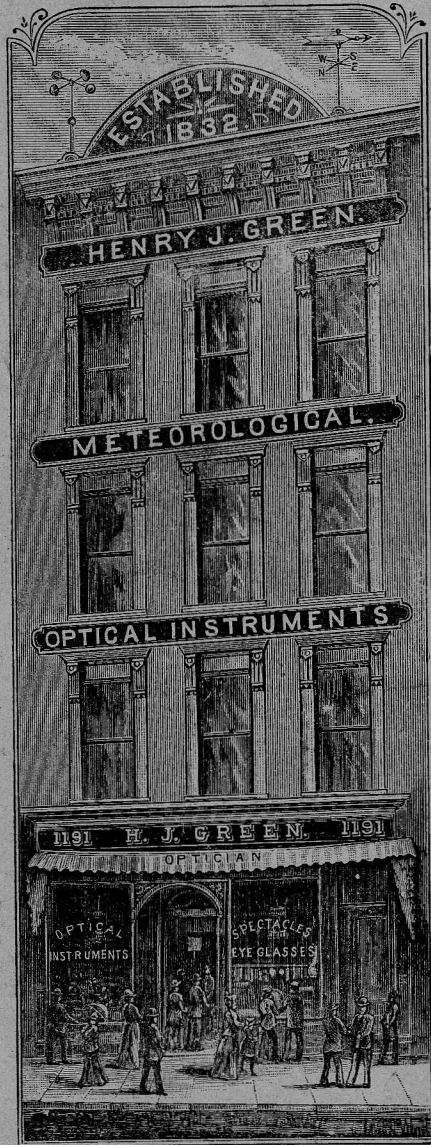


# HENRY J. GREEN,

— MANUFACTURER OF —

## METEOROLOGICAL AND SCIENTIFIC INSTRUMENTS

To the  
United States  
Signal Service,  
Smithsonian  
Institution,  
United States  
Geological  
Survey,  
United States  
Navy,  
United States  
Coast Survey,  
United States  
Fish  
Commission,  
And other De-  
partments of the  
United States  
Government.



State Weather  
Bureaus,  
State  
Agricultural  
Experiment  
Stations,  
Meteorological  
Service of  
Canada,  
University of  
Tokio, Japan,  
And to the  
Principal  
Observatories  
and  
Universities  
of this Country.

1191 BEDFORD AVENUE, BROOKLYN, N. Y.

— 1892. —

## NOTICE.

ALL PACKING BOXES WILL BE CHARGED FOR.

The utmost care is exercised in packing, but I cannot hold myself accountable for breakage in transportation.

The Express Company's charges for collecting and returning the money on C. O. D. bills must be paid by the parties ordering the goods.

ESTABLISHED 1832.

**HENRY J. GREEN,**

MANUFACTURER OF

**METEOROLOGICAL AND SCIENTIFIC  
INSTRUMENTS,**

TO THE

**United States Weather Bureau,**

**Smithsonian Institution,**

**United States Geological Survey,**

**United States Navy,**

**United States Coast Survey,**

**United States Fish Commission,**

And other Departments of the United States Government.

**State Weather Bureaus,**

**State Agricultural Experiment Stations,**

**Meteorological Service of Canada,**

**University of Tokio, Japan,**

And to the Principal Observatories and Universities of this Country.

---

**1892.**

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**HENRY J. GREEN,**

**1191 Bedford Avenue,**

**BROOKLYN, N. Y.**

## BAROMETERS.

*Barometers built upon the plan herein described were first gotten up by James Green, under the direction of the Smithsonian Institution, and for many years were known to meteorologists and scientists as "Green's Smithsonian Standard Barometers."*

*The establishment of the United States Signal Service Meteorological Bureau greatly increased their popularity. The Bureau not only adopted them for use on stations, but in its publications recommended them to private observers, and I have continued to enjoy the undivided honor of supplying all demands from these sources up to the present time.*

*For field or mountain use they are particularly adapted, and they have been for years the only mercurial barometer used by the United States Geological Survey.*

*In the construction of my large observatory barometers, it will be found that the points of refinement are better covered, and the quality of the work is of a higher order than those of similar pretension made in Europe or in this country.*

*I have given particular attention to the production of perfect barometer tubes of large diameter. In 1879, at the request of the Chief Signal Officer of the Army, I personally devised and constructed the barometer adopted as a reference standard by the United States Signal Service. The tube is 1.05 inch bore, and was prepared by a method and mode of procedure entirely original with me.*

## STANDARD BAROMETER, &c.

My Theoretical Standard Barometer is one identical with that of the Kew Observatory, England.

My copy of this standard was obtained by means of two barometers of refined construction, built especially for the purpose, in my own workshop and then carried by me personally to and from the Kew Observatory. Mr. Whipple, the Superintendent, very kindly and voluntarily making special comparisons.

---

The United States Signal Office standard of barometer remains as heretofore the Kew standard. By courtesy of the Chief Signal Officer, the standard of H. J. Green has been compared with the office standard from time to time.

## STANDARD OF LENGTH.

My most authentic standard of length is the Yard and its sub-divisions, graduated upon a bar of brass of the same alloy as those made for the Counties of the State of Maryland, by James Green, under the direction of J. H. Alexander, in 1845.

The graduation is the handiwork of the eminent mechanic, Joseph Saxton, and was made at the U. S. Bureau of Weights and Measures.

In 1878 the Yard was officially examined at the U. S. Bureau of Weights and Measures, and found correct within  $\frac{1}{10000}$  of an inch.

In the following year J. & H. J. Green had the honor of making the large normal barometer adopted as reference standard by the U. S. Signal Service. In connection with this, two brass rods 30 inches in length as adjusted by the Saxton graduation, were reported by the Bureau of Weights and measures, through the U. S. Signal Office, to be within  $\frac{1}{10000}$ .

Again a scale of 8 inches, and divided by me to twentieths of an inch, the Bureau reported, "The 8 inch scale is standard at 60° F. and the variation of its several inches does not exceed  $\frac{1}{20000}$  of an inch."

For the metric scale, the values given in Guyot's Meteorological Tables are adopted; for example: 762 millimetres at 0°C. = 30 inches at 62° F.; 761.75 millimetres = 30 inches at a temperature common to both.

## APPENDIX E.\*

## GREEN'S STANDARD BAROMETER.

1. The following is an account of Green's improved standard barometer, adopted by the Smithsonian Institution, for observers of the first class.

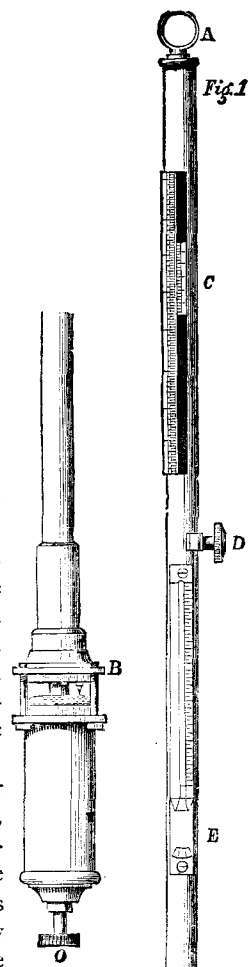
2. The barometer consists of a brass tube, (Fig. 1) terminating at top in a ring A, for suspension, and at bottom in a flange B, to which the several parts forming the cistern are attached.

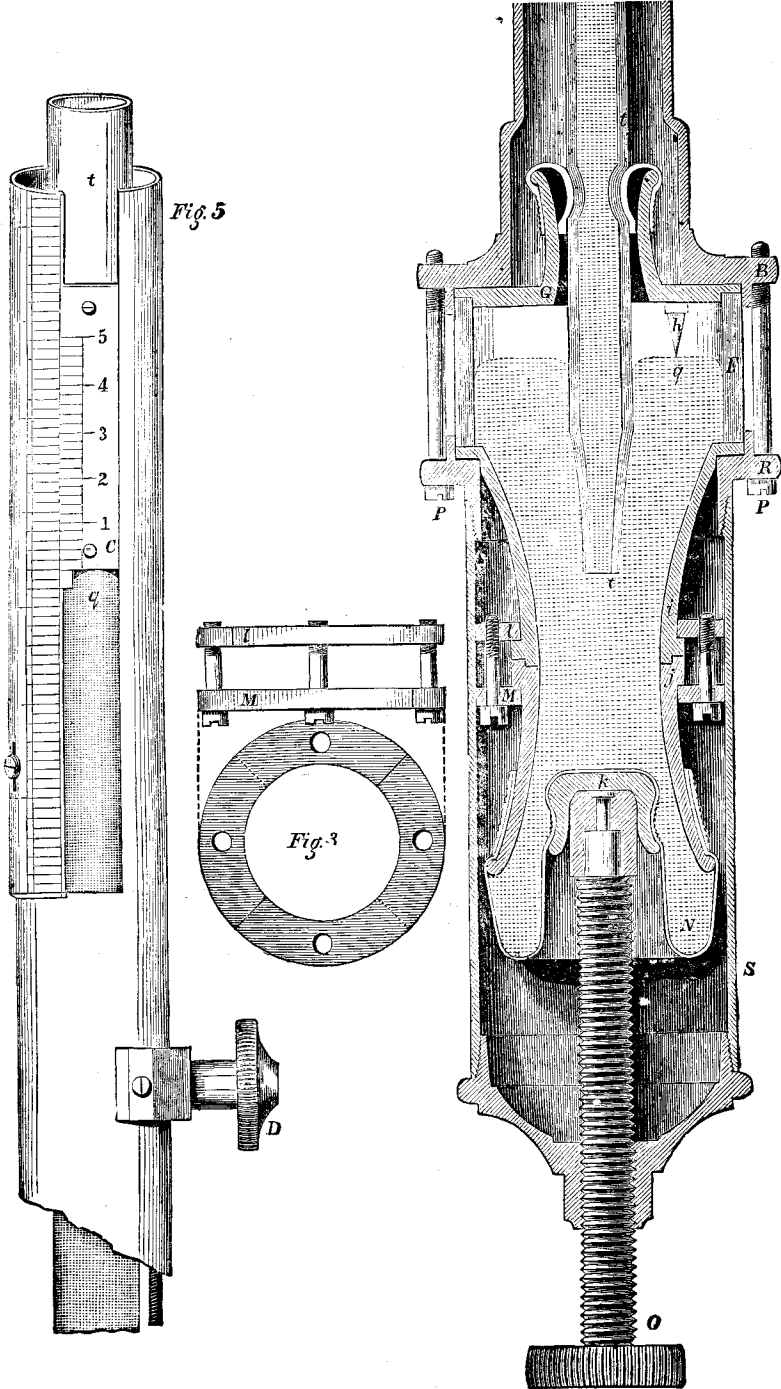
3. The upper part of this tube is cut through so as to expose the glass tube and mercurial column within, seen in Fig. 5. Attached at one side of this opening is a scale, graduated in inches and parts; and inside this slides a short tube *c*, connected to a rack work arrangement, moved by a milled head D; this sliding tube carries a vernier in contact with the scale, which reads off to  $\frac{1}{100}$  (002) of an inch.

4. In the middle of the brass tube is fixed the thermometer E, the bulb of which being externally covered, but inwardly open, and nearly in contact with the glass tube, indicates the temperature of the mercury in the barometer tube, not that of the external air. This central position of the thermometer is selected that the mean temperature of the whole column may be obtained; a matter of importance, as the temperature of the barometric column must be taken into account in every scientific application of its observed height.

