

METEOROLOGICAL *Instruments*



LIST No. M4.
· 1950 ·

NEGRETTI
& ZAMBRA

LONDON AND
AYLESBURY
· ENGLAND ·

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Meteorological Instruments



List M4.
· 1950 ·

**NEGRETTI
& ZAMBRA**

LTD.

P. E. NEGRETTI · P. A. NEGRETTI · P. N. NEGRETTI · H. W. IBBOTT · S. H. PITT.

122 REGENT STREET LONDON, W.1

Telephone Regent 3406

Telegrams: Negretti, Piccy, London

Scientific °
° *Instrument*
Manufacturers

o

**LONDON
& AYLESBURY**
· ENGLAND ·

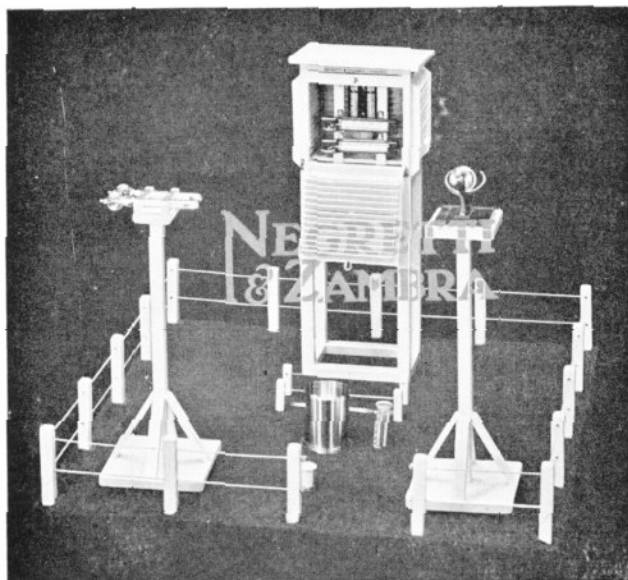
Guarantee

We GUARANTEE that our Meteorological Instruments are of the best quality material and workmanship, and that should any instrument become unserviceable through defects in manufacture within a period of two years from date of supply such instrument will be repaired or replaced free of charge.

Regretti & Zambra



The illustration shows a model observer's station and includes



a representative selection of Meteorological instruments

Foreword

Various changes have taken place since the last edition of this catalogue was printed: these have been embodied as far as possible in this issue to bring it up to date.

Our Head Office in Holborn Viaduct having been destroyed by enemy action in 1940, we are now established at 122 Regent Street, LONDON, W.1.

In endeavouring to make this Catalogue of METEOROLOGICAL INSTRUMENTS as comprehensible as possible, we have considered it will be of interest and service to our customers abroad to know the pattern and types which are specially recommended by the METEOROLOGICAL AUTHORITIES OF THE BRITISH ISLES.

With the permission of the Meteorological Department of the AIR MINISTRY, we are able to embody extracts from the official specifications of instruments used by the METEOROLOGICAL OFFICE, and also to use in some instances illustrations of the particular pattern.

In addition, we have in many cases quoted the wording in the official publications—"OBSERVERS HANDBOOK," "MARINE OBSERVER'S HANDBOOK," "BRITISH RAINFALL," etc.

We therefore, acknowledge our indebtedness to the Director of the Meteorological Office for his courtesy in granting us such permission.



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* Industrial Instruments.

† Meteorological Instruments.



Anemometers ●

- EXPOSURE The matter of exposure is of great importance to secure accurate results.
- SITING The site selected should be such that the instrument is in no way sheltered by trees or buildings. As a rough guide it is recommended that the lowest point above the roof for a wind vane is 10 feet, and the minimum height for a pressure tube anemometer head is 20 feet above the roof.
- MAST & SUPPORT The mast and support described on page twenty are designed for the correct exposure of the heads which are erected at the top. The spindle or composition tubing connects these with the indicator or recorder fixed at the base of the mast.
- TESTS Anemometers and pressure heads may be tested in the wind channel of the National Physical Laboratory and corrections given to be applied at various speeds.
- CALIBRATION The calibration of a self-recording anemometer of the pressure tube type can be checked by an accurately-divided "U" tube water manometer, provided that the constants of the head are known. This method does not apply to check readings below 20 miles per hour: for low velocities a more elaborate apparatus which gives pressure readings in head of water to an accuracy of 0.001 in. or 0.01 mm. is employed.
- SETTING UP In setting up a wind vane, care must be taken that it is orientated to the true north and not the magnetic north. The variation between true and magnetic north is not a constant and can be ascertained by reference to a map showing the curves of equal magnetic variation. True north can also be ascertained from the position of the Pole Star or from the sun at noon, local apparent time.



Metres per second Miles per hour

● *Anemometers*

CUP ANEMOMETER

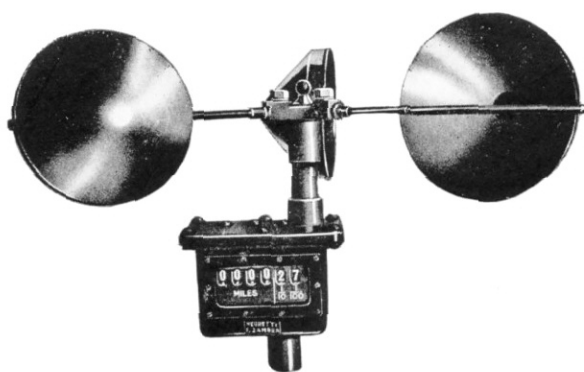
M.1990

The latest standard Anemometer has three conical cups 5" diameter with beaded rims and detachable metal arms. The movement is transmitted by a steel spindle to a counter mechanism reading up to 10,000 miles in 1/10ths and 1/100ths. The ratio of the distance travelled by the cups is known as the "factor" of the anemometer and in this case is 2.98 which is allowed for in the calibration of the instrument.

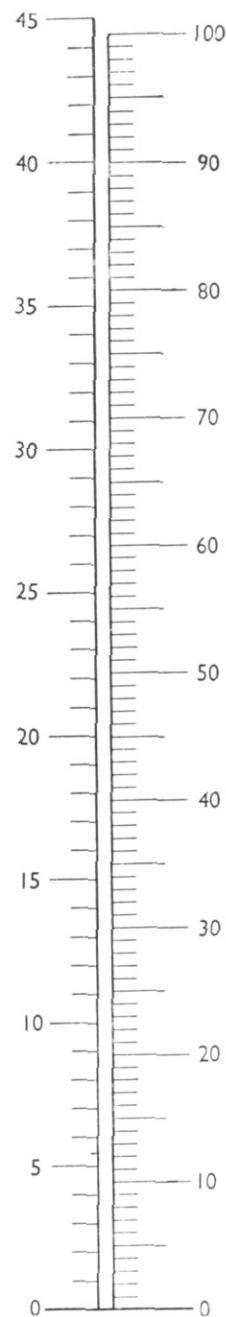
The "run" of the wind during the interval between two successive readings, 12 or 24 hours as the case may be, can therefore be found by subtracting one reading from the other.

If the instrument is placed in a position where access cannot be readily obtained the dial can be read at a distance with the aid of binoculars.

PRICE £20 5 0



M.1990



M.1991 As above, but calibrated up to 10,000 kilometres.

PRICE £20 5 0

DIMENSIONS :

1 ft. 8 in. × 7 in. × 6 in.

WEIGHT : 15 lb.

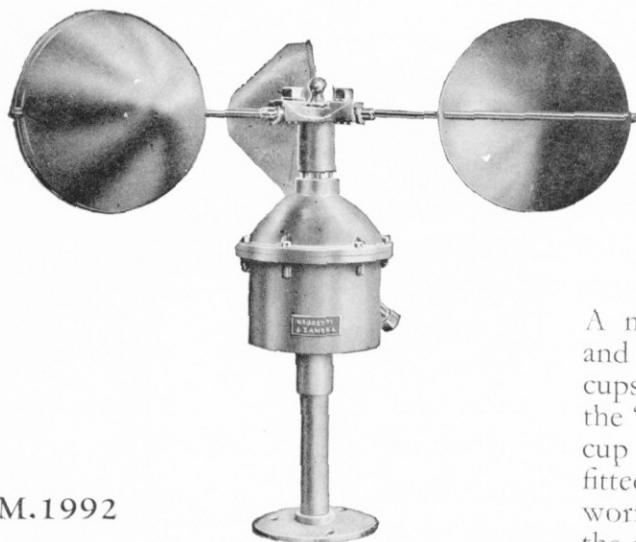
LONDON ●

Established 1850

● ENGLAND



Anemometers ●



M.1992

CONTACT CUP ANEMOMETER

With three 5 in. diameter beaded conical cups and arms, detachable from the spider.

A mercury contact switch is incorporated and arranged so that however slowly the cups rotate the switch cannot remain in the "on" position. Hardened steel cone and cup bearings, with standard steel ball are fitted to the spindle and a phosphor bronze worm transmits the movement of the cup to the contact mechanism.

Average wind speed is calculated by reference to the time interval between contacts. These may be connected to ear phones, to a bell, or to a signal lamp supplied with current from a three-volt battery. Fitted storage cases can be supplied complete with box spanner for the nuts which secure the cup arms.

PRICE: £20 5 0

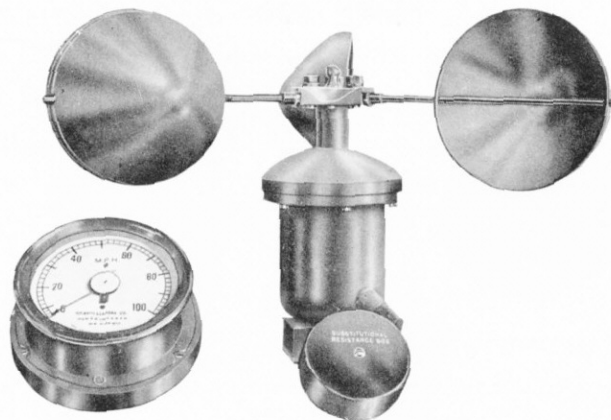
DIMENSIONS :

1 ft. 8 in. × 7 in. × 6 in.

WEIGHT : 15 lb.

GENERATOR TYPE CUP ANEMOMETER

This comprises the standard de-mountable 5 in. cups and arms on metal spider, mounted on a box casting containing the Generator. The voltage arising from the rotation of the cup spindle is used as a measure of the velocity of the wind and is indicated continuously on a sensitive voltmeter calibrated in miles per hour. Two Indicators may be used without affecting the calibration.



M.1993

RANGES: 0/100 m.p.h. or 0/160 Ks/hr.

DIMENSIONS : Height 11½ in. Axis to edge of cup 9 in.

WEIGHT : 15 lb.

With 3 yds. cable, cup lifter, spanner, fitted storage case, and two Indicators.

PRICE: £66 10 0

or with one Indicator £49 15 0

LONDON ●

Established 1850

● ENGLAND



● *Anemometers*

M.2015

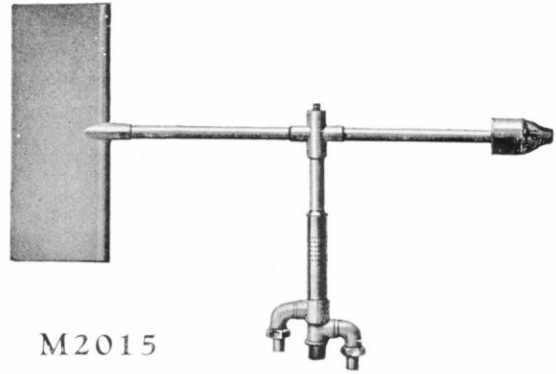
WIND VELOCITY HEAD

This is used in conjunction with the dial indicator illustrated on this page or with the Anemo-Biograph—M.2020 (page 12). It consists of an open-ended tube set into the wind by means of the vane and a suction tube exposed on all sides to the wind. The effect of the wind is to produce a pressure in the former and a suction in the latter, both dependent upon the wind velocity.

PRICE : £16 10 0

DIMENSIONS : 2 ft. × 1 ft. × 10 in.

WEIGHT : 15 lb.



M2015

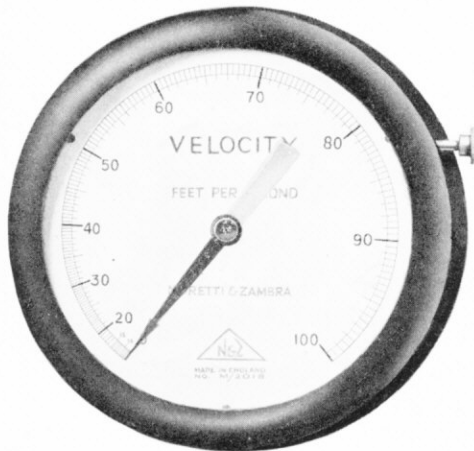
The horizontal tube is of brass and the head is supported by a hardened steel pivot which bears in a cup filled with lubricating oil. Two threaded connections with unions are provided for attaching composition tubing $\frac{3}{8}$ in. bore.

M.2016 Composition tubing $\frac{3}{8}$ in. bore, 6d. per ft.

M.2017 Two water traps, brass tubular type, fitted with brass cocks.

PER PAIR : £3 6 0

M.2018



DIAL INDICATOR

This is a precision differential pressure gauge with balanced non-corrodible diaphragm movement. Pressure is led to the inside of the diaphragms which are enclosed in an airtight case provided with static connection. An external zero adjustment is provided and the case is fitted with two $\frac{1}{4}$ " B. S. P. Union nuts and liners. Ranges : 0/70 or 0/140 miles per hour, 0/100 or 0/220 kilometres per hour, 0/100 or 0/220 feet per second, 0/30 or 0/60 metres per second. With 8 in. aperture dial.

PRICE : £20 15 0

DIMENSIONS : 1 ft. × 10 in. × $3\frac{1}{4}$ in.

WEIGHT : 12 lb.

M.2019 As above but with 16 in. aperture dial.

PRICE : £31 7 6

DIMENSIONS : 1 ft. 9 in. × 1 ft. 8 in. × 4 in.

WEIGHT : 35 lb.

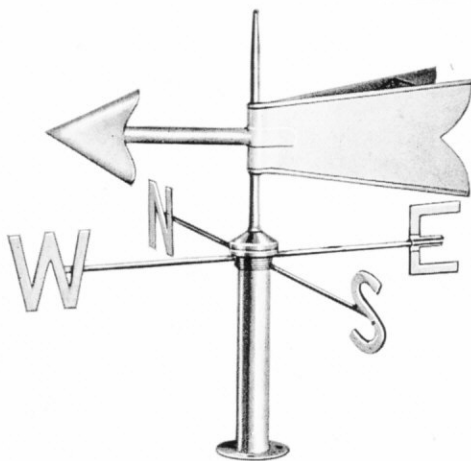
● *Wind Vanes*

M.2028 WIND VANE

Small size for attachment to a pole or standard, with brass flange fitting. All parts, enamelled white and stoved. The fittings unscrew and are taken to pieces for convenience in packing.

DIMENSIONS : 1 ft. 4 in. × 1 ft. 3 in.

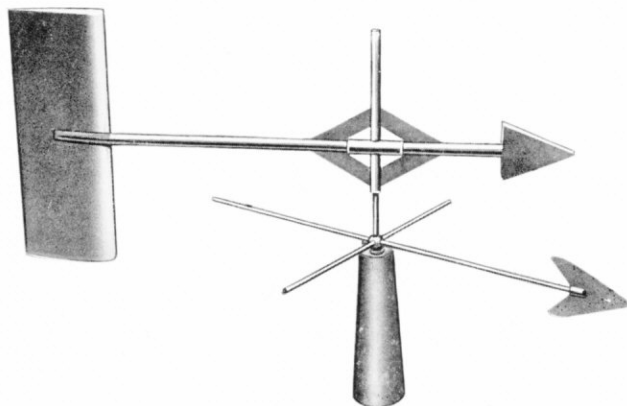
WEIGHT : 2½ lb.



PRICE : £3 7 6

M.2029 WIND VANE. Large size, complete with direction indicator, British Meteorological pattern. Copper streamlined vane with brass weight, accurately balanced and rotating on ball bearings. The bearing spindle is of hardened steel carried in a brass boss which is arranged with screwed fitting for attachment either to a steel mast or to a flange for fitting on a wooden post. All parts are heavily enamelled grey and stoved. The compass point letters are made of brass sheet 4 in. high rivetted to the ends of the direction arms which are of brass rod, and screwed into the brass boss which fits on the brass base fitting.

The arms of the brass boss are all detachable for transport purposes.

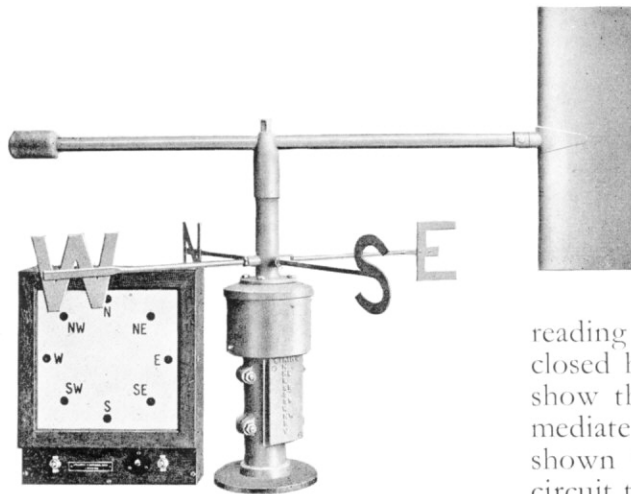


DIMENSIONS :

2 ft. 8 in. × 1 ft. 8 in.

WEIGHT : 8 lb.

PRICE : £10 17 6



Wind Vanes ●

REMOTE READING M.1994
TYPE

WIND VANE MK., IIA comprises an eight segment commutator connected to the lamps inside the remote reading indicator. This consists of a closed hard wood box with markings to show the points of the compass. Intermediate positions such as S.E. by S. are shown when two adjacent lamps are in circuit together. A switch is provided so that the current supply can be interrupted at will.

An additional switch with buzzer or lamp is incorporated so that a contact

anemometer (see page 8) may be used in conjunction with the direction indicator.

DIMENSIONS : 2 ft. 8 in. × 10½ in. × 7½ in.

WEIGHT : 25 lb.

With two indicator dials

PRICE : £64 8 6

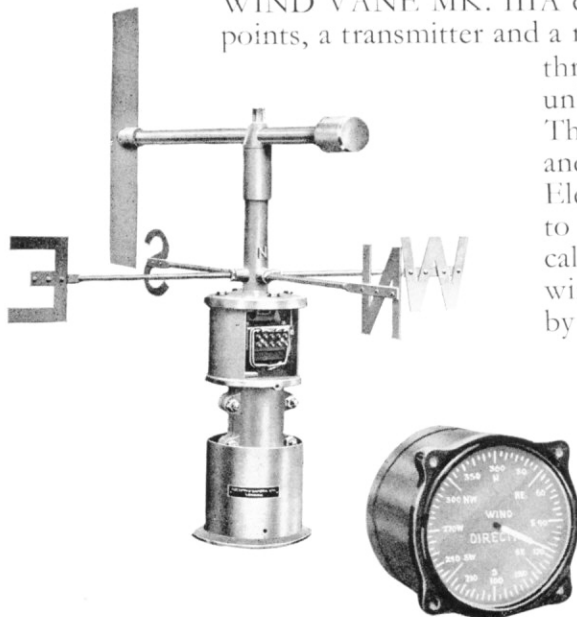
With one indicator dial

PRICE : £49 7 6

WIND VANE MK. IIIA comprises a rotating vane with cardinal points, a transmitter and a receiver. The central spindle is coupled through a universal joint to an electrical unit in a gunmetal housing. M.1995

The transmitting unit is readily replaceable and has an accuracy of ±1 degree of arc.

Electric wiring connects the transmitter to a miniature Desynn meter which is calibrated in degrees and indicates the wind direction. The Desynn is operated by a 12v. D.C. current.



DIMENSIONS :

2 ft. 4 in. × 8 in. × 7 in.

WEIGHT : 20 lb.

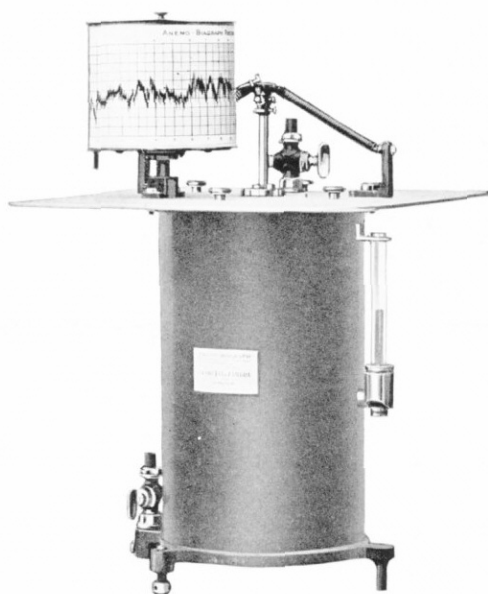
PRICE :

With two indicators

£57 0 0

With one indicator

£45 0 0



Wind Velocity Recorders ●

THE "ANEMO-BIAGRAPH" M.2020

This wind velocity recorder, which is used with the head described on page 9, consists of a cylindrical brass chamber partly filled with liquid. A floating "bell" is partially immersed in the liquid, and a rod from its domed top passes upwards through a close-fitting ebonite bush in the airtight cover plate and carries the recording pen.

Pressure from the head is led inside the bell above the liquid level, causing it to rise until constrained by two helical springs attached to the top of the vertical pen rod.

The suction side of the head is connected to the top of the chamber, that is, outside the bell, and thus augments the movement of the bell. The springs, which are of hardened and tempered steel treated to resist corrosion, are so arranged that a practically uniform velocity scale is obtained.

The liquid used, which acts as a seal, is a mixture of pure glycerine and water, having a specific gravity of 1.16.

Daily Drum (8-day clock)	5 in. diam. × 4.5 in. high
Pen travel, 100 m.p.h. (160 k.p.h.)	3 in.
Chart	4.2 in. × 16.2 in.
Time Scale	0.6 in. per hour

The mechanism is protected by a glass domed cover.

M.2020

"ANEMO-BIAGRAPH"

Complete with glass cover, liquid, pen,

ink and 100 charts £68 5 0

Charts per 100 15 0

Can of liquid £2 15 6

(For Head, Connecting Pipes, Water Traps, etc., see page 9.)

DIMENSIONS: 2 ft. × 1 ft. 1 in. × 1 ft. 3 in.

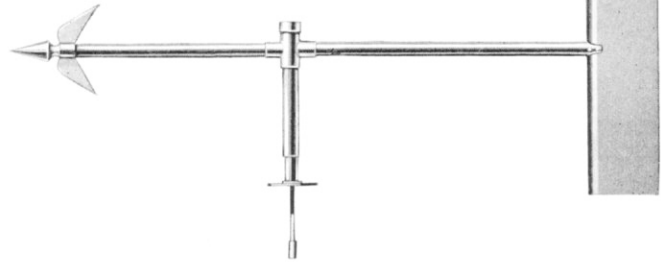
WEIGHT: 25 lb.



● *Wind Direction Recorders*

M.2010 WIND DIRECTION HEAD

The Wind Direction Recorder shown below is used in conjunction with the head illustrated on the right. This head consists of a brass tubular standard and flange at the top of which a vane rotates on ball bearings. The vane is constructed of brass tubing, and is fitted with a cast iron arrow point and a streamlined tail of light copper sheet.



M. 2010

A feature of the recorder is the special pen operating cam device which enables a full record to be obtained of wind direction either side of the “N” and “S” points.

To enable such a record to be obtained the chart is marked N.E.S.W.N.E.S. and on reaching the highest or lowest part of the chart the record is automatically brought either to the “inside” N. or S. position.

At the point where the instrument is coupled to the direction shafting is provided a Hook’s joint to compensate for any error in alignment, also a key-way for taking up expansion of the shaft due to changes of temperature, and a clamping device for setting the Recorder in correct orientation.

The case is of polished mahogany, with glass front and two folding covers.

Daily Drum (8-day clock)

- 5 in. diam. × 4.5 in. high
- Pen travel . . . 1 revolution of vane 2.3 in.
- Chart 4.2 in. high × 16.2 in. wide
- Time scale 0.6 in. per hour

M.2010 WIND DIRECTION HEAD

Dimensions : 4 ft. × 2 ft. × 6 in.
Weight : 11½ lb.

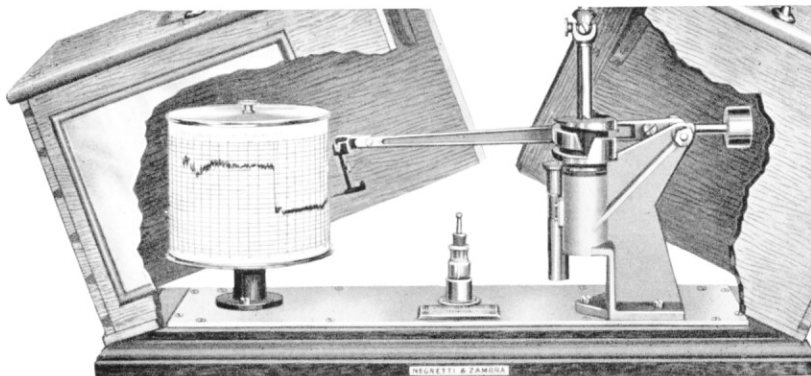
PRICE : £15 5 0

M.2011 Spindle in lengths of 5 ft. × ⅝ in. steel tubing, with brass joints screwed and pinned.

PRICE per 5 ft. length :

£1 5 0

M.2014 WIND DIRECTION RECORDER



M.2014 WIND DIRECTION RECORDER

With pen filler, ink and 100 charts. Dimensions : 11 in. × 1 ft. 9½ in. × 8½ in.

Weight : 24 lb.

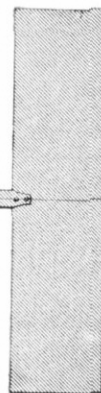
PRICE : £54 0 0

Spare Charts per 100 :

15 0

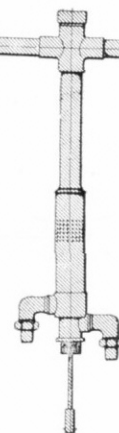


● Wind Velocity and Direction Recorders



M.2026 WIND VELOCITY AND DIRECTION HEAD

The head illustrated here is constructed on the Dines' principle and is used in conjunction with the combined Wind Velocity and Direction Recorders described on pages 15 to 19.

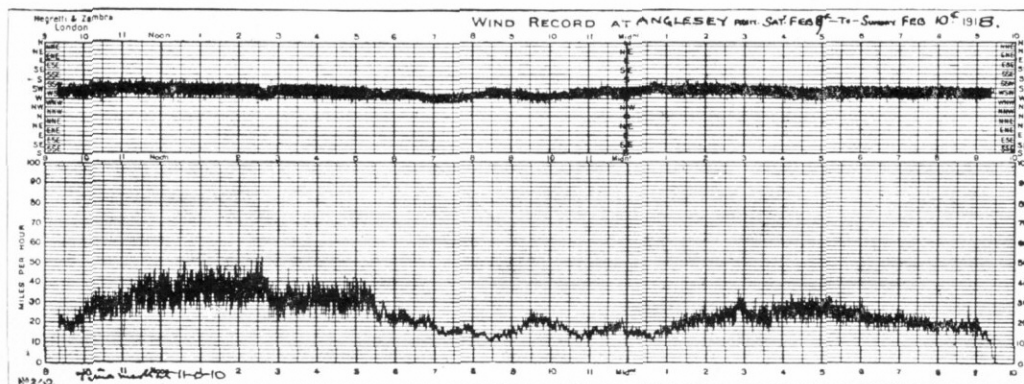


PRICE :
£21 10 0
N.P.L. CERTIFICATE
£3 0 0

It consists of a Wind Direction Head which actuates the transmitting spindle to the Recorder combined with a Velocity Head as described in page 9, which gives the required differential air pressure for operating the Recorder. The horizontal tube is 3 ft. 6 in. long and the streamlined tail 2 ft. × 6 in. The head rotates on ball bearings.

DIMENSIONS : 3 ft. 6 in. × 3 ft.

WEIGHT : 16 lb.



RECORD FROM A COMBINED "ANEMO-BIAGRAPH" AND WIND DIRECTION RECORDER

(REDUCED SCALE)



Wind Velocity and Direction Recorders ●

COMBINED ANEMO-BIAGRAPH AND WIND DIRECTION RECORDER. This instrument is similar to the Wind Velocity Recorder described on page 12, but has, in addition a direction recorder mounted on the base plate so that the record of the direction is immediately above that of the velocity. Two records on the chart are, therefore, synchronised. With 20 ft. of steel spindle, two lengths of 25 ft. composition tubing, two water traps, liquid, pens, bottle of ink and 100 charts.

