMPASS,** with cover, Double Sights, Fig. 167, engraved silvered metal dial, with engraved graduated ring Diam. of box 2½ inch	1	10	0
434	Ditto ditto ... " " 2¾ "	1	15	0
435	Ditto ditto ... Diam. of box 3 inch	2	0	0
436	Ditto ditto ... " " 3½ "	2	8	0
437	Ditto ditto ... " " 4 "	2	10	0
438	Ditto ditto ... " " 4½ "	2	15	0
439	Ditto ditto ... " " 5 "	3	5	0

Sling leather cases, 5/- to 7/- each extra.

Compasses and Clinometer.

Fig. 168.

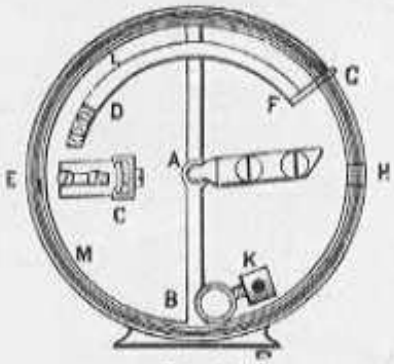


Fig. 169.

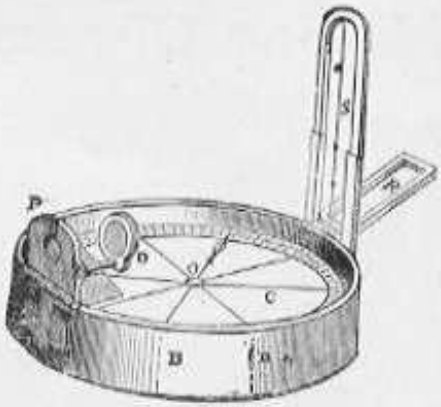


Fig. 170.

No.							£	s.	d.
440	**PRISMATIC COMPASS,** Hutchinson's Improved Form, Fig. 168, in morocco case, 2 in. diam., each						1	10	0
441	Ditto	ditto	ditto in sling case			3 " "	2	5	0
442	Ditto with Azimuth glasses, Fig. 170, consisting of shades and mirror, in morocco case,					2 " "	2	0	0
443	Ditto	ditto	ditto in sling case			3 " "	2	15	0
444	Ditto	ditto	ditto	ditto		3½ " "	3	0	0
445	Ditto	ditto	ditto	ditto		4 " "	3	10	0
446	Ditto	ditto	ditto	ditto		4½ " "	3	15	0
447	**CLINOMETER,** Watkin Patent, Fig. 169, as adopted in His Majesty's Service, 2½-in. diam., in sling case ... ... each						1	10	0

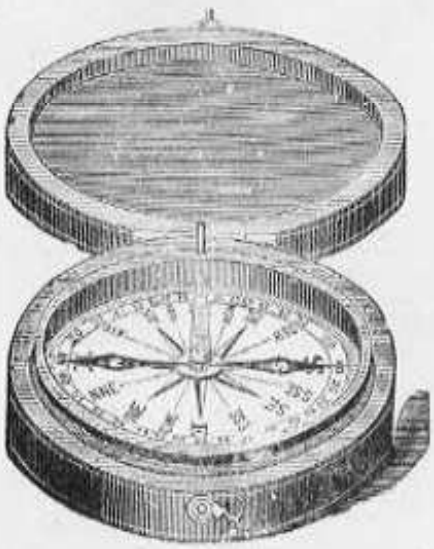


Fig. 171.