5. The cistern (Fig. 2) is made up of a glass cylinder F, which allows the surface of the mercury *q* to be seen, and a top plate G, through the neck of which the barometer tube *t* passes, and to which it is fastened by a piece of kid leather, making a strong but flexible joint. To this plate, also is attached a small ivory point *h*, the extremity of which marks the commencement or zero of the scale above. The lower part, containing the mercury, in which the end of the barometer tube *t* is plunged, is formed of two parts *i j*, held together by four screws and two divided rings *l m*, in the manner shown in Figs. 2 and 3. To the lower piece *j* is fastened the flexible bag N, made of kid leather, furnished in the middle with a socket *k*, which rests on the end of the adjusting-screw O. These parts, with the glass cylinder F, are clamped to the flange B by means of four long screws P and the ring R; on the ring R screws the cap S, which covers the lower parts of the cistern, the supports at the end the adjusting screw O. G, *i*, *j* and *k* are of box-wood; the other parts of brass or German silver. The screw O serves to adjust the mercury to the ivory point, and also, by raising the bag, so as to completely fill the cistern and tube with mercury, to put the instrument in condition for transportation.

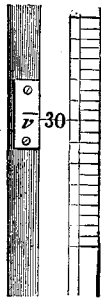
\* From "The Barometer, Thermometer, Hygrometer, and Atmospheric Appearance at Sea and on Land," etc., by Commodore Thornton A. Jenkins, U. S. Navy.





6. In Fortin's barometer, and also Delcro's modification of it, a cement is used to secure the mercury against leakage at the joints. This, sooner or later, is sure to give way; and tested under the extremes of the thermometrical and hygrometrical range of this climate especially, has made this defect more evident. This was removed by the substitution of iron in the place of wood; but it was soon found impracticable, in this form of cistern, to prevent damage from rust. These objections led to the present plan of construction which effectually secures the joints without the use of any cement. The surfaces concerned are all made of a true figure, and simply clamped together by the screws, a very thin leather washer being interposed at the joints. This would not be permanent, however, but for the especial care taken in preparing the boxwood. The boxwood rings are all made from the centres of the wood, and concentric with its growth. They are worked thin and then toughened, as well as made impervious to moisture, by complete saturation with shellac. This is effected by immersing them in a suitable solution in vacuo. The air being withdrawn from the pores of the wood is replaced by the lac. This, however, with the after-drying or baking, requires care; but when properly done, the wood is rendered all but unchangeable.

7. Another peculiarity consists in making the scale adjustable to correct for capillarity, so that the barometer may read exactly with the adopted standard, without the application of any correction; and this, too, without destroying the character of the barometer as an original and standard instrument. Near the 30 inches line, Figure 4, is a line *v*, on the main tube; this last line is distant exactly 30 inches from the tip of the ivory point; therefore, when these lines coincide, or make one line, the scale is in true measurement position; or the 30 mark is exactly 30 inches from the tip of the ivory point in the cistern. In this position, the amount of correction due to capillarity being ascertained, the scale is then moved that quantity and clamped firm. The barometer will now give the readings corrected for capillarity, and thus avoid at once the labor of applying a correction, and the risk of error from an accidental neglect of it.



8. It must be borne in mind that this correction applies only to the particular tube, and while preserved in good condition.

9. If this tube is injured and again used, or another tube put in its place, the scale should then be moved until the lines coincide, the amount of correction for the repaired or the new tube being estimated until a good comparison can be made directly or intermediately with the Smithsonian standard,

10. The connecting the parts *i* and *j* by rings and screws, Figs. 2 and 3, rather than by a single screw cut on the edge, is an improvement, as the single wood-screw is apt, after a time, to adhere so firmly that it is often difficult, and sometimes impossible, with safety to the parts, to separate it.

11. It is not advisable to disturb the cistern, unless it becomes difficult, from the oxide of mercury which gradually forms, to make the adjustment of the mercury to the ivory point, as there is more or less risk in doing so. Any one accustomed to such mechanical affairs, with due attention to the plan, can, however, take out the mercury from the cistern, refill, clear the parts of adhering oxide, and replace them; the instrument all the time being kept vertical, with the cistern at top, as the mercury must not be allowed to come from the tube.

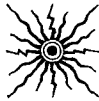
12. To insure a good vacuum by the complete expulsion of all air and moisture,



the boiling of the mercury in the tube is done in vacuo; and care should be taken to preserve it in good condition.

13. To put up the barometer for observation, suspend the barometer by the ring A in a good light near to and at the left side of a window, and, when practical, in a room not liable to sudden variations of temperature. Record the temperature, and then by the screw O lower the mercury in the cistern until the surface is in the same plane with the extremity of the ivory point. As this extremity of the point is the zero of the scale, it is necessary at each observation, to perfect this adjustment. It is perfect when the mercury just makes visible contact. If the surface is lowered a little, it is below the point: and if raised a small amount, a distinct depression is seen around the point. This depression is reduced to the least visible degree. A few trials will show that this adjustment can always be made to a thousandth of an inch.

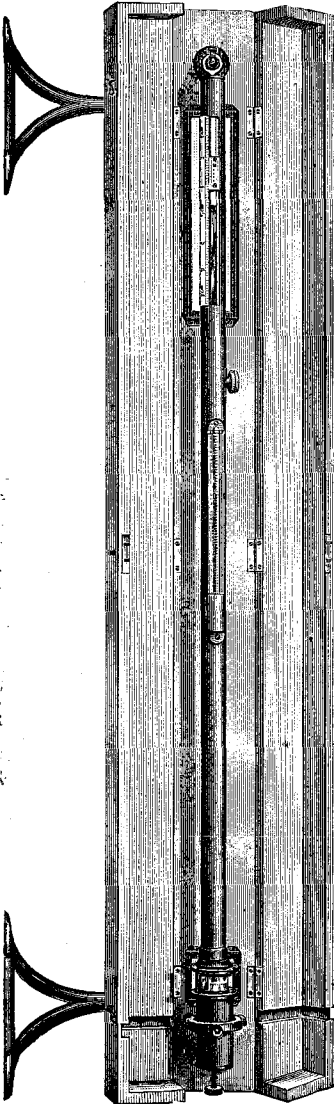
14. The adjustment effected, bring the lower edge of the vernier C, Fig. 5, by means of the milled head D, into the same plane with the convex summit of the mercury in the tube. Looking through the opening, with the eye on a level with the top of the mercury in the tube, when the vernier tube is too low, the light is cut off; when too high, the light is seen above the top of the mercury. It is right when the light is just cut off from the summit, the edge making a tangent to the curve. A piece of white paper placed behind, and also at the cistern, will be found to give a more agreeable light by day, and is, besides, necessary for night observations; the lamp being placed before the instrument and above the eye, to reflect the light.



## OBSERVATORY BAROMETERS,

AS SUPPLIED TO

UNITED STATES WEATHER BUREAU, THEIR VOLUNTEER OBSERVERS, &amp;C.



1 4

No correction for capillary action, or instrumental error, is given with these barometers, as their scales have been adjusted until readings were obtained identical with my standard.

Corrections for the attached thermometer accompany each instrument.

For basis of standards, see Barometer, &c., page 3.

1. OBSERVATORY BAROMETER, with scale extending down to 26 inches (an approximate altitude of 4,000 feet) divided to tenths of an inch, and reading by vernier to  $\frac{1}{100}$ th of an inch. The tube is 0.25 inch bore, and has been freed from air and moisture by boiling the mercury therein. The attached thermometer consists of a well seasoned tube with graduation and figures etched on its stem, and mounted so that it can be easily removed for testing, &c. The barometer can be used simply suspended by passing the ring at the top over a nail or other convenient support, but the board or box, (the latter is shown in the illustration), described below possesses some advantages. Price of the barometer without board or box. †.....\$30 00

† Metric scale in place of English at above prices.

Metric scale in addition to English on Nos. 1, 2, 5 and 6, \$4 00 extra.

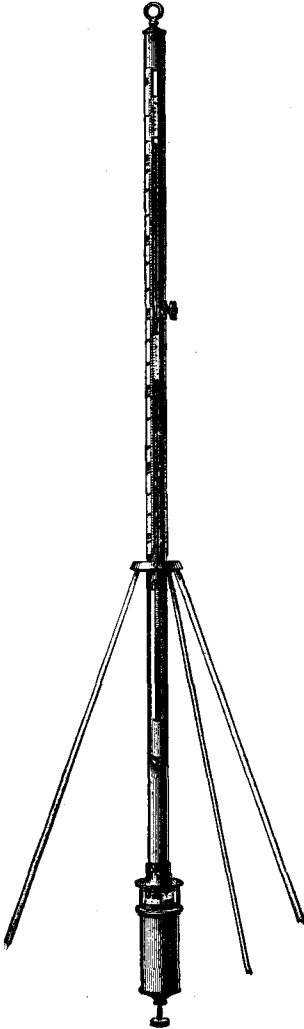
2. OBSERVATORY BAROMETER similar to No. 1, but with scale divided to twentieths of an inch, and reading by vernier to  $\frac{1}{500}$ th. † . . . \$33 00.
3. MAHOGANY BOARD suitable for Nos. 1 and 2, and to which is attached a suspension piece to receive the ring, a system of steady-ing screws below to clamp about the cistern, and white opal glass plates arranged to furnish a pleasant background for reading the instrument. . . . . 4 50
4. MAHOGANY BOX suitable for Nos. 1 and 2, with lock and key and provided with iron brackets. The front and sides turn back disclosing the barometer ready for use ; in other respects its fittings are similar to No. 3. This box is suitable for mounting parallel to a window ; being pierced at the back, light is admitted to the opal glass plates forming a translucent background. The brackets can be changed to the right by simply removing the screws. . . . . 8 50
5. OBSERVATORY BAROMETER, with scale extending down to 24 inches, (an approximate altitude of 6,000 feet,) divided to tenths of an inch, and reading by vernier to  $\frac{1}{100}$ th. Otherwise the same as No. 1. † 34 00
6. OBSERVATORY BAROMETER, with scale extending down to 24 inches, (an approximate altitude of 6,000 feet,) divided to twentieths of an inch, and reading by vernier to  $\frac{1}{500}$ th. Otherwise the same as No. 1. † 35 00
7. MAHOGANY BOARD, the same as No. 3, but fitted to suit barometers Nos. 5 and 6. . . . . 5 50
8. MAHOGANY BOX, the same as No. 4, but fitted to suit barometers Nos. 5 and 6. . . . . 9 00

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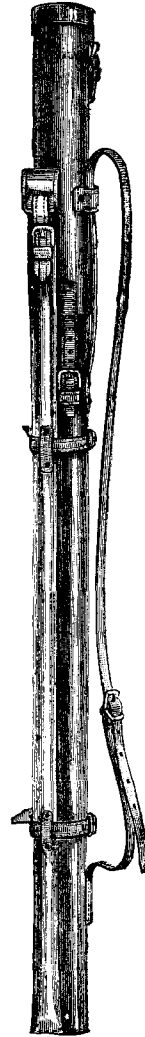
† Metric scale in place of English at above prices.

Metric scale in addition to English on Nos. 1, 2, 5 and 6, \$4 00 extra.

MOUNTAIN BAROMETERS.



12-13.



14.