M.2027

Daily Drum (8-day clock)	5 in. diam. × 6 in. high
Chart	5.8 in. × 16.2 in.
Time Scale	0.6 in. per hour
Pen Travel (0/100 m.p.h. or 160 k.p.h.)	3.1 in.
Pen Travel (North to South)	1.1 in.

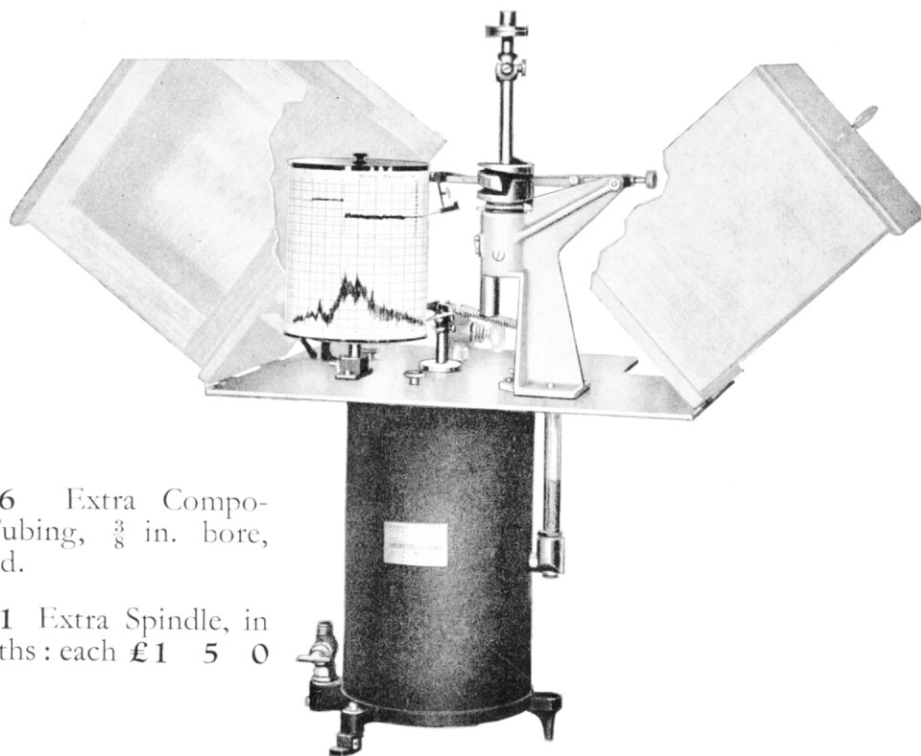
DIMENSIONS :

1 ft. 11 in. × 1 ft. 5 in. × 1 ft. 3 in.

WEIGHT : 81 lb.

PRICE : £123 17 6

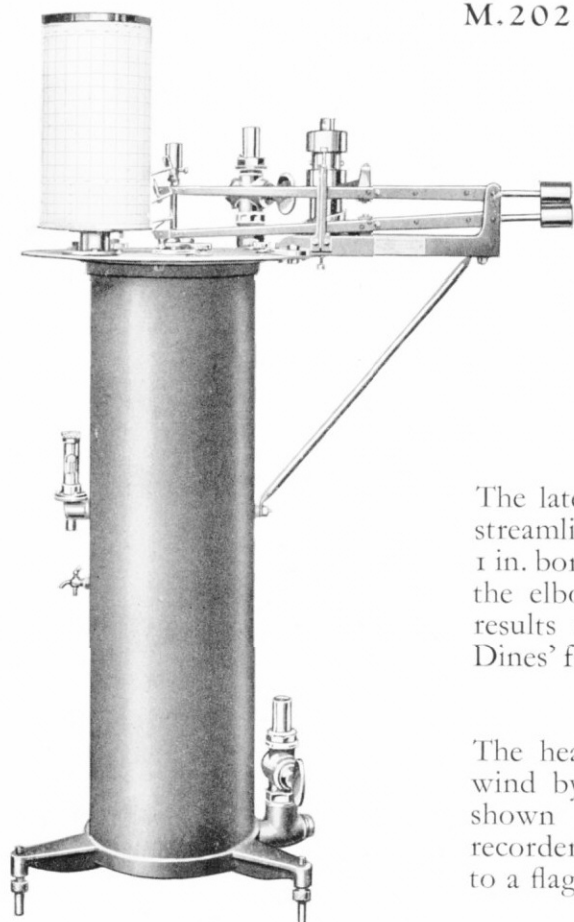
CHARTS : per 100, 17 6



M.2016 Extra Composition Tubing, $\frac{3}{8}$ in. bore, per ft. 6d.

M.2011 Extra Spindle, in 5 ft. lengths : each £1 5 0

● *Velocity and Direction Recorders*



M.2023 DINES' WIND VELOCITY
& DIRECTION RECORDER

This instrument, with Direction Recorder, consists of two parts—the head, which is exposed to the wind, and the recording apparatus. These two parts are connected to each other by metal tubing and tubular shafting. The principle is that described on the preceding pages.

The latest type of head is furnished with a streamlined shaped vane, has passages of 1 in. bore, and a cylindro-conical shroud over the elbows: this has been found to give results to a nearer approximation of the Dines' factor.

The head is given a free exposure to the wind by erection at the top of a mast as shown on page 20. For the velocity recorder, a head may be supplied for fitting to a flagstaff or pole.

The velocity recorder contains a float, which is a specially shaped copper vessel closed at one end, placed with its open end downwards in a vessel partially filled with water and sealed from the air in the room in which it is placed.

To the top of the float is fixed a rod which passes through what is practically an airtight collar in the cover of the water vessel; this rod carries a pen of the swinging gate type. The shape of the float is calculated mathematically according to the law governing the relation of pressure to wind velocity, so that an even velocity scale is obtained.



Velocity and Direction Recorders ●

M.2023 DINES' WIND VELOCITY AND DIRECTION RECORDER

This direction recorder is of the Meteorological Office Twin Pen, Mark II Type. The arms carrying the pen are actuated by a cam mechanism attached to a spindle, which is coupled up to the head by tubular shafting.

At the lower end of the direction shaft is a sliding sleeve for disconnection of the recorder, if necessary, without altering the orientation. A sliding key-way guards against stress from expansion of the direction shaft.

COMPLETE with head and vane, 40 ft. of direction shaft, 15 ft. of 1 in. bore composition or compoflex tubing, bottle of ink, 400 charts, and full set of accessories. Dines' Anemometer with Direction Recorder Mark II.

DIMENSIONS : 3 ft. 3 in. × 2 ft. WEIGHT : 144 lb., with cover.
£181 10 0

- A dustproof metal cover with glass doors and lid can be supplied at extra cost if desired. £20 16 6

M.2024 Dines' Wind Velocity Recorder only, with head and vane. Glass shade, two coils of 50 ft. composition or compoflex tubing, bottle of ink, 400 charts and full set of accessories.

DIMENSIONS : 3 ft. 3 in. × 2 ft. WEIGHT : 103 lb.
£107 0 0

M.2025 EXTRA COMPOSITION TUBING, 1 in. bore . . . per foot :
PRICE ON REQUEST

DAILY DRUM (8 day clock)	5 in. diam. × 9·15 in. high
CHART	9 in. × 16½ in.
TIME SCALE	0·6 in. per hour
PEN TRAVEL, 0 to 100 m.p.h.	6 in.
PEN TRAVEL, North to South	1·8 in.

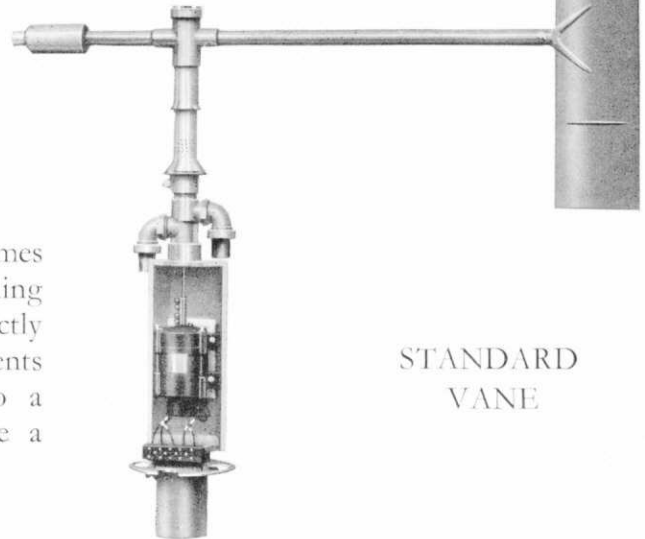
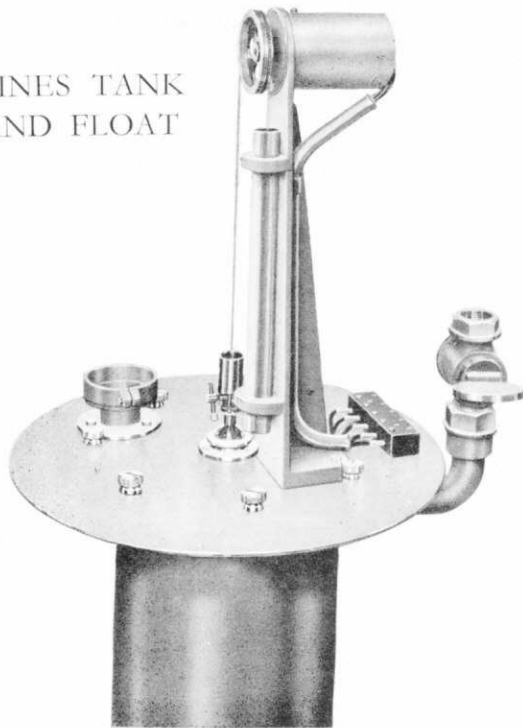
STANDARD CHARTS employ the following ranges :—
 Combined Velocity and Direction Recorder 110 m.p.h., and direction record. 50 metres per second and direction record.
 Velocity Recorder only :—100 m.p.h., and equivalent pressure in lb. per square foot, 120 m.p.h. equivalent pressure in lb. per square foot, 180 k.p.h. and equivalent pressure in kgs. per square metre.

● *Wind Velocity and Direction Recorders*

M.2031A DISTANT RECORDING
ANEMOMETER FOR —

Velocity and Direction overcomes the necessity for the recording mechanism to be situated directly below the vane. The movements are transmitted electrically to a recording unit which may be a considerable distance away.

DINES TANK
AND FLOAT

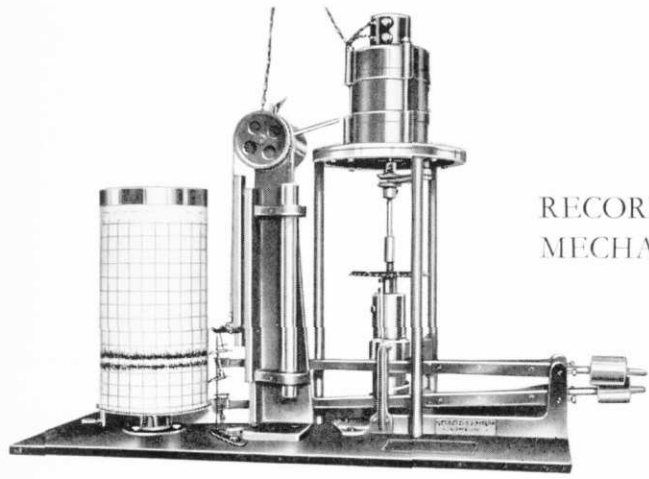


STANDARD
VANE

The standard vane is shown with the shroud removed. This shroud protects the elbows on the vane and the electrical direction transmitting unit, the rotor of which is connected to the shaft depending from the rotating vane. A series of wires which may be as much as 1000 yards long, connects this transmitter to the corresponding receiving unit at the top of the recorder, connected over the helices of the standard twin pen direction recorder. These electrical units are designed to rotate through equal angles and therefore the recorder is capable of giving a trace of the movements of the vane, the trace being recorded in the usual manner on a standard clock drum and chart.



Wind Velocity and Direction Recorders ●



RECORDING
MECHANISM

At or near the site of the vane but not necessarily vertically underneath, is fixed the standard Dines' Tank and Float for the velocity recorder. The pen rod and shot cup have an attachment comprising a chain, pulley and counter-weight, the latter operating in a tube fixed to a metal bracket on the top plate. The pulley is fixed to a shaft of another and smaller electrical transmitting unit at the top of the tank unit for velocity, and as the float rises and falls the rotor for this unit revolves.

This unit is connected by a series of wires to the corresponding receiving unit on the recording instrument and in this the rotor follows exactly the angular movement of the transmitter. This rotary movement is converted to a rise and fall movement through a chain over a pulley and causes a pen carriage to move up and down on a bracket. The same clock and drum with chart receives the trace of the velocity pen and thus a complete indirect record is obtained at a distance from the point of observation. A clock drum on the tank may be supplied for purposes of comparison.

Alternating current is required 200/250 volts 50 cycles single phase A.C.

Complete with recorder in hard wood glazed cabinet.

TOTAL WEIGHT: 193 lb.

PRICE: £350 0 0

Short clock drum and clock with base casting for obtaining a check of the velocity reading at transmitting end extra £16 13 6

400 Velocity Charts for same extra £4 15 6

● *Anemometer Mast*

MAST AND SUPPORT M.2032

CONSISTING OF:—

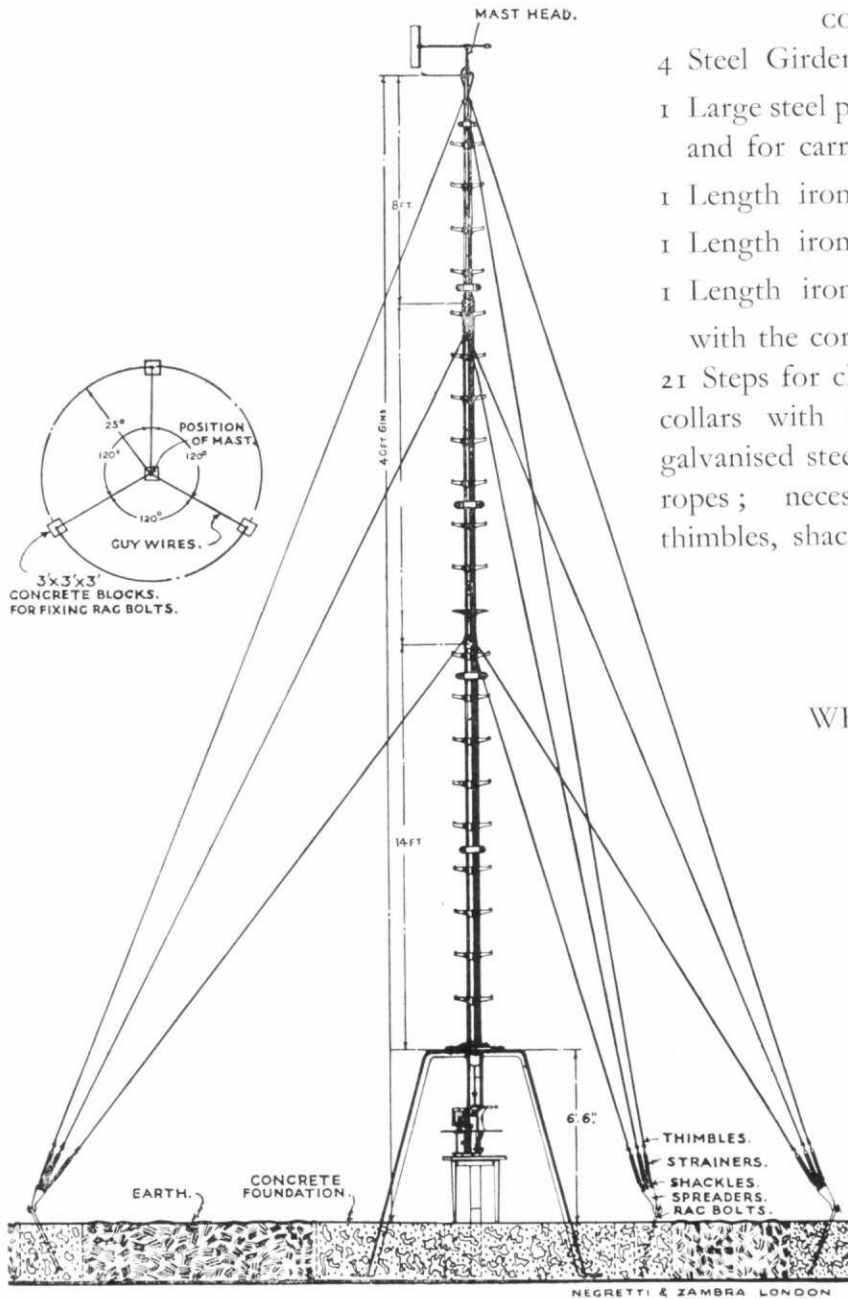
- 4 Steel Girder supports, 7 ft. 6 in. high.
- 1 Large steel plate for bolting these together and for carrying the mast, with
- 1 Length iron tube, 14 ft. × 3 in. dia.
- 1 Length iron tube, 12 ft. × 2½ in. dia.
- 1 Length iron tube, 8 ft. × 2 in. dia.

with the corresponding reducing sockets.
 21 Steps for clamping to the mast; 2 or 3 collars with hooks for the guy ropes; galvanised steel wire for 8 or 9 sets of guy ropes; necessary rag bolts, spreaders, thimbles, shackles and straining bolts.

40 ft. HIGH.

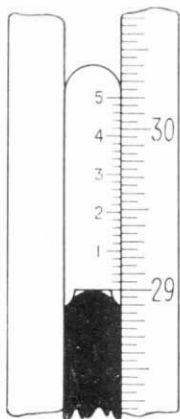
£75 0 0

WEIGHT: 1000 lb.



NEGRETTI & ZAMBRA LONDON

● *Standard Barometers*



THE VERNIER consists of a short scale, the distance between the divisions of which is slightly less than that between those of the barometer scale.

In the case of English scales divided in inches, 25 vernier divisions are equal to 24 divisions on the barometer scale. As each of the latter is equivalent to 0.050 in., each vernier division is thus shorter by 0.002 in.

IN HANDLING AND ERECTION, a standard barometer requires great care. If it has to be moved it should be sloped very carefully so that the mercury slowly fills the upper part of the tube. When the tube is full, the adjustment screw should be screwed up, but not forced in any way. The barometer may now be handled, but with care; it can be carried in a horizontal position, or preferably vertically with the CISTERN UPPERMOST.

For export the barometer is packed in a special case; this case is taken to the docks by one of our staff and stowed specially in a safe position on board a ship sailing direct to the port nearest its destination. The consignee, having been warned of the date of sailing, meets the ship on its arrival, and personally removes the case.

For delivery inland, the barometer is given into the charge of the guard of a through train, and met by the consignee upon arrival at destination.

National Physical Laboratory Certificates provide the corrections for index or scale errors, and the corrections for temperature, latitude and reductions to sea level can be found in various meteorological text books.



Fortin Barometers ●



Type 'A' with tube 0.4 in. internal diameter and cistern built up of brass, glass and box-wood with adjustable screw. The scale is engine engraved and silvered and fitted with glass protecting sheath, and the vernier is operated by a milled head screw with a rack and pinion movement. The thermometer is mounted in a brass frame and the tube is graduated and figured on the scale. The barometer is mounted on an oak panel (or mahogany if specially required) with opal glass reflectors. Strong metal support at top and ring at the bottom fitted with three clamping screws. It may also be supplied in a glazed panelled case, see page 25.

	SCALE RANGE	DIVIDED TO	THERMOMETER
Inches	26 to 32.5	0.002	5° to 120° F.
Millimetres	660 to 820	0.05	-15° to 50° C.
Millibars	880 to 1100	0.1	250° to 320° A.

SINGLE SCALE

M.2034	– Graduated in inches.	PRICE :	£27 12 6
M.2035	– Graduated in millimetres.	PRICE :	£27 12 6
M.2036	– Graduated in millibars.	PRICE :	£27 12 6
	N.P.L. CERTIFICATE.	EXTRA :	£2 3 6

DOUBLE SCALE

M.2037	– Inches and millimetres.	PRICE :	£31 0 0
M.2038	– Inches and millibars.	PRICE :	£31 0 0
M.2038A	– Millimetres and millibars.	PRICE :	£31 0 0
	N.P.L. CERTIFICATE	EXTRA :	£2 10 0

DIMENSIONS : 4 ft. 4 in. × 6 in. × 5½ in.

WEIGHT : 33 lb.



● *Fortin Barometers*

Type B, with tube 0.5 in. diameter.
 Type C, with tube 0.6 in. diameter.

Types B and C are similar to type A (page 23), but of heavier construction and with larger cisterns. Type D has a square frame, as shown.

STANDARD FORTIN BAROMETER, TYPE D, with tube 0.6 in. diameter, square frame and cistern suitable for an Observatory, Public Institution, etc., where an imposing barometer of high precision is required.

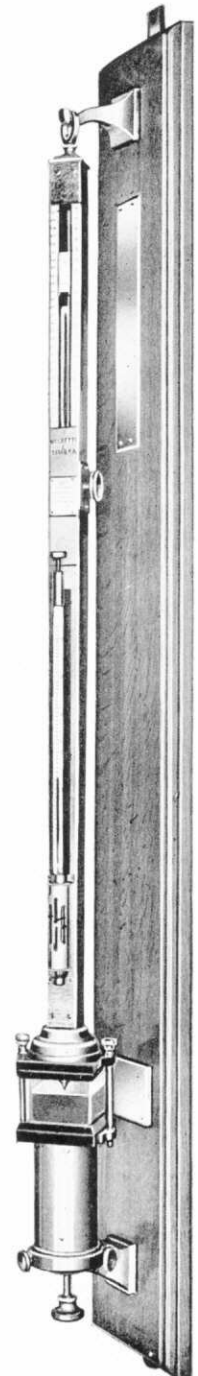
This cistern is built up of cast iron and enclosed in a highly finished brass case; the scale is engine engraved and silvered on a square brass tube. The vernier is operated by a milled-head screw with a rack and pinion movement. The attached thermometer is exceptionally bold, and mounted in a highly-finished brass frame. The barometer is supplied mounted on a polished mahogany panel with bevelled opal glass reflectors.

	SCALE RANGE	DIVIDED TO	THERMOMETER
Inches	26 to 32.5	0.002	5° to 120° F.
Millimetres	660 to 820	0.05	-15° to 50° C.
Millibars	880 to 1100	0.1	250° to 320° A.

WITH ANY TWO OF THE ABOVE SCALES

M.2039 Type B.	. . . . .	£39 10 0
M.2040 Type C.	. . . . .	PRICES ON
M.2041 Type D.	. . . . .	REQUEST
N.P.L. CERTIFICATE	. . . . .	£2 10 0

DIMENSIONS : 4 ft. 4 in. × 6 in. × 6½ in.
 WEIGHT : 40 lb.





Kew Barometers ●

STANDARD KEW TYPE
BAROMETER

This barometer requires only one setting and is very largely used for general observations. It is constructed on similar lines to the Fortin previously described (except for the cistern), and is supplied on a polished wood panel with reflector and brackets. The tube is 0.3 in. diameter.

SINGLE SCALE

M.2043	Range 26 to 32.5 in. reading to .002 in.	£22 12 6
M.2044	Ditto 660 to 820 mm. to 0.05 mm.	£22 12 6
M.2045	Ditto 880 to 1100 mb. to 0.1 mb.	£22 12 6
	N.P.L. CERTIFICATE	£2 3 6

DOUBLE SCALE

M.2046	Ditto, range 26 to 32.5 in. and 660 to 820 mm.	£26 0 0
M.2047	Ditto, range 26 to 32.5 in. and 880 to 1100 mb.	£26 0 0
M.2047A	Ditto, range 660 to 820 mm., and 880 to 1100 mb.	£26 0 0
	N.P.L. CERTIFICATE	£2 10 0

DIMENSIONS : 3 ft. 2 in. × 6 in. × 5½ in.

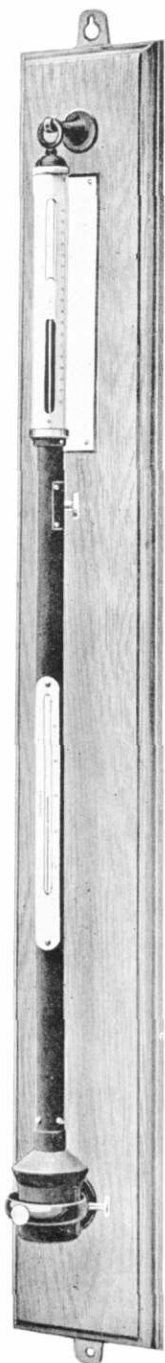
WEIGHT : 19 lb.

GLASS PANELLED CASES

The foregoing Fortin and Kew Barometers can be supplied mounted in glass panelled, dust-proof fumed oak cases (or polished mahogany if specially required), fitted with plate glass door and sheet glass sides, two locks and keys, at the following additional prices:—

M.2048	For Fortin Barometer, Type A	£16 12 6
M.2049	For Fortin Barometer, Type B	£16 12 6
M.2055	For Kew Barometers	£16 12 6

DIMENSIONS : 4 ft. 3 in. × 8 in. × 7½ in. WEIGHT : 30 lb.



● *Kew Barometers*

KEW PATTERN STATION OR MARINE
BAROMETER

BRITISH METEOROLOGICAL
OFFICE SPECIFICATION

M.2054

Bore of the visible part of the tube 8 mm., fitted with air trap in the form of an inverted pipette 2 in. to 2½ in. long. Cistern made of Firth's "Staybrite" steel 3 to 4 mm., thick, left bright. Scale silvered, protected by a glass tube, graduated 870 to 1100 millibars and 25.7 in. to 32.6 in., readable by vernier to 1060 mb., and 31.4 in. Vernier operated by milled-head screw working with a rack and pinion and reading to 0.1 mb., or 0.002 in.

Thermometer mounted in a brass frame, tube graduated 260/320° A. or 5/120° F. Gymbal ring with suspension arm 60 mm. long, and bracket for wall attachment. Box of varnished deal ½ in. thick, with lock and key and rope handles; box fitted with india-rubber packings.

WITH N.P.L. CERTIFICATE £34 5 0

M.2054A

"Gold" Slide. For attachment to a Kew Pattern Barometer in place of the ordinary attached thermometer for computing the corrections to be applied to the readings £9 7 6

N.P.L. CERTIFICATE 18 9

KEW PATTERN MARINE BAROMETER, similar to M.2054 Kew Station Barometer except that the bore of the tube is contracted above the air trap so that the movement of the mercury is damped, the falling time for 1.5 in. to 0.5 in. (50 mb. to 18 mb.) above actual reading being between 6 and 9 minutes. The suspension arm is 12 in. long.

KEW TYPE MARINE BAROMETER

Scale 26 in. to 32.5 in., reading to .002 in. £22 7 6 M.2055

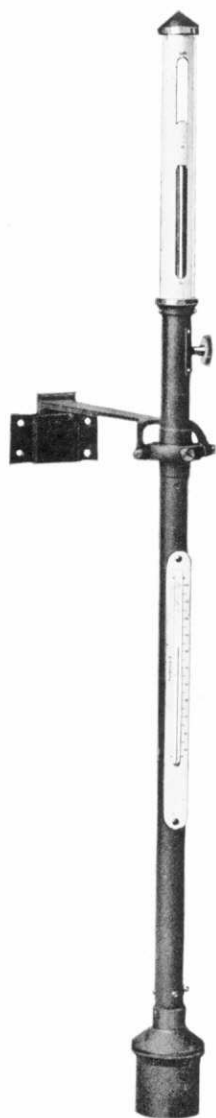
Ditto, 660 to 820 mm. to .05 mm. £22 7 6 M.2056

Ditto, 880 to 1100 mb. to .1 mb. £22 7 6 M.2057

N.P.L. CERTIFICATE £2 10 0

DIMENSIONS: Box 3 ft. 2 in. × 4½ in. × 4½ in.

WEIGHT: 20 lb.



M.2055

Barometers ●

MOUNTAIN BAROMETER

A standard barometer of the Fortin type for determining altitudes.

The tube is 0.2 in. bore filled with pure distilled mercury; the cistern is constructed on the Fortin principle as described on page 21. The scales are graduated from 15 to 31 in., or 380 to 790 mm., and can be read by vernier to 0.002 in. or 0.05 mm.

Thermometer mounted in brass case, graduated on the stem 1° F., or 0.5° C. Tripod of brass tubes, folding into three parts.

Solid leather case built up on a light metal frame shaped to take the barometer and tripod; it has a leather cap and strong strap.

