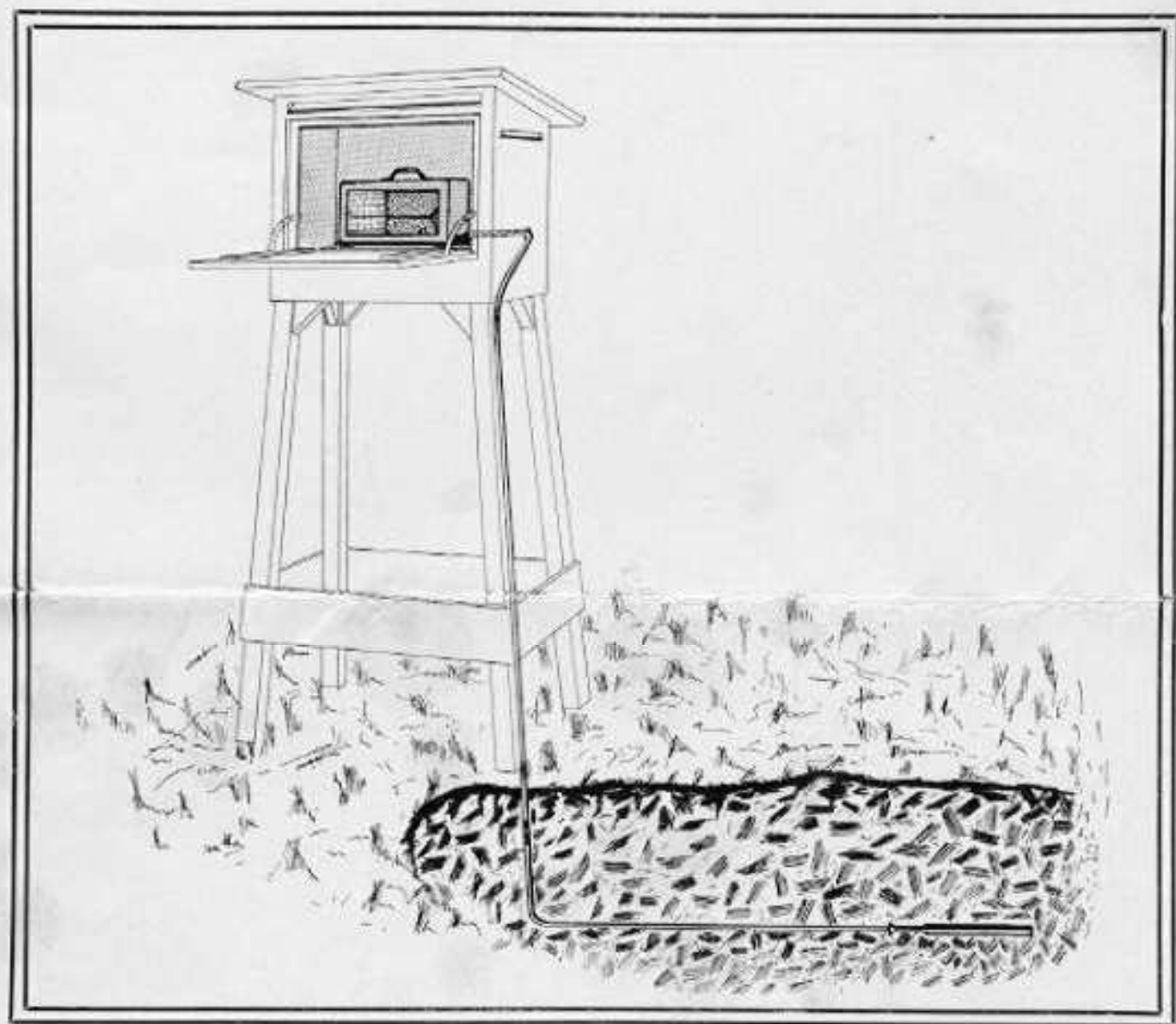


EARTH TEMPERATURE RECORDERS

Mercury Expansion Type.