9. MOUNTAIN BAROMETER, with scale extending down to 20 inches, (an approximate altitude of 10,000 feet,) divided to tenths of an inch, and reading by vernier to  $\frac{1}{100}$ th. The tube is of extra stout glass, and 0.23 inch bore.....\$38 00
10. MOUNTAIN BAROMETER similar to No. 9, with scale divided to twentieths of an inch, and reading by vernier to  $\frac{1}{600}$ th\*..... 40 00
11. MOUNTAIN BAROMETER with two verniers, scale extending down to 14 inches, (an approximate altitude of 18,000 feet,) divided to tenths of an inch, and reading by vernier to  $\frac{1}{100}$ . The tube is of extra stout glass and 0.23 inch bore..... 52 00
12. MOUNTAIN BAROMETER similar to No. 11, but with scale divided to twentieths of an inch, and reading by vernier to  $\frac{1}{300}$ th\*..... 55 00
13. LIGHT BRASS TRIPOD with gimbals for mountain barometer, can be readily detached and the parts packed into the pocket and sheath of leather case shown in No. 14, (in the cut of tripod No. 13 the full length of the legs is not shown). To support the barometer a small attachment has to be made to its frame ; the cost of doing this is included in the price of tripod..... 8 00
14. LEATHER SLING CASE for mountain barometer, with pocket and sheath to contain tripod..... 10 00
15. LEATHER SLING CASE for mountain barometer without pocket and sheath..... 8 00

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\* The U. S. Geological Survey use Nos. 10 and 12 exclusively.

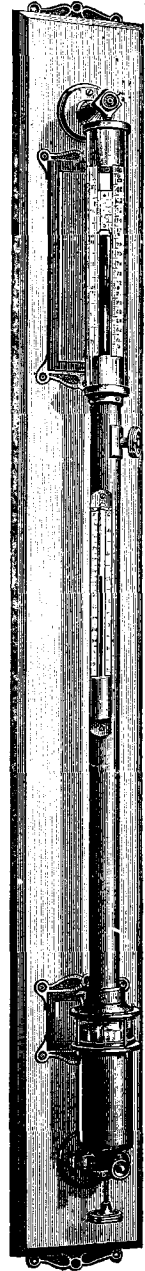
## STANDARD OBSERVATORY BAROMETERS.

These barometers I can confidently recommend as the most accurate, portable standards ever produced, the tubes are prepared by a more refined method than by boiling the mercury therein and are subjected to a severe test for perfection of vacuum before mounting.

No correction for capillary action or instrumental error, is given with them, as their scales are most carefully adjusted until readings are obtained identical with my standard.

Corrections for the attached thermometer accompany each instrument.

For basis of standards, see Barometer, &c., page 3.



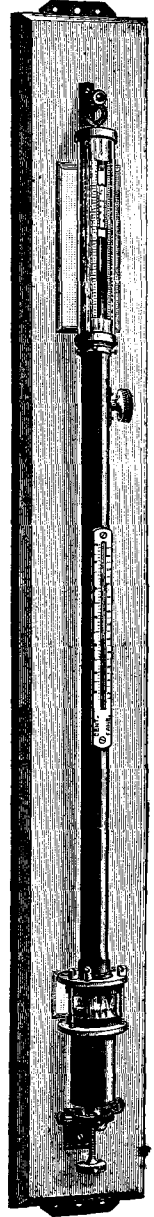
16. STANDARD OBSERVATORY BAROMETER with tube 0.6th inch bore, provided with two scales; the English standard divided into twentieths of inches, and the French standard divided into millimetres, the verniers reading to  $\frac{1}{300}$  (.002) of an inch, and  $\frac{1}{20}$  (.05) m. m. respectively. The attached thermometer is of exceptional accuracy; the tube well seasoned, and has both Fahrenheit and Centigrade scales etched upon its stem.\* . . . . . \$75 00
17. No. 16 mounted on polished mahogany board, as shown. . . . . 85 00
18. No. 16 mounted in glass case, lighted front and sides, frame of polished mahogany, with lock and key. . . . . 100 00
19. STANDARD OBSERVATORY BAROMETER with tube 0.8th inch bore. The frame is of the same pattern, but much larger than No. 16. 140 00
20. No. 19 mounted on polished mahogany board. . . . . 155 00
21. No. 19 mounted in glass case, lighted front and sides, frame of polished mahogany, with lock and key. . . . . 170 00

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\* To the U. S. Navy I have had the honor of supplying several of Nos. 16 and 19 in glass case. One of these has been erected in almost every Navy Yard and Branch Hydrographic Office in the country. For University or College standards they are particularly adapted, and reports from those that already have them, have been exceedingly complimentary.

## BAROMETERS BUILT AFTER THE ENGLISH MODEL

Of my own manufacture, each accompanied with my certificate, showing the amount of correction to be applied for instrumental error; also corrections to be applied to the attached thermometer. For basis of standards, see Barometer, &c., page 3.

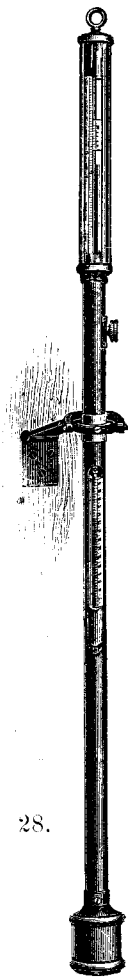




22. STANDARD OBSERVATORY BAROMETER with tube 0.5th inch bore, provided with two scales; the English standard divided into twentieths of inches, and the French standard divided into millimetres; the verniers reading to  $\frac{1}{500}$  (.002) of an inch, and  $\frac{1}{10}$  (.10) m.m. respectively. The attached thermometer is graduated on its stem into degrees Fahrenheit, and on the silvered brass mount into half degrees Centigrade.....\$60 00
23. No. 22 mounted on polished mahogany board, as shown..... 65 00
24. No. 22 mounted in glass case, lighted front and sides, frame of polished mahogany, with lock and key..... 80 00
25. STANDARD OBSERVATORY BAROMETER, with tube 0.6th inch bore. The frame is of the same pattern, but larger than No. 22..... 68 00
26. No. 25 mounted on polished mahogany board..... 75 00
27. No. 25 mounted in glass case, lighted front and sides, frame of polished mahogany, with lock and key..... 90 00



## MARINE BAROMETER.

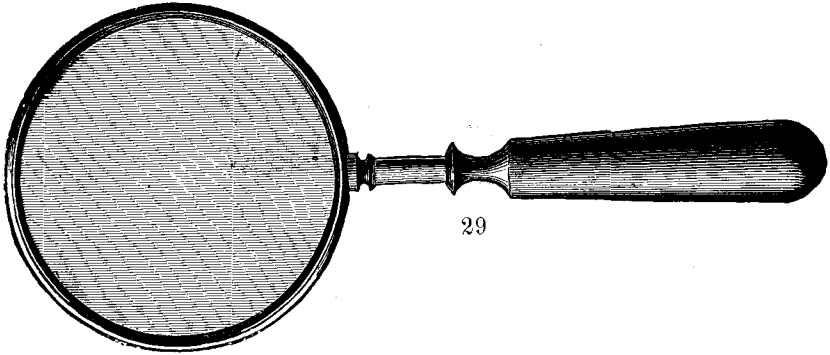


28.

28. MARINE BAROMETER, differing from Fortin's principle in there being no adjustment provided for setting the mercury in the cistern to a fixed point, the slightest deviation therein, caused by its rise and fall in the tube being compensated for in graduating the scale. The tube toward its lower end is much contracted so as to prevent oscillation of the mercurial column from the motion of the ship; just below this is a trap to arrest any small bubbles of air from finding their way upward. The scale is arranged to read by vernier to  $\frac{1}{100}$ th of an inch. The barometer is suspended in a revolving centre ring in gimbals at one end of a brass arm, the other being screwed to the wall. Fitted into a pine box for transportation . . . . . \$36 00  
 Without pine box . . . . . 33 00

☞ No. 28 I have the honor to supply to the U. S. Navy, also to the Yachts Alva, Electra, Namouna, N. Y. Yacht Club and others.

## ACHROMATIC READING GLASS.



29. A useful aid in reading the barometer or other instruments.  
 Lens  $3\frac{1}{4}$  inch diameter, focus 9 inches, mounted in metal  
 frame with wood handle..... \$2 25

## BAROMETER TUBES.

Bore, .23 to .26 inch.

30. Extra Barometer tubes (empty) cleaned, shaped, and hermetical-  
 ly sealed, each..... 1 25  
 31. 2, packed in pine box for travel..... 3 75  
 32. 4, " " " " "..... 6 50

## MERCURY.

33. Mercury, chemically pure, (prepared by me) in iron bottles, 2 lbs. 2 50  
 34. " " " " " " " 4 lbs. 4 50  
 35. Mercury, chemically pure, (prepared by me) in stone bottles, 2 lbs. 1 75  
 36. " " " " " " " 4 lbs. 3 50

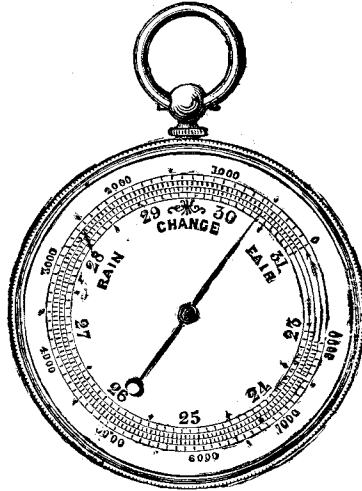
PRICES SUBJECT TO CHANGE.

## IMPLEMENT BOXES.

37. U. S. GEOLOGICAL SURVEY IMPLEMENT BOX,  $12 \times 6 \times 3\frac{1}{2}$  inches,  
 containing all necessary tools and materials for repairing Green's  
 Mountain Barometer in the field, including 4 lbs. of mercury, ex-  
 tra cistern glass, clamps, bags, &c..... 12 00  
 38. U. S. GEOLOGICAL SURVEY IMPLEMENT BOX,  $13\frac{1}{2} \times 11 \times 6\frac{1}{2}$  inches,  
 containing all necessary tools and materials for boiling mercury in  
 tubes and repairing Green's Mountain Barometer in the field, in-  
 cluding 8 lbs. of mercury, 2 quarts of alcohol, lamp and stand, ex-  
 tra cistern glass, clamps, bags, &c..... 24 00

## ANEROID BAROMETERS.

FOR ALTITUDE PURPOSES.



I do not manufacture these, but keep on hand the finest quality of instruments (London make), these are tested by me, both for temperature and scale, and those not coming up to my standard are either improved in my own workshop or altogether rejected. Each instrument is provided with a card, showing its scale comparison for every inch with my standard mercurial barometer. The pocket size ( $2\frac{1}{2}$  inch) is by far the most popular among scientists.

Aneroid Barometer,  $1\frac{3}{4}$  inch dial, with movable altitude scale, compensated for temperature ; in morocco case.

39.	to 3,000	feet.....		\$23 00
40.	“ 5,000	“ .....		22 00
41.	“ 8,000	“ .....		22 00
42.	“ 10,000	“ .....		23 00
43.	“ 15,000	“ .....		24 00
44.	“ 20,000	“ .....		25 00

Aneroid Barometers, as above,  $2\frac{1}{2}$  inch dial.

45.	to 3,000	feet.....		23 00
46.	“ 5,000	“ .....		22 00
47.	“ 8,000	“ .....		22 00
48.	“ 10,000	“ .....		23 00
49.	“ 15,000	“ .....		24 00
50.	“ 20,000	“ .....		25 00

In leather sling case, \$2.00 extra.