M.2058 Range 15 to 31 in., reading to .002 in. £81 0 0

M.2059 Range 380 to 790 mm., reading to 0.05 mm. £81 0 0

N.P.L. CERTIFICATE. £1 18 6

Leather case, 3 ft. 4 in. × 3 in. diam. £1 18 6

Weight: 8 lb.

STUDENT BAROMETER (Type E). This is a simpler form of the Fortin Barometer described on page 21. The tube is 0.25 in. bore, the frame and cistern bronzed; the board is of stained oak, fitted with reflectors and brackets.

M.2060 Range 27 to 31 in., reading to .002 in. £16 7 6

M.2061 Range 690 to 790 mm., reading to .05 mm. £16 7 6

N.P.L. CERTIFICATE £1 0 0

DIMENSIONS: 3 ft. 9 in. × 4 in. × 4 in.

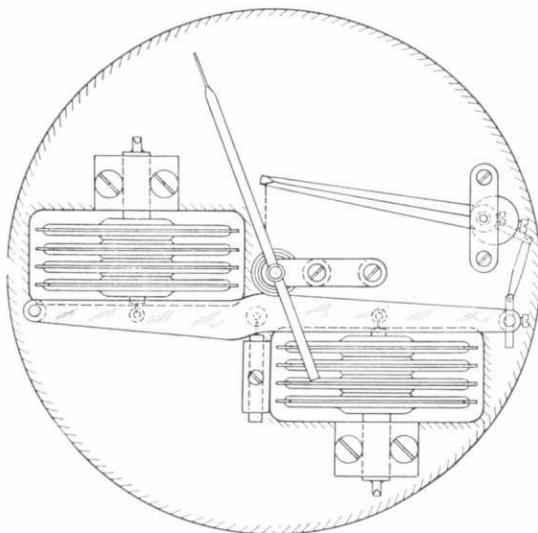
WEIGHT: 11 lb.



M.2058

● *Aneroid Barometers*

PRECISION TYPE



Movement



M.2062

ANEROID BAROMETERS are liable to be subject to four main sources of error :—

1. HYSTERESIS, i.e. the observed difference between the instrument readings with pressure increasing and decreasing at a known rate of exchange.
2. CREEP OR DRIFT, i.e. the change of reading at a constant pressure after a change of pressure.
3. TEMPERATURE, i.e. the change in the elasticity modulus of the dilating members.
4. FRICTION, BACKLASH and mechanical inconsistency.

An examination of these errors reveals the following :—

(a) The material from which the diaphragms are constructed has an important bearing on their performance and we found, after having carried out a long series of tests on diaphragms constructed of different materials, that those constructed of **hardened and tempered steel**, gave far the best results for reducing, if not entirely eliminating, hysteresis and drift.

(b) The use of the 'U' shaped spring and its anchorage together with the internal springs also tends to introduce errors of hysteresis and creep ; these are eliminated by the employment of the hardened and tempered steel diaphragms. Correctly proportioning the shapes and sizes of the corrugations also has an important bearing on the performance of the diaphragms.

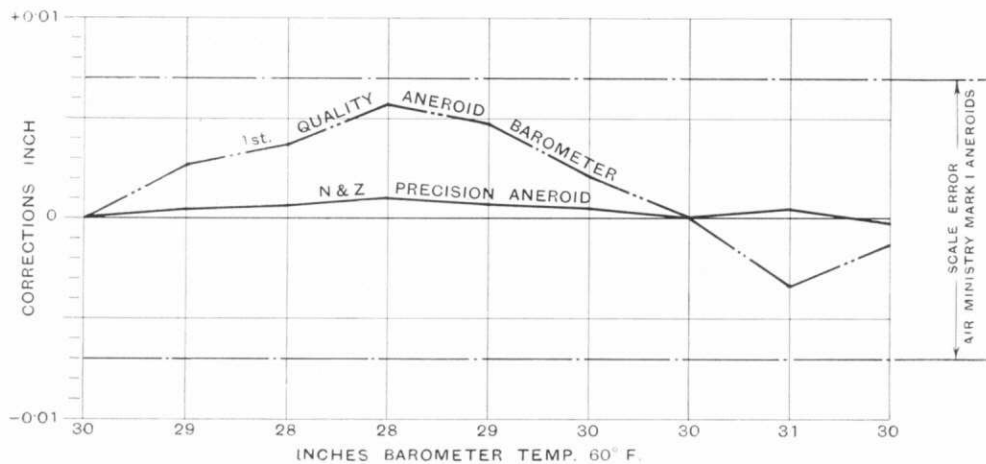


Aneroid Barometers ●

(c) The method of compensation by means of a bimetallic arm, which affects zero compensation only, is replaced by suitably proportioning the volume of the space inside the diaphragms when closed to that when opened, and by leaving a certain amount of dry air in the diaphragms, thus a compensation which varies with the deflection, can be effected. As the diaphragms open, the pressure of imprisoned air falls, due to the increased volume and consequently the correcting effect of temperature on the air diminishes as the load or deflection decreases.

This method of compensation, together with the improved method of construction of the diaphragms and their connections, secures practically perfect compensation of temperature over the whole range of the instrument.

(d) The mechanical magnification of the diaphragm movement is usually too high for consistent reading free from friction, this has been overcome in the Negretti & Zambra Precision Aneroid by the special design of the instrument.



The above graph of the performance of an N. & Z. Precision Aneroid under various tests for **Hysteresis, Temperature, etc.**, shows the marked superiority when compared with the usual type of first class aneroid, and with the limits of the Air Ministry Specification.



● *Aneroid Barometers*

The movement employs two sets of four exhausted diaphragm stacks; each stack consists of eight nickel-plated hardened and tempered steel diaphragms. The two sets of stacks are fixed to the frame of the instrument, and the free ends are connected to a magnifying lever in such a manner that the two boxes are balanced. The magnifying lever is of girder construction, and the fulcrum is formed by a flexing strip of stainless steel. The diaphragm stacks are also connected to the balancing lever by flexing strips. At the end of the magnifying lever the movement of the boxes is magnified, and at this point the movement is unaffected by position and balance, and is free from friction or backlash. The control at this point is considerable, due to the number of diaphragms used. The end of the magnifying lever is then linked to a second lever mounted on a practically frictionless spindle with point bearings. Attached to this spindle is a third lever which operates a chain and pulley mechanism. The pulley is of large diameter and operates on a spindle with a thrust bearing. A hair spring is used to give the required tension on the chain.

The pointer is of tubular form, extremely light and rigid in construction, and is formed into a knife edge for reading purposes.

The frame carrying the diaphragms and movement is of special construction to avoid effects of strain or distortion.

The setting adjustment consists of a quadrant and pinion which, in effect, rotates the whole movement and eliminates any possibility of characteristic errors being introduced when a setting is made. This is operated from the back of the case.

The dial is of brass, $4\frac{1}{2}$ " diameter, engine divided and silvered. An anti-parallax mirror is fitted behind the knife edge of the pointer.

A magnifying lens is also provided, which is attached to the rotating bezel.

M.2062

PRECISION ANEROID BAROMETER with $4\frac{1}{2}$ in. dial and anti-parallax mirror, complete in teak box.

PRICE: £67 15 0

STANDARD RANGES :

28/32 in. 950/1100 mb. 700/800 mm.

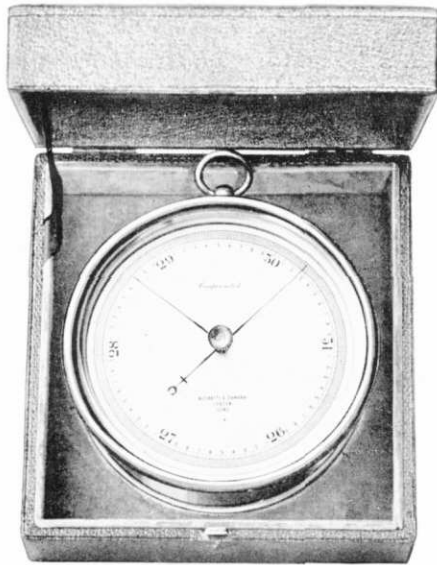
24/32 in. 850/1100 mb. 650/800 mm.

WEIGHT : 4 lb. 14 oz.



Aneroid Barometers ●

BRITISH METEOROLOGICAL
OFFICE SPECIFICATION MARK I.



A high-class Aneroid Barometer suitable for surveying, meteorological and general purposes where extreme precision is not required and the cost of the special instrument described on the previous page is not warranted.

Movement compensated for temperature, mounted in a brass case with suspension bow and bevelled-glass front. An index hand is provided on the cover glass and is set by a knurled button. The dial measures 4 in. diameter, is engine divided and figured, and the instrument is complete in leatherette case with hinged lid.

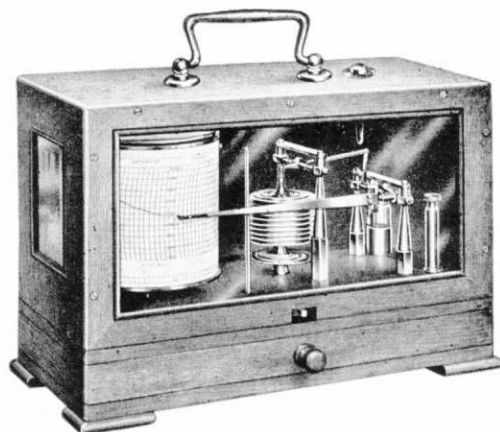
M.2063	Range 26/31 in. and 855 to 1050 mb.	£7 15 0
M.2064	Ditto, 26 in. to 31 in.	£7 15 0
M.2065	Ditto, 65 to 79 cm.	£7 15 0
	N.P.L. CERTIFICATE	£1 14 6
M.2063A	Ditto, M.O. Pattern, Mark II, a simpler type; graduated 855 to 1050 mb.	£4 0 0
M.2064A	Ditto, 26 in. to 31 in.	£4 0 0
M.2065A	Ditto, 65 to 79 cm.	£4 0 0

● *Barographs*

M.2067 BRITISH METEOROLOGICAL OFFICE SPECIFICATION

Movement 7 to 8 chambers of spun diaphragms with inside springs.

Case of mahogany french polished, dovetailed corners, front and left-hand side of case glazed; a stout handle is secured to lid. For time marking a spring push-knob is fitted into the cover for depressing the recorder arm at the right-hand end, the push-knob being flush with the mahogany. A drawer is fitted to the bottom of the case to hold a spare pen arm. A stoppered bottle for ink is sunk into a socket in the baseplate, with a brass dipper. The range is from 950/1050 mb. Weekly drum.



M.2067

Clock drum	93 mm. high
Time scale (12 hours)	2.0 cm.
Pressure scale (10 centibars)	7.5 cm.
With bottle of ink and 100 charts	£31 17 6
Charts per 100,	12 0
DIMENSIONS : 1 ft. × 8½ in. × 6¼ in. WEIGHT : 9 lb.	

M.2068 Barograph of the simplest type. Movement consisting of four sets of spun diaphragms mounted on brass baseplate, and fitted in plain oak case with removable cover, glass all sides and top.

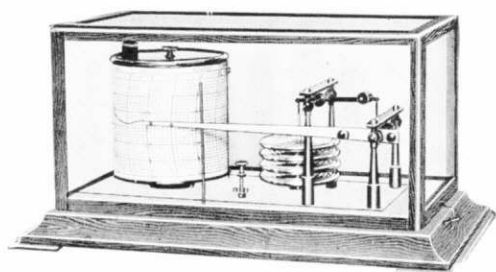
Range 28/31 in. or 720/800 mm. ; clock, daily or weekly as **M.2069**
With bottle of ink and 100 charts.

£17 18 0

Charts, per 100 12 0

DIMENSIONS : 1 ft. 1 in. × 6½ in.
× 7½ in.

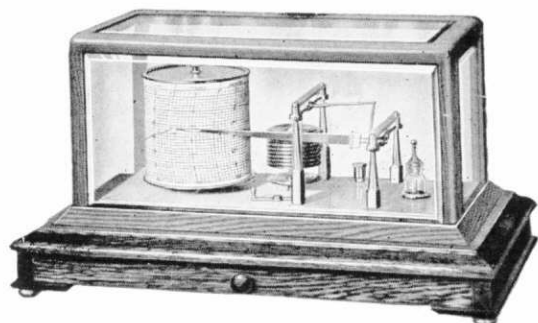
WEIGHT : 8 lb.



M.2068



Barographs ●



Barograph of the highest quality workmanship and finish. **M.2069**

Movement consisting of a specially - formed set of diaphragms (see page 28), fully compensated, operating lever mechanism to the pen-arm spindle.

Jewelled pivots are provided to reduce friction to a minimum.

A special form of zero adjustment is fitted, by which the diaphragms are raised or lowered in a truly vertical plane.

The pen-arm is hinged in order to ensure an even pressure of the pen on the chart. The whole movement is mounted on a polished brass plate, and all brass parts are highly polished and stove-lacquered with the best possible finish.

The instrument is mounted in an oak or polished mahogany case, with bevelled glass panels and drawer for charts.

Daily (8-day clock) or weekly drum	3.6 in. dia. × 3.6 in. high.
Pen travel	3 in.
Chart	3.6 in. × 11.8 in.
Time Scale (daily)	0.45 in. per hour.
Time Scale (weekly)	1.54 in. per day.
Pressure Scale	1 in. per 1 in. barometric pressure

PRICE

M.2069 Range 28/31 in. or 720/800 mm., with bottle of ink and 100 charts **£29 3 0**

M.2070 Range as above, with sector dial graduated in 1/10ths of an inch or 2 mm., with ink and 100 charts **£33 14 6**

Charts per 100 **12 0**

Presentation Plates in brass or silver

PRICE ON REQUEST

M.2069/70 DIMENSIONS : 1 ft. 4 in. × 9 in. × 8½ in.

WEIGHT : 12 lb.

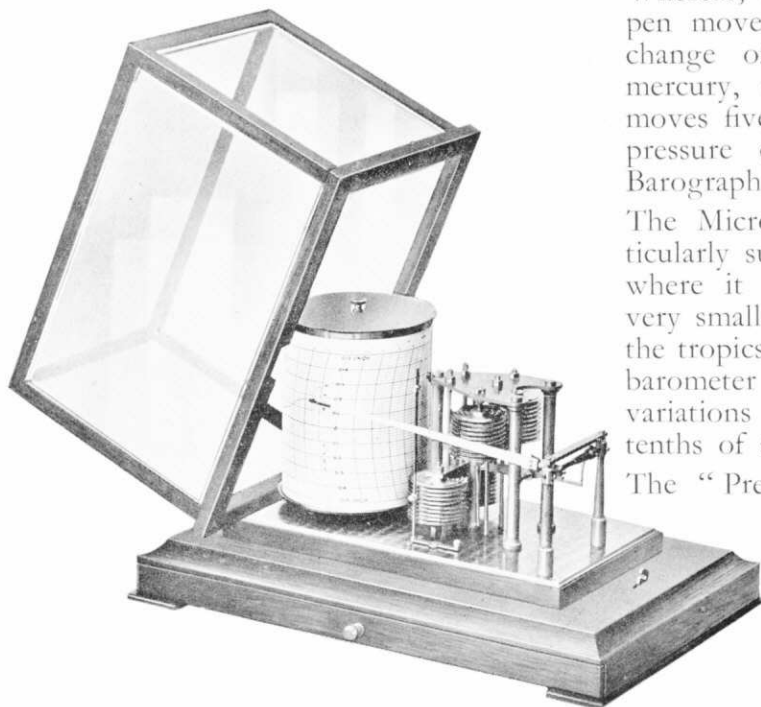
● *Micro-Barographs and —*

THE “MICRO-BAROGRAPH”
& “PRECISION BAROGRAPH”

Both these instruments give a magnified trace of barometric pressure changes, and only differ in the degree of “openness” of their respective records. Whereas, in the normal barograph, the pen moves 1 in. over the chart for a change of pressure of one inch of mercury, the “Micro-Barograph” pen moves five times as much for the same pressure change, and the “Precision Barograph” about twice as much.

The Micro-Barograph is therefore particularly suitable for use in special cases where it is necessary to show clearly very small variations of pressure, and in the tropics, where the movements of the barometer are practically those of diurnal variations and amount only to a few tenths of an inch.

The “Precision Barograph,” where the same chart height represents 3 inches, 80 mm. or 100 mb. change of pressure, has its application where the maximum sensitivity is required together with a range fully covering barometric changes such as are more usually met with.



To provide adequate pen control in these instruments four capsule-stacks, as described on page 28, are used as compared with the single one employed in ordinary barographs. They are arranged in balanced pairs, and their deflections are transmitted to the main lever through flexing strips, thus avoiding frictional errors and loss of motion.

A pivoted extension on the main lever is spring loaded to bear on an adjusting screw also mounted on the lever. From the end of this extension, a link transmits the lever movement to a crank on the pen-arm spindle. On the micro-barograph the range of adjustment is sufficient to permit a record to be obtained of any inch change of pressure selected within a total range of three inches, or its equivalent, whilst, on the Precision Barograph, it is used only for “zero” adjustment.



— Precision Barographs ●

Rigid stops, acting directly on the capsule-stacks, limit their movement to that for the total range of pressures for which the instrument is intended.

Both instruments are compensated for temperature changes. In the case of the Micro-Barograph the compensation may be adjusted to cover correctly any residual temperature variations over the inch of pressure selected.

MICRO-BAROGRAPH

Chart Drum	5 in. diameter × 6 in. high.
Clock	Daily (running 8 days with one winding) or weekly.
Chart	5·8 in. × 16·2 in.
Pressure Scale	5 in. high for 1 in., 25 mm. or 30 mb.
Time Scale (daily)	0·6 in. per hour.
Time Scale (weekly)	2·06 in. per day.

50 or 60 division charts may be overprinted to suit the range selected, viz. : 25/26 in., 30/31 in., 750/775 mm. or more usually, -0·5/+0·5 in., -12·5/+12·5 mm. or -15/+15 mb.

The case is of polished oak with drawer for charts and hinged glazed cover.

M.2071 Micro-Barograph as described with ink and 100 Charts	PRICE £86 0 0
Charts per 100	15 0
N.P.L. Certificate	PRICE £12 0 0

PRECISION BAROGRAPH

This instrument is similar in construction to the micro-barograph, the only difference being that it is adjusted to cover a fixed, but wider pressure range. The excellent pen control obtained from its four capsule stacks ensures a precise record being obtained, of about twice the usual "openness."

Chart drum and clock particulars as for **M.2071** above.

Pressure Scale 5 in. high for 3 in., 80 mm. or 100 mb.

Case of polished oak with drawer for charts and hinged glazed cover.

M.2072 Precision Barograph. Ranged for 28 in. to 31 in., 720 to 800 mm. or 950 to 1050 mm.	
With ink and 100 charts	PRICE £72 17 6
Charts per 100	15 0

DIMENSIONS of both these instruments are :

1 ft. 6½ in. × 12 in. × 10½ in.

WEIGHT : 22 lb. (approx.).



● *Rain Gauges*

Rainfall is measured in terms of the depth of water, which would be collected upon a level area of any size, supposing the rain to fall uniformly over the area at the rate at which it falls into the gauge.

The Rain Gauge is used to measure the precipitation of rain, snow, hail and sleet, and in its simplest form consists of a funnel to receive the rain, and a glass or metal receiver to collect the rain which falls into the funnel. The important considerations of a satisfactory gauge are the proportions of the funnel to prevent splashing out of heavy rain; the collection of snow, etc.; the height of the rim of the funnel above ground level; the minimising of evaporation errors, and the prevention of damage by frost or corrosion.

It has been proved that the amount of rain measured in a gauge with a rim of 5 in. diameter is practically identical with that of a gauge with an 8 in. rim. Rain Gauges are almost invariably of 5 in. or 8 in. diameter (metric equivalent 125 mm. and 200 mm.).

The measurement of rain may be in terms of decimals of an inch, usually $\cdot 01$ in. (exceptionally $\cdot 005$ in.) or decimals of a millimetre, usually $\cdot 1$ mm.—the former being employed by the average observer in the British Isles, the latter by the British Meteorological Office and countries using the metric system.

The Recording Rain Gauge is not a labour-saving device but is an adjunct to an eye-read instrument, and provides information which is not apparent in a 12 or 24 hours' reading, viz., INTENSITY, RATE AND DURATION. Both gauges should be set up on the same site.

When no rain has fallen for some time, a recording rain gauge should be tested by pouring into the funnel quantities of water corresponding to definite intervals on the chart.

In cold weather, a night-light placed inside below the funnel of the gauge will prevent freezing.

Snow or frozen rain water may be measured by carefully warming the funnel and receiver indoors or by applying hot cloths to the outside of the funnel and receiver, or by adding a definite amount of warm water which must be subtracted from the total amount measured.

Rain Gauges ●

M.2080 RAIN GAUGE, BRITISH METEOROLOGICAL OFFICE SPECIFICATION. Constructed of stout copper, funnel surmounted with turned brass rim 8 in. diameter; outer case fitted with splayed base; inner can with wire rim and brass drop handle, taper measure as shown under Fig. **M.2096** (page 40), graduated in inches.

PRICE: £7 6 6

M.2081 Ditto, with measure graduated in millimetres.

PRICE: £7 6 6

M.2082 Rain gauge, 8 in. "Snowdon" pattern. Specification as above, but the outer case is parallel without a splayed base; with measure as Fig. **M.2102** (page 40).

PRICE: £6 4 6



DIMENSIONS: 1 ft. 9½ in. × 1 ft. 1½ in. diameter.

WEIGHT: 9 lb.

M.2083 RAIN GAUGE, BRITISH METEOROLOGICAL OFFICE SPECIFICATION. Constructed of stout copper, funnel surmounted with a turned brass rim 5 in. diameter. Outer case with splayed base; inner can with wire rim, lip, and brass drop handle; measure, taper form, as **M.2094** (page 40), graduated in inches.

PRICE: £4 9 6

M.2084 Ditto, with measure graduated in millimetres.

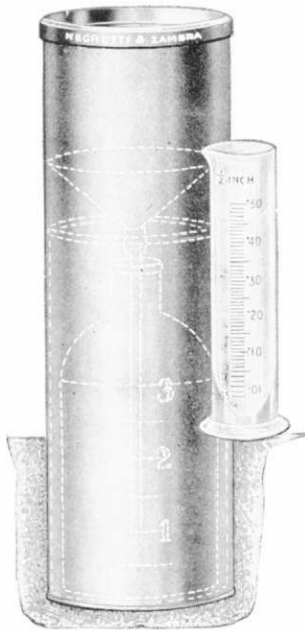
PRICE: £4 9 6

Meteorological Office Certificate 12 6

DIMENSIONS: 1 ft. 7½ in. × 8½ in. diameter.

WEIGHT: 8 lb.

● Rain Gauges



M.2085 RAIN GAUGE, 5 in. "Snowdon" Pattern.

The specification of this rain gauge is similar to the foregoing, except that the outer case is parallel without a splayed base. There is provided a glass bottle graduated in $\frac{1}{2}$ in. of rainfall. The graduated measure is of the "Camden" type shown under Fig. M.2097 on page 40, with lip and foot. Constructed of copper.

PRICE: £3 8 6

M.2086 Ditto, in galvanised iron.

£3 1 6

Meteorological Office Certificate 12 6

Dimensions 1ft. 4 $\frac{1}{2}$ in. \times 5 $\frac{1}{4}$ in.

Weight: 4 lb.

M.2088 RAIN GAUGE, "Bradford" Pattern. Capacity 18 in.; funnel of the "Snowdon" type, made of galvanised iron with turned brass rim 5 in. diameter; outer case of galvanised iron, inner can of zinc with wire rim, dished cover and brass drop handle. Dip rod of cedar, graduated 18 in. in .1 in. Measure graduated 1 in. in subdivisions of .01 in.

PRICE £6 12 6

M.2089 Ditto, in stout copper £7 4 6

DIMENSIONS: 2 ft. 6 in. \times 5 $\frac{1}{4}$ in.

WEIGHT 7 lb.

M.2090 RAIN GAUGE, "Mountain" Pattern.

Capacity 27". Specification as above.

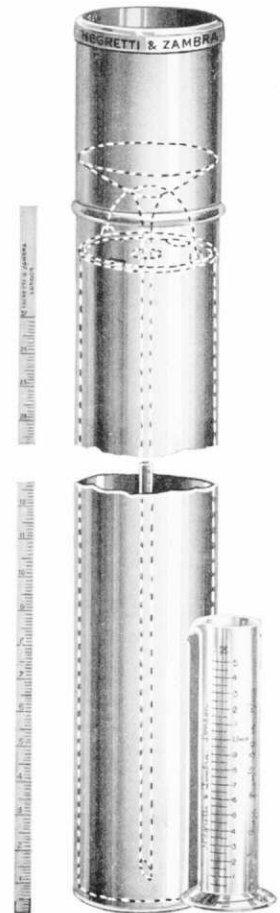
Graduated measure to 1 $\frac{1}{2}$ " in Subdivisions of .05". PRICE £8 9 0

M.2091 Ditto, in copper £9 5 0

Meteorological Office Certificate 12 6

DIMENSIONS 3 ft. 6 in. \times 5 $\frac{1}{4}$ in.

WEIGHT 30 lb.



Rain Gauges ●

M.2089A RAIN GAUGE "OCTOPENT" PATTERN.

Capacity of inner can 27 in., for weekly or monthly observations, with turned brass rim 5 in. diameter, outer body of sheet copper, with splayed base firmly fixing into the ground, and with copper inner can. A dip rod of cedar is included, and also a frost protector that obviates damage if the water becomes frozen. Measure **M.2099** in inches.

PRICE ON REQUEST

M.2089B Ditto, but with measure in millimetres.

PRICE ON REQUEST

DIMENSIONS : 2 ft. 3 in. × 1 ft. 1¼ in.

WEIGHT : 7 lb.

M.2092 RAIN GAUGE, dial type, indicates on a dial the number of hundredths of an inch of rainfall, passing the gauge since the last observation. Funnel of copper with brass rims 8 in. square, outer case of copper, with glass front and setting hand.



The mechanism consists of a bucket with open end divided into two parts and pivoted about its central point; this bucket tilts when .01 in. of rain has been collected, and an escapement advances over a toothed wheel and the index hand moves over a dial at each step. The dial is graduated in divisions of .01 in. up to 1 in. with a smaller dial to 10 in.

PRICE : £17 10 0

M.2092A Ditto, indicating up to 200 inches for tropical use.

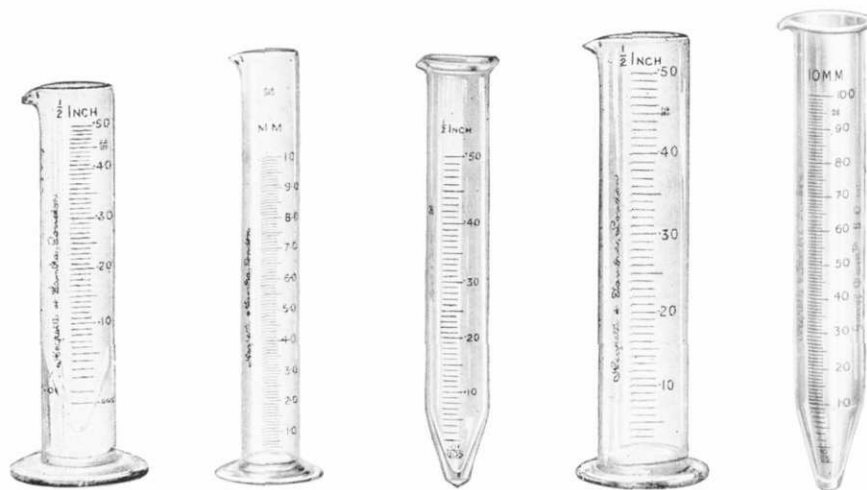
PRICE : £22 10 0

DIMENSIONS : 10 in. × 8 in. × 8 in.

WEIGHT : 6¼ lb.



● *Rain Gauge Measures*



M.2097 M.2098 M.2094 M.2102 M.2095

RAIN GAUGE MEASURES, Meteorological Office pattern with long taper at the lower end and stout rim for pouring and holding.