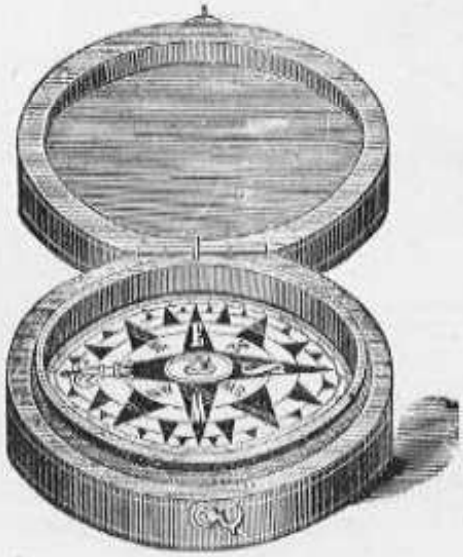
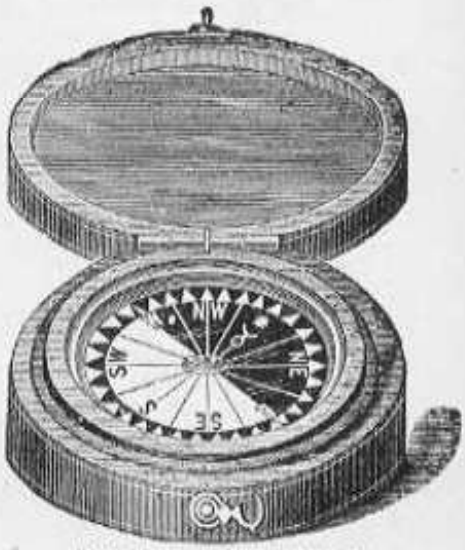


Fig. 172.



DAY AND NIGHT COMPASS.
Fig. 173.

Best quality Compasses, fitted in morocco cases, nickel fronts, and self-acting stops.

No.					£	s.	d.
448	Fixed Morocco Case Nickel Front-stop Compass, N and S blued needle, 1-inch compass			per doz.	1	15	0
449	" " ... ... Fig. 171,		1¼ " ... ... "		2	8	0
450	" "		1½ " ... ... "		2	10	0
451	" " agate cap		1 " ... ... "		2	8	0
452	" " "		1¼ " ... ... "		2	10	0
453	" " "		1½ " ... ... "		2	15	0
454	" " bar needle, agate cap		1 " ... ... "		2	10	0
455	" " " "		1¼ " ... ... "		2	15	0
456	" " " "		1½ " ... ... "		3	0	0
457	" " " " engraved metal dial		1 " ... ... "		3	5	0
458	" " " " " "		1¼ " ... ... "		3	10	0
459	" " " " " "		1½ " ... ... "		3	15	0
460	" " day and night float card dial, agate cap		1 " ... ... "		2	10	0
461	" " " " " " " Fig. 173		1¼ " ... ... "		2	15	0
462	" " " " " " "		1½ " ... ... "		3	0	0
463	" " ordinary float card, agate cap		1 " ... ... "		2	10	0
464	" " " " " Fig. 172 ...		1¼ " ... ... "		2	15	0
465	" " " " "		1½ " ... ... "		3	0	0

Compasses.

Fig. 174 full size.

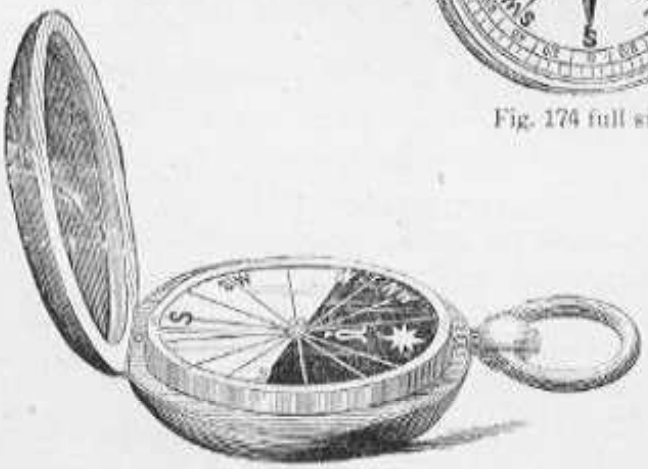


Fig. 175 full size.

Fig. 176 full size.

No.			£	s.	d.
466	Nickel Case Compass, with bar needle, enamel card dial, in Morocco case, Fig. 174, ... each		0	6	0
467	" " Singer's Patent Card, in Morocco case, Fig. 176, each		0	6	0
468	" " Singer's card dial and jewelled cap in hunter case, Fig. 175, 1¾ inch diam. ... ... each		0	9	0
469	" " Singer's card dial and jewelled cap in hunter case, 2 inch diam. ... ... each		0	10	0
470	" " Singer's patent pearl dial and jewelled cap, 1½ inch diam. ... ... each		0	12	0
471	" " Singer's patent pearl dial and jewelled cap, 1¾ inch diam. ... ... each		0	13	0
472	" " Singer's patent pearl dial and jewelled cap, 2 inch diam. ... ... each		0	15	0

Nos. 468 to 472 supplied in superior quality and best water gilt, 4/- each extra. These numbers have an automatic stop which stops when cover is shut. They will be found very durable and handy for the pocket.