## Aneroid Barometer, 5 inch dial in leather sling case.

51. to 3,000 feet.....	\$35 00
52. " 4,000 " .....	35 00
53. " 5,000 " .....	34 00
54. " 8,000 " .....	34 00
55. " 10,000 " .....	35 00
56. " 15,000 " .....	37 00
57. " 20,000 " .....	38 00

## ANEROID BAROMETERS,

FOR WEATHER PURPOSES.

58. Five inch open silvered metal dial, scale extending down to 25 inches and divided to fiftieths of an inch, in velvet lined case....	\$15 00
59. Similar to No. 58, but with enameled card dial.....	14 00
60. Similar to No. 58, but with curved thermometer attached to dial, scale extending down to 28 inches.....	16 00
61. Similar to No. 60, but with enameled card dial.....	15 00

The above are the best aneroid barometers on the market for the price, for weather purposes they are thoroughly reliable, and are the only grade I could recommend for scientific use. A certificate of corrections accompanies each instrument.

I also carry in stock a cheaper grade for HOUSEHOLD USE, prices upon application.

## ANEROIDS REPAIRED.

Aneroid barometers repaired, estimates furnished upon examination, tests made and correction cards furnished at nominal rates. Parties calling at our office can have their aneroids set to standard free of charge.

## BOOKS ON METEOROLOGY.

PRICE.

GUYOT.—Tables, Meteorological and Physical, prepared for the Smithsonian Institution. By A. Guyot, Ph. LL.D. (Out of print)..	
LOOMIS.—A treatise on Meteorology, with a collection of Meteorological Tables. By Elias Loomis, LL. D., Professor of Natural Philosophy and Astronomy in Yale College. Cuts, 8vo, sheep..	\$1 75
PLYMTON.—The Aneroid and How to Use it. Compiled by Geo. W. Plymton (Van Nostrand's Science Series No. 35) .....	50

## STANDARD THERMOMETER, &c.

MY THEORETICAL MERCURIAL STANDARD THERMOMETER is one identical with that of the Kew Observatory, England.

THE OBSERVATORY OF YALE COLLEGE have adopted the Kew as their theoretical mercurial standard, see "American Journal of Science, May, 1881."

THE UNITED STATES NAVAL OBSERVATORY have adopted a standard furnished by H. J. Green, for the testing of clinical thermometers, used in the Naval Service, see Report of Superintendent of Naval Observatory, 1886.

THE UNITED STATES WEATHER BUREAU have adopted the air thermometer as the standard for temperatures. The normal mercurial standards which I have furnished the Weather Bureau have, on comparison with the air thermometer, shown so small a deviation that it may be fairly questioned whether it was owing to the air thermometer itself,\* or to the particular form adopted to represent the standard of ideality. The amount in question being but a few hundredths of a degree Fahr.

Extract from the article "Metrology at the Northwestern University," *Sidereal Messenger*, November, 1888, page 399.

"For thermometric standards there are among others, four Kew standards, two by Baudin, six by Geissler and two very perfect standards by H. J. Green, of New York. The last standards by Green are exceptionally fine, the calibration of one being perfect the whole length of the scale, and the other having only one error and that so small as to be almost, if not quite, within the error of observation. With these are a boiling-point and freezing-point apparatus and a water comparator, devised by Dr. Ewell, for the comparison of thermometers."

The following extract of a letter from Prof. Rogers is an unsolicited testimonial :

Waterville, Me. Jan. 26th, 1890.

"Allow me to congratulate you on the remarkable results you have attained in perfecting an instrument for the precise measurement of temperature. I have yet to hear of a thermometer which has a record at all comparable with that of No. 529."

Faithfully Yours,

WM. A. ROGERS.

\* "The most accurate readings which one can make on an air thermometer will vary several hundredths of a degree."—*Rowland*.

EXTRACT FROM THE REPORT OF THE THERMOMETRIC BUREAU, WINCHESTER  
OBSERVATORY OF YALE COLLEGE, FOR THE YEAR  
1881—1882.

“An interesting event in the progress of thermometry has been accomplished by the Messrs. J. & H. J. GREEN, who have sent to the observatory four standard thermometers of American glass, which have a practical coincidence of their scales with our own Kew standards. The middle point correction depending on the glass alone has heretofore been about  $0.3$  for American made standards. The Messrs. GREEN, however, by using a glass for the bulb, of their own manufacture, have produced standards which we find have corrections for the middle point, depending on the glass alone, which are within our own errors of comparison.”



## STANDARD THERMOMETERS

OF EXTREME PRECISION,

— WELL SEASONED AND BULBS FORMED FROM —

### GREEN'S IMPROVED GLASS,

Graduated and figured on the stem, and provided in felt-lined brass cases. The tubing from which these thermometers are made is selected with especial reference to uniformity of bore, and the graduations are laid down by referring to a table of corrections obtained for each thermometer by careful calibration.

#### FAHRENHEIT SCALE.

No.	Length of Tube about.	Graduated about.	Graduated into.	Price.
200	24 to 25 inches.	+ 32° to + 212° F.	$\frac{1}{5}^{\circ}$ F.	\$25 00
201	24 to 25 inches.	0 to + 120 F.	$\frac{1}{5}^{\circ}$ F.	25 00
202	24 to 25 inches.	0 to + 150 F.	$\frac{1}{5}^{\circ}$ F.	25 00
203	24 to 25 inches.	— 30 to + 120 F.	$\frac{1}{5}^{\circ}$ F.	25 00
203a	24 to 25 inches.	+ 32 to + 120 F.	$\frac{1}{10}^{\circ}$ F.	25 00

#### CENTIGRADE SCALE.

No.	Length of Tube about.	Graduated about.	Graduated into.	Price.
204	24 to 25 inches.	0° to + 100° C.	$\frac{1}{10}^{\circ}$ C.	\$25 00
205	24 to 25 inches.	— 15 to + 50 C.	$\frac{1}{10}^{\circ}$ C.	25 00
206	24 to 25 inches.	— 15 to + 65 C.	$\frac{1}{10}^{\circ}$ C.	25 00
207	24 to 25 inches.	— 35 to + 50 C.	$\frac{1}{10}^{\circ}$ C.	25 00
207a	24 to 25 inches.	0 to + 50 C.	$\frac{1}{20}^{\circ}$ C.	25 00

See Page 34.

100,000 Thermometer Tubes kept constantly on hand.

## METEOROLOGICAL THERMOMETERS

Made from Tubing Selected for Uniformity of Bore, Well Seasoned, and  
Bulbs Formed from

### GREEN'S IMPROVED GLASS.

Our thermometers, on account of their extreme accuracy, have been used exclusively by at least nine-tenths of the most prominent scientists and meteorological institutions in the United States during the past quarter of a century. They are not only exceptionally accurate at temperatures above the freezing point, but are equally so at temperatures below it.

Extract from the Report of the Chief Signal Officer for 1884, page 91.

“It would be a somewhat difficult matter for makers to point thermometers at very low temperature, but the determination of their corrections at these points is very simple. Now, however, Mr. Green points thermometers made for the Signal Service at  $+12^{\circ}$  and  $-8^{\circ}$  and also  $+112^{\circ}$  F.

“The graduations are continued above and below these points as they were previously above  $92^{\circ}$  and below  $32^{\circ}$ .”

NOTE. Since the above report I have succeeded in devising apparatus by which I now point accurately as low as  $-28^{\circ}$  F. (Pointing below  $32^{\circ}$  F. has, I believe never before been introduced into practical thermometry.)



98-99.



102.



100.



103-A.



98. EXPOSED THERMOMETER, latest U. S. Weather Bureau pattern, 11 inches long, mounted upon an aluminum back: graduated on the stem with five lines and figures engraved upon the aluminum back the lower part of which is cut away, exposing cylindrical bulb. A brass support accompanies the thermometer, which when screwed to the wall or other support, extends the thermometer about two inches, thus allowing a free circulation of air around the bulb.

\$2 75

99. EXPOSED THERMOMETER, former U. S. Weather Bureau pattern, (Green's Porcelain Strip) differs from No. 98 only in being mounted on a silvered brass back with five lines and figures engraved on a porcelain strip ranged at its side. With support same as No. 98.

2 75

102. EXPOSED THERMOMETER, (Green's pattern) in all respects the same as No. 99, except that the scale is not "cut away" but continued to the bottom of the bulb, for the purpose of affording it protection. With support same as No. 98.

2 75

100. EXPOSED THERMOMETER, (former U. S. Weather Bureau pattern) 12 inches long, graduated and figured on the stem, mounted on a silvered brass plate, the lower part of which is cut away, exposing cylindrical bulb. With support same as No. 98.

2 50

103a. The support of the thermometer shown in No. 103a is bent in such a manner as to bring the thermometer at right-angles to the plane to which it is fastened. It can be applied to any of the above-mentioned thermometers, in place of the usual support and without additional cost.

Our Barometers and Thermometers will be found in use on every Station of the U. S. Weather Bureau.

## MAXIMUM REGISTERING THERMOMETERS.

---

The following description of Green's maximum thermometer is taken from Appleton's Encyclopedia, first edition, article Thermometer, page 431 :

"Mr. James Green, of New York, appears (1860) to have removed the objections to the previous forms of maximum thermometer, and produced a highly simple and perfect instrument. In this the tube is straight throughout, but the bore is for a short space just above the bulb contracted to a very small size—this being readily accomplished with the elliptical bore by compressing the tube upon the posterior side; and the size is made such that, while expansion forces the mercury through in regular and minute pulses or globules, the space upon the mercury's tending to return proves so small that the cohesive forces give to the liquid, as in the last named, the globular surface (usually ascribed to repulsion of the glass), and so break the column, leaving it to show, as above, its highest point. The instrument is provided with a suitable support, from a pin upon which it can be safely swung with a pendulous or revolving movement, when the centrifugal force suffices to return the mercury, as required for a new observation."

103. MAXIMUM THERMOMETER, (latest U. S. Weather Bureau pattern), 12 inches long, mounted upon an aluminum back; graduated on stem with five lines and figures engraved upon the aluminum back. With support and pin complete \$4 50
- 104a. MAXIMUM THERMOMETER, (former U. S. Weather Bureau pattern, Green's) 12 inches long, graduated on stem, indelible five lines and figures on a porcelain strip, ranged at its side, the whole mounted on a silvered brass plate, with support and pin complete 4 50
104. MAXIMUM THERMOMETER, (former U. S. Weather Bureau pattern), 12 inches long, graduated and figured on stem, mounted on a silvered brass plate. with support and pin complete 4 25

Our Barometers and Thermometers will be found in use on every Station of the U. S. Weather Bureau.

## MINIMUM REGISTERING THERMOMETERS.

---

Rutherford's Minimum Thermometer, which is the only one in general use, has alcohol for its fluid, and is always placed with its tube nearly horizontal, the bulb end a little lower. In the bore of the tube moves freely a black glass index. A slight elevation of thermometer bulb uppermost will cause the glass index to flow to the surface of the fluid, where it will remain. On a decrease of temperature the alcohol recedes, taking with it the glass index; on an increase of temperature the alcohol alone ascends in the tube, leaving the end of the index farthest from the bulb indicating the minimum temperature.