M.2093	For 5 in. gauge, graduated in millimetres	. . . . .	£1 3 6
M.2094	For 5 in. gauge, graduated in inches	. . . . .	£1 2 0
M.2095	For 8 in. gauge, graduated in millimetres	. . . . .	£1 9 0
M.2096	For 8 in. gauge, graduated in inches	. . . . .	£1 7 6

RAIN GAUGE MEASURES WITH FOOT AND LIP

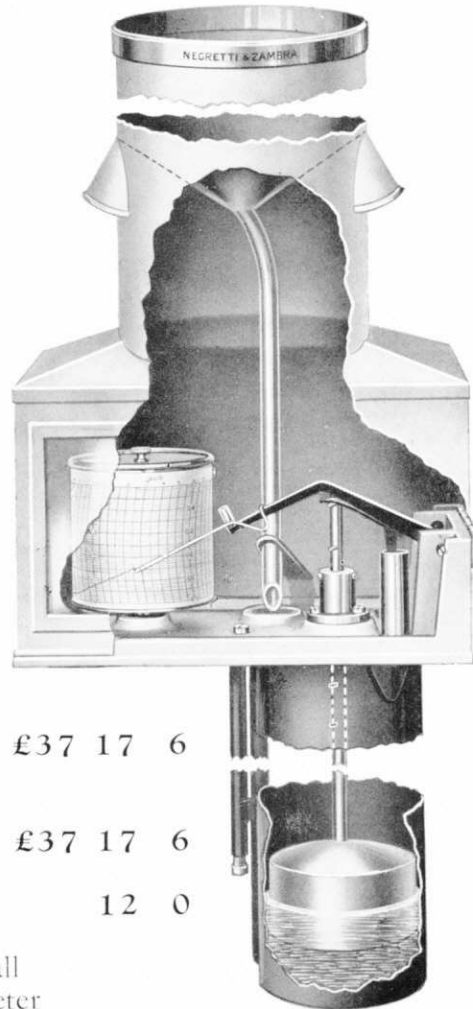
M.2097	For 5 in. gauge, graduated in inches, "Camden" pattern, taper showing the first .005 in.	. . . . .	16 6
M.2097A	ditto with back lines (essential when certification is required)	. . . . .	£1 0 0
M.2098	For 5 in. gauge, graduated in millimetres	. . . . .	16 6
M.2099	For 5 in. gauge, to hold 1 in.	. . . . .	£1 1 0
M.2100	For 5 in. gauge, to hold 1½ in.	. . . . .	18 0
M.2101	For 12.5 cm. gauge, graduated in millimetres	. . . . .	16 6
M.2102	For 8 in. gauge, graduated in inches	. . . . .	17 6
M.2103	For 8 in. gauge, graduated in millimetres	. . . . .	16 6
M.2104	For 20 cm. gauge, graduated in millimetres	. . . . .	£1 1 0
	Meteorological Office Certificate	. . . . .	2 6
	Excepting Nos. M.2099, M.2100	. . . . .	3 0

Recording Rain Gauges ●

THE “HYETOGRAPH” gives a record of duration and intensity of rainfall.

From a 6 in. diameter funnel the rain is led through a pipe to a float chamber. A rod attached to the float lifts the pen arm through a stud and pallet device. When the pen reaches the top of the chart, viz., 0.5 in. rainfall, the pallet disengages with the stud and the pen arm falls to the bottom of the chart. The pallet then engages with the next stud, and this operation is continuous until the container is full, viz., 4 in. of rainfall. When the float rod is depressed by hand, a syphon tube rapidly empties the gauge.

The baseplate is of cast iron, aluminium painted to prevent corrosion; cover of galvanised iron with glass front; funnel with turned brass ring, float chamber and float of copper.



M.2105 English Scale, with bottle of ink and 100 charts £37 17 6

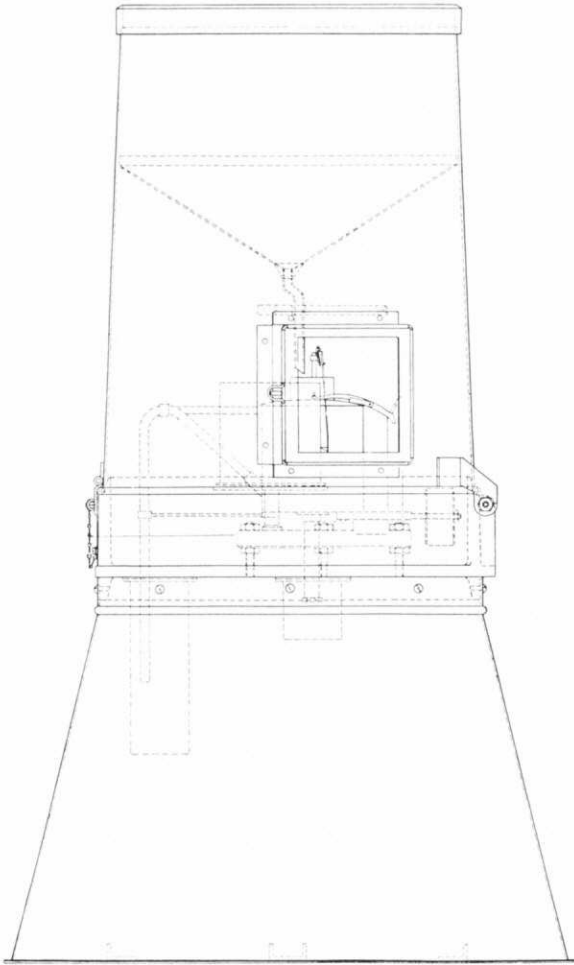
M.2106 Ditto, metric scale, with ink and 100 charts £37 17 6

Charts—on special paper, per 100 12 0

- Maximum Capacity 4 in. of rainfall
- Funnel 6 in. in diameter
- Float 4 in. in diameter
- Pen Travel 3 in. = $\frac{1}{2}$ in. of rainfall
- Daily Drum (8 day clock).
Time Scale 0.45 in. per hour
- Depth in the ground 12 in.
- Height above ground 18 in.
- WEIGHT 57 lb.

N.B. All rain gauge charts are printed on special paper which has practically no alteration due to changes in humidity.

● *Recording Rain Gauges*



M. 2106A DINES TILTING SYPHON RAIN GAUGE to British Meteorological Office Specification. With funnel 11.31 in. diameter and of the usual form.

The float chamber is in the form of a tilting container held in its normal position by means of a trigger and catch.

The rain water entering the chamber lifts the float which also carries the recording pen.

When 5 mm. (or 0.20 in.) of rain has been recorded, the trigger is released from the catch and the float chamber tilts, causing the water to syphon out. The pen is automatically held off the chart until the syphoning is completed, and the chamber has been returned to its normal position by a counter-balance weight.

The instrument is strongly constructed throughout and is supported on a splayed base built up on a circular gun-metal casting, which is sunk into the ground.

With bottle of ink and 100 charts PRICE ON APPLICATION

- Capacity Unlimited.
- Funnel 11.31 in. diameter.
- Pen Travel 10 mm. = 1 mm. of rainfall.
- Daily drum (8-day clock) Time Scale 11.4 mm. per hour.
- Overall height 33 1/4 in.

WEIGHT : 62 lb.



Recording Rain Gauges ●

THE "SURVEY" GAUGE is mounted on a substantial cast iron base, containing a float chamber.

As the rain rises in the float chamber, a float causes a heart-shaped cam to rotate by means of a rack and pinion device. The rotation of the cam causes the pen to move up and down the chart, giving an uninterrupted record. The float chamber capacity 10 in. of rain, is readily emptied by a drain cock in the base of the instrument.

Should the capacity of the gauge be exceeded, the surplus rain overflows into a reservoir; capacity 12 in. of rain at the base of the instrument. The projection of the vertical rod is an indication when it is necessary to drain out the gauge.

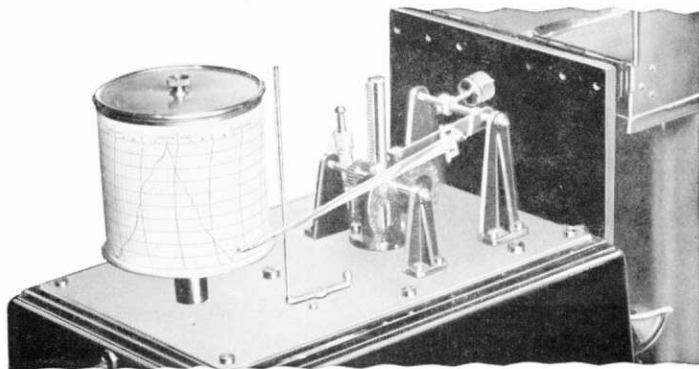
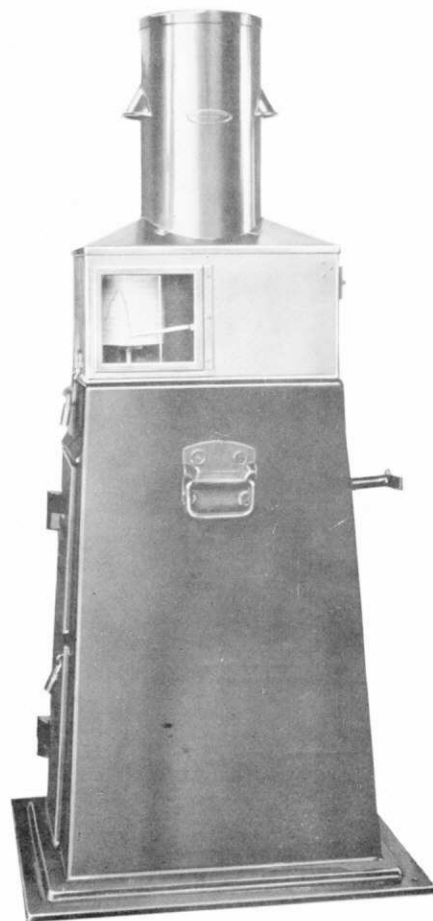
M.3000 English Scale . PRICE ON APPLICATION

M.3001 Metric Scale . PRICE ON APPLICATION

Maximum Capacity: 10 in. (245 mm.) of rainfall, plus 12 in. (305 mm.) into overflow tank.

Funnel 6 in. (152.4 mm.) diameter

Pen Travel . 3 in. = 1 in. (3 mm. = 1 mm.) of rainfall



Daily Chart (8-day clock)
Time Scale. 0.45 in.
(10.43 mm.) per hour.
Weekly Chart (8-day
clock) Time Scale.
1.54 in. (39 mm.)
per day.

DIMENSIONS :
3 ft. 6 in. × 1 ft. 7 in. ×
1 ft. 4 in.

WEIGHT :
154 lb.

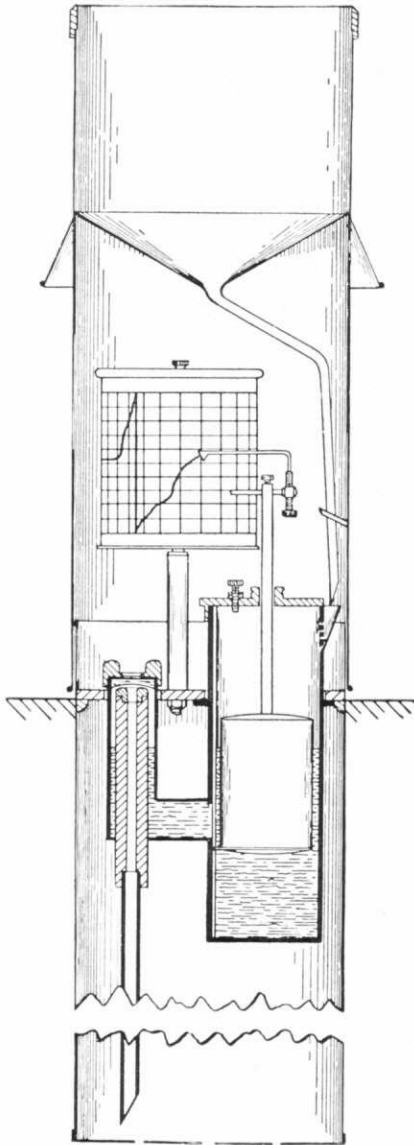
● *Recording Rain Gauges*

“NATURAL SYPHON” GAUGE. Automatically syphons after each 0.5 in. of rainfall.

The rain is collected in a 6 in. diameter funnel and is led through a pipe to a float chamber, where it is recorded by a float mechanism. As the float rises, the pen attached to the float rod traces the record on a clock-driven chart. When the pen reaches the top of the chart for 0.5 in. of rainfall, the syphon automatically comes into action and discharges the gauge rapidly. The pen falls to the bottom of the chart and the cycle is repeated.

The gauge is constructed of galvanised metal, aluminium painted to prevent corrosion. The cover is surmounted by a funnel of the “Snowdon” type, with 6 in. diameter turned brass ring.

The charts are printed on special waterproof paper which has practically no alteration due to changes in humidity.



M.2107 With pen, ink and 100 charts on special paper.

English Scale £37 17 6

M.2108 Ditto, metric scale £37 17 6

Charts, on special paper, per 100 12 0

Capacity Unlimited

Funnel 6 in. diameter

Float 2 in. diameter

Pen Travel 3 in. = ½ in. of rainfall

Daily Drum (8-day clock)

Time Scale 0.45 in. per hour

Depth in the ground 15 in.

Height above ground 15 in.

WEIGHT: 40 lb.



Recording Rain Gauges ●

“TILTING BUCKET” Recording Rain Gauge.
Records rainfall in increments of 1/100 in.

The rain is led to a bucket with open ends, divided into two compartments, and pivoted about its central point; it tilts over when .01 in. of rainfall has been collected.

An escapement advances a toothed wheel to which is attached a profile cam; resting on this cam is a brass roller attached to the pen arm, which is thus raised step by step for each .01 in. of rainfall up to 1 in.; the roller then trips off the cam and the pen returns to the zero of the chart; an oil-filled dashpot damps the fall. Attached to the escapement wheel is a dial graduated to 1 in. in sub-divisions of .01 in.

Cover of sheet metal and base plate of cast iron, with bottle of ink and 100 charts.

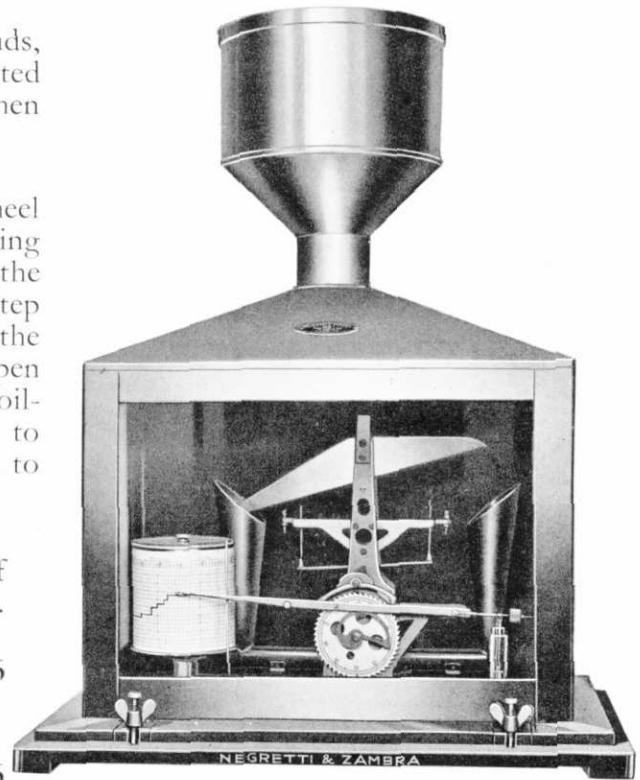
M.2110 English Scale . £64 7 6

M.2111 Metric Scale to 25 mm.
£64 7 6

Ditto, Tropical Pattern, with cover and funnel of copper, polished or enamelled; cast brass base plate; various parts of the mechanism sand-blasted and lacquered and windows sand-blasted inside.

M.2111A English Scale . £71 7 6

M.2111B Metric Scale to 25 mm.
£71 7 6



Capacity . . . Unlimited
Funnel . . . 8 in. diameter
Pen Travel . . . 3 in. = 1 in. of rainfall
Daily Drum (8-day
clock) Time Scale 0.45 in. per hour
Weekly Drum
Time Scale 1.54 in. per day
Overall height. . . 28 in.
Dimensions: 2ft. 4in. × 1ft. 9in. × 1ft. 2in.

WEIGHT: 33 lb.

● *Evaporation Gauges*

M.2113

M.2113 PICHE'S EVAPORIMETER. A glass tube about 9 in. long \times 0.6 in. diameter is graduated in ccm. A metal clip holds a disc of porous paper, from which the water in the tube evaporates, and the alteration of level indicates the degree of evaporation.

PRICE: 19 0

M.2114 Box of 150 Discs PRICE: 2 0

M.2115 EVAPORIMETER. A copper vessel with 8 in. or 20 cm. diameter turned brass rim is fitted with a wire guard to prevent animals from interfering with the water.

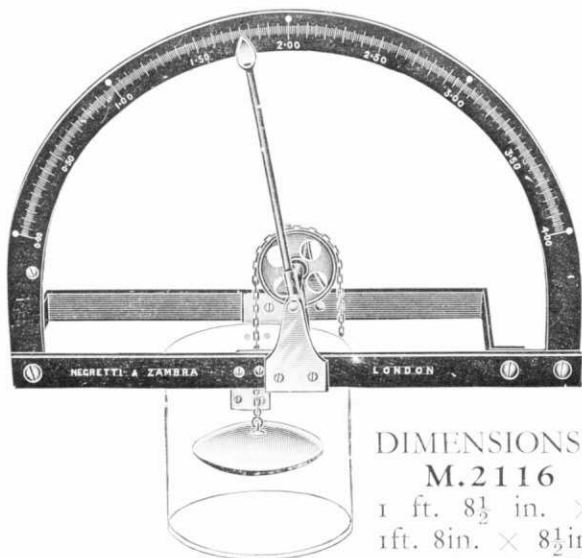
A glass measure is graduated in .01 in. or .1 mm. in relation to the brass rim, and is used for measuring the water in the gauge.

PRICE: £3 3 0



M.2116 "INDEX" EVAPORATION GAUGE. A copper float rises and falls in a copper cylinder, which acts as a still water chamber. A brass chain attached to the float operates a brass wheel and turns an index hand attached to the axis; the float is correctly counterpoised. The index hand moves over an arc $9\frac{1}{2}$ in. radius; the scale of 0 to 4.00 in. subdivided to .02 in. is engraved on a brass strip attached to the iron frame. The wrought iron frame is designed to fit on the corner of the recognised tank.

PRICE: £24 10 0



DIMENSIONS :
M.2116
 1 ft. $8\frac{1}{2}$ in. \times
 1ft. 8in. \times $8\frac{1}{2}$ in.
 WEIGHT 10lb.

M.2117 TANK, of galvanised iron, $\frac{1}{8}$ in. thick, measuring 6 ft. \times 6 ft. \times 2 ft., with braced ends and still water chamber.

PRICE ON REQUEST

Sunshine Recorders ●

The instruments for recording bright sunshine are :—

“ CAMPBELL-STOKES ” RECORDER, where the sun’s rays are focused by means of a glass sphere upon prepared and printed cardboard strips.

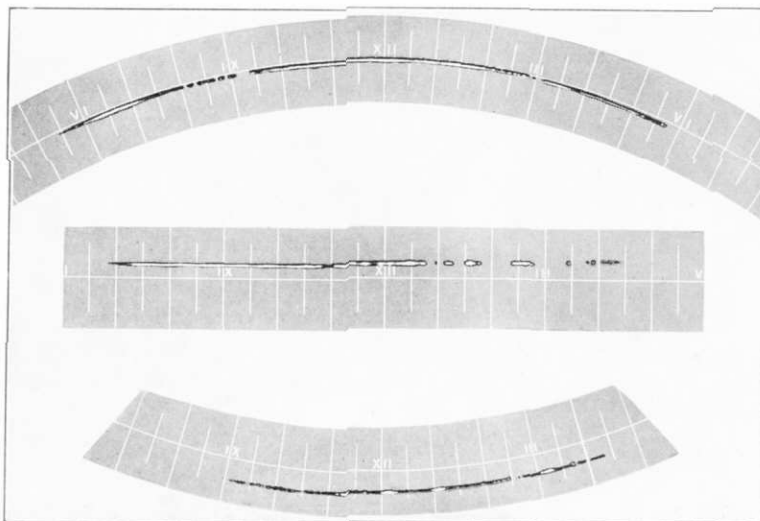
“ JORDAN ” RECORDER, where the sunlight enters a hole in a light-tight circular box, and leaves a trace on a specially prepared sensitised chart.

In order that all returns of sunshine should be absolutely comparable, the Campbell-Stokes recorder has been adopted as Standard by such authorities as the British Meteorological Office, the Canadian Meteorological Service, the Union of South Africa, and most of the British Colonies.

THE SETTING UP of a sunshine recorder is all-important for accurate records :—

- (a) The base must be perfectly level.
- (b) The frame carrying the charts must be tilted and clamped to the correct latitude of the place of observation.
- (c) The instrument must be correctly in the meridian of the station.

INSTRUCTIONS FOR SETTING either by compass (making due allowance for magnetic deviation) or by the clock (allowing for the equation of time) are published in most text-books.



●
SPECIMEN
TRACES
OF
CARDS
OF
CAMPBELL-
STOKES
RECORDER
●

● *Sunshine Recorders*



M.2119 CAMPBELL-STOKES PATTERN

For latitudes 0° to 45°
or 45° to 65°

The instrument consists of base-plate, standard, semi-circular arc, brass casting for holding the recording cards generally known as the bowl, and a glass sphere.

The base is a heavy polished slate slab.

The standard is a brass upright, with plate and clamp for fixing the arc at the correct latitude.

The semi-circular arc, which carries a graduated scale of latitudes, has bosses at each end accurately drilled and tapped to take the securing bolts and locking nuts for the sphere.

The bowl is machined with three concentric grooves to take the three patterns of cards, as follows:—

Equinoctial (Straight)	. . .	width 1.56 in.
Summer (Long Curve)	. . .	width 1.26 in.
Winter (Short Curve)	. . .	width 1.26 in.

The edge of the bowl should be cut so that when it is adjusted for its mean latitude, the plane of the cut shall be approximately horizontal. The sphere is of well-annealed glass, refractive index 1.512. Focal length 2.95 in.

DIAMETER : 4 in. WEIGHT : 26 lb. PRICE : £32 17 6

Sunshine Recorders ●

Note: WHEN ORDERING SUNSHINE RECORDERS
THE LATITUDE SHOULD ALWAYS BE STATED

M.2120 CAMPBELL-STOKES SUNSHINE RECORDER

BRITISH M.O. PATTERN FOR USE
IN TEMPERATE LATITUDES :
45° to 65°

Provided with a scale and an adjustment enabling it to be set correctly for any latitude between these limits.



The glass sphere is supported on a pillar with a cupped top and capable of such adjustment as may be required to bring the sphere truly central with respect to the bowl. The sphere is of well-annealed glass, refractive index 1.512, focal length 2.95 in., diameter 4 in. The instrument is built up on a gun-metal sub-base fitted with three levelling screws, which are in turn located on a substantial gun-metal casting.

PRICE: £33 11 0

M.2121 CAMPBELL-STOKES Sunshine Recorder, Tropical Pattern. Suitable for use in latitudes between 5° North and 45° South, or 5° South and 45° North.

Similar to above except with respect to the mounting of the sphere. Two brass caps are screwed in holes accurately drilled diametrically opposite to each other in the glass sphere, and two adjustable pivots, fitted at the ends of the semi-circular supporting frame, engage in tapered holes in the caps.

PRICE: £38 5 0

M.2122 A supply of cards lasting one year consists of 150 Long Curve, 150 Short Curve, and 100 Straight.

£2 10 0

M.2123 A template of celluloid for totalling the trace.

2 6

M.2124 Glass sphere to standard specification
Drilling extra

£11 12 6

17 0

● *Sunshine Recorders*

M.2127 JORDAN PHOTOGRAPHIC
SUNSHINE RECORDER



This is a simple instrument mounted on a cast iron base with pivot and clamp for latitude. The ivory scale is graduated from $20/70^{\circ}$ and a clamping spanner is provided. The cylinder has a pin hole on the east and on the west, and the sunlight entering the holes leaves a trace on the sensitised chart fitted in the cylinder.

The chart, which is printed for a.m. and p.m. records, is coated with a special solution of sensitivity sufficient to record the sun's rays but not to fog the rest of the chart.

The record is a narrow band of dark blue and is fixed by rinsing the chart in water. The trace is tabulated after the chart is rinsed.

PRICE: £6 18 0

M.2128 SENSITISED CHARTS, per 100 9 6

DIMENSIONS : $4\frac{1}{2}$ in. \times $4\frac{1}{2}$ in. \times 7 in.

WEIGHT : 3 lb.



Nephoscopes ●

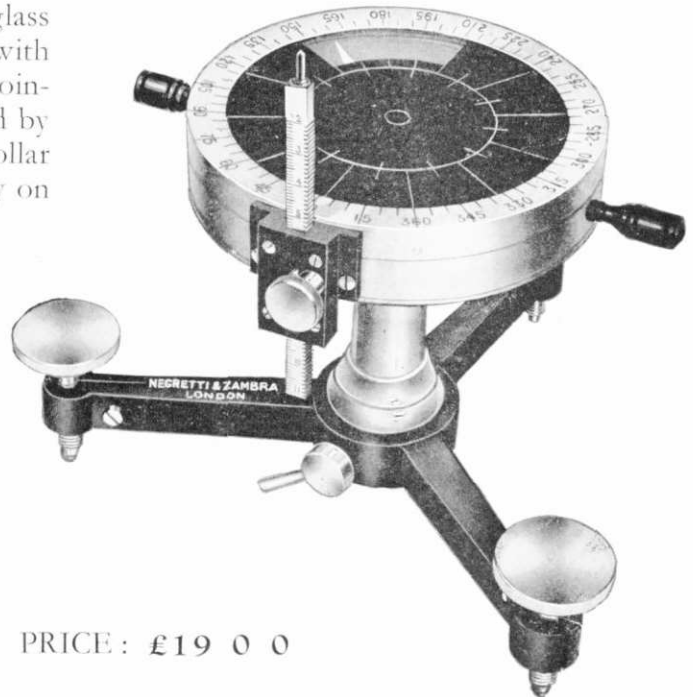
M.2133 FINEMANN NEPHOSCOPE

For determining the direction of drift of clouds and their velocity-height ratio.

This consists of a disc of black glass mounted on a tripod stand fitted with three levelling screws. A vertical pointer, which can be raised or lowered by rack and pinion, is attached to a collar which can be rotated independently on the mirror.

A scale of millimetres engraved on the edge of the pointer gives the height of the tip above the glass surface.

The black glass disc is engraved with concentric circles and radii. The case is of stout wood with hinged cover, in which are fixed three brass plates on which the instrument can be used.



PRICE : £19 0 0

M.2134 BESSON NEPHOSCOPE for direct vision, with 3 ft. metal "comb" mounted on a tall rotatable upright.

The upright is of brass rod about 7 ft. 6 in. long, mounted by means of rings and clamps to a post in such a way that it may rotate freely. The cross-piece is about 3½ ft. long furnished with six equidistant vertical spikes.

PRICE ON REQUEST.

● *Standard Thermometers*

The equipment of a normal station, in addition to a mercury barometer, rain gauge and sunshine recorder, includes the following thermometers :

Dry Bulb Thermometer	} In Stevenson's Screen
Wet Bulb Thermometer	
Maximum Thermometer	
Minimum Thermometer	
Grass Minimum Thermometer	
Earth Thermometers.	

“The accurate measurement of the temperature of the air in the open is one of the most difficult of all meteorological measurements, for it is so readily affected by effects of radiation. Radiation from the sun, the clouds, the sky, the ground and surrounding objects passes in straight lines through the air without appreciably affecting its temperature, for air is very transparent to radiant heat, especially if it is dry.

But the instrument that is used to measure the temperature of the air is some kind of thermometer, and is made of material which intercepts radiant heat to an appreciable extent. In consequence the reading of the instrument may differ from that corresponding with true air temperature by an amount up to 50°F., or even more.

Such differences depend partly upon the nature of the thermometer, partly upon the amounts of the different kinds of radiation experienced, and partly upon the wind velocity and other extraneous factors. The reading of a thermometer freely exposed in the open may thus bear no determinable relation to the temperature of the particles of air in which it is placed.

It is usual, therefore, to provide some form of thermometer shelter or “screen,” which will serve to support the thermometers and to protect them from the weather and accidental damage, and at the same time shield them from radiation without impairing the free passage of air over the bulbs of the thermometers.” *

THE STEVENSON SCREEN should be erected 4 ft. above the ground, preferably over a grass plot and with the door facing due north (south in Southern Hemisphere) or even somewhat east or north, so that the sun may not shine on the instruments.

* “THE DICTIONARY OF APPLIED PHYSICS.”
METEOROLOGICAL INSTRUMENTS—by R. CORLESS, O.B.E., M.A.



Thermometer Comparison Table ●

The table on the right shows the comparison between the three temperature scales most commonly in use. The Centigrade scale takes the freezing point of water as 0°C. and the boiling point of water as 100°C. at sea level in latitude 45°.