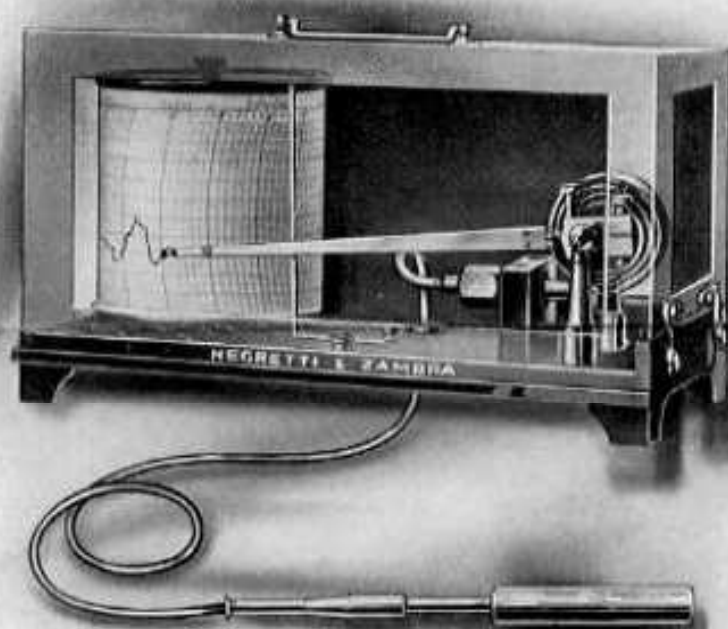
PATENT No. 167000



by

NEGRETTI & ZAMBRA





MODEL B.

Negretti & Zambra's

EARTH TEMPERATURE RECORDERS

Mercury Expansion Type.

PATENT No. 167000

THE importance of obtaining accurate information as to the variation of the temperature of the earth is essential in certain investigations dealing with Agriculture, Mining, Health, Meteorology, etc., and the Negretti & Zambra Earth Temperature Recorder is produced to give a record of these temperatures on a chart with very great precision.

The method adopted hitherto by means of a glass thermometer with a high thermometric lag let down into an iron tube buried in the earth is open to objection where the immersion is not great, due to the uncertainty as to the time at which the temperature was reached. A thermometer with a high thermometric lag will give the temperature, not at the time of observation, but many minutes or an hour or so before, also such a thermometer will never give the maximum or minimum temperatures where there is much fluctuation. Further, where the depth of immersion is of great importance, such an arrangement gives uncertainty due to the effect of conduction of the iron tube, and the air space above the thermometer.

A more recent method is to bury the bulb of a glass thermometer in the soil, and for the convenience of reading the indicating portion is bent "L" shape above the ground level. Provided readings are taken at short intervals where the bulb is near the surface, such a method is to be preferred. The inconvenience, however, of taking readings at short intervals, especially where the effects of clouds and sun have to be considered, suggests that a record on a chart of these temperatures is very desirable.



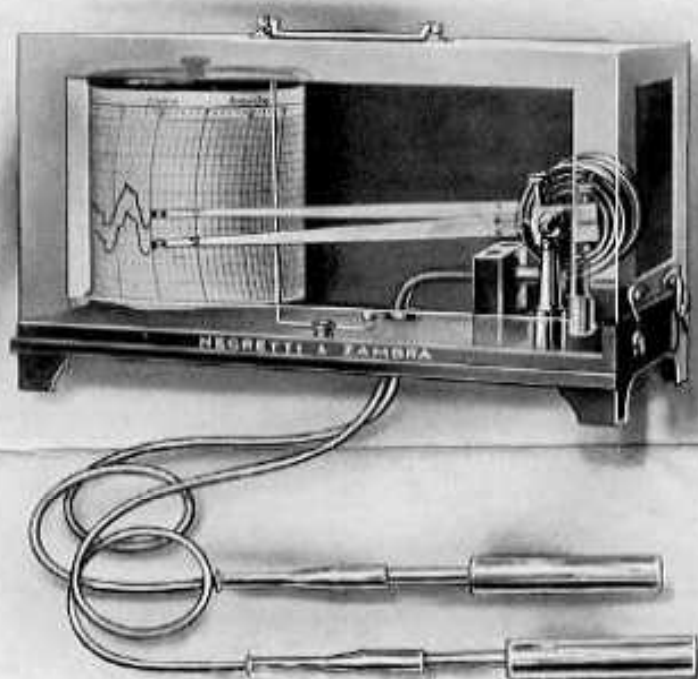
The Negretti & Zambra Temperature Recorder is produced with a view to giving an accurate record of these temperatures. The following is a brief description of the instruments:—

Types.