106. MINIMUM THERMOMETER, (latest U. S. Weather Bureau pattern,) 12 inches long, mounted upon an aluminum back; graduated on the stem with five lines and figures engraved upon the aluminum back. A brass support accompanies the thermometer, which, when screwed to the wall or other support extends it about two inches, thus allowing a free circulation of air around the bulb. The upper end of the thermometer is pivoted to the support by a screw; the bulb end rests in a notch, from which it can be raised for the purpose of setting. . . . . \$3 75

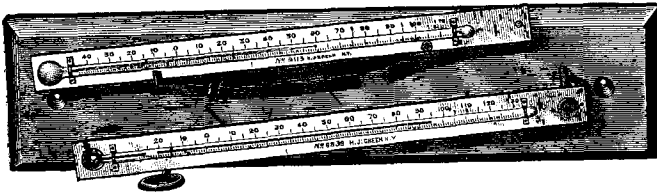
107a. MINIMUM THERMOMETER, (former U. S. Weather Bureau pattern, Green's) 12 inches long, graduated on stem, indelible five lines and figures on a porcelain strip, ranged at its side, the whole mounted on a silvered brass plate, with support same as No. 106. . . . . 3 75

107. MINIMUM THERMOMETER, (former U. S. Weather Bureau pattern) 12 inches long, graduated and figured on the stem and mounted on a silvered brass plate, with support same as in No. 107a. . . . . 3 50

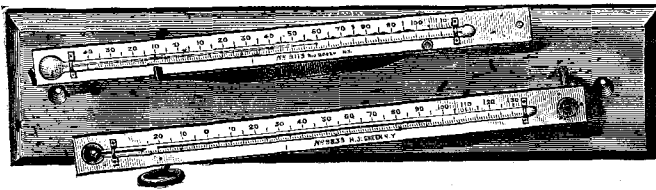
Our Barometers and Thermometers will be found in use on every Station of the U. S. Weather Bureau.

MAXIMUM AND MINIMUM REGISTERING THERMOMETERS  
IN SETS.

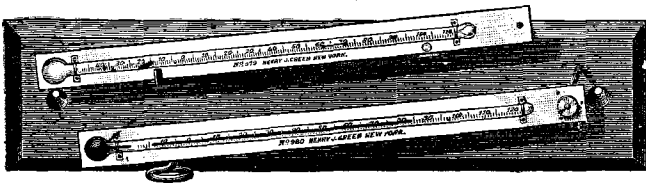
110 A.



111.

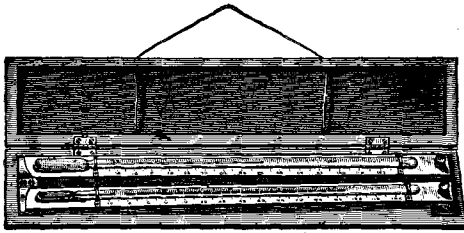


112.

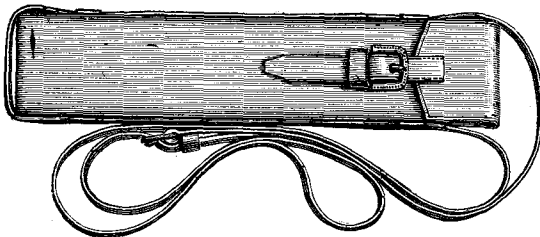


- 110 a. Set of Maximum and Minimum Thermometers, (latest U. S. Weather Bureau pattern,) Nos. 103 and 106 mounted on oil-finished pine board..... \$8 25
- 111. Set of Maximum and Minimum Thermometers, (former U. S. Weather Bureau pattern,) Nos. 104a and 107a mounted on oil-finished pine board..... 8 25
- 112. Set of Maximum and Minimum Thermometers, (former U. S. Weather Bureau pattern,) Nos. 104 and 107 mounted on oil-finished pine board..... 7 75

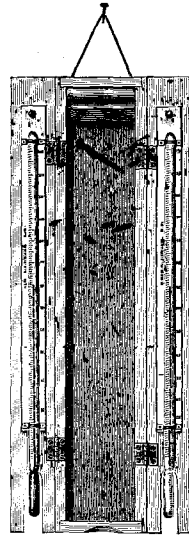
PORTABLE INSTRUMENTS.



No. 113.



A

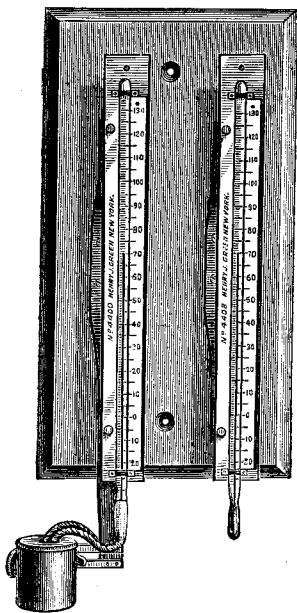


No. 119.

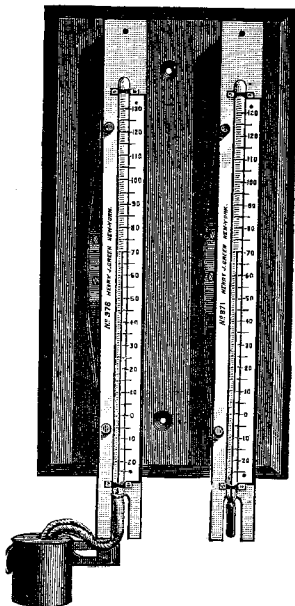
- 113. Set of Maximum and Minimum Thermometers, mounted in oil-finished pine box..... \$8 50
- The above in leather sling case for travel, Fig. A..... 10 50
- 119. PSYCHROMETER, Wet and Dry bulb Thermometers, mounted in oil-finished pine box..... 7 00
- The above in leather sling case for travel, Fig. A..... 9 00

# PSYCHROMETERS.

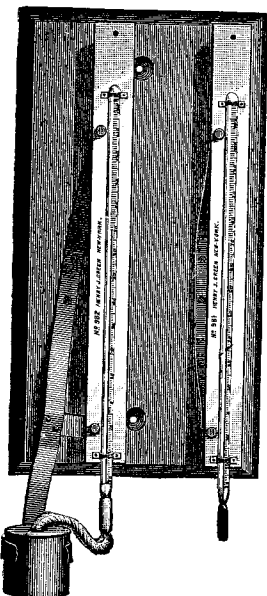
116 A.-116.



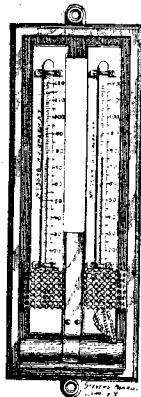
117.



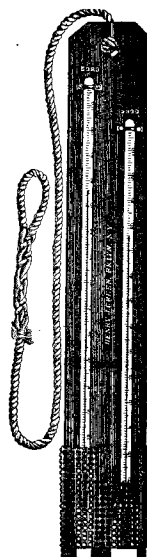
118.



151.



150.



- 116a. PSYCHROMETER, Wet and Dry Bulb thermometer (latest U. S. Weather Bureau pattern,) consists of two of the thermometers as described under No. 98 suitably mounted on an oil-finished pine board, with water cup complete. . . . . \$6.50
116. PSYCHROMETER, Wet and Dry bulb thermometer, (former U. S. Weather Bureau pattern,) consists of two of the thermometers as described under No. 99 complete as above . . . . . 6.50
117. PSYCHROMETER, Wet and Dry bulb thermometers, (Green's pattern,) consists of two of the thermometers described under No. 102 complete as above. . . . . 6.50
118. PSYCHROMETER, Wet and Dry bulb thermometers, (former U. S. Weather Bureau pattern,) consists of two of the thermometers described under No. 100 complete as above. . . . . 6.00
151. PSYCHROMETER, Wet and Dry bulb thermometers, graduated on the stem, and five lines and figures engraved on silvered brass plate, nine inch brass frame, with water cup and perforated brass guard to protect the bulbs, very neat and compact form. . . . . 5.00

## SLING PSYCHROMETER.

150. Consisting of two Cylindrical Bulb Thermometers, graduated and figured on the stem and mounted one a little above the other, upon a light brass frame, with a perforated guard to protect the bulbs while swinging, but which can be raised, by sliding up the frame, for the purpose of moistening the linen covered bulb. Length complete, 13 inches.
- Price, . . . . . 5.00
- Brush for moistening bulb, . . . . . 25
- Extra linen covers per doz., . . . . . 50

## WET-BULB COVERING AND WICKING.

121. Green's ready-made cylindrical, fine linen coverings, with wicking attached, to suit the above cylindrical bulb psychrometer thermometers. Orders should be accompanied by a piece of card or stiff paper notched out so as to show the diameter of bulb to be covered. Per doz. . . . . 50

## PSYCHROMETER SCREEN.

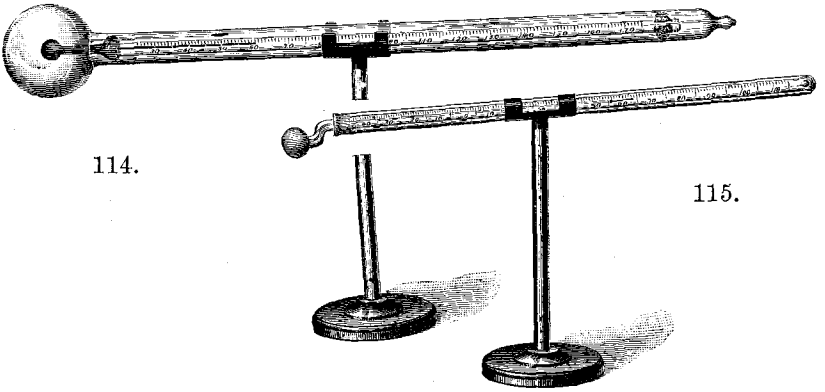
120. PSYCHROMETER SCREEN, louvered front and sides, perforated bottom, sloping top, lock and key. . . . . 6.00
- 120a. Similar to No. 120, but smaller. Suitable for No. 151 . . . . 400

### SOIL THERMOMETERS.

For ascertaining the temperature of the soil at various depths, of the pattern devised for the New York Agricultural Experiment Station and as supplied to more than thirty of the State Agricultural Experiment Stations etc. Consists of a stout stem graduated and figured thermometer, inclosed in a wooden case, the upper part of which is cut away, exposing the scale, which is about 11 inches long, this length being the same for all the thermometers.



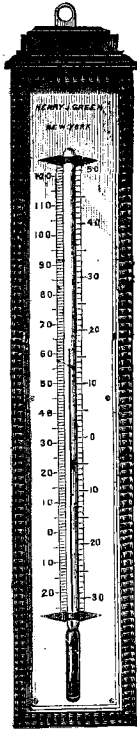
Inches deep.	Price	Inches deep.	Price.
300. 1	\$4 50	306. 36	\$9 00
301. 3	5 00	307. 48	11 00
302. 6	5 50	308. 60	13 00
303. 9	6 00	309. 72	15 00
304. 12	6 50	310. 84	17 00
305. 24	7 00	311. 96	19 00



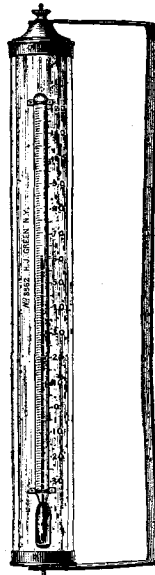
- 114. GREEN'S MAXIMUM REGISTERING SOLAR RADIATION THERMOMETER with blackened bulb; inclosed in a glass bulbed tube very perfectly exhausted of air and moisture, mounted on brass stand . . . \$10 00
- Do. do. without brass stand . . . . . 8 00
- 115. MINIMUM REGISTERING TERRESTRIAL RADIATION THERMOMETER, naked bulb, stem protected by glass jacket, mounted on brass stand. . . . . 7 00
- Do. do. without brass stand . . . . . 5 00



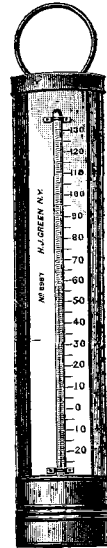
HENRY J. GREEN, BROOKLYN, N. Y.