473 **WRIST STRAP COMPASS**, metal dial, bar needle, side stop, each ... 0 10 0

Charm Compasses for the Watch Chain.

Fig. 176.

Fig. 177.

Fig. 186.

Fig. 179.

No.			£	s.	d.
474.	Fig. 177.	Capstan pattern, 10 ct. gold 30/- each, in silver, each	0	9	0
475.	Fig. 178.	Nickel, 9/- doz. ... ... Gold plated, per doz.	0	12	0
476.	Fig. 179.	Anchor and wheel, 18ct. gold, £4 each, 15 ct. gold ... ... each	3	10	0
478.	Fig. 180.	Transparent Belcher, gilt or nickel, 15/- per doz. In silver, H.M. ... ... per doz.	1	10	0
479.	Fig. 181.	Life Buoy, pebble, 18 ct. gold, £3 each. 15 ct. gold ... ... each	2	10	0
480.	Fig. 182.	Wheel pattern, 15 ct. gold, £2 10s. each. In silver ... ... each	0	18	0
481.	Fig. 183.	Anchor and Life Buoy, 18 ct. gold, £3 15s. each. 15 ct. gold	3	10	0
482.	Fig. 184.	Cable pattern, pebble, 15 ct. gold, £2 5s. each. In silver ... ... each	0	18	0
483.	Fig. 185.	Miniature Gimbal, 18 ct. gold, £3 15s. each. 15 ct. gold ... ... each	3	0	0
484.	Fig. 186.	Plain Needle pattern, gilt, 9/- per dozen. In silver ... ... per doz.	0	16	0

Fig. 185.

Fig. 180.

Fig. 184.

OTHER PATTERNS QUOTED FOR IF DESIRED.

Fig. 181.

Fig. 182.

Fig. 183.

Spirit Levels, Steel Tapes and Land Chains

Fig. 187.

Fig. 188.

No.

485 Spirit Levels, wood bodies, Fig. 187, with brass top plates, 8-in., 15/-; 9-in., 20/-; 10-in., 23/-; 12-in., 30/-; 14-in., 40/- per doz.

486 Spirit Levels, wood bodies, top and bottom plates, 6-in., 30/-; 8-in., 35/-; 9-in., 48/-; 10-in., 50/-; 12-in., 60/-; 14-in., 75/- per doz.

487 Brass Spirit Levels, best solid brass, Fig. 188, 4-in., 30/-; 5-in., 35/-; 6-in., 45/-; 7-in. 50/-; 8-in., 55/-; 10-in., 63/- per doz.

488 Superior do., with superior ground glass divided bubbles, 4-in., 8/-; 5-in. 10/-; 6-in., 12/-; 7-in., 14/-; 8-in., 16/-; 10-in., 20/- each

489 Best Circular Spirit Levels, in cases, stoutly made, 1-in. dia., 6/-; 1¼-in. dia., 7/-; 2-in. dia., 10/-; 2½-in. dia., 14/- each.

No.			£	s.	d.
490	**IMPROVED STEEL TAPE,** ¾-in. wide, in solid leather case (red, black, or brown), with flush handle, marked in inches and feet, 20 feet long ...		0	15	0
491	Do. ... do. ... do. 33 ,, ...		0	18	0
492	Do. ... do. ... do. 50 ,, ...		1	4	0
493	Do. ... do. ... do. 66 ,, ...		1	10	0
494	Do. ... do. ... do. 80 ,, ...		2	0	0
495	Do. ... do. ... do. 100 ,, ...		2	5	0
496	**LAND CHAIN,** best steel wire, No. 11, 3 oval rings, with brass swivel handles and tallies, 33 ft. long		0	9	0
497	Do. ... do. ... do. ... 50 ,,		0	10	0
498	Do. ... do. ... do. ... 66 ,,		0	14	0
499	Do. ... do. ... do. ... 100 ,,		0	18	0
500	Do. best iron wire, No. 8, as used by H.M. Government ... 33 ,,		0	7	6
501	Do. ... do. ... do. ... 50 ,,		0	9	0
502	Do. ... do. ... do. ... 66 ,,		0	11	0
503	Do. ... do. ... do. ... 100 ,,		0	13	0

Mr. Hicks manufactures also

Acetometers.
Acidometers.
Air Pumps.
Alkalimeters.
Alcholometers, various.
Anemographs, or Self-Recording Wind Gauges.
Anemometers, various.
Argentometers, for Photographers' use.