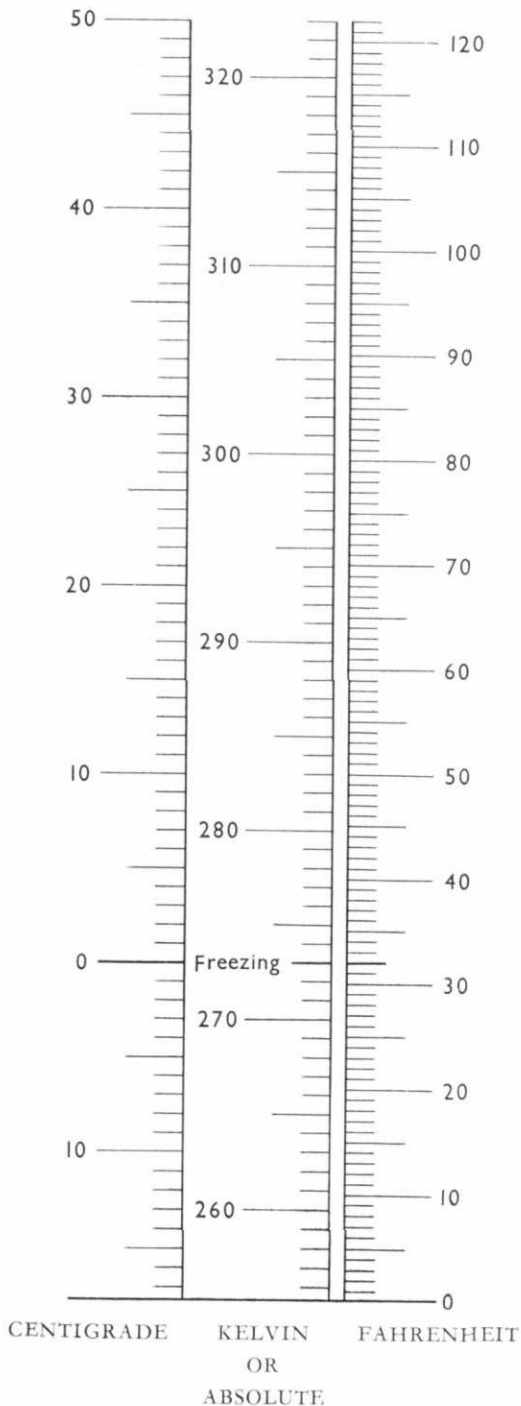
The Fahrenheit scale, with 32°F., and 212°F., as the freezing and boiling points respectively. With both of these scales it is frequently necessary to refer to degrees of cold which are far below zero, thus giving a negative value. In these cases the Kelvin or absolute scale is employed where zero is the lowest temperature conceivable according to the Kinetic theory, i.e., 273°C.

In the Kelvin scale water freezes at 273°K., and boils at 373°K., from which it will be observed that Centigrade and Kelvin degrees are equally spaced, and that Centigrade can be converted into Kelvin merely by adding 273 degrees. In order to convert Fahrenheit to Centigrade the following formula is used :

$$\frac{5}{9} (\text{°F.} - 32) = \text{°C.}$$

and in order to convert Centigrade to Fahrenheit :

$$\frac{9}{5} (\text{°C.}) + 32 = \text{°F.}$$



● *Glass Thermometers*



M.2135 STANDARD MAXIMUM THERMOMETER, British M.O. pattern, to B.S.I. specification 692-1936. Tube protected by an outer glass sheath. Length 13½ in. Bulb of normal glass; stem of British lead glass. Range 0/130°F., or 15/145°F., divided single degrees, figured every 10 degrees. PRICE: £2 5 3

N.P.L. Certificate 0/130°F. 4 0

N.P.L. Certificate 15/145°F. 6 0

M.2135A Ditto, Canadian pattern -40/+110°F. £2 8 6

N.P.L. Certificate £1 0 0



M.2136 STANDARD MINIMUM THERMOMETER, British M.O. pattern, to specification as above, tube filled with rectified spirits of wine, and fitted with a floating index. Range -30/+100°F., or -10/+120°F. Safety cavity to 150°F.

PRICE: £2 5 3

N.P.L. Certificate 4 0

M.2136A Ditto, Canadian pattern -80/110°F. £2 8 6

N.P.L. Certificate £1 10 0

For Ordinary Thermometers of this type, see page 60.

For Wet and Dry Bulb Thermometers of this type, see page 77.



M.2137 STANDARD MAXIMUM THERMOMETER, specification and ranges as **M.2135** above, mounted on mahogany stock with two brass hanging plates, centres 9½ in. apart. PRICE: £2 15 0

N.P.L. Certificate 0/130°F. 4 0

N.P.L. Certificate 15/145°F. 6 0



M.2138 STANDARD MINIMUM THERMOMETER, specification and ranges as **M.2136** above, mounted on mahogany stock with two brass hanging plates, centres 9½ in. apart. PRICE: £2 15 0

(NOTE: The range of **M.2137** 8 used in Australia is 0/140°F.)

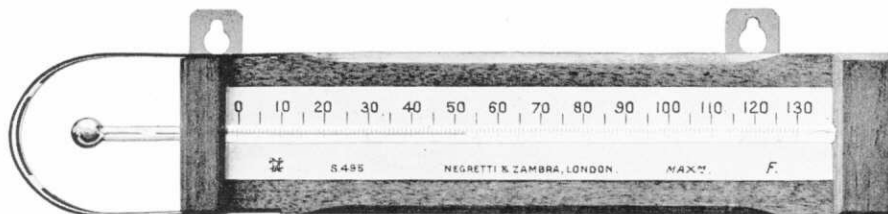
N.P.L. Certificate 4 0

ANY OF THE ABOVE THERMOMETERS CAN BE SUPPLIED WITH EQUIVALENT RANGE IN °C.

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.



Glass Thermometers ●



M.2139 STANDARD MAXIMUM REGISTERING THERMOMETER. Tube 12 in. long, fitted with opal glass scale in mahogany mount; bulb protected by brass guard, overall length 13½ in.; bulb of normal glass, stem of British lead glass fitted with maximum constriction. Range 0/130°F., divided on stem in single degrees, figured every 10 degrees on scale. Mount fitted with two brass hanging plates 8½ in. apart.

PRICE: £3 1 9

N.P.L. Certificate: 3 6

M.2140 Ditto, -15/+55°C. £3 1 9

N.P.L. Certificate: 3 6

M.2141 Ditto, Low range -40/+120°F. £3 7 0

N.P.L. Certificate: £1 0 0

M.2142 Ditto, Tropical Range 25/150°F., or -5/+65°C. £3 1 9

N.P.L. Certificate: 5 6



M.2143 STANDARD MINIMUM REGISTERING THERMOMETER. Specification as above. Stem filled with rectified spirits of wine, and fitted with floating index. Range -20/+110°F.

PRICE: £2 16 3

N.P.L. Certificate: 3 6

M.2144 Ditto, -30/+45°C. £2 16 3

N.P.L. Certificate: 3 6

M.2145 Ditto, Low range -70/+110°F. £3 1 9

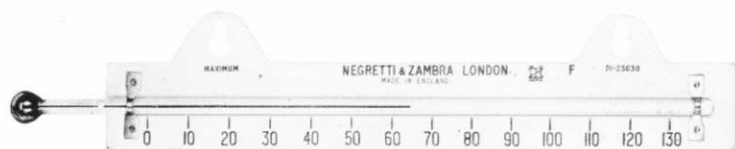
N.P.L. Certificate: £1 10 0

M.2146 Ditto, Tropical. Range -5/+130°F. or -20/+55°C. £2 16 3

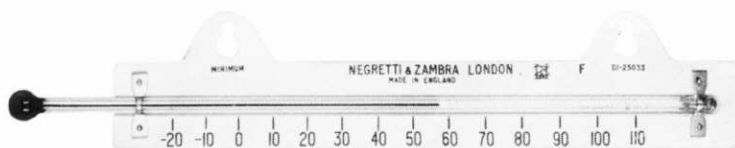
N.P.L. Certificate: 3 6

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.

● *Glass Thermometers*



- M.2147 STANDARD MAXIMUM THERMOMETER. Tube 10¼ in. long and with white enamelled steel plates. Range 0/130°F. £1 7 6
- M.2148 Ditto, -15/+55°C. £1 7 6



- M.2149 STANDARD MINIMUM THERMOMETER, as above. Range -20/+110°F. £1 7 6
- M.2150 Ditto, -30/+45°C. £1 7 6



- M.2151 MINIMUM THERMOMETER, TERRESTRIAL RADIATION (or grass Minimum) THERMOMETERS, British M.O. pattern to B.S.I. Specification 692-1936. Length 13½ in. with outer glass sheath. Range -30/+100°F. or -10/+120°F., divided on the stem in single degrees, and figured every 10 degrees. Safety cavity to 150°F. £2 5 3
- M.2152 Ditto, -35/+40°C. £2 5 3



- M.2153 Ditto, with bulb blown in the shape of a link to give a larger surface of exposure. Range -30/+100°F., or -10/+120°F. £2 9 6
- M.2154 Ditto, -35/+40°C. £2 9 6

- M.2154A TERRESTRIAL RADIATION MAXIMUM THERMOMETER, with outer glass sheath, length 13½ in., black bulb. Range 20/200°F. Similar to M.2135 £2 12 6

- National Physical Laboratory Certificate for any of the Thermometers on this page with the exceptions of M.2152 and M.2154A 3 6
- M.2152 4 0
- M.2154A 6 0

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.

Glass Thermometers ●



M.2155 SOLAR RADIATION THERMOMETER. Maximum registering thermometer, with bulb and 1 in. of stem coated with dull lamp black enclosed in a glass sheath completely exhausted of air. Length 15 in., bulb of normal glass. Range 20/200°F., divided on the stem and figured every 10 degrees. PRICE : £3 3 6

M.2156 Ditto, -5/+95°C. PRICE : £3 3 6

M.2157 Ditto, fitted with small U-tube gauge to show that the vacuum in the sheath is maintained. PRICE : £3 14 6

National Physical Laboratory Certificate for above thermometers : for corrections to the thermometer before being sheathed. PRICE : 5 6

M.2158 ACTINOMETER (MARIE DAVY). An actinometer is used for ascertaining approximately the quantity of heat which the earth receives from the sun, and consists of a

pair of thermometers mounted in an hermetically sealed sheath, one bulb being left bright and the other coated with lamp black. Range 20/200°F., mounted on a base of polished hard-wood, with holes for the thermometers.

PRICE : £6 18 6

M.2159 Ditto, -5/+95°C. PRICE : £6 18 6

M.2160 ACTINOMETER THERMOMETER, bright or black bulb as above.

PRICE : £2 9 6

NOTE : The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.



National Physical Laboratory Certificate for corrections before thermometer is sheathed. Each 5 6

● *Earth Thermometers*

M.2161 EARTH THERMOMETER. M.O. pattern with outer glass protecting sheath, overall length 12 in. × 0.9 in. diameter. Range: 20/100°F. Divided on the stem in single degrees, and figured every 10 degrees. The bulb is embedded in paraffin wax of melting point 120°F. A stout piece of rubber tubing with boxwood plug and brass screw-eye is securely bound round the upper end of the sheath.

PRICE: £2 12 9

M.2162 Ditto, range -5/+40°C.
N.P.L. Certificate

PRICE: £2 12 9
3 6

M.2163 Wrought Iron Tube for above, 1½ in. bore, with wooden plug at lower end, painted two coats of black enamel, japanned copper cover and brass chain.

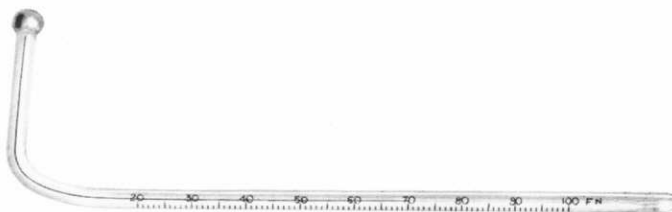
1 ft.	2 ft.	4 ft.	6 ft.	12 ft.
£1 13 0	£1 15 6	£2 6 0	£2 17 6	£4 7 6

M.2164 Steel Tube, M.O. pattern, 1¼ in. bore, with solid steel cone at lower end; 3 in. diameter flange, copper cap and brass chain. Painted two coats of red lead paint and one coat of black enamel.

1 ft.	4 ft.
£4 8 0	£4 19 0

M.2165 RIGHT ANGLE EARTH THERMOMETER, British M.O. Specification. Range 20/100°F. 8 in. scale, divided on stem in single degrees and figured every ten degrees

Mk. 1A 4 in. stem.
Mk. 1B 8 in. stem.
Mk. 1C 2 in. stem.



PRICE: £1 2 0

N.P.L. Certificate 4 6

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.



Earth Thermometers ●

M.2166 MAXIMUM AND MINIMUM EARTH THERMOMETERS

Six's pattern. Range 10/120°F., divided on the stem and mounted on a turned boxwood stick, with brass rings top and bottom, and rubber protecting ring. Length overall, 11½ in., diameter, 1⅛ in.

PRICE: £3 0 0

M.2167 Ditto, range -10/+50°C. N.P.L. Certificate

PRICE: £3 0 0
7 0

EARTH THERMOMETERS

(Enclosed scale type) scale portion 12 in. long × ¾ in. diameter with opal glass scale. Range -5/+130°F. divided in single degrees or -20/+60°C. divided in half degrees. With stem lengths for the following depths:

M.2168A for Surface Temperatures and 5 c.m. depth.

PRICE: £2 12 0

M.2168B for 10 c.m. depth £2 13 0

M.2168C for 15 and 20 c.m. depth £2 14 6

M.2168D for 30 and 40 c.m. depth £2 17 6

M.2168E for 50 c.m. depth £3 0 0

M.2168F for 100 c.m. depth £3 5 0

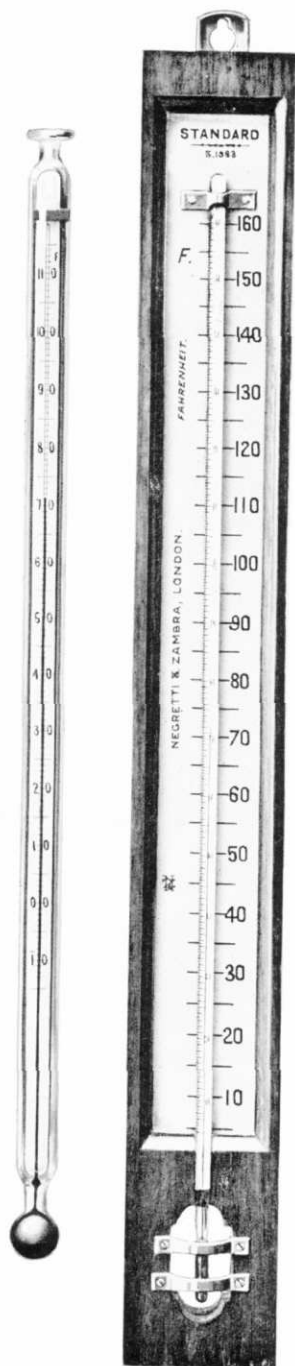
M.2168G BRACKET for the above, constructed of mild steel, rust-proofed and finished black enamel Each 18 9

M.2168B
AND
M.2168G

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.



● *Glass Thermometers*



STANDARD THERMOMETER, 21 in. long, with finest quality annealed tube divided on stem. Opal glass scale on which the divisions and figures are permanently fired. Mounted on polished mahogany frame.

RANGES

TYPE	RANGE	SUB-DIVIDED TO	EACH	WITH N.P.L. CERTIFICATE EXTRA
M.2170	-30/120°F.	0.2°	£6 11 9	£1 0 0
M.2171	+10/160°F.	0.2°	£6 9 0	15 0
M.2172	+30/250°F.	0.5°	£6 19 0	£1 0 0
M.2173	-30/50°C.	0.1°	£6 11 9	4 6
M.2174	-10/70°C.	0.1°	£6 9 0	15 0
M.2175	0/120°C.	0.2°	£6 19 0	£1 0 0

ORDINARY THERMOMETER, British Meteorological Office pattern to B.S.I. specification 692-1936. Tube protected by an outer glass sheath, and overall length 13½ in. Bulb of normal glass, stem of British lead glass supported inside the sheath by a ring of rubber; sheath permanently fused on to the thermometer at a point between the bulb and the lowest graduation. Divided on the stem in single degrees and figured every 10 degrees.

M.2176 Mark I. Range -15/+115°F., or 0/130°F.
PRICE: £1 15 9

National Physical Laboratory Certificate 4 0

M.2176A Ditto, Canadian pattern -40/+110°F.
PRICE: £2 0 3

National Physical Laboratory Certificate £1 0 0

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.

Glass Thermometers ●

ORDINARY THERMOMETER, British Meteorological Office pattern, Marks I, IB and IC. Tube $10\frac{3}{4}$ in. long, filled with mercury, fitted on porcelain scale plate with raised side (both) divided on the stem in single degrees and marked every 5° , figured every 10° on the raised (both) side of the porcelain scale plate.

M.2177	Mark IA. Range $-15/+115^{\circ}\text{F}$.	£1 3 9
	N.P.L. Certificate	3 6
M.2178	Mark IC. Range $-40/+85^{\circ}\text{F}$.	£1 6 9
	N.P.L. Certificate	£1 0 0
M.2179	Mark IB. Range $0/130^{\circ}\text{F}$.	£1 3 9
	N.P.L. Certificate	3 6

When required these thermometers can be supplied mounted on the white enamelled steel scale plate as the dry bulb thermometer illustrated on page 79. Prices as above.

NOTE: A pair of these thermometers, one fitted with wick and muslin, constitute the Wet and Dry Bulb Hygrometer used by the British Meteorological Office.

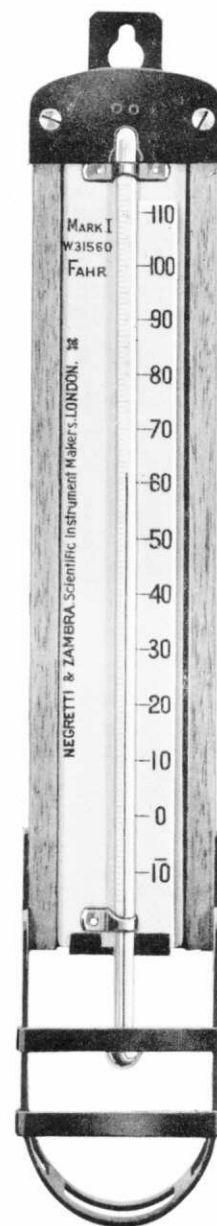
M.2180 Protector for Marine Screen Thermometer, British Meteorological Office Specification. This frame provides a support for Ordinary Thermometers as above, and is a mahogany stock fitted with brass guard and turned-up brass fitting to support the base of the porcelain scale; it has also a top fitting and a brass hanger.

£1 7 6

M.2181 Protector for Sea-Water Thermometer, British Meteorological Office Specification. This frame provides a protecting support to the above thermometers when used for sea-water observations. It resembles the above in all respects, except that in place of the guard there is a brass reservoir into which the bulb of the thermometer will dip.

£1 13 0

NOTE: The prices quoted for N.P.L. Certificates are for single instruments only. Special prices will be quoted for quantities.



M.2177 WITH
PROTECTOR
M.2180



● *Deep Sea Thermometers*

DEEP SEA THERMOMETER. The NEGRETTI & ZAMBRA original patent "Reversing" or "Turnover" pattern indicates the temperature AT THE SPOT WHERE IT IS REVERSED.

The action is that when it descends into the sea it acts as an ordinary thermometer, the mercury rising and falling according to the temperature of the stratum through which it passes. When, however, the prearranged depth is reached and a reverse motion given to the line to pull the apparatus to the surface, the column of mercury breaks automatically, and that which is cut off at the constriction or appendix remains to indicate the actual temperature at the moment of reversal at the prearranged depth.

The thermometer consists of a tube and bulb made of glass of known constants, such as Borosilicate, of a length suited to the range of scale and graduations as described later, and with two cavities, of which the lower is to accommodate surplus mercury if the thermometer is heated above the scale value. The upper cavity takes the surplus mercury when the thermometer, after reversal, passes through layers of water at a temperature higher than that at the reversal. This surplus must not fall and join the main column or it would falsify the reading, and therefore the tube is made so that it will hold the maximum amount which may expand during any one sounding. The latest type of cavity takes the form of a loop which adds great strength to the thermometer where it is most needed.

Various forms of constriction have been tried, but that which has, up to now, met with the greatest success, is in the form of an appendix which is visible in all N. & Z. deep sea thermometers. Upon reversal, the mercury starts to flow from the point of the appendix and then breaks at the point where this joins the main column. Experience shows that this form of "break" gives the most exact reproductions of readings, which is, of course, the vital point of a reversing thermometer.

The bulb and stem are protected against pressure effects up to at least three tons per square inch (470 kgms. per sq. cm.), by an outer glass sheath with mercury round the bulb to conduct changes of temperature rapidly to the thermometer.



Deep Sea Thermometers ●

THE AUXILIARY OR SIDE THERMOMETER is fitted to the latest pattern deep sea thermometers because a correct reading of the column of mercury trapped during reversal can only be obtained when read at the same temperature as when the thermometer was reversed.

The side thermometer shows the present temperature of the trapped mercury, and a correction must be applied which depends on :

- (a) The difference in temperature "T" between the side thermometer and the temperature indicated by the trapped mercury.
- (b) The volume of the trapped mercury "V."
- (c) The coefficient of apparent expansion of mercury in the glass, of which the thermometer is made "A."

With regard to (a) it is assumed that the temperature of the trapped mercury, when reversed, is as indicated by the column when read. This simplifies the calculation somewhat, and the error introduced is negligible.

(b) The volume of mercury is expressed in units of that volume which would occupy the space between two successive degree marks of the reversing thermometer. The volume which would give a reading on the reversing thermometer at 0 degrees is obtained by adding the reading in degrees if above zero, and subtracting it if below.

The thermometer is also marked with the coefficient of apparent cubical expansion of mercury in the glass of which it is made.

Taking the symbols given in (a), (b) and (c), the correction to be applied is : $T \times V \times A$.

EXAMPLE

The reversing thermometer reads . . .	12°C.
The side thermometer reads . . .	17°C.
The volume at 0°C. is	95°.
The coefficient of expansion of mercury in the glass is	1/6100 per degree C.

$$\text{The correction is } (17 - 12) \times (95 + 12) \times \frac{1}{6100}$$

$$= \frac{5 \times 107}{6100} = 0.09^\circ \text{ approx.}$$

As the reversing thermometer when read was at a higher temperature than when reversed, this correction is to be subtracted from 12°, and the temperature at reversing thus becomes 11.91°C.

● *Deep Sea Thermometers*

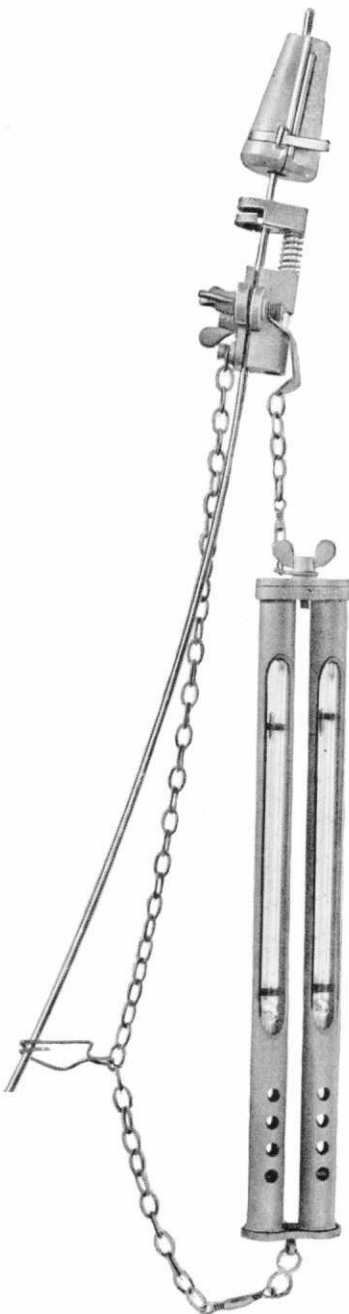
M.2185



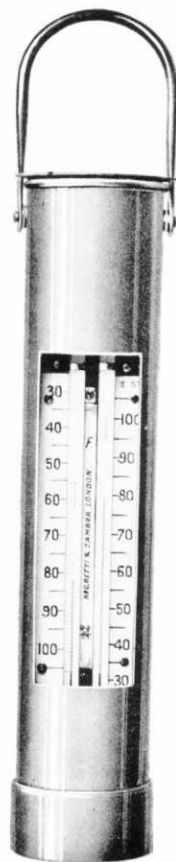
M.2182



M.2186A



M.2188



REVERSING FRAME constructed to take a pair of full-sized thermometers, consisting of two brass tubes attached by a chain to a spring release which is clamped on to the sound line or wire. A heavy brass weight or messenger

of stream-lined design runs down the line, impinges on a lever which, in turn, releases the clip holding the frame which causes the latter to turn completely over. This is the simplest, most reliable, light and yet robust form of frame.



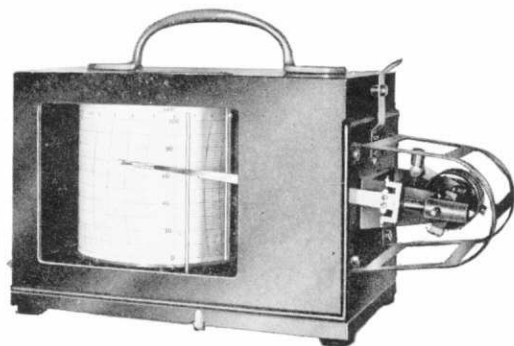
Deep Sea Thermometers ●

	M.2182	M.2183	M.2184	M.2185
Overall Length	25 cm.	32 cm.	32 cm.	32 cm.
Range of Scale	-2/+25°C.	-2/+25°C.	-2/+12°C.	-2/+30°C.
Sub-divisions	0.5°C.	0.2°C.	0.1°C.	0.2°C.
Approx. scale value of 1°C.	4 mm.	6 mm.	10 mm.	5 mm.
Correction by N.P.L. to	0.05	0.05	0.02	0.05
PRICE	£5 0 0	£7 10 0	£7 10 0	£7 10 0
N.P.L. Certificate for pressure and temperature tests	15 0	£1 0 0	£1 7 0	£1 0 0
M.2185A DEEP-SEA THERMOMETER, unprotected type for depth measurements; range -2/+30°C. divided to 0.1°C.				
				£7 10 0
				N.P.L. Temperature test certificate 17 0
				N.P.L. Pressure test certificate £6 0 0
M.2185B Ditto, range -2/+60°C. divided to 0.2°C.				
				£7 10 0
				N.P.L. Temperature test certificate 13 0
				N.P.L. Pressure test certificate £6 0 0
M.2185C THERMOMETER FOR WATER BOTTLES (Nansen-Petersen) length 320 mm., range -2/+16°C. divided to 0.1°C.				
				£4 14 0
M.2185D Ditto, length 385 mm., range -2/+32°C. divided to 0.1°C.				
				£6 3 6
				N.P.L. Certificate 12 0

FRAMES

M.2186A	REVERSING FRAME, Marine Biological improved type to take two thermometers, in stout wooden case	£13 0 0
M.2187A	Ditto, to take one thermometer	£11 0 0
NOTE: The above prices do not include thermometers.		
M.2187B	WOODEN FLOAT FRAME (loaded) which reverses on ascending, suitable for shallow depths for any of the above thermometers	£3 13 6
M.2188	Miller pattern DEEP SEA THERMOMETER, registering the maximum and minimum temperatures. Bulb protected against pressures up to 3 tons per sq. inch. Thermometer graduated +30/100°F. in single degrees. Opal glass scale, on which the figures are permanently fired. Mounted on vulcanite back in stout copper case. Complete with magnet for resetting the indices.	£8 12 6
M.2189	Ditto, range -5/+40°C., graduated in 0.5°	£8 12 6
	N.P.L. Certificate for scale error and pressure test	17 6
DIMENSIONS: 11½ in. × 2½ in. × 2¼ in. WEIGHT: 1¾ lb.		

● *Recording Thermometers*



5862 BI-METALLIC THERMOGRAPH, one of the simplest instruments for recording temperature. The mechanism consists of a bi-metallic helix which coils and uncoils with changes of temperature, thereby operating a pen recording on the typical clock driven chart.

The bi-metallic type has a small thermal lag and the helix operates direct on the pen arm spindle without any levers or links. The control is sufficient to overcome the friction of the pen ; further the scale value is constant for even increments of temperature. The bi-metallic element is mounted on a brass bracket and iron base, and protected by a slotted brass guard.