312.



316.



320.

THERMOMETERS FOR INDOOR USE.

312.	THERMOMETER, rosewood case, glass front, 9 inch.....	\$3 50
313.	“ “ “ “ 12 “ .....	4 00
314.	“ “ “ “ 15 “ .....	5 00
315.	“ “ “ “ 18 “ .....	6 00

THERMOMETERS FOR OUTDOOR USE.

316.	THERMOMETER inclosed in glass cylinder, arranged to revolve on bracket, which can be fastened to the right or left hand, very convenient for window use, 9 inch.....	4 00
317.	do. do. do. do. 12 “ .....	5 00
318.	do. do. do. do. 15 “ .....	6 50
319.	do. do. do. do. 18 “ .....	8 50

COPPER CASE THERMOMETERS.

320.	THERMOMETER in stout copper case, stem graduated, 10 inch..	2 75
321.	“ “ “ “ 11 “ ...	3 00

WATER THERMOMETER.

322.	WATER THERMOMETER (U. S. Weather Bureau pattern) mounted in brass case with door and valves, complete....	10 00
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### OIL INSPECTORS' THERMOMETER.

- 500. 9 inches long, graduated and figured on stem, reading from 90° to 150° F. in half degrees, each degree between 115 and 125 being numbered, very accurate and distinct. This pattern is adopted by the Michigan State Inspector of Illuminating Oils, and others. Price in felt-lined brass case.....\$4 00

### PRECISION CLINICAL THERMOMETERS.

The methods and apparatus used in the manufacture of our precision clinical thermometers are based upon strictly scientific principles, and differ entirely from those in general use ; they are the same that we use in the manufacture of our thermometers for scientific research, clinical standards, delicate testing, etc. and by means of which we attain almost absolute accuracy, this we not only attain but maintain by means of a special kind of glass used in their construction, thermometers made from this glass will not sensibly increase their readings with age, therefore our clinicals are not only accurate but are unalterably so.

The principle of registration we use is that commonly known as "indestructible index," (Invented by J. Green, described in Appleton's Encyclopedia, first edition, article Thermometer, page 431.)

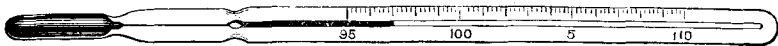
### EASY READING CLINICAL THERMOMETER.

(GREEN'S IMPROVED.)



The ordinary Clinical Thermometer is figured every five degrees and the degrees between must be counted, this is rather confusing to the eye and mistakes sometimes happen ; GREEN'S IMPROVED CLINICAL is figured every other degree, this space the eye can readily cover and mistakes on this account are thereby avoided ; used in combination with our LENS FRONT CASE, this way of figuring is simply perfection.

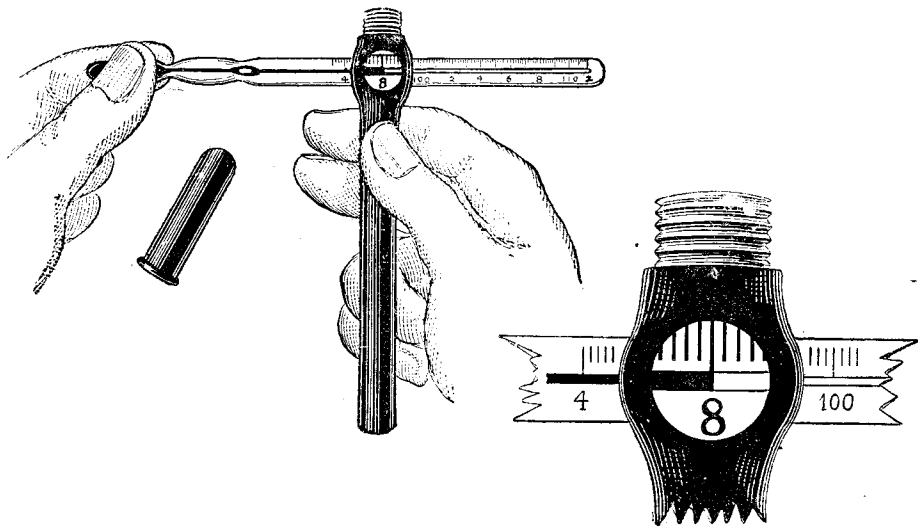
- 292. Price of 4 inch thermometer in ordinary hard rubber case, with certificate of corrections.....\$2 00
- 293. Same, in lens front case..... 2 50



- 290. Same quality as above but figured as in the ordinary way, viz. every five degrees. In ordinary hard rubber case, with certificate of corrections.....\$2 00
- 291. Same, in lens front case..... 2 50

## GREEN'S PATENT LENS FRONT CLINICAL THERMOMETER CASE.

Patented July 22d. 1890.



Why purchase the expensive lens front clinical thermometer that magnifies the mercury column only? When it is broken the lens is broken. Avoid this by purchasing once for all one of GREEN'S LENS FRONT CLINICAL THERMOMETER CASES, it will not only magnify the mercury column of any ordinary clinical thermometer, but its graduation also, so that tenths of degrees can be easily read. When your ordinary clinical is broken you still have your handy little LENS FRONT CASE ready to receive another.

294. The LENS FRONT CASE will also be found useful as a hand microscope for the examination of minute objects. Price..... \$1 00

### ORDINARY CLINICAL THERMOMETERS.

These thermometers are of well seasoned tubes, and are warranted superior in point of accuracy to anything in the market for the price.



- 295. Easy reading, (figured every other degree,) in hard rubber case..... \$1 00
- 296. " " " " in lens front case..... 1 75
- 297. Same quality as above, figured in the ordinary way, (every five degrees,) in hard rubber case..... 1 00
- 298. Same as above, in lens front case..... 1 75



# CYLINDRICAL BULB THERMOMETERS,

WELL SEASONED AND BULBS FORMED FROM

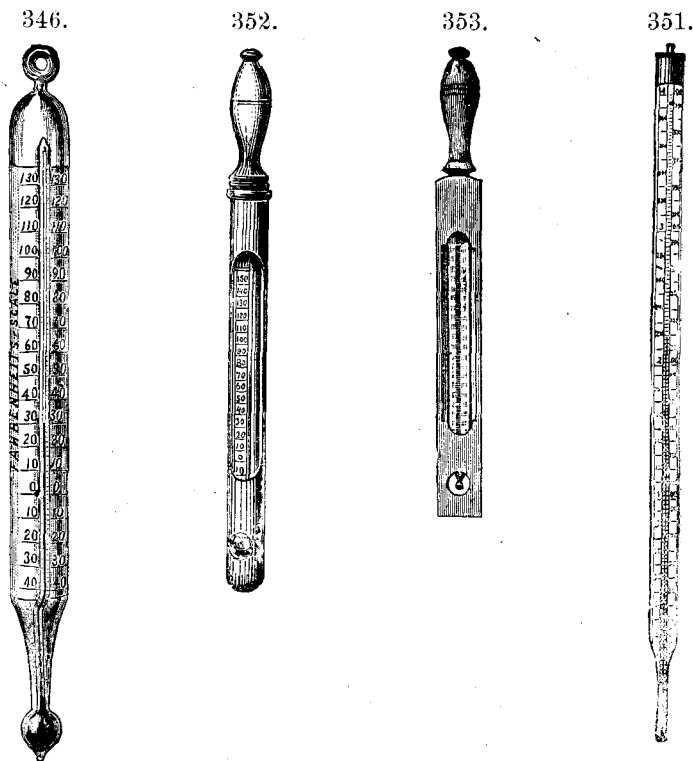
“GREEN’S IMPROVED GLASS,”

Graduated and figured on the stem, and provided in felt-lined brass cases. Thermometers made to order subject to an advance of 10 per cent. and upward upon this list.

FAHRENHEIT SCALE.

CENTIGRADE SCALE.

No.	Leng. of Tube.	Graduated about.	Graduated into.	Price		No.	Leng. of Tube.	Graduated about.	Graduated into.	Price	
				\$	cts.					\$	cts.
208	6 in.	0° to + 120° F.	1° F.	2	50	245	6 in.	- 15° to + 50° C.	1° C.	2	50
209	6 in.	+ 32 to + 212 F.	2° F.	2	50	246	6 in.	0 to + 100 C.	1° C.	2	50
210	9 in.	0 to + 120 F.	1° F.	2	75	247	9 in.	- 15 to + 50 C.	1° C.	2	75
211	9 in.	+ 32 to + 150 F.	1° F.	2	75	248	9 in.	0 to + 65 C.	1° C.	2	75
212	9 in.	+ 32 to + 212 F.	1° F.	2	75	249	9 in.	0 to + 100 C.	1° C.	2	75
213	12 in.	- 30 to + 120 F.	1° F.	3	50	250	12 in.	- 35 to + 50 C.	1° C.	3	50
214	12 in.	0 to + 120 F.	1° F.	3	50	251	12 in.	- 15 to + 50 C.	1° C.	3	50
215	12 in.	+ 32 to + 120 F.	1° F.	3	50	252	12 in.	0 to + 50 C.	1° C.	3	50
216	12 in.	+ 32 to + 150 F.	1° F.	3	50	253	12 in.	0 to + 65 C.	1° C.	3	50
217	12 in.	+ 32 to + 212 F.	1° F.	3	50	254	12 in.	0 to + 100 C.	1° C.	3	50
218	12 in.	+ 32 to + 300 F.	1° F.	3	50	255	12 in.	0 to + 150 C.	1° C.	3	50
219	12 in.	+ 32 to + 450 F.	1° F.	3	50	256	12 in.	0 to + 230 C.	1° C.	3	50
220	12 in.	+ 32 to + 600 F.	2° F.	3	50	257	12 in.	0 to + 315 C.	1° C.	3	50
221	15 in.	- 30 to + 120 F.	1° F.	4	50	258	15 in.	- 35 to + 50 C.	1° C.	4	50
222	15 in.	0 to + 120 F.	1° F.	4	50	259	15 in.	- 15 to + 50 C.	1° C.	4	50
223	15 in.	+ 32 to + 120 F.	1° F.	4	50	260	15 in.	0 to + 50 C.	1° C.	4	50
224	15 in.	+ 32 to + 150 F.	1° F.	4	50	261	15 in.	0 to + 65 C.	1° C.	4	50
225	15 in.	+ 32 to + 212 F.	1° F.	4	50	262	15 in.	0 to + 100 C.	1° C.	4	50
226	15 in.	+ 32 to + 300 F.	1° F.	4	50	263	15 in.	0 to + 150 C.	1° C.	4	50
227	15 in.	+ 32 to + 450 F.	1° F.	4	50	264	15 in.	0 to + 230 C.	1° C.	4	50
228	15 in.	+ 32 to + 600 F.	2° F.	4	50	265	15 in.	0 to + 315 C.	1° C.	4	50
229	18 in.	- 30 to + 120 F.	1° F.	6	00	266	18 in.	- 35 to + 50 C.	1° C.	6	00
230	18 in.	0 to + 120 F.	1° F.	6	25	267	18 in.	- 15 to + 50 C.	1° C.	6	25
231	18 in.	+ 32 to + 120 F.	1° F.	6	00	268	18 in.	0 to + 50 C.	1° C.	6	00
232	18 in.	+ 32 to + 150 F.	1° F.	6	25	269	18 in.	0 to + 65 C.	1° C.	6	25
233	18 in.	+ 32 to + 212 F.	1° F.	6	00	270	18 in.	0 to + 100 C.	1° C.	6	00
234	18 in.	+ 32 to + 300 F.	1° F.	6	00	271	18 in.	0 to + 150 C.	1° C.	6	00
235	18 in.	+ 32 to + 450 F.	1° F.	6	00	272	18 in.	0 to + 230 C.	1° C.	6	00
236	18 in.	+ 32 to + 600 F.	1° F.	6	00	273	18 in.	0 to + 315 C.	1° C.	6	00
237	21 in.	- 30 to + 120 F.	1° F.	8	50	274	21 in.	- 35 to + 50 C.	1° C.	8	50
238	21 in.	0 to + 120 F.	1° F.	8	00	275	21 in.	- 15 to + 50 C.	1° C.	8	00
239	21 in.	+ 32 to + 120 F.	1° F.	8	50	276	21 in.	0 to + 50 C.	1° C.	8	50
240	21 in.	+ 32 to + 150 F.	1° F.	8	50	277	21 in.	0 to + 65 C.	1° C.	8	50
241	21 in.	+ 32 to + 212 F.	1° F.	8	50	278	21 in.	0 to + 100 C.	1° C.	8	50
242	21 in.	+ 32 to + 300 F.	1° F.	8	00	279	21 in.	0 to + 150 C.	1° C.	8	00
243	21 in.	+ 32 to + 450 F.	1° F.	8	00	280	21 in.	0 to + 230 C.	1° C.	8	00
244	21 in.	+ 32 to + 600 F.	1° F.	8	00	281	21 in.	0 to + 315 C.	1° C.	8	00



COMMON IMPORTED CHEMICAL THERMOMETERS,

All glass with exception of scale which is of paper.