Barktrometers.
Barometers, all kinds of
Binnacles, Ships.
Boiling Point Apparatus.
Burettes, in Plain and Opaque Glass.

Cameras.
Captain George's Barometer.
Cathetometers.
Charts, of every description.
Clinometers, Ships.
Do. Col. Watkin's Patent.

Electrical Apparatus.
Eudiometers.

Flasks.

Gauges—Gas, Rain, Steam, Tide and Water.

Hydrometers, all kinds of.
Hypsometrical Apparatus.

Lactometers, for Testing Milk.
Levels—Ship's Drainage and Surveying.

Magic Lanterns.
Magnifying Glasses.

Measures—Tape and Steel.
Do. Glass.

Pedometers.
Pyrometers, in great variety.

Quadrants.

Range Finders.

Salinometers.
Sextants.
Spectacles and Eye Glasses.
Storm Bottles.
Surveying Instruments.
Screens for Thermometers.
Ship's Logs.
Syringes—Hypodermic, &c.

Time Glasses.
Thermometers, Board of Trade.
Do. Clinical, all kinds of.
Do. Deep Sea.
Do. Dimenion.
Do. Differential.
Do. Oven.
Do. Self-Recording.
Do. Solar and Terrestrial Radiation.

View Finders.

Urinary Cabinets and Stands.
Urinometers.

Water Hammers.
Wind Vanes.

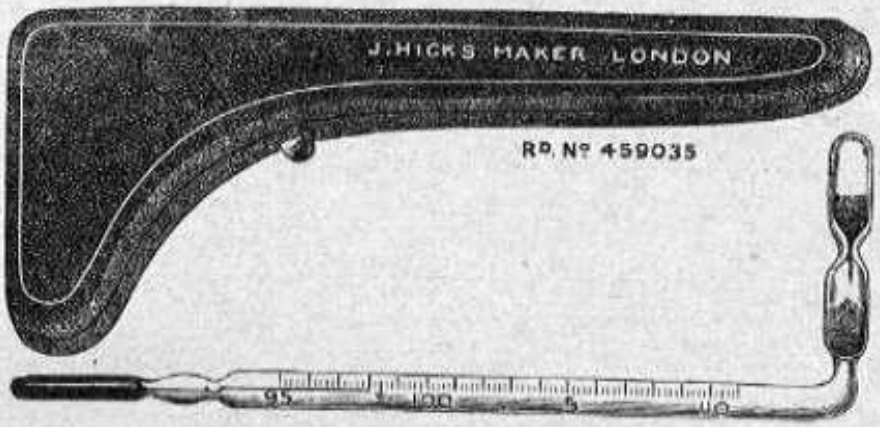
PRICES ON APPLICATION.

INDEX.

N.B.—Special Illustrated Price List of SEXTANTS now ready.
Copy sent free on application.

Hicks' Patent One-Minute & Half-Minute Clinical Thermometers

WITH TIME GLASS.



THESE CELEBRATED THERMOMETERS have now been adapted to use with either one minute or half-minute time glass. This will be found very useful when a watch is not at hand for timing.

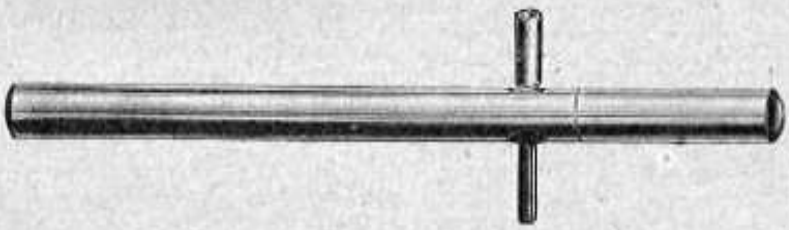
Directions for Use.

Place the Thermometer under the tongue, with the Time Glass turned downwards, and noting that all the sand has left the upper chamber. Now, without removing the Thermometer from the mouth, turn the Time Glass upwards again, and when the sand has all run through the temperature will be found indicated on the attached thermometer.

Complete in case, as illustrated, 10/6 each.