Two types of instruments are made.

Model "B" is a single pen recording instrument, with chart scale 5 in. high, and length of chart 16.2 in., divided into days or hours.

Model "D" is a double pen recording instrument, with chart similar to "B."



MODEL D.
(FOR ILLUSTRATION OF MODEL B SEE PAGE 2.)

These recorders have rectilinear charts with vertical clock drums, similar to the illustration. The charts may be weekly or daily.

Range.

The standard range is plus 20 to 120° F., giving 20° F. per inch on the chart and with even increments of temperature. Other ranges may be supplied at slightly increased cost.

Capillary.

The standard length of semi-flexible capillary between the bulb and the recorder is 15 ft., but longer lengths up to 150 ft. capillary may be supplied at increased cost.

Errors.

Temperature Recorders of all types are subject to certain errors which are not always appreciated by users, and it has been our object either to eliminate these errors or reduce them to negligible proportions.

Compensation. We have seen records of earth temperatures where the trace shows apparent rapid fluctuations of temperature where the bulb was buried at a considerable depth; such fluctuations were impossible. The apparent fluctuations were due to sun and cloud effects on the recorder and capillary.

Traces taken on our recorders do not show these errors even in tropical countries. As a practical test of this, we have tested a number of these instruments in an oven with the bulb kept constant at 104° F. outside the oven. With an increase in temperature of the recorder and capillary of 50° F. the maximum error was under 0.1° F., and which is scarcely readable on the chart.

Barometer Change. A change in barometric pressure has no effect whatever on the accuracy of our recorders, as is the case in certain types of ether vapour pressure thermometers where these errors are of the order of a few degrees with 1 in. change of the barometer.

Friction. Friction and backlash errors are practically eliminated, due to the Bourdon tube operating direct on the pen arm spindle without levers or gears, and due to the large amount of control obtained from a mercury expansion thermometer.

Sensitivity. The N. & Z. Recorder is very sensitive to temperature change. The bulbs are very long in proportion to the diameter, to give greater surface exposure. They are buried in the ground to the required depth, and packed round with local soil. Steel compared with glass is a good conductor, and it is found that if the volume of a mercury in steel bulb is many times greater than a mercury in glass thermometer, it is equally sensitive to temperature change in most mediums. To give some indication of the sensitivity, a mercury in steel thermometer will indicate a change of temperature from 60° to 200° F. in 20 seconds in water.

Corrosion. In order to eliminate the possibility of corrosion of the steel capillary or bulb, the capillary is encased in copper tubing hermetically sealed at both ends, outside of which lead tubing is drawn on the bulb and copper capillary throughout its length.