346.	7 inches long, reading to 120° or 220° F.	8	40
347.	9 " " " " " "		60
348.	12 " " " " " "		75
349.	12 " " to 300° F.		85
350.	15 " " " " or 400° F.	1	25

Thermometers similar to above but with porcelain scale and brass caps.

351.	15 inches long, reading to 400° or 600° F.	1	75
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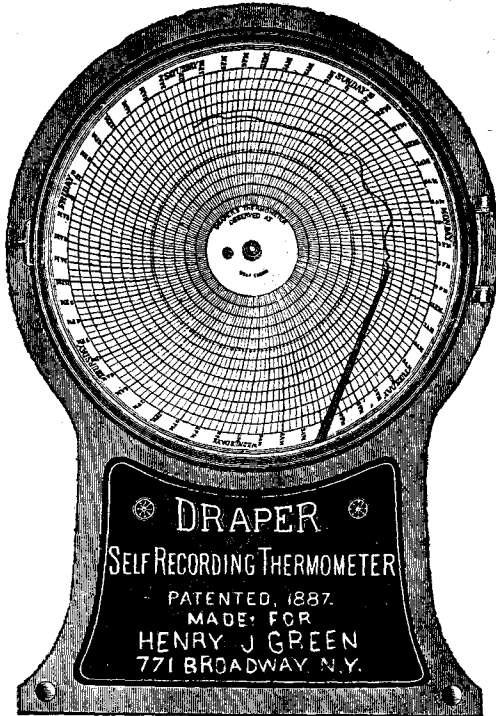
BATH THERMOMETERS.

352.	BATH THERMOMETER in polished cylindrical wooden frame, with handle to unscrew, 7 inch thermometer.	75
353.	BATH THERMOMETER in square wooden frame, with handle, 7 inch thermometer, with porcelain scale.	85

DAIRY THERMOMETER.

354.	All glass floating Dairy Thermometer marked for "Churning" "Cheese" and "Scalding"	35
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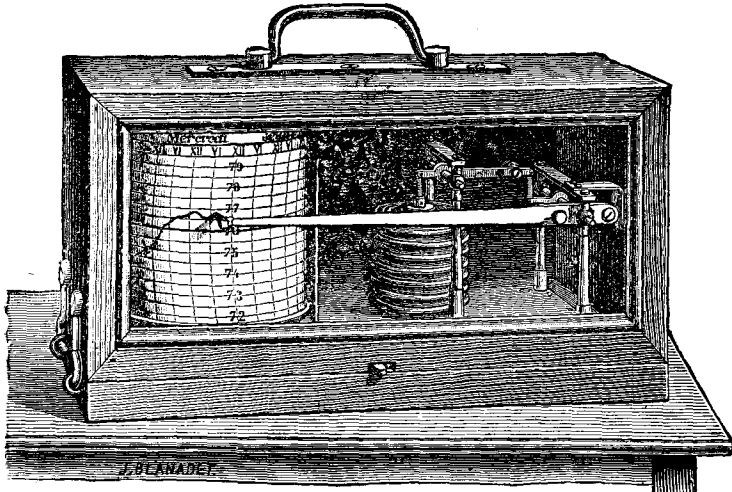
The Draper Thermograph or Self-Recording Thermometer.

345. Consists of a bimetallic thermometer in a case which carries a disc, with a chart upon its axle instead of hands like the ordinary clock. The very slightest variation or fluctuation in temperature causes motion in the thermometer, which is most completely and effectively communicated to a lever, the long arm of which carries a pen with the point resting upon the chart on the face of the disc. The clock needs to be wound, the chart changed and the pen supplied with ink prepared for the purpose once each week. 12 charts. 1 bottle of ink and dropper accompany each instrument. Size, 14 x 20 inches. . . . \$30 00

345a. Similar to above, size 10 x 14 inches. . . . 15 00  
 Extra charts for Nos. 345 and 345a. per hundred. . . . 3 00

Extra charts for Nos. 345 and 345a. per hundred.

SELF-RECORDING ANEROID BAROMETER.

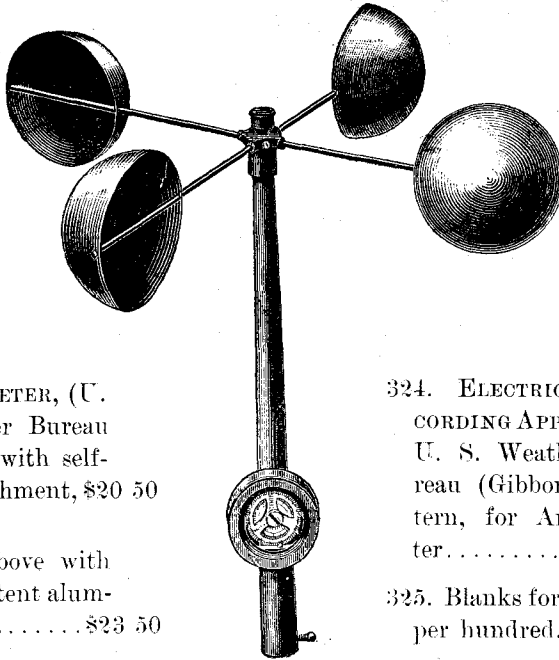


Richard Barograph, as adopted by the U. S. Weather Bureau, scale extending from 28 to 31 inches, divided into twentieths of an inch, . . . . \$45 00

SELF-RECORDING THERMOMETER.

Breguet's principle, similar in style to the above, scale from + 5° to + 100° F. 50 00

ANEMOMETERS.



323.

323. ANEMOMETER, (U. S. Weather Bureau pattern,)\* with self-oiling attachment, \$20 50

323a. The above with Green's Patent aluminum cups. . . . . \$23 50

324. ELECTRICAL RECORDING APPARATUS, U. S. Weather Bureau (Gibbon's) pattern, for Anemometer. . . . . \$26 00

325. Blanks for No. 324 per hundred. . . . . \$1 00

\* This pattern without the oiling attachment was designed and made by H. J. Green. in 1875.

ANEMOMETER CUPS OF ALUMINUM.

(GREEN'S IMPROVED.)

Anemometer cups of aluminum are far superior to the painted brass cups now in use.

Aluminum is between three and four times lighter than brass, bulk for bulk, its tensile strength is greater and air, wet or dry, has no corrosive action upon it.

A set of brass cups without attachments weigh about eleven ounces ; a set of aluminum cups weigh about three ounces, consequently with the aluminum cups there is less wear upon the frictional parts and a gain in point of sensitiveness to light winds; the everlastingly smooth surface of aluminum compared with painted brass when air friction is considered is another point in its favour.

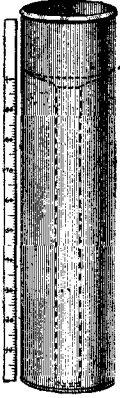
WIND VANE.

334. UNITED STATES WEATHER BUREAU WIND VANE, sunset. . . . . \$ 8 00

The above with cardinal points. . . . . 14 00



331.

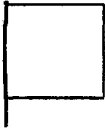


RAIN GAUGES.

- 330. UNITED STATES WEATHER BUREAU STANDARD RAIN GAUGE, 8 inches diameter, with measuring stick..... \$ 5 25
- 331. RAIN GAUGE, 3 inches diameter with overflow and measuring stick..... 1 25
- 332. GREEN'S STANDARD RAIN GAUGE of 50 square inch surface, consists of a cylindrical vessel, the receiving surface of which is an accurately turned brass ring. To prevent splashing it is made almost sharp at the edge ; the vessel is divided midway into two parts by a funnel-shaped partition with small central opening, through which the rain passes below, where by reason of the confined space no sensible evaporation takes place ; through a short tube at its side the rain is poured out into a glass graduate provided for measuring and which is divided into cubic inches, tenths and hundreds..... 7 00
- 333. GREEN'S STANDARD RAIN GAUGE of 20 square inch surface..... 6 00

U. S. WEATHER BUREAU WEATHER SIGNALS.

No. 1.  
White Flag.



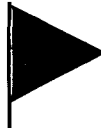
Clear or Fair.

No. 2.  
Blue Flag.



Rain or Snow.

No. 3.  
Black Triangular Flag.



Temperature.

No. 4.  
White Flag.  
Black Centre.



Cold Wave.

The above set is ordinarily sufficient, but for those desiring a more elaborate one may be added : A red flag with black center, indicating "Storm is expected to be of marked violence" ; A yellow flag, white center, indicating "Winds expected will not be so severe" ; A white pennant, indicating "Westerly Winds," that is, from North to Southwest inclusive, and a red pennant, indicating "Winds expected to be Easterly," that is, from Northeast to South inclusive.

PRICE OF ABOVE.

Sizes	3x3	4x4	5x5	6x6 Ft.
Anchor,	\$0.75 per Flag.	\$1.15 per Flag.	\$1.65 per Flag.	\$2.25 per Flag
English,	0.95 "	1.45 "	2.05 "	2.90 "

Toggles and Becketts are included with each flag.  
A canvas bag to contain them furnished with each set.