DAILY (8-day) clock or weekly drum to any of the standard ranges shown below. Hinged glass-panelled cover of japanned metal, and complete with 100 charts and bottle of ink.

PRICE : £16 7 6

M.2228 Ditto, to British Meteorological Specification, with copper case on base of gun metal, with 100 charts and ink. Pen arm 185 mm. long, moving over 10 mm. for every 10°F. Clock drum 92 mm. high × 93 mm. diam. With daily or weekly clock.

PRICE : £21 2 6

Spare Charts per 100 12 0

DIMENSIONS :

11 in. × 5 in. × 7 in.

WEIGHT : 8³/₄ lb.

Clock drum	. .	3.7 in. diam. × 3.6 in. high.
Pen travel	. .	3 in.
Chart	. .	3.6 in. × 11.8 in.
Time scale	. .	0.45 in. per hour.
Time scale	. .	1.54 in. per day.
Temperature scale	. .	33.3°F. (18.3°C.) per inch.

RANGES

0/+100°F.	+50/+150°F.	0/+55°C.
+30/+130°F.	-10/+45°C.	+10/+65°C.

DIMENSIONS : 10¹/₂ in. × 5 in. × 7 in.

WEIGHT : 8 lb.

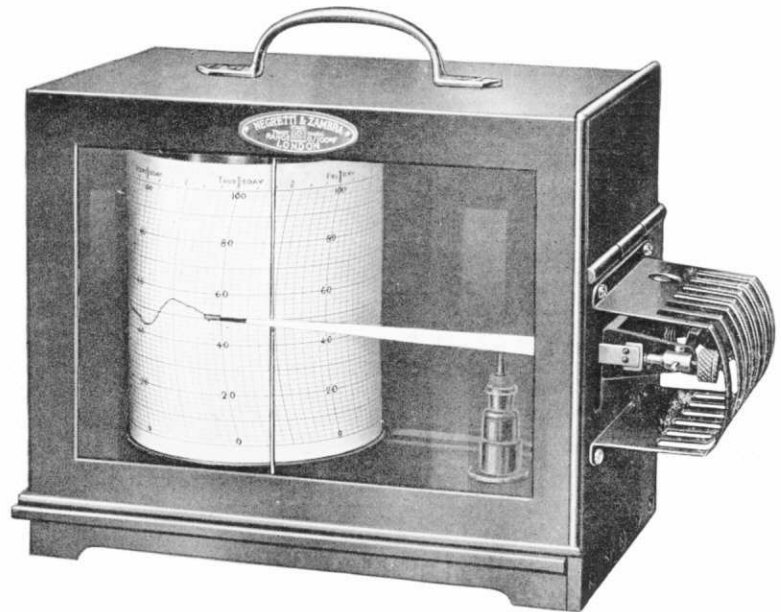
Spare Charts (per 100) : 12 0

Recording Thermometers ●

5885 RECORDING THERMOMETER

Large size bimetallic movement similar to specification on page 66 but with more open time and temperature scales.

Daily (8-day clock) or weekly drum, with any standard range given below.



Hinged glass panelled cover of japanned metal, with lock and key.
With 100 charts and bottle of ink.

PRICE: £21 15 0

Spare charts per 100: 15 0

Clock drum 5 in. diam. × 6 in. high.
Pen travel 5 in.
Chart 5·8 in. × 16·2 in.
Time scale (daily) 0·6 in. per hour.
Time scale (weekly) 2·06 in. per day.
Temperature scale 20°F. (11°C.) per inch.

RANGES

0/+100°F.
+30/+130°F.
+50/+150°F.
-10/+45°C.
0/+55°C.
+10/+65°C.

DIMENSIONS: 13½ in. × 7½ in. × 10¾ in.

WEIGHT: 19½ lb.



● *Mercury in Steel* -

NEGRETTI & ZAMBRA MERCURY IN STEEL RECORDING THERMOMETERS are used for records of air temperatures, earth temperatures, sea surface temperatures and wet and dry bulb temperatures. The movement consists essentially of three parts—bulb, capillary tubing, and Bourdon tube—all made of steel. These are welded together to form the complete system, which is filled with mercury under great pressure.

The capillary tubing is of specially drawn steel, of very fine bore, and is enclosed in an outer tube of copper or lead for protection. These instruments may be supplied with lengths of tubing up to 150 ft. and for lengths in excess of 50 ft. compensating links are fitted to counteract the changes in ambient temperature.

The action is direct, as the spindle of the pen arm is attached to the Bourdon tube without any levers, gears, or hair springs. The result is that inaccuracies generally caused by friction are practically eliminated.

Only the finest quality materials are used throughout. All parts are tested and inspected before assembly, and each instrument is separately calibrated against standards certified by the N.P.L.

No instrument is passed out until it has completed a duration test in the Inspection Department, where a full record of its performance is kept with check readings and calibration corrections, a copy of which is sent out with each instrument.

Duplex Recording Thermometers with two systems and two pens recording on the same chart can be supplied at extra cost.

The Air Temperature Recorder illustrated on the following page and constructed on the above principle is fitted with bulb TT/210 of small diameter and considerable length to obtain sensitivity, and is usually coated with copper. The special capillary type bulb TT/243 is of steel tubing $\frac{3}{32}$ in. diam., in 2 in. diam. coils and may be supplied as an alternative where the most sensitive type of bulb available is required.

● RANGES ●

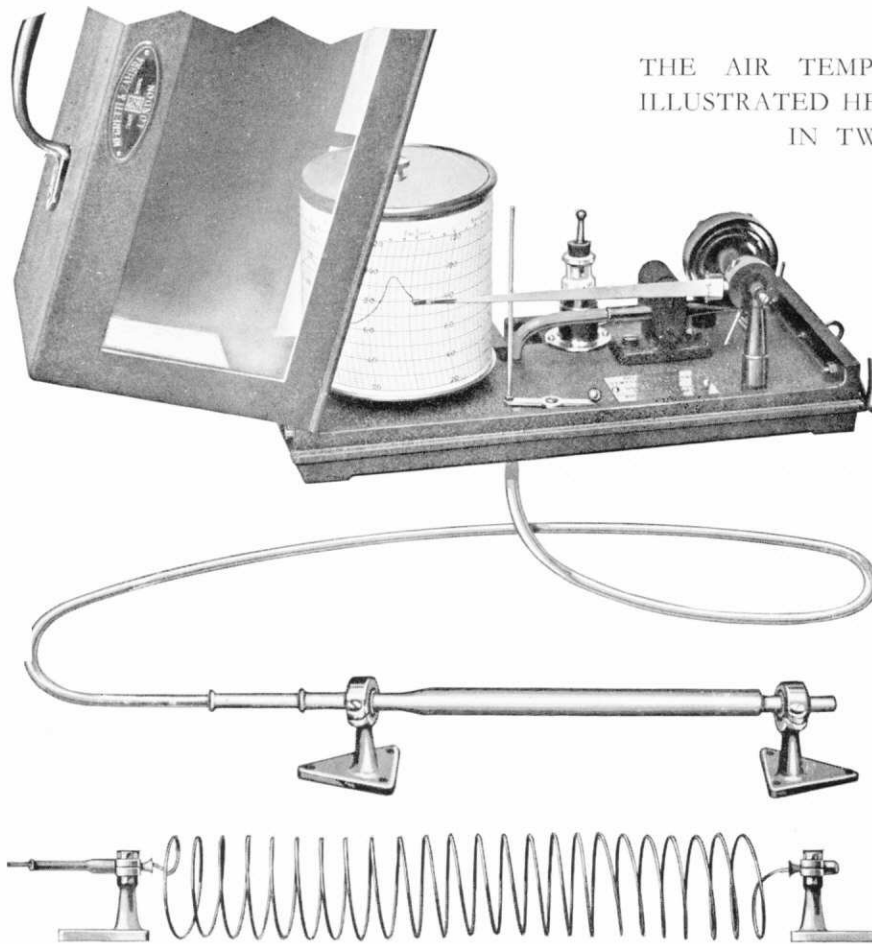
0/100°F.
30/130°F.

50/150°F.
-10/+40°C.

0/50°C.
10/60°C.



Air Temperature Recorders ●



THE AIR TEMPERATURE RECORDER
ILLUSTRATED HERE MAY BE SUPPLIED
IN TWO MODELS

CHARTS

Model "A," per 100 12 0
Model "B," per 100 15 0

DIMENSIONS OF CASE

Model "A"
11½ in. × 6 in. × 5¼ in.
Weight: 10 lb.

Model "B"
1 ft. 2½ in. × 8½ in. × 7½ in.
Weight: 23 lb.

MODEL "A"

Clock drum	3.6 in. diam. × 3.6 in. high
Pen Travel	3 in.
Chart	3.6 in. × 11.8 in.
Time Scale (daily)	0.45 in. per hour
Time Scale (weekly)	1.54 in. per day
Temperature Scale	33.3°F. or 16.6°C. per in.

MODEL "B"

5 in. diam. × 6 in. high
5 in.
5.8 in. × 16.2 in.
0.6 in. per hour
2.06 in. per day
20°F. or 10°C. per inch

M.2230. Model "A" Recorder with bulb TT/210, 10 ft. of copper covered capillary tubing. Bottle of ink and 100 charts.

£31 17 6

M.2233. Ditto, Model "B"

£36 15 0

Extra for TT/243 sensitive bulb.

£4 0 0

Extra for capillary tubing in excess of 10 ft. (per foot).

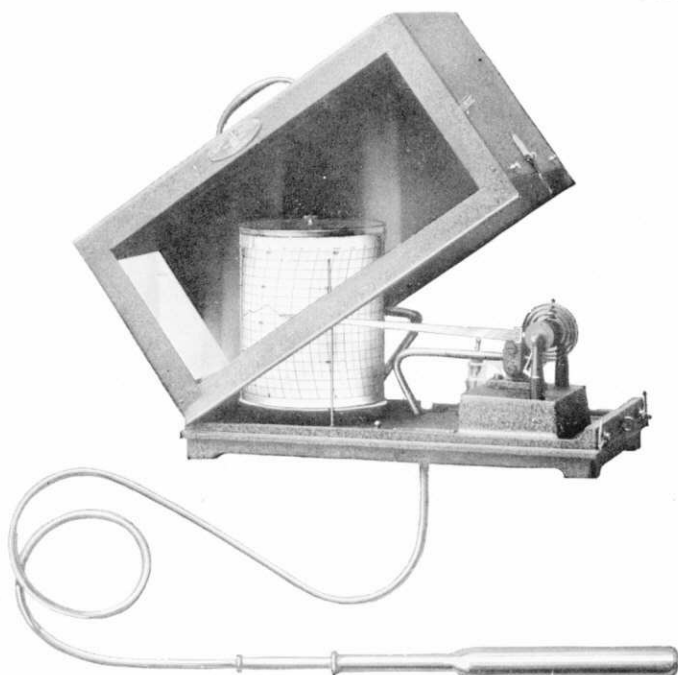
4 6

● *Mercury-in-Steel*

M.2236

EARTH TEMPERATURE
RECORDER

Constructed on the Mercury-in-Steel principle as described on previous page.



These instruments have been supplied to Government Departments and Research Departments in this country and abroad, and have given every satisfaction under varying conditions. Many have been in use for years without requiring any adjustment or attention beyond the winding of clocks and changing of charts.

The bulb is of steel of small diameter and 10 in. or more in length, coated with lead for protection against corrosion; it is buried horizontally in the ground at the depth at which temperature records are required.

This method of obtaining earth temperatures is one of great precision and much more convenient than taking the readings by means of mercury-in-glass thermometers.



Earth Temperature Recorder ●

The capillary tubing is also lead coated to withstand the corrosive effect of chemicals in the ground. It may be any length up to 150 feet, and the standard instrument is supplied with 15 feet of capillary, bottle of ink and 100 charts.

Daily (8-day clock) or weekly drum.

Range 20/120°F., or -10/+40°C.

Hinged glass-panelled japanned metal cover to case.

Clock drum 5 in. × 6 in. high

Pen travel 5 in.

Chart 5.8 in. × 16.2 in.

Time Scale (daily) 0.6 in. per hour.

Time Scale (weekly) 2.06 in. per day.

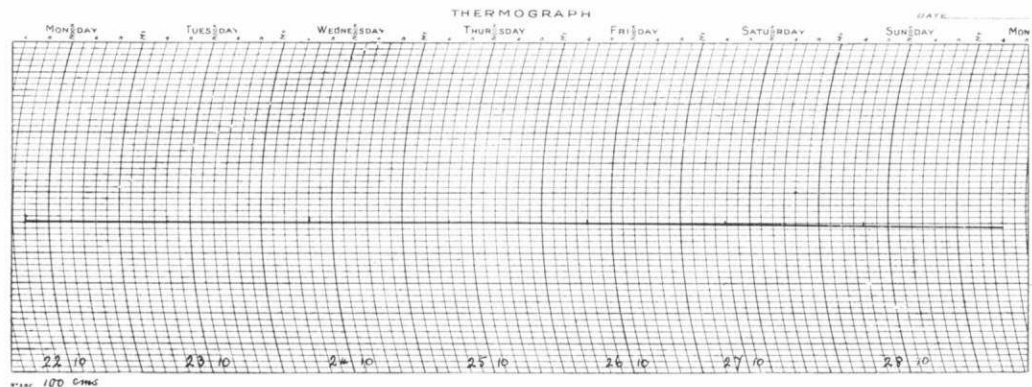
Temperature Scale 20°F., or 10°C. per in.

PRICE : £36 12 6

Capillary, lead coated, over 15 ft. Extra per foot 5 6

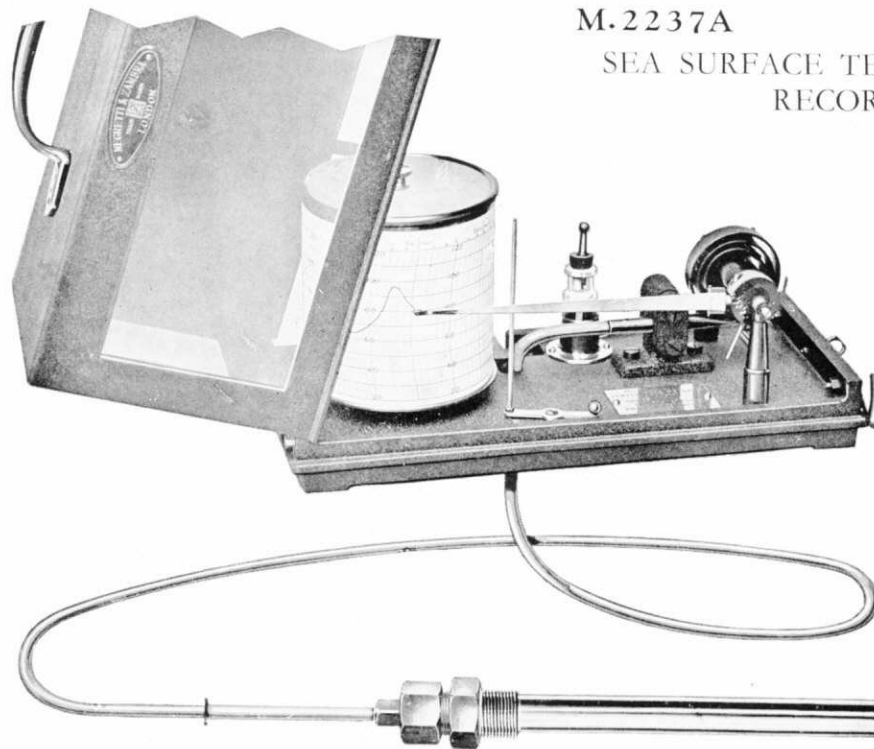
Charts per 100 15 0

DIMENSIONS : Case : 1 ft. 2½ in. × 8½ in. × 7½ in. WEIGHT : 10 lb.



The above reproduction (by kind permission of the Cotton Research Board, Egypt) is from one of a set of seven M.2236 recorders, where the bulbs are buried at various depths up to 1 metre. Where the surface graphs show marked daily amplitude, the above shows practically no deviation, and the perfect method of compensation is demonstrated by the fact that the recorder and the capillary tube were subject to a daily variation of temperature of 20°C., or more.

● *Mercury-in-Steel*



M.2237A

SEA SURFACE TEMPERATURE
RECORDER

SEA SURFACE TEMPERATURE RECORDER. Constructed on the Mercury-in-Steel principle previously described. BULB AND FITTING. Two methods of exposing the bulb in the sea-water are in use :—

- (a) In a recess in the keel whilst the ship is under construction or repair. In this case the bulb, about 15 in. long by 1 in. diameter, is heavily coated with lead to prevent corrosion, and is protected by a stout perforated bronze plate or guard.
- (b) In the main intake pipe for the condensers, which provides a great volume of water immediately from the sea, and has been proved by experience to be the most satisfactory position for the bulb. In this case the bulb, as shown above, is provided with a bronze pocket, which has the double advantage of protecting the bulb against corrosion and of enabling it to be safely removed at any necessary time.

CAPILLARY. This may be any length, depending on the most suitable position for the recorder. It is always lead coated as a protection against corrosion.

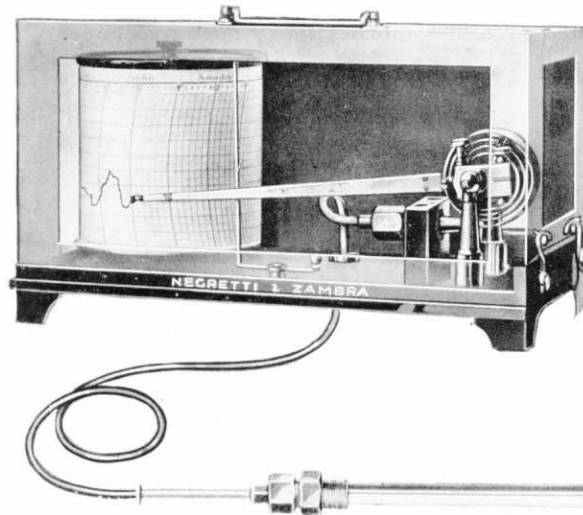


Temperature Recorders ●

RANGES

-5/+35°C., -2½/+25°C., for polar work. 20/100°F. (overload to 110°F.)
30/90°F. (overload to 100°F.).

Daily (8-day clock) or weekly drum.



MODEL A

MODEL B

Clock drum	3·6 in. dia. × 3·6 in. high	5 in. dia. × 6 in. high
Pen travel	3 in.	5 in.
Chart	3·6 in. × 11·8 in.	5·8 in. × 16·2 in.
Time Scale (daily)	0·45 in. per hour	0·6 in. per hour
Time Scale (weekly)	1·54 in. per day	2·06 in. per day

M.2237A. Model A, with bulb as paragraph (a) page 72, and 10 ft. lead coated capillary tubing. Complete with bottle of ink and 100 charts. PRICE: £33 12 6

Guard Extra: £1 10 0

M.2237B. Model B, ditto, ditto PRICE: £39 15 0

M.2238A. Model A, with bulb and pocket as paragraph (b) page 72, and with 10 ft. of capillary tubing. Complete as above PRICE: £32 7 6

M.2238B. Model B, ditto, ditto PRICE: £37 5 0

Capillary tubing, lead coated per ft. extra 5 6

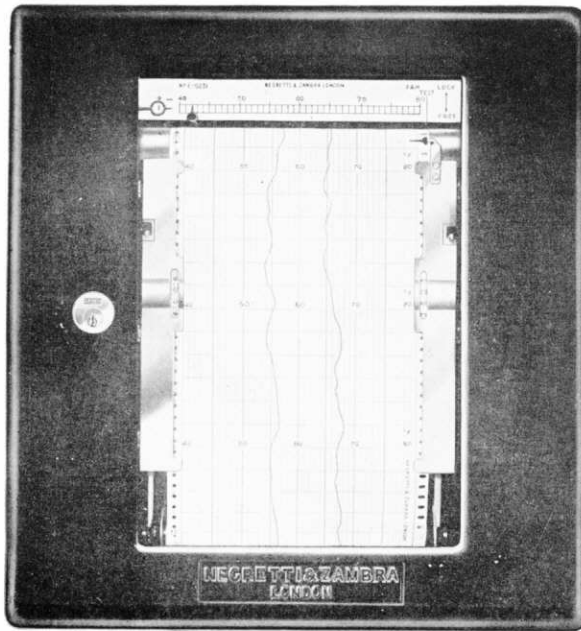
Charts, Model A, per 100 extra 12 0

Charts, Model B, per 100 extra 15 0

Case: Model A, 11½ in. × 6 in. × 5¼ in., weight 10 lb.

Model B, 1 ft. 2½ in. × 8½ in. × 7½ in., weight 23 lb.

● *Electrical Resistance*



THE ELECTRICAL RESISTANCE TEMPERATURE RECORDER is also employed for air and earth temperatures. With this instrument the Recorder may be placed at practically any distance from the element, and the connection is by means of ordinary copper cable.

A continuous record is also obtained on the one chart for 50 days; on the other hand the movement is not so robust as with the Mercury-in-Steel type, and the instrument requires more careful treatment.

One, two, three or four records are obtained in different coloured inks on the one chart; the bold indicating scale and pointer are readable up to a distance of 10 ft., and a numerical index shows which point is being indicated.

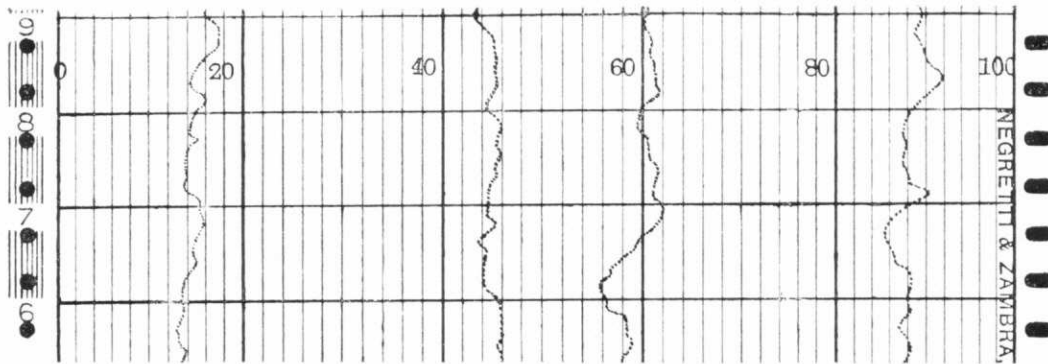
The instrument requires an A.C. supply to operate the mechanism, and the resistance circuit may be operated from accumulators or from the mains by means of a special voltage stabilising unit which may be supplied.

Complete with standardising resistance and two, 2-volt accumulators.

E.1311 single point	£81 0 0
E.1312 two points	£85 0 0
E.1313 three points	£89 5 0
E.1314 four points	£99 0 0
SPARE CHART ROLL, complete with ink ribbon (including purchase tax)	12 6
E.242 MAINS UNIT, to enable the resistance circuit to be operated from 200/250 volts, A.C. supply, in place of accumulators Extra	£11 10 0



Temperature Recorders ●



PORTION OF CHART ACTUAL SIZE

E/443 MOISTURE PROOF AIR TEMPERATURE RESISTANCE BULB, with nickel coil element for use outdoors or for use under damp conditions. WEIGHT $3\frac{1}{2}$ lb.
PRICE: £2 9 0

E/445 GLASS THERMOMETER fitted to above. 14 0

E/503 MOULDED BAKELITE AIR TEMPERATURE BULB for use in rooms, offices, etc. 3 in. diameter \times 2 in. high. WEIGHT $\frac{1}{4}$ lb. PRICE: £1 3 0

E/505 EARTH TEMPERATURE RESISTANCE ELEMENT, with tinned copper protecting sheath, and complete with 6 ft., of lead covered $\frac{3}{1029}$ in. cable.
PRICE: £2 13 0

E/449 WET AND DRY BULB ELEMENT for humidity measurement, complete with wick and trough.
PRICE: £6 15 0

(For further details of Wet and Dry Bulb Fittings, see List H.20).

E/408 COPPER CONNECTING CABLE, $1/1044$ twin taped, braided and compounded for distances up to 150 yards.

PRICE: per yard 7d.

E/410 As above, but lead covered.
PRICE: per yard 1.11d.
Prices of larger sizes of cable and three-core cables will be quoted on request.



E/503



E/443 —



E/449



E/505

● *Hygrometers*

HYGROMETERS used for meteorological observations may be classified under the following main headings :—

- (a) Wet and dry bulb hygrometers without means for ventilating the wet bulb.
- (b) Wet and dry bulb hygrometers, ventilated type, where the air is in motion relative to the bulbs, such as the whirling hygrometer, Assmann psychrometer, etc.
- (c) Hair hygrometers, indicating or recording.
- (d) Gregory hygrometers, indicating or recording.

The tables commonly used with the wet and dry bulb hygrometer to obtain relative percentage humidity, vapour pressures, dew point, etc., are as follows :—

WET AND DRY BULB THERMOMETERS exposed in a Stevenson Screen.

Fahrenheit. Hygrometric Tables, Meteorological Office Publication M.O. 265.

“Bilham” Humidity Slide Rule, for temperate latitudes.

“Bilham” Humidity Slide Rule, for tropical latitudes.

Centigrade. Instructions Meteorologiques—Angot.

WET AND DRY BULB THERMOMETER in moving air.

Fahrenheit. Psychrometric Tables, U.S. Dept. of Agriculture—W.B. 235

Ditto, abbreviated form, on celluloid plate—Negretti & Zambra.

Centigrade. Aspirations Psychrometer-Tafeln—Assmann.

Ditto, abbreviated form, on celluloid plate—Negretti & Zambra.

A full discussion on Hygrometers will be found in :—

The proceedings of the Physical Society of London, Vol. XXXIV, Part II, containing :—

“A discussion on Hygrometers,” including papers.

“Some Modified Forms of Hygrometers”—Ezer Griffiths, F.R.S.

“The Rationale of Glaisher’s System of Hygrometry”—F. J. W. Whipple, M.A., F.INST.P.

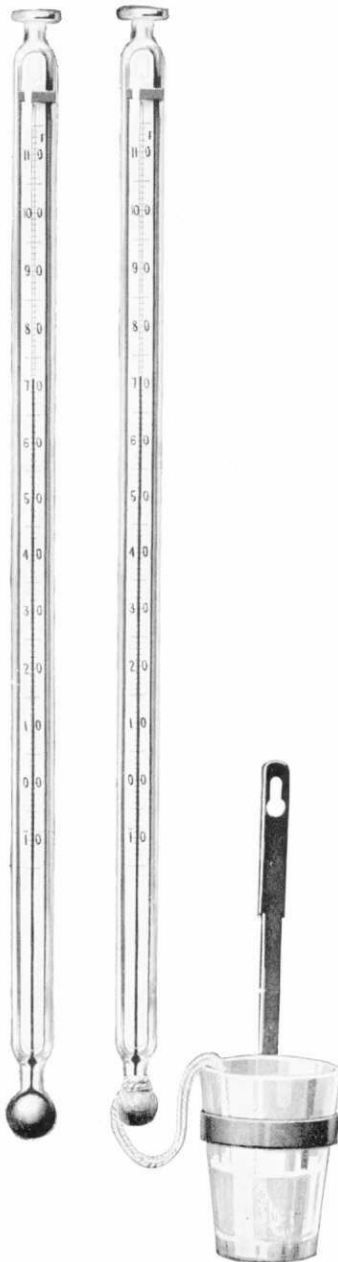
“Meteorological Instruments”—W. E. K. Middleton, M.Sc., F.R.S.

“The Measurement of Humidity in Closed Spaces”—H.M. Stationery Office.

“The Dictionary of Applied Physics, Vol. II.”



Hygrometers ●



M.2199A STANDARD HYGROMETER MARK

I for use vertically. British Meteorological Office pattern to B.S.I. specification 692-1936. Tubes protected by outer glass sheaths; overall length 12½ in. Bulbs of normal glass, stems of British lead glass supported inside the sheaths by rings of rubber; sheaths permanently fused on to the thermometers at a point between the bulbs and the lowest graduations. Range 0/130°F., or -15/+115°F., divided on the stem in single degrees and figured every 10°. Wet bulb with muslin and wick. Glass water reservoir with bronzed brass bracket.