GRAFTON'S PATENT SELF-SETTING

Clinical Thermometer Case.

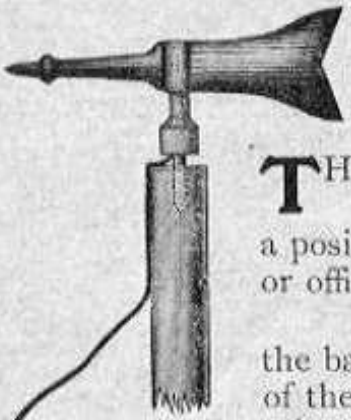


JAMES J. HICKS, SOLE MAKER TO THE PATENTEE.

In Clinical Thermometers, as commonly made, difficulty is experienced in re-setting the index, and this case enables the operation to be performed with the minimum of trouble and without the liability which at present exists of the instrument slipping from the fingers and being broken.

The Case is provided with a pair of projecting arms (one of which has a loose sleeve), which, when held between the fingers, enable the Case to be easily rotated so that the centrifugal force developed, will, in a few turns, cause the mercury to be driven past the constriction in the bore back to the bulb.

To re-set the Thermometer place it in the Case, which be sure to cap. Hold the loose sleeve of the one arm firmly between the forefingers and thumb of the left hand, keeping the remaining fingers clear of the Case, which is then revolved by giving the roughened arm one good spin with the forefinger and thumb of the right hand, the roughened arm being immediately released so as to allow the case to be revolved for two or three seconds on its other arm, the sleeve acting as a bearing. A fairly sharp twist is usually necessary, and after a few trials anyone can effect this. ... ... each 1/6



Patent Electrical Wind Indicator.

THIS Electrical Apparatus for showing the direction of the wind, consists of a vane with commutator fitted on to the top of a pole in such a position as to catch all winds, and an indicator (placed in any hall, room or office) connected to same by a small cable.

There are nine different coloured wires, *one* of which is attached to the base of vane, and runs, as shown in the illustration, through the coil of the battery on to the top of the indicator, and conveys current to the other wires. Each of the remaining *eight* wires leads from the vane direct to one of the compass points, N., N.N.E., N.E., &c., &c., on the indicator. These points have a round *black* disc against them. At the lower part of the indicator there is a push which, on being pressed, causes a *white* disc to replace one of the black, according to the direction of the wind. For instance, if the wind is in the North the white disc will appear under N. When two white discs appear, the reading is taken from the *intermediate* letters.

The Wind Indicator can be fixed with ease by any person, the chief point to remember is to connect the wires to their proper points in the vane and in the indicator; and to assist them to do this correctly the wires have different colours corresponding to their respective stations.

The vane is generally fixed to a *pole*, but in many houses this is not required, as the vane can be attached to some portion of the building.

These Indicators have been fitted up at Lloyds, The Constitutional Club, The Hotel Metropole, and many private houses, and have given every satisfaction.

SEVERAL TESTIMONIALS HAVE BEEN RECEIVED.

ADVANTAGES.

Some instrument of this kind has been wanted for many years for use in Watch-houses, Signal Stations, Lighthouses, Meteorological Stations, Observatories, Harbours, Docks, &c., &c., and it is particularly applicable to Hotels, Hospitals, Houses, &c., especially in large towns where the streets totally obscure the true direction of the wind.

This Indicator can be read at any time of day or night, and during calm or hurricane weather, by simply pressing the push; the latter is inserted to save wear of the battery, which will run for years.

The **friction** of the vane is reduced to a minimum, and is less than in the ordinary type.

The cable, about ⅝in. in diameter, can be practically **any length,** a great advantage over the old mechanical systems.

Perfect simplicity, no springs or complicated gear to get out of order, and only the best material used. Several Indicators can be worked from one vane.

The ordinary Leclanché cell is employed, and where electric bells, &c., are in use, their battery will probably suffice.

By the application of a clock and a special indicator, the direction of the wind can be automatically recorded on a strip of paper, at stated intervals.

Supplied at the lowest possible price, and only the best workmanship employed.

Price of Vane, Spindle, Indicator with 8in. dial & Battery, **£9 10s.**

" " " " 16in. dial " **£12 10s.**

Waterproof Cable, covered in Silk, **2/-** per yard.

Waterproof Cable, covered in Cotton, **1/6** per yard.

Sole Manufacturer J. J. HICKS.