## HYDROMETERS.

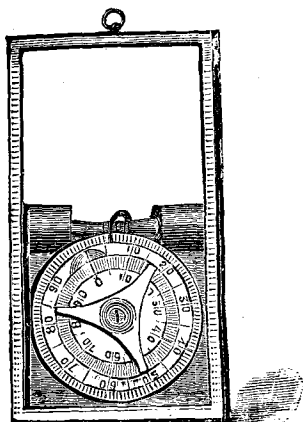
HYDROMETER, for either alkali or syrup, each.....	\$	50
Do.    do.    acid, ammonia, cider, salt or spirit.....		75
Do.    do.    coal oil or vinegar.....		1 00
TWADDLE'S HYDROMETERS, No. 1—0 to 24; No. 2—24 to 48; No. 3—48 to 74; No. 4—74 to 102; No. 5—102 to 138; No. 6 —138 to 170 each.....		75
SPECIFIC GRAVITY HYDROMETER, 700 to 1000.....		75
Do.    do.    do.    1000 to 1850.....		1 00
STANDARD SPECIFIC GRAVITY HYDROMETER, ranging either from 700 to 800, 800 to 900, or 900 to 1000.....		1 50
STANDARD SPECIFIC GRAVITY HYDROMETER, ranging either from 1000 to 1100, 1100 to 1200, 1200 to 1300, 1300 to 1400, 1400 to 1500, 1500 to 1600, 1600 to 1720, 1720 to 1850.....		1 75
BEST STANDARD HYDROMETERS, Baume scale in tenths of a degree either from 0 to 10, 10 to 20, 20 to 30, 30 to 40, 40 to 50, 50 to 60, 60 to 67.....		1 75
HYDROMETERS, Baume scale in half degrees, either from 10 to 30, 30 to 50, 50 to 70, 70 to 95.....		1 25
Do.    do.    do.    combined with thermometer		2 25
ALCOHOLOMETER, Proof and Tralles scale.....		1 00
Do.    do.    do.    combined with thermometer		2 00
ALCOHOLOMETER, with copper can and thermometer.....		5 00
LACTOMETER, for milk, N. Y. and N. J. Board of Health scale.....		75
Do.    do.    do.    combined with thermometer....		2 50
SACCHAROMETER, Balling's.....		1 00
Do.    do.    do.    combined with thermometer.....		2 00
SACCHAROMETER, Long's.....		1 00
SACCHAROMETER, Kayser's combined with thermometer.....		2 00
SACCHAROMETER, copper can with thermometer, Long's scale.....		4 50
SALINOMETER, for sea-water, 3 scales, temperature of 190° 200° and 210° F.....		1 00
URINOMETER, Dr. Prout's for Sp. Gr. of urine.....		75
Do.    do.    with 2 oz. graduated jar in neat morocco case.		1 75
WINE HYDROMETER, Ocheles scale for gravity of must before ferm- entation and alcohol scale for use after fermentation.....		1 75

## HAND LEVELS.



329.

328. GREEN'S HAND LEVEL, as supplied to Prof. Jas. D. Dana, 9 inches long, in leather case . . . . . \$8 00
329. GREEN'S LATEST IMPROVED HAND LEVEL, 9 inches long, with slide tube, by which its length can be reduced to 5 inches, very convenient for the pocket. . . . . 9 00



335.

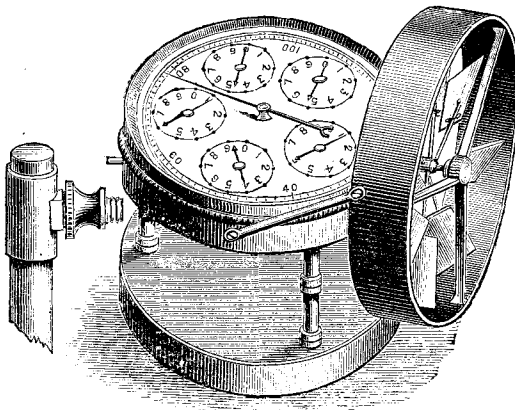
335. ODOMETER for ascertaining the number of miles traveled by a carriage, wagon, or other vehicle; the instrument is strapped to the wheel and simply records its revolutions; by measuring the circumference of the wheel the number of revolutions corresponding to a mile can be easily ascertained; it will record 10,000 revolutions before repeating, which in a wheel of 12 feet circumference is nearly 23 miles. Inclosed in stout leather covered brass box with strap complete. . . . . \$15 00

## MISCELLANEOUS.

336. Regnault's Hygrometer . . . . . \$30 00
337. Hypsometer or Thermo-Barometer. . . . . 25 00
338. Prismatic Compass, U. S. Engineer pattern. . . . . 22 00
339. Geological Compass, with Clinometer and sights. . . . . 10 00
340. Do. do. do. in leather sling case. . . . . 12 00
341. Steam Thermometer. . . . . 8 00
342. Hotwell Thermometer. . . . . 25 00
343. Uptake Thermometer. . . . . 7 50
345. Piche Evaporimeter. . . . . 4 50
346. Sunshine Recorder. . . . . 18 00

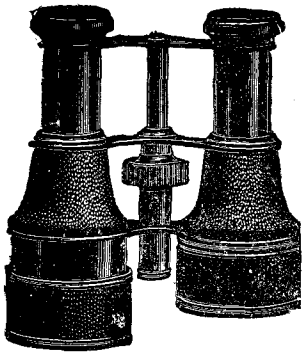
ALL KINDS OF THERMOMETERS MADE TO ORDER.

500. ARCTIC THERMOMETER (alcohol) as supplied to the Greely and Greely relief Expeditions..... ± 50
501. CLINICAL THERMOMETER STANDARD with corrections as supplied to the leading Clinical Thermometer makers of the United States. 9 inches long, scale 90° to 110° F. graduated into tenth degrees. Mounted in brass case..... \$10 00



326.

326. ANEMOMETER OR AIR METER, sensitive to very light currents, for measuring the velocity (horizontal or vertical) of air currents in flues, mines, sewers, public buildings, &c., size of instrument about 4 inches square, will record 10,000,000 feet before repeating..... \$24 00
327. Do. do. do. to 1,000 feet..... 22 00



ACHROMATIC FIELD OR MARINE GLASSES.

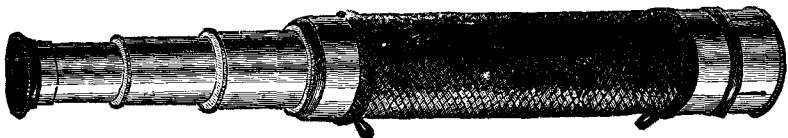
Carefully selected with special regard to their optical perfection, and warranted.

We have no hesitation in offering to exchange any glass not entirely satisfactory. All my stock is personally examined and tested.

The following glasses are manufactured by Lemaire, of Paris. I also have in stock others made by Bardou, Chevalier, etc. Prices quoted on application.

- 1100. U. S. Signal Service Field or Marine Glass, black morocco body and sun-shades, finely black japanned draw tubes, cross bars and tops. In sole leather sling case, 24 lignes. . . . . \$17 00
- 1101. Do. do. 26 lignes. . . . . 19 00
- 1102. Similar to No. 1100 but with jointed cross bars, affording adjustment for pupillary distance, 26 lignes . . . . . 23 00
- 1103. Field or Marine Glass, black morocco body with sun-shades, black japanned or oxidized draw tubes, cross bars, tops and trimmings, in morocco sling case, price according to size as follows.  
 15 17 19 21 24 26 28 lignes.  
 \$8. 75 \$9.50 \$10.50 \$11.50 \$13.25 \$14.75 \$23.00
- 1104. Field or Marine Glass, similar to above, but with 12 lenses, in sole leather sling case, 26 lignes. . . . . 24.00
- 1105. Superior Binocular Telescope, 16 lenses, black morocco body with sun-shades, finely black japanned draw tubes, tops and trimmings, jointed cross bars, affording adjustment for pupillary distance. In sole leather sling case 15 lignes. . . . . 45 00
- 1106. Do. do. do. do. 17 lignes. . . . . 50 00
- 1107. As above, but Aluminum frame, Russian leather body, highly burnished aluminum draw tubes, jointed cross bars and trimmings. In sole leather sling case, 15 lignes. . . . . 100 00

PORTABLE ACHROMATIC TELESCOPES.

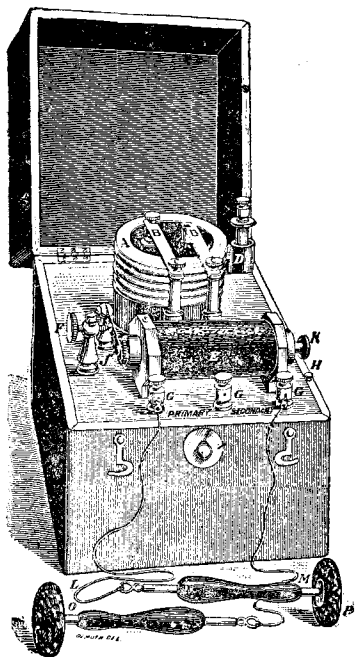


1200.

1200. Achromatic Telescope, braided twine covered body, highly burnished brass draw tubes, according to size as follows.

Open.	Length.	Closed.	Diameter of Object glass.	
13½ inches		5 inches	10 lignes. . . . .	\$2 50
16½ "		6 "	12 " . . . . .	2 75
17 "		6 "	13 " . . . . .	3 00
17 "		6½ "	14 " . . . . .	3 50
23 "		8 "	16 " . . . . .	5 00
30 "		9¾ "	19 " . . . . .	6 25
34 "		10¼ "	22 " . . . . .	10 50
			11 lignes=1 inch.	

## ELECTRO MEDICAL BATTERIES.



Family Battery,

I carry in stock a large assortment, including the following.

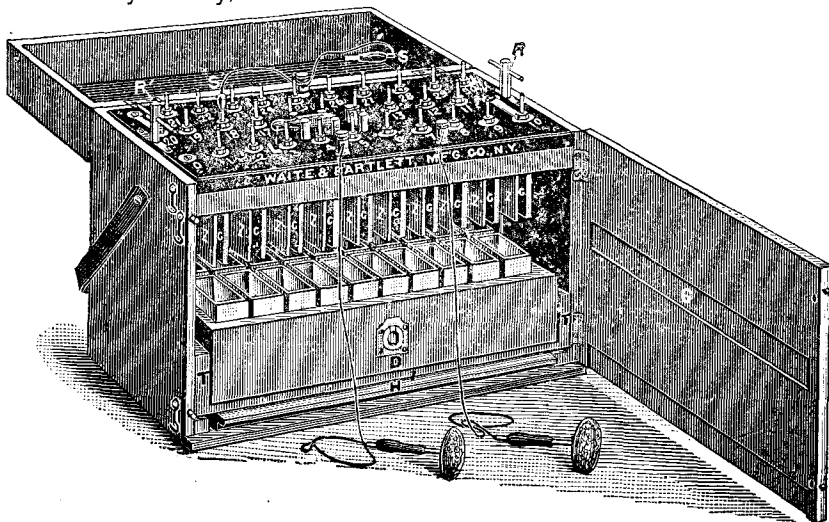
The "ACME" designed especially for Family use. In polished cherry case. . . . . \$ 5 50

Faradic Battery in solid oak or mahogany case suitable for either Physicians' or Family use. . . . . 10 00

Physicians' Faradic Battery, one of the most complete batteries for medical use made in portable form, has fine and coarse interrupters, single contact key for testing muscles, etc. In handsome antique oak or mahogany case. . . . . 20 00

Galvanic Battery, guaranteed to be first class and give satisfaction. In handsome antique oak or mahogany case. Price according to size as follows.

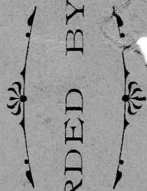
6 Cell. . . . .	\$12.00	20 cell. . . . .	\$30 00
12 " . . . . .	20 00	30 " . . . . .	38 00
16 " . . . . .	24 00		



### PLUG AND SOCKET GALVANIC BATTERY.

Full description and cut of any of the above batteries sent upon application.

**A Gold Medal and A Diploma of Honor**



AWARDED BY THE



**INTERNATIONAL FISHERIES EXHIBITION, LONDON, 1883.**

Green's Instruments Exhibited by the U. S. Signal Service.