PRICE : £3 19 6

N.P.L. Certificate per pair 8 0

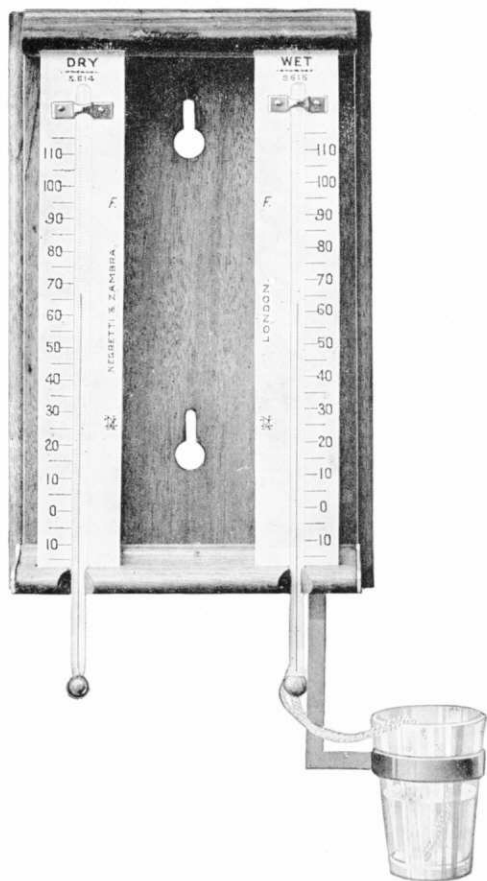
M.2199B For horizontal use in the screen
M.2194A page 91. Figured horizontally and nitrogen filled. PRICE : £3 19 6

N.P.L. Certificate, verifying the thermometers in a horizontal position. per pair 8 0

NOTE : In the use of wet and dry bulb Hygrometers, the muslin must be clean, and should be changed before it becomes dirty. The water used must be soft, either distilled or rain water.

Full particulars regarding the management of these instruments during frosty weather will be found in the text-books.

● *Hygrometers*



M.2200 STANDARD HYGROMETER.

This instrument consists of a pair of thermometers mounted on a board, the bulb of one thermometer being covered with muslin kept moist by means of a wick dipping into a water reservoir.

Tubes $10\frac{1}{4}$ in. long, with bulbs of normal glass and English lead capillary, fitted on opal glass scale plates on a mahogany mount with two holes for suspension.

Range $-15/+115^{\circ}\text{F.}$, divided on the stem in single degrees and figured on the scale every 10 degrees. Glass water cup carried on bronzed brass bracket.

PRICE: £4 9 0

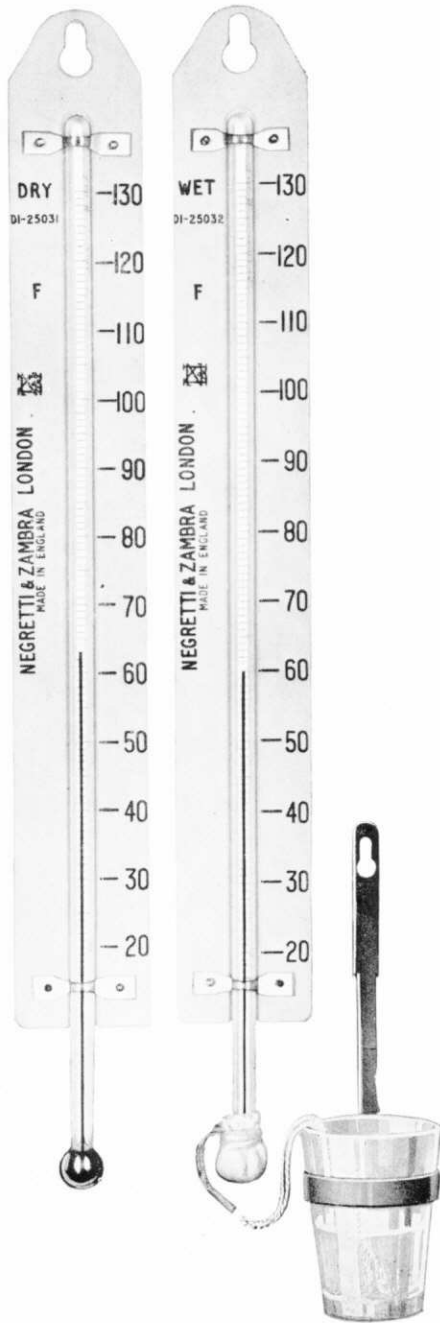
M.2201 Ditto, $-25/+45^{\circ}\text{C.}$ PRICE: £4 9 0

M.2202 Ditto, tropical
 ranges $10/140^{\circ}\text{F.}$
 or $-10/+60^{\circ}\text{C.}$ PRICE: £4 9 0

National Physical Laboratory Certificate per pair 8 0



Hygrometers ●



M.2203 STANDARD HYGROMETER

Tubes $10\frac{1}{4}$ " long, bulbs of normal glass and English lead capillary; white enamelled steel scale plates. Range $20/130^{\circ}\text{F.}$, divided on the stem in single degrees and figured every 10 degrees on raised edge of scale plate. Glass water reservoir with bronzed brass bracket.

PRICE : £2 15 0

M.2204 Ditto, $-5/+55^{\circ}\text{C.}$,, £2 15 0

The above with tropical ranges:—

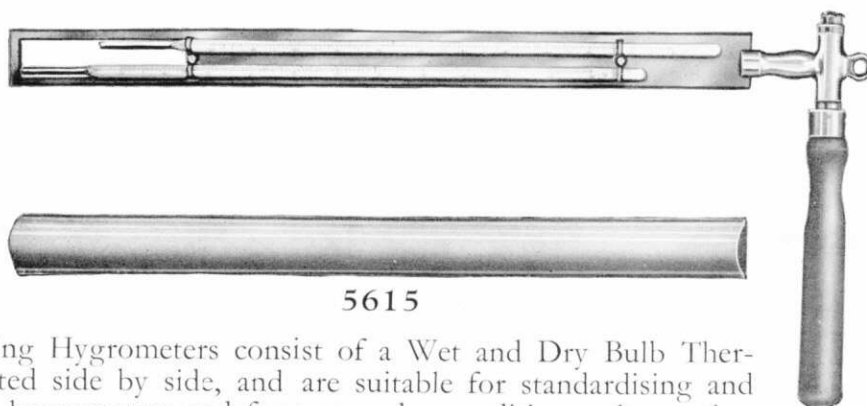
- $10/140^{\circ}\text{F.}$
- $-10/+60^{\circ}\text{C.}$
- without extra charge.

National Physical Laboratory Certificate:

PRICE per pair : 7 0

STANDARD HYGROMETERS, used by the Meteorological Service of the Dominions and Crown Colonies, consist of two ordinary thermometers as described on page 60 or the M.2199A, page 77.

● *Hygrometers*



5615

Whirling or Sling Hygrometers consist of a Wet and Dry Bulb Thermometer mounted side by side, and are suitable for standardising and calibrating hair hygrometers and for use under conditions where other types of instruments cannot be employed.

The Hygrometer should be whirled for about half a minute, stopped and quickly read, the wet bulb first. This should be repeated three or four times. The revolutions should not be less than four per second in order to obtain an air speed past the bulb of at least 15 ft. per second.

Precision type with 11 in. tubes, divided and figured on the stem, mounted on brass frame with handle, complete in polished copper case.

5615	range 10/110°F.		PRICE: £5 18 6
5616	range 20/130°F.		£5 18 6
5617	range -10/+45°C.		£5 18 6
5618	range -5/+55°C.		£5 18 6
	N.P.L. Certificate	per pair	7 0
	Spare Tubes	EACH:	£1 11 0

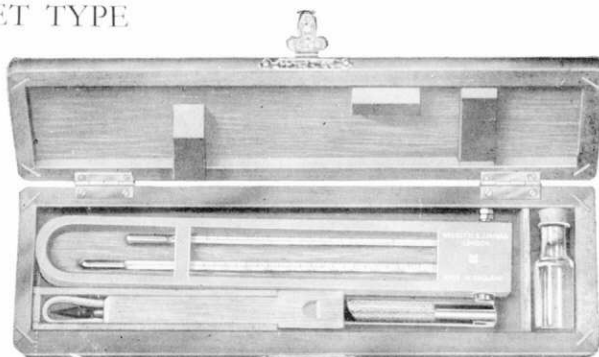
POCKET TYPE

Designed for extreme portability, with 6 in. tube and 4 in. scale, divided and figured on the stem, mounted on aluminium frame, with folding handle. Complete with spare tubular wick, brush, etc., fitted in wooden case.

5607	range 10/110°F.		PRICE: £3 1 6
5608	„ -10/+45°C.		£3 1 6
Spare Tubes		EACH:	12 6

As above, but fitted in solid leather case:

5609	range 10/110°F.		PRICE: £3 16 0
5610	„ -10/+45°C.		£3 16 0



5609



Hygrometers ●



5667

5667 THE HAIR HYGROMETER OR HYGROSCOPE, range 10/100% relative humidity consists of a bundle of hairs or other organic tissue which changes its length when it absorbs moisture.

The instrument takes the form of a 4 in. diameter case, beneath which is a slotted tube in which the hairs are mounted. At the lower end of the tube an adjustment screw is provided to which the hairs are anchored. At the top end of the hairs a link piece is connected direct to a crank on the pointer spindle.

The primary scale indicates relative percentage humidity, the subsidiary scale—the dewpoint.

There are no springs, gears, or cords in the mechanism, and errors due to backlash, friction, etc., are thus reduced to a minimum.

The hygroscope can be readily checked from time to time, either by wetting the element with a camel hair brush, in which case it should read approximately 95% : or better still, by means of the wet and dry bulb whirling hygrometer described on page 80. PRICE : £6 0 0



PH/1

PH/1 4 in. dial Pocket Hair Hygrometer (Hygroscope) range 0/100% relative humidity ; metal case, 4½ in. diameter overall, finished eggshell black ; dial enamelled white with black divisions and figures.

PRICE : £2 15 0

● *Gregory Hygrometer*

This apparatus represents a revolution in humidity measurement, and is an entirely new departure from previous methods. The element shown full size on the right consists of a plastic frame carrying platinum clad electrodes. Round these electrodes is wound a skein of very fine fibres, impregnated with a chemical having the property of absorbing or giving up moisture very rapidly until it attains equilibrium with its surroundings. The amount of moisture which it contains governs its electrical resistance, and, with a constant voltage the current thus gives a reading of relative humidity direct, without reference to tables.



An important feature of this instrument is its rapidity of response to a change of humidity and a correct reading can be obtained in about 30 seconds.

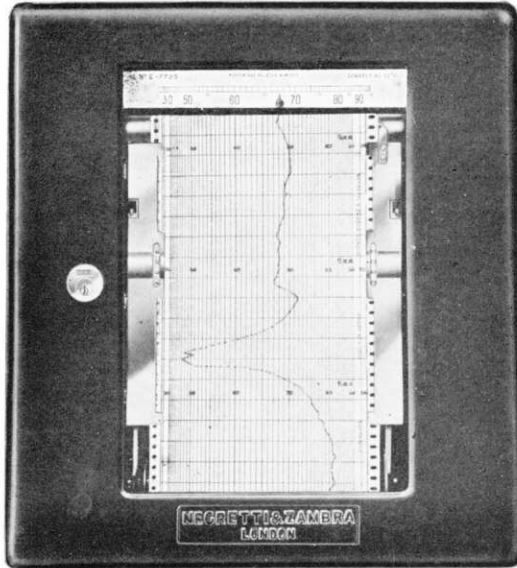
Providing the air is not actually stagnant, there is no need for artificial circulation. Another important feature is that a record may be kept at a considerable distance from the point of measurement. The standard element, as illustrated, is fitted with a small bayonet cap male adaptor, and can be mounted if required in a Stevenson screen (see pages 90 and 91).

The effective life of the element varies with conditions of use from four to twenty months, after which it will begin to lose calibration, owing to the gradual evaporation of the special chemical employed. When this occurs there will be signs of discolouration of the electrodes, and the element should be returned to our works for reconditioning.

For Meteorological purposes it is usual to connect the element to a Recorder as shown on the opposite page, but portable, single or multi-point indicators can also be used (see our list H/20).



Gregory Hygrometer ●



H.1311 GREGORY HUMIDITY RECORDER, range 10/60 or 20/100% R.H. Mounted in moisture and fumeproof case, of diecast aluminium alloy, heavily enamelled black and stoved, and suitable for projection or flush panel mounting. With 5 in. illuminated scale, 50 ft. chart, speed ½ in. per hour, visible portion 18 hours, duration 50 days; or 2 in. per hour, visible portion 4½ hours, duration 12½ days. Including special stabiliser and transformer, to enable the instrument and element to be operated from 200/250 volts, 50 cycle single phase A.C. supply, and complete with Gregory element.

PRICE: £110 12 6

H.1312 As above, but arranged to give two records in different coloured inks, and with two elements. PRICE: £123 0 0

H.1313 Ditto for 3 records and with 3 elements. PRICE: £134 0 0

H.1314 Ditto for 4 records and with 4 elements. PRICE: £153 0 0

H.600 Spare elements. EACH: £5 5 0

Reconditioning service per element. £1 10 0

Spare Chart Rolls, complete with ink ribbon. 12 6

(Including Purchase Tax)

Any twin core cable may be used for connecting the elements to the recorder. For use in exposed places or out of doors we recommend: E/410 twin cable rubber covered, braided and lead covered per yard 1 11

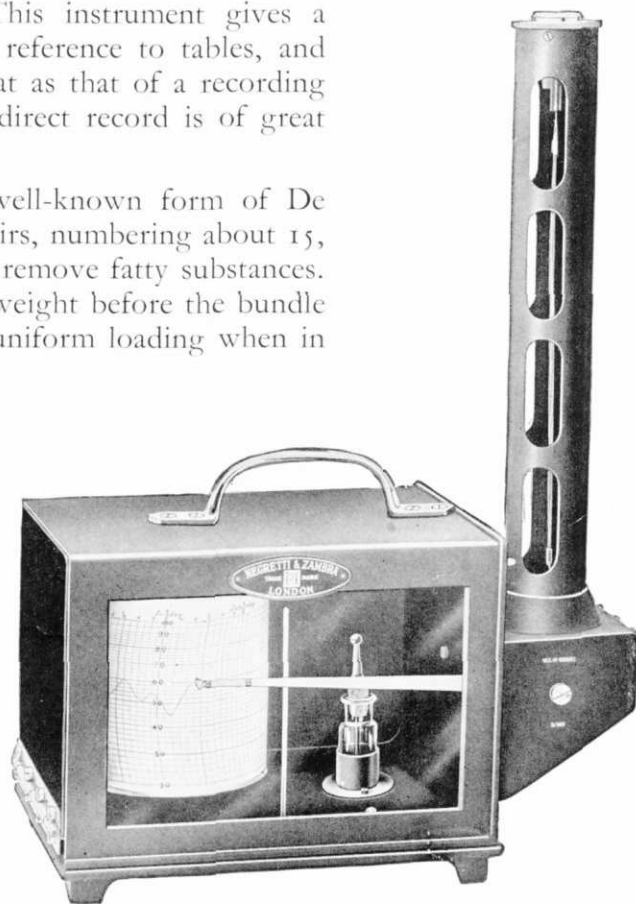


● Hair Hygograph

5669 HAIR HYGROGRAPH. This instrument gives a direct record of humidity without reference to tables, and although its accuracy is not so great as that of a recording wet and dry bulb hygrometer, its direct record is of great value.

The instrument is based on the well-known form of De Saussure's hair hygrometer. The hairs, numbering about 15, are specially selected and treated to remove fatty substances. Each hair is loaded with a known weight before the bundle is clamped together: this ensures uniform loading when in operation. The hairs are contained in a well-ventilated cylindrical brass tube, the top end being anchored to an adjustable screw in the cap. The other end of the hairs operates through a connecting link to a crank on the pen-arm spindle, which is mounted in jewelled bearings.

The design necessitates unequal dividing of the chart, but offers the great advantage that all levers, gears, cams, etc., to obtain even divisions, are eliminated, and the hairs are coupled up directly with the arm.



5669

Daily (8-day clock) or weekly drum; range 10/100% relative humidity. With pen filler, ink and 100 charts.

Clock drum	3.6 in. × 3.6 in.
Pen travel	3 in.
Chart	3.6 in. × 11.8 in.
Time scale (daily)	0.45 in. per hour
" " (weekly)	1.54 in. per day
Humidity scale	10 to 100%

Dimensions: 14" × 10½" × 5"

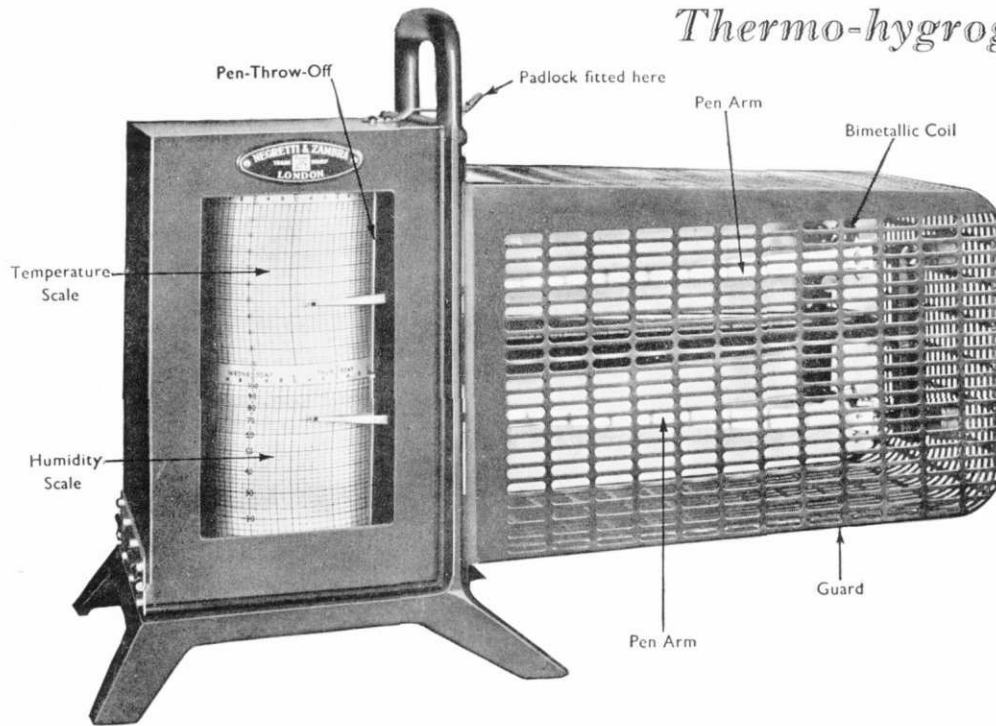
Weight: 9½ lb.

PRICE: £18 15 0

Charts per 100: 12 0



Thermo-hygrograph ●



5675 COMBINED TEMPERATURE AND HUMIDITY RECORDER, recording on the one chart the changes in both temperature and humidity.

The thermometric element is of the bimetallic type described on page 66, and the pen records on the upper part of the chart. The hygrometric record is obtained from the action of human hairs as described on page 84, and is on the lower part of the chart. Daily (8-day clock) or weekly drum, with ranges as below.

The pen arms and movements situated well away from the case, are protected by a stout perforated metal frame.

PRICE :
 £29 7 6
 Charts per 100
 17 6

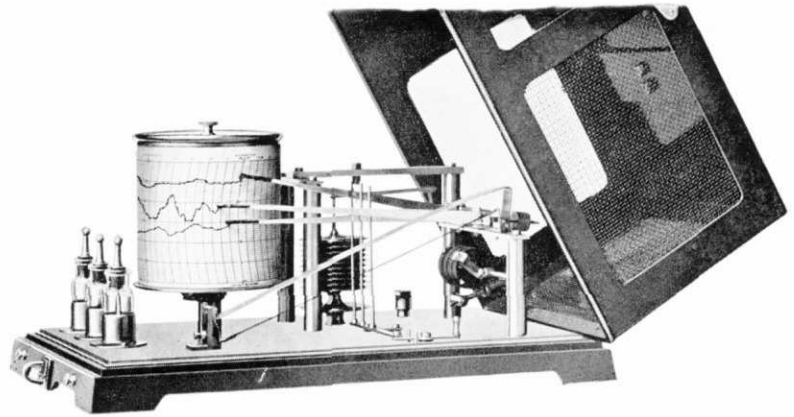
Hinged glass-pannelled cover to case, with padlock and key, pen filler, ink and 100 charts.

Clock Drum	. . . . .	3.6 in. dia. × 7 in. high
Pen travel	. . . . .	3 in. per scale
Chart	. . . . .	7 in. × 16.2 in.
Time scale (daily)	. . . . .	0.45 in. per hour
„ „ (weekly)	. . . . .	1.54 in. per day
Temperature scale	. . . . .	33.3°F. (18.3°C.) per in.
Humidity scale	. . . . .	10 to 100% in 3 inches

$\left. \begin{matrix} 10/110^{\circ}\text{F.} \\ 30/130^{\circ}\text{F.} \end{matrix} \right\} 10/100\% \text{ Humidity } \left\{ \begin{matrix} -15/40^{\circ}\text{C.} \\ 0/55^{\circ}\text{C.} \end{matrix} \right.$
 Dimensions : 1 ft. 5 in. × 11½ in. × 6 in. Weight 15 lb.

● *Baro-Thermo-Hygrograph*

M.2074
BARO-THERMO-
HYGROGRAPH



The instrument records on one chart the three separate traces of barometric pressure, temperature and humidity.

The passing of the pens on the chart is arranged by setting them a fixed amount, say, one hour, in advance of each other ; this enables the clock drum to be of standard height and not three times as high as usual.

The barometer mechanism consists of a set of diaphragms of the special type described on page 28 ; the movement is transmitted to the pen arm through a link and lever mechanism ; a setting screw for adjustment is provided.

The thermometer mechanism consists of a bimetallic spiral coil, the movements of which are transmitted through a crank and link to the pen arm.

The hygrometer mechanism consists of a bundle of about 15 strands of human hair suitably treated, and their movement is transmitted directly by a crank to the third pen arm. Ranges are : Barometer, 28 in. to 31 in. ; Thermometer, 0/120°F., Hygrometer, 10/100% or 700 to 800 mm., 0/50°C. ; 10/100%.

Daily (8-day clock) or weekly drum	3.6 in. dia. × 3.6 in. high
Chart	3.6 in. × 11.8 in.
Time scale (daily)	0.45 in per hour
" " (weekly)	1.54 in. per day
Scales	1 in. pressure per in. and 40°F. per in. 90% humidity for 3 in.

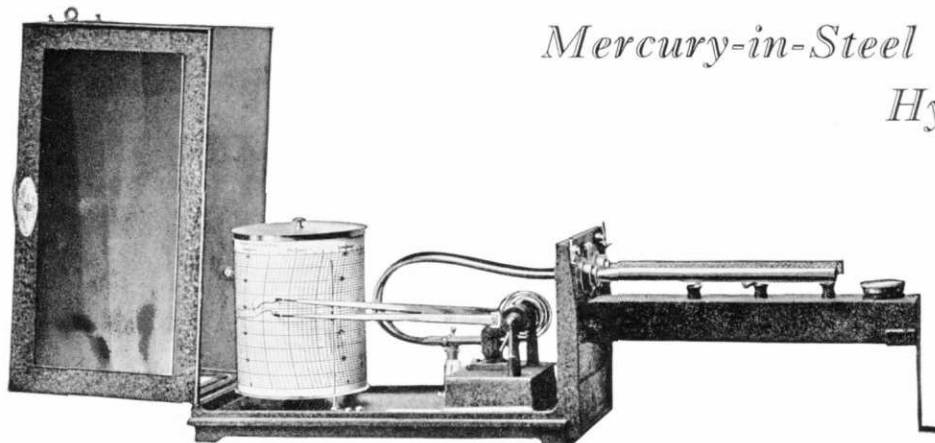
Dimensions :
1' 2" × 7½"
× 8½"
Weight : 9 lb.

The brass plate carrying the three movements is mounted on a cast-iron base with a hinged, well-ventilated, glass panelled metal cover. With 3 pen fillers, 3 bottles of different coloured inks, and 100 charts.

PRICE : £60 15 0
Charts per 100 12 0



*Mercury-in-Steel Recording
Hygrometers* ●



5639 Mercury in Steel Recording Hygrometer. An instrument of great precision, with two mercury in steel movements, as described on page 68. With a close fitting wick over one of the bulbs, which dips into a tank, and ensures a film of moisture always surrounding the bulb. These wicks are readily renewable. The bulbs are sheathed in staybrite steel to prevent corrosion. Mounted in hinged glass panelled case, with padlock and key and with daily (8-day clock) or weekly drum and any of the ranges given below. Complete with pen filler, ink, 6 spare wicks and 100 charts.

PRICE : £53 5 0

Charts per 100 : 15 0

Dimensions : $27\frac{1}{4}$ in. \times $8\frac{7}{8}$ in. \times $7\frac{1}{2}$ in. Weight 30 lb.

Clock drum	5 in. dia. \times 6 in. high
Pen travel	5 in.
Chart	5.8 in. \times 16.2 in.
Time scale (daily)	0.6 in. per hour
" " (weekly)	2.06 in. per day
Temperature scale	20°F. or 10°C. per in.

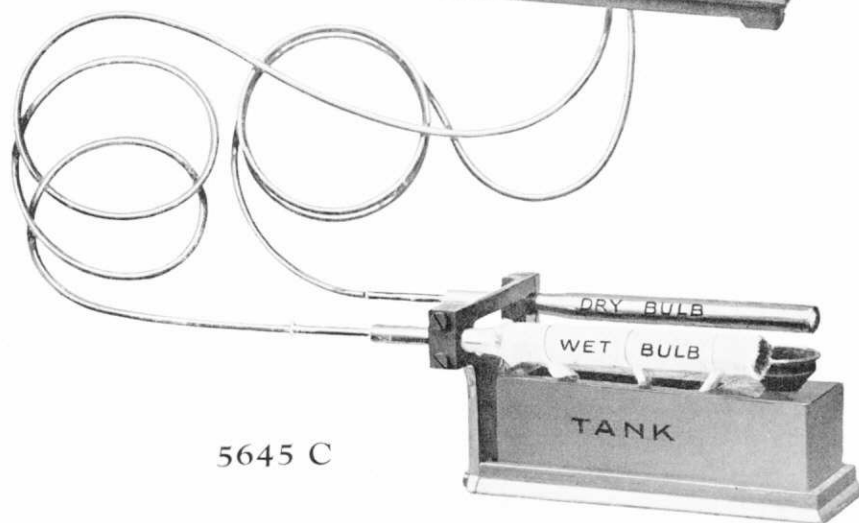
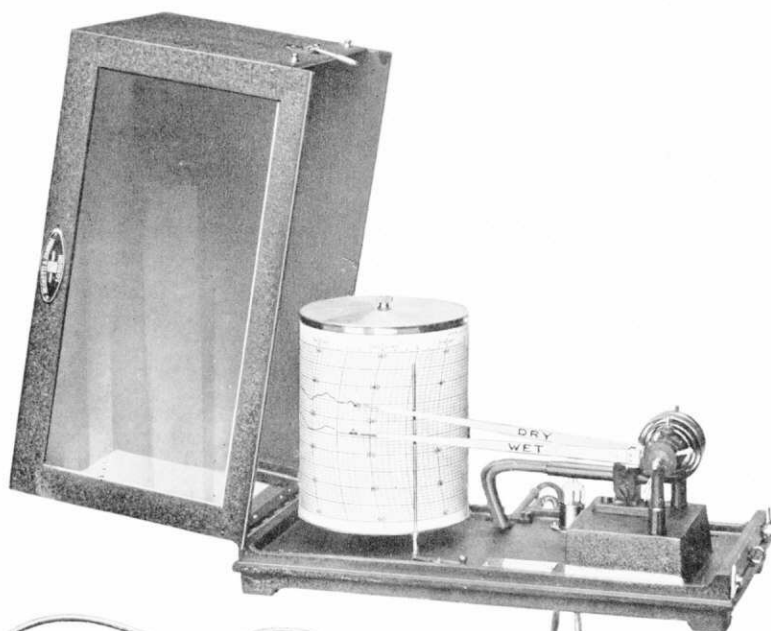
RANGES :

0/100°F.	50/150°F.	0/50°C.
30/130°F.	-10/+40°C.	10/60°C.

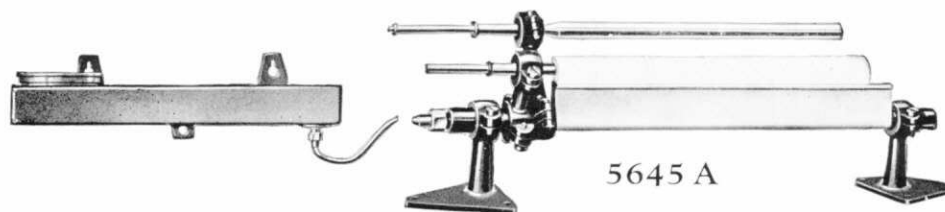
M.2244B As above, but arranged on the Assmann principle, with a ventilating fan which draws a continuous flow of air over the bulb for the purpose of obtaining humidity readings of the greatest precision. Complete with A.C. or D.C. Motor.