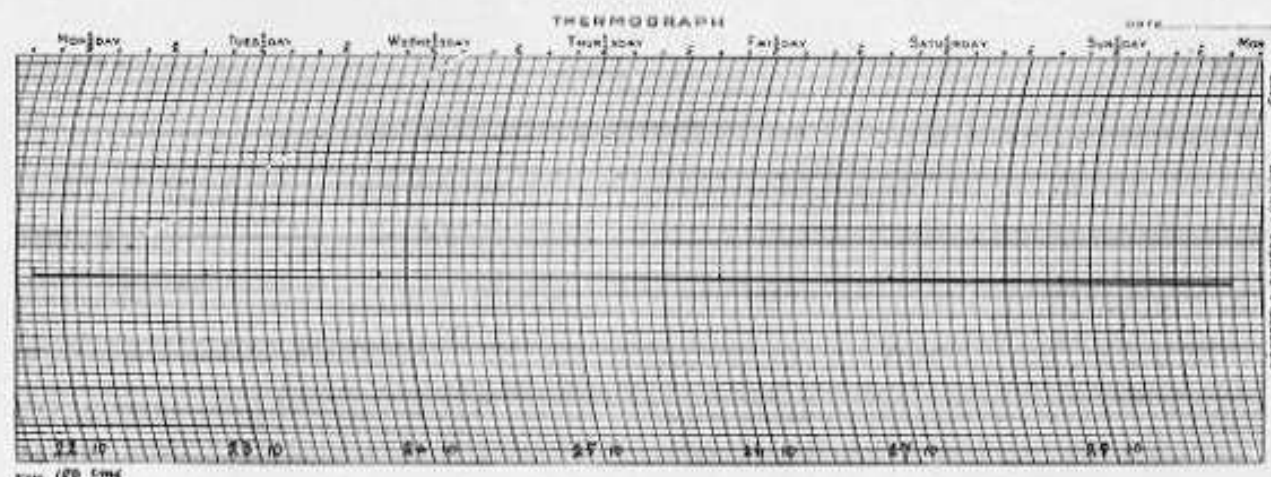
Case. The recorder is mounted in a reasonably dust-proof case, but where it is required to be fitted in the open it is advisable to enclose it in a screen.



Reliability.

We have made a large number of these recorders, and many have been in use for years without requiring any attention or adjustment beyond the winding of clocks and changing of charts.

We have supplied these instruments to Government Departments and Research Departments in this country and abroad, where they have given every satisfaction under varying conditions.



Specimen Chart.

We reproduce, reduced scale, a record obtained from one of these instruments, where the bulb was inserted one metre deep in the soil. This record shows a remarkably even trace, and when it is realized that the recorder and capillary were subjected to a daily variation of temperature of 20°C ., or more, it will be conceded that our method of compensation is remarkably accurate.

We have seen records from these instruments where five recorders were used with bulbs at varying depths. The amplitude of the trace near the surface is very marked, and extends right up and down the chart. As the bulbs are inserted at lower depths, this amplitude decreases until practically a straight line is traced, as shown in the above specimen.

Guarantee.

We guarantee these recorders to be of sound materials and first-class workmanship, free from all mechanical defects. We guarantee the accuracy as follows:—

- (a) The maximum error rising or falling, air temperature 60°F ., plus or minus 0.5 per cent. of the range, without tapping.



- (b) Change of 30° F. of both the capillary and recorder, maximum error 0.1 per cent. of the range, 10 ft. capillary. Bulb at 60° F.
- (c) Change of 30° F. of either the capillary or recorder, maximum error 0.1 per cent. of the range, 10 ft. capillary. Bulb at 60° F.
- (d) Error due to difference in level between the indicator and the bulb, 0.05 per cent. per foot. Allowance can be made for this in calibrating the instrument, if the position of the bulb is given.
- (e) No error due to barometer change or pressure of the earth surmounting the bulb.

Prices.		£	s.	d.
Model "B." Earth Temperature Recorder, range 20/120° F. single pen. Chart scale, 5 in. high by 16.2 in. long, as described above, complete with 15 ft. capillary tubing, weekly or daily clock drum, lead-coated capillary and bulb. Pen, ink and 100 charts	24	17	6
Additional lead-covered capillary per foot	0	5	6
Model "D." Ditto ditto with two pens and two lengths of capillary and bulbs	37	7	6
Additional lead-covered capillary for each length, beyond 15 ft. of either capillary per foot	0	5	6

NEGRETTI & ZAMBRA

Scientific Instrument Makers

38 HOLBORN VIADUCT, E.C.1

Branch . . . 122 Regent Street, W.1

Factory: Half Moon Works, Barnsbury, N.1

LONDON

Telegrams:
"NEGRETTI,
GENT.
LONDON"

Telephones:
No. 1525 City
No. 583 Holborn
No. 2072 Regent

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ASTRONOMICO
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