PRICE on REQUEST

● *Distant Reading*



5645 C



5645 A



Mercury-in-Steel Recording Hygrometers ●

DISTANCE RECORDING HYGROMETER. The mercury in steel principle described on page 68 is employed in the design of this instrument so that the bulbs, tank, etc., may be located out in the open, and the recorder placed in the observation room. It is admitted that the inside of a Stevenson screen should be as free as possible from superfluous metal, etc., which may tend to vitiate the readings of the thermometers, and the particular advantage of this instrument is that only the bulbs of the apparatus are actually inside the screen. Both bulbs are made of Staybrite to avoid corrosion, and one is provided with a close-fitting muslin sleeve with skirt dipping into the water.

The two bulbs are clamped to a casting which carries the water tank situated directly under the bulbs.

The water tank usually supplied holds $1\frac{1}{4}$ pints, but when desired a specially large tank holding $2\frac{1}{2}$ pints can be substituted.

Daily (8-day clock) or weekly drum, ranges as below.
Capillary, any length up to 150 ft.

	MODEL C	MODEL D
Clock drum	3.6 in. dia. × 3.6 in. high	5 in. dia. × 6 in. high
Pen travel	3 in.	5 in.
Chart	3.6 in. × 11.8 in.	5.8 in. × 16.2 in.
Time scale (daily)	0.45 in. per hour	0.6 in. per hour
" " (weekly)	1.54 in. per day	2.06 in. per day
Temperature scale	33.3°F. or 16.6°C. per in.	20°F. or 10°C. per in.

RANGES

0/100°F. 30/130°F. -10/+40°C. 0/50°C.

5645 C With 10 ft. capillary to each bulb, 6 spare wicks, pen filler, ink and 100 charts.

	MODEL C	MODEL D
PRICE: £53 12 6	£58 10 0	
Extra capillary per ft.	4 6	4 6
Charts per 100	12 0	15 0

5645 A Ditto, with supply of water maintained from a tank which may be placed any distance away.

PRICES: MODEL C £54 12 6 MODEL D £59 10 0

	Dimensions	Weight
Case { MODEL C	$11\frac{1}{2}'' \times 6'' \times 5\frac{1}{4}''$	15 lb.
MODEL D	$1' 2\frac{1}{2}'' \times 8\frac{1}{2}'' \times 7\frac{1}{2}''$	26 lb.



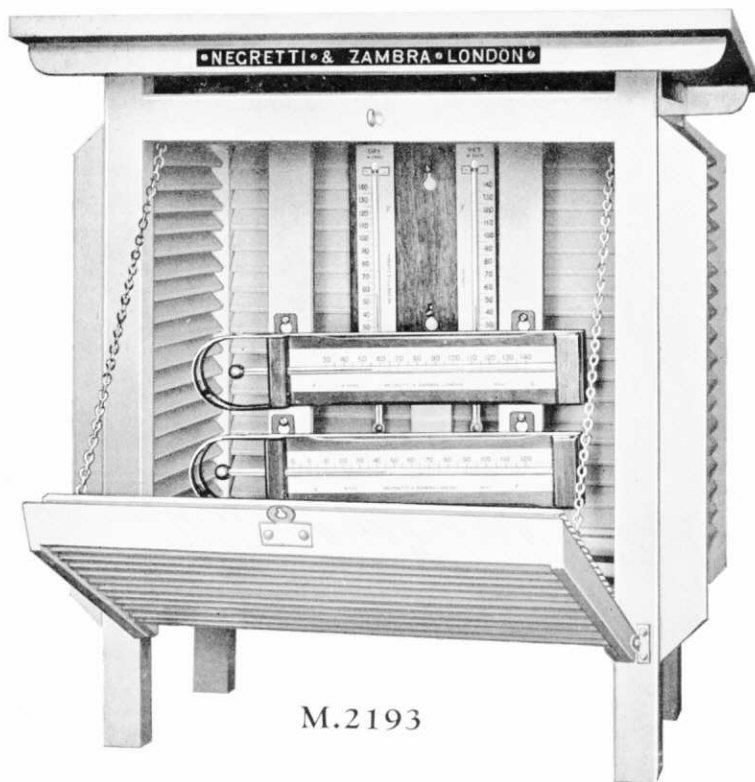
● *Thermometer Screens*

M.2193 STANDARD

STEVENSON SCREEN

With double louvres, 18 on each side; inside dimensions 16 in. × 16 in. × 9 in.; hinged door with 18 double louvres, brass hasp, staple and padlock.

The bottom consists of three boards with ventilation spaces between them; the roof is made in two parts, the inner of plain board drilled with holes, the outer jointed and tenoned. Three uprights for the thermometers are fitted in the correct positions inside the screen. All parts are finished two coats of paint, and one coat of white enamel.



M.2193

PRICE : £12 2 6

M.2194 Four posts 5 ft. × 4 in. × 3 in. to serve as a stand.

PRICE : £3 5 0

M.2193A Stevenson screen. British Meteorological Office pattern.

PRICE : £19 0 0

Dimensions : **M.2193** 2' 0" × 2' 1" × 1' 5"
M.2193A 2' 3" × 1' 11" × 1' 8"

Weight 31 lb.
60 lb.

M.2193B Screen fitting to take sheathed thermometers.

PRICE : £1 1 0

M.2193C Galvanised Stand for Stevenson screen, British Meteorological Office Specification, as described on page 91.
Weight 63 lb.

PRICE : £5 15 0

Thermometer Screens



M.2194A STEVENSON SCREEN, British Meteorological Office Specification, for sheathed thermometers. This screen, smaller and lighter in construction, has been specially designed for the maximum, minimum, dry bulb, and wet bulb sheathed thermometers. The screen is double louvred and measures internally 16½ in. wide, 12 in. high and 6 in. deep; brass clips are fitted to support the thermometers. For thermo-

mers see 2135/2136A, page 54 and 2199B, page 77.

Weight 20 lb.

PRICE: £12 2 6

M.2194B Galvanised Stand for above. Constructed of angle steel, 4 ft. 6½ in. high with cross bracing of mild steel strip and a 5 in. square footplate at base of each upright. Complete with bolts and nuts and spanner for assembly.

PRICE: £5 5 0

Weight 50 lb.

M.2195 Large Stevenson Screen, British Meteorological Office pattern; to accommodate two recording instruments and the usual thermometers. The construction and dimensions are similar to **M.2193** page 90, except in regard to the length. Two doors to the front. Measurements inside the posts, 3 ft. 5 in. × 1 ft. 4 in. × 9 in.

Weight 80 lb.

PRICE: £39 10 0

M.2195A Galvanised Stand for above large screen.

PRICE: £6 6 0

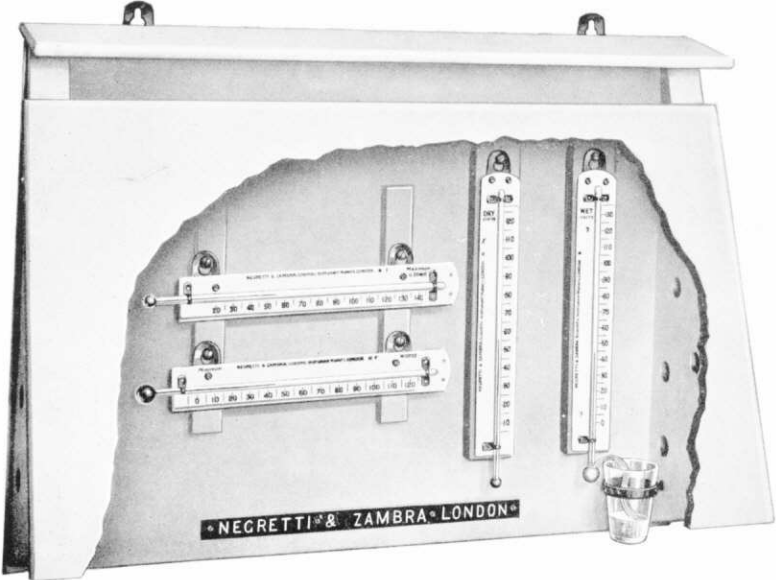
Weight 84 lb.

M.2196 Shipboard Portable Screen. Inside dimensions 13 in. × 11 in. × 15¾ in. Made of best yellow pine with single louvres.

PRICE: £7 15 0



● *Meteorological Sets*



M.2198 SET OF INSTRUMENTS

This installation comprises a set of standard thermometers mounted on a screen of the Glaisher type.

THE MAXIMUM THERMOMETER

—is that described under **M.2147** page 56.

THE MINIMUM THERMOMETER

—is that described under **M.2149** page 56.

THE HYGROMETER

—is that described under **M.2203** page 79.

The screen is of hard wood, painted white and suitably battened to avoid warping, with hinged front, ledge for rain drainage, ventilated sides, and two stout brass back plates.

THE COMPLETE SET COMPRISES THE ABOVE, AND—
5 in. Snowdon rain gauge and measure. Pad of 12 monthly record sheets. “Observer’s Handbook.”

PRICE: £13 17 6

National Physical Laboratory Certificates and Meteorological Office Certificate for Rain Gauge £1 0 0

NOTE

As the readings of thermometers exposed in a Glaisher type differ from those in a Stevenson’s Screen, the British Meteorological Office Authorities do not accept readings from the above.
Dimensions : 2 ft. 0 in. × 1 ft. 6½ in. × 7 in. Weight 30 lb.



Test Thermometers



TEST THERMOMETERS are very suitable for standardising electrical resistance or distance thermometers etc., where great accuracy is required without total immersion. The bulb is of a comparatively large volume and the bore of the indicating column of mercury is of large area. The capillary tube leading from the bulb to the indicating tube is of very small diameter. This construction makes for greater accuracy in partially immersed thermometers and reduces their emergent stem corrections.

These thermometers are calibrated for 4 in. immersion, and the lower ranges are graduated in both Centigrade and Fahrenheit degrees.

Each thermometer is supplied in a cardboard case.

DOUBLE SCALE

Type	Range	Sub-divided	Each	N.P.L. Cert.
M.2271	-40° to +140°F. and -40° to 60°C.	0.5°F. 0.2°C.	£4 4 0	£1 10 0
M.2272	0° to 250°F. and -18° to 120°C.	0.5°F. 0.2°C.	£4 17 6	£1 10 0
M.2273	200° to 500°F. and 93° to 260°C.	0.5°F. 0.2°C.	£5 4 6	£1 10 0

SINGLE SCALE

M.2274	200° to 950°F.	2.0°F.	£4 8 6	£2 0 0
M.2275	90° to 510°C.	1.0°C.	£4 8 6	£2 0 0

● *Test Manometers*

M.2277B PRECISION MANOMETER

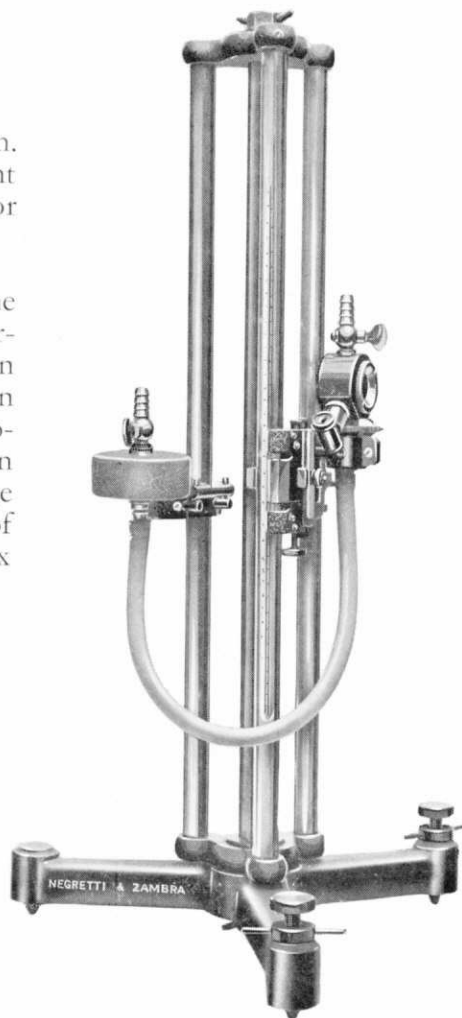
For the measurement of pressures up to 100 cm. head of water, this instrument enables consistent and accurate readings to be taken to $\cdot 05$ mm. (or $\cdot 002$ in.)

The apparatus consists of a cathetometer frame with a graduated scale and movable vernier carriage on which is mounted a cistern having an eyepiece set below the water level and at such an angle that a magnified view is obtained of a submerged index point. The surface of the water in the cistern acts as a mirror and a reflected image of the index is also seen, the exact datum level of the water being obtained when the tip of the index and its image just appear to touch.

A U-tube is formed by the connection of a thick walled rubber tube from an outlet on the bottom of the cistern to a second chamber or cistern which can be clamped at any desired position on another vertical rod. Having filled the cistern so that the datum level is correct with the vernier set at zero or at a selected point on the scale, the pressure or suction to be measured is indicated by the movement of the cistern necessary to produce a balancing head of water, to restore the datum level.

Suctions, pressures, or differential pressures can be measured by making suitable connections to either or both chambers.

The gauge can be used with pitot or venturi tubes for determining air flows or for measuring with precision the depth of water in tanks, for calibrating other gauges and indeed for any purpose involving the exact determination of pressures.



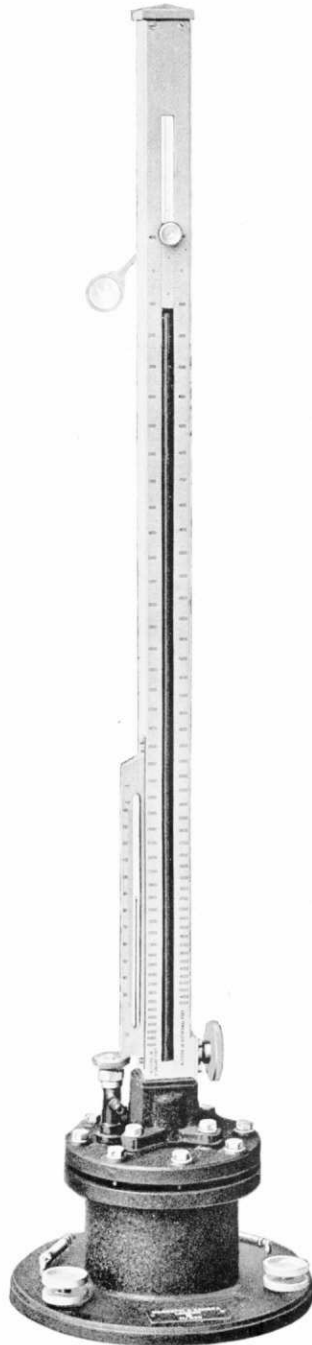
PRICE on REQUEST

Dimensions : 4' 5" × 1' 5" × 1' 4"

Weight : 104 lb.



Test Barometers ●



M.2280 STANDARD TEST BAROMETER for measuring pressure below normal atmospheric pressure with precision such as for instance in the calibration of aneroids, etc.

The bore of the glass tube is 0.5 in., and the vernier reads to .002 in. The cistern is of cast iron, with a connecting pipe for coupling to a pump or receiver.

In order to make the barometer reasonably safe in transport, the cistern is fitted with a needle valve, which shuts off the connecting pipe, so that when the barometer is inverted there is no loss of mercury. The barometer is transported in an inverted position in a special crate with carrying handle.

The instrument is fitted with a thermometer for temperature corrections.

M.2280 TEST BAROMETER, as above, with any one scale. **PRICE: £124 10 0**
 Extra per additional scale **£3 3 6**
 N.P.L. Cert. for pressure scales only **Extra.**

Any four of the following scales can be provided :

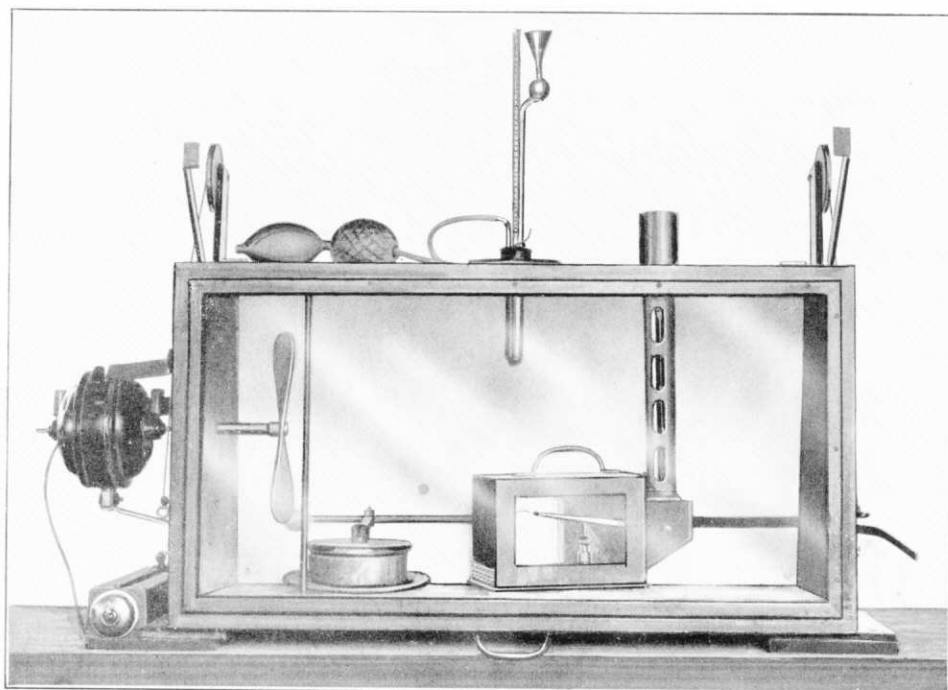
1. Inches mercury pressure ranged 32" to 2"
2. Mms. mercury pressure ranged 800 to 50 mm.
3. Altitude —500 to +18,000 metres.
4. Altitude —1000 to +60,000 feet.
5. Mbs. mercury pressure ranged 1080 to 70 mbs.

It must be stated whether the scales should be graduated to "Isothermal" or "I.C.A.N." Height Tables, and to "Standard" or "London Laboratory" conditions.

Dimensions : 3' 7" × 10" × 10"

Weight : 32 lb.

● *Hygrometer Test Chamber*



THE APPARATUS for testing Hygrometers consists of a wooden chamber lagged against sudden temperature changes and with double glass window. Inside the chamber an electrically operated fan is provided for rapid circulation of the air, and for establishing definite humidities aqueous solutions or salt or acid are used. Some typical values are given below.

H ₂ SO ₄ (Aqueous solution)								
°C.	20	0	20	0	20	16	20	0
DENSITY	1.205	1.215	1.311	1.326	1.375	1.518	1.281	1.296
% R.H.	78.6	76.8	54.7	52.2	40.7	13.8	61.7	59

	CaCl ₂ .6H ₂ O (Sat. Soln.)	LiCl H ₂ O	NaCl	NH ₄ Cl
°C.	10	20	20	20
% R.H.	38	32.3	15	79.5

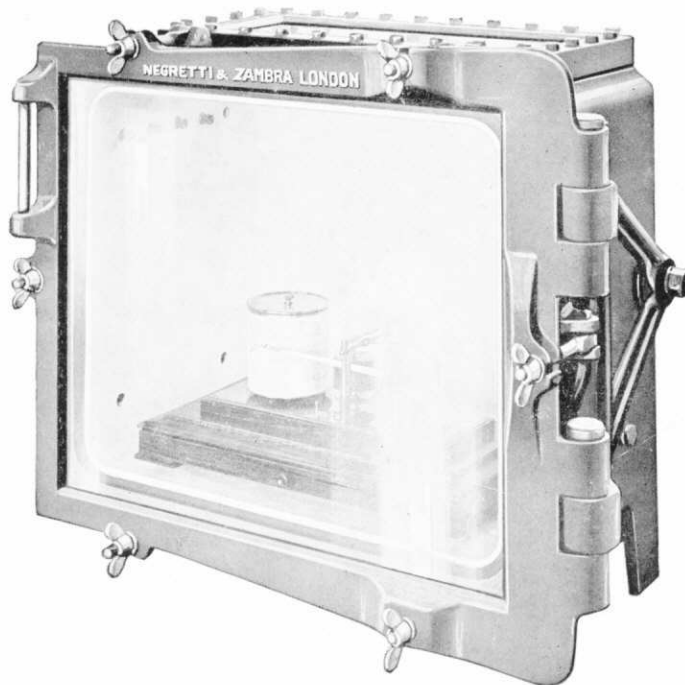
Alternatively the relative humidity may be found by means of a wet and dry bulb hygrometer or a dew point apparatus.

M.2276 Hygrometer Testing Apparatus Price on application.



Barometer Test Apparatus ●

M.2284



*As supplied to the
British Air Ministry.*

M 2284 VACUUM CHAMBER for testing aneroids, barographs, etc., within the range of $34''$ to $9''$ of barometric pressure. The chamber is of cast iron, with a $1''$ plate-glass window at the top, and a $1\frac{1}{4}''$ plate-glass panelled door in front. The door is on special hinges, and a joint is made between the plate glass and the chamber with a rubber ring. Six wing nuts are provided for holding the door closed. Wire guard, if required, at additional cost.

A connection is made for exhaust, also terminals for any electric connections that may be required for heaters, etc., when carrying out temperature tests under a vacuum. Inside dimensions $20\frac{1}{2}''$ wide \times $17''$ high \times $13''$ deep.

M 2284	Vacuum Chamber	. . . . .	PRICE: £134 0 0
G 335	Needle Valve with union (two required)	. . . . .	each 16 6
G 362	Copper Tubing, $\frac{1}{4}''$ o/d. \times 22 S.W.G.	. . . . .	per foot 9
G 357	Couplings, Brass	. . . . .	each 1 3
G 369	Tee-piece with unions	. . . . .	„ 3 0
	$2' 2'' \times 2' 4'' \times 1' 6''$	500-lb.	



FAHRENHEIT AND CENTIGRADE CONVERSION TABLE

°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.
-40	-40	10	-12.2	60	15.6	110	43.3	160	71.1
-39	-39.4	10.4	-12	60.8	16	111	43.9	161	71.7
-38.2	-39	11	-11.7	61	16.1	111.2	44	161.6	72
-38	-38.9	12	-11.1	62	16.7	112	44.4	162	72.2
-37	-38.3	12.2	-11	62.6	17	113	45	163	72.8
-36.4	-38	13	-10.6	63	17.2	114	45.6	163.4	73
-36	-37.8	14	-10	64	17.8	114.8	46	164	73.3
				64.4	18				
-35	-37.2	15	-9.4	65	18.3	115	46.1	165	73.9
-34.6	-37	15.8	-9	65	18.3	116	46.7	165.2	74
-34	-36.7	16	-8.9	66	18.9	116.6	47	166	74.4
-33	-36.1	17	-8.3	66.2	19	117	47.2	167	75
-32.8	-36	17.6	-8	67	19.4	118	47.8	168	75.6
-32	-35.6	18	-7.8	68	20	118.4	48	168.8	76
-31	-35	19	-7.2	69	20.6	119	48.3	169	76.1
		19.4	-7	69.8	21				
-30	-34.4					120	48.9	170	76.7
-29.2	-34	20	-6.7	70	21.1	120.2	49	170.6	77
-29	-33.9	21	-6.1	71	21.7	121	49.4	171	77.2
-28	-33.3	21.2	-6	71.6	22	122	50	172	77.8
-27.4	-33	22	-5.6	72	22.2	123	50.6	172.4	78
-27	-32.8	23	-5	73	22.8	123.8	51	173	78.3
-26	-32.2	24	-4.4	73.4	23	124	51.1	174	78.9
-25.6	-32	24.8	-4	74	23.3			174.2	79
						125	51.7	175	79.4
-25	-31.7	25	-3.9	75	23.9	125.6	52	176	80
-24	-31.1	26	-3.3	75.2	24	126	52.2	177	80.6
-23.8	-31	26.6	-3	76	24.4	127	52.8	177.8	81
-23	-30.6	27	-2.8	77	25	127.4	53	178	81.1
-22	-30	28	-2.2	78	25.6	128	53.3	179	81.7
-21	-29.4	28.4	-2	78.8	26	129	53.9	179.6	82
-20.2	-29	29	-1.7	79	26.1	129.2	54	180	82.2
								181	82.8
20	-28.9	30	-1.1	80	26.7	130	54.4	181.4	83
-19	-28.3	30.2	-1	80.6	27	131	55	182	83.3
-18.4	-28	31	-0.6	81	27.2	132	55.6	183	83.9
-18	-27.8	32	0	82	27.8	132.8	56	183.2	84
-17	-27.2	33	0.6	82.4	28	133	56.1	184	84.4
-16.6	-27	33.8	1	83	28.3	134	56.7	185	85
-16	-26.7	34	1.1	84	28.9	134.6	57	186	85.6
				84.2	29			186.8	86
-15	-26.1	35	1.7	85	29.4	135	57.2	187	86.1
-14.8	-26	35.6	2	86	30	136	57.8	188	86.7
-14	-25.6	36	2.2	87	30.6	137	58.3	188.6	87
-13	-25	37	2.8	87.8	31	138	58.9	189	87.2
-12	-24.4	37.4	3	88	31.1	138.2	59	190	87.8
-11.2	-24	38	3.3	89	31.7	139	59.4	190.4	88
-11	-23.9	39	3.9	89.6	32			191	88.3
		39.2	4			140	60	192	88.9
-10	-23.3					141	60.6	192.2	89
-9.4	-23	40	4.4	90	32.2	142	61.1	193	89.4
-9	-22.8	41	5	91	32.8	143	61.7	194	90
-8	-22.2	42	5.6	91.4	33	143.6	62	195	90.6
-7.6	-22	42.8	6	92	33.3	144	62.2	195.8	91
-7	-21.7	43	6.1	93	33.9	145	62.8	196	91.1
-6	-21.1	44	6.7	93.2	34	145.4	63	197	91.7
-5.8	-21	44.6	7	94	34.4	146	63.3	197.6	92
						147	63.9	198	92.2
-5	-20.6	45	7.2	95	35	147.2	64	199	92.8
-4	-20	46	7.8	96	35.6	148	64.4	199.4	93
-3	-19.4	46.4	8	97	36.1	149	65	200	93.3
-2.2	-19	47	8.3	98	36.7	150	65.6	201	93.9
-2	-18.9	48	8.9	98.6	37	150.8	66	201.2	94
-1	-18.3	48.2	9	99	37.2	151	66.1	202	94.4
-0.4	-18	49	9.4	100	37.8	152	66.7	203	95
				100.4	38	152.6	67	204	95.6
0	-17.8	50	10	101	38.3	153	67.2	204.8	96
1	-17.2	51	10.6	102	38.9	154	67.8	205	96.1
1.4	-17	51.8	11	103	39.4	154.4	68	206	96.7
2	-16.7	52	11.1	104	40			206.6	97
3	-16.1	53	11.7	105	40.6	155	68.3	207	97.2
3.2	-16	53.6	12	105.8	41	156	68.9	208	97.8
4	-15.6	54	12.2	107	41.1	156.2	69	208.4	98
				107.6	41.7	157	69.4	209	98.3
5	-15	55	12.8	108	42.2	158	70	210	98.9
6	-14.4	55.4	13	109	42.8	159	70.6	210.2	99
6.8	-14	56	13.3	109.4	43	159.8	71	211	99.4
7	-13.9	57	13.9					212	100
8	-13.3	57.2	14						
8.6	-13	58	14.4						
9	-12.8	59	15						



PUBLICATIONS

	£	s	d
A Short Course in Elementary Meteorology	2		6
Meteorological Observer's Handbook		(on request)	
Meteorology for Aviators	7		6
Cloud Forms	1		3
Manual of Meteorology (Sir Napier Shaw)			
Vol. I Meteorology in History	1	15	0
Vol. II Comparative Meteorology	2	2	0
Vol. III The Physical Process of Weather	2	2	0
Vol. IV Meteorological Calculus:			
Pressure and Wind	1	17	6
The Drama of Weather (Sir Napier Shaw)	12		6
Quarterly Journal—Royal Meteorological Society	10		0
British Rainfall—Annual	1	1	0
Mills Pocket Rainfall Register 1/- plus 3d. P. Tax	1		3
Charts for Tabulating Records of Thermometer, Rain, Sun etc.			
Large size 18" × 10" Pad of 12 sheets (last 12 months)	3		0
Small size 9" × 5½" Pad of 12 sheets (last 12 months)	1		9
Tables for Wet and Dry Bulb Thermometers in Still Air,			
Fahrenheit Scale (M.O. 265)	1		0
Centigrade (Instruments Meteorologique-Angot)	1		0
For Ventilated or Aspirated Hygrometer			
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