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THE CAMBRIDGE SCIENTIFIC INSTRUMENT COMPANY, LIMITED.

NOTES ON CALLENDAR SUNSHINE RECORDER.

The Recorder consists of two essential parts, (1) the recorder, and (2) the receiver.

The recorder consists of a Wheatstone Bridge in which the movement of a slider along the bridge-wire is automatically effected by delicate relays worked by a current passing through the galvanometer between the bridge arms. According as the moving coil of this galvanometer is deflected in one direction or the other a relay circuit is connected through one or other of two electro-magnets. Each of these magnets is mounted on a clock, the movement of which is prevented by a brake. When the current energises a magnet this brake is lifted, allowing the clockwork to revolve. The clocks are connected by differential gearing with a recording pen which is pulled in one direction or the other according as the brake is lifted on the corresponding clock. The bridge slider moves with the pen and tends to restore balance.

The actual receiving part of the apparatus consists of two resistance coils wound on a mica frame, the two coils being as exactly similar as possible in all respects and having a resistance of approximately 14 ohms each. The actual value is not essential as long as the two coils are of equal resistance when in the dark. One coil is covered with a thin layer of black enamelled glass. The coils are placed in a hermetically sealed glass vessel filled with dry air as shewn in the photograph enclosed. The receiver is connect by means of four wires to the Callendar Recorder; these four wires are generally made in the form of a cable protected by lead sheathing.

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For the reduction of results Professor Callendar has hitherto recommended that they should be expressed in mean hours of sunshine, to conform with the prevailing method as closely as possible. It must be remembered, however, that a mean sunshine hour on one of Professor Callendar's recorders corresponds to a definite quantity of heat received by the earth's surface, and is not a vague and indefinite entity like the hour of clear sunshine recorded by the usual burning glass or photographic methods. For instance, the burning glass gives the same record for an hour of clear sunshine in Winter and Summer, whereas the Winter sun in England is about four time less intense than the Summer sun.

For practical application in Meteorology it is most important that the instruments should be reduced to the same standard by direct comparison with each other. There is no other instrument in existence capable of recording the vertical component of the total radiation, or the total quantity of heat received by the earth's surface, so that the comparison with other instruments must involve some additional elements of uncertainty which it is desirable to eliminate from the comparisons. Instruments for recording or indicating the normal component of the solar radiation are of no use for meteorology because they are profoundly affected by atmospheric absorption, whereas Professor Callendar's instrument is not, and because, while they include an unknown and indeterminate error due to radiation from the sky, they neglect the greater part of this important factor,

Reduction to Absolute Measure:- There are many difficulties in the absolute reduction of results, which could be only appreciated by those who have made special study of this difficult question, and

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the absolute reduction factor must remain for the present subject to considerably greater uncertainty than the relative or comparative values. The following factor represents however a degree of accuracy which is probably sufficient for any purpose to which it could be applied; and is of much higher order than current estimates of the value of the "Solar Constant".

10 scale divisions (40 mm.) on Professor Callendar's standard which is his "Mean Sunshine" using bridge wire No.1 (equivalent resistance 1 ohm per 20 cms.) corresponds to a vertical intensity of 0.328 calories per sq. cm. per minute.

To reduce values obtained with a given sunshine receiver and Callendar recorder using bridge wire No.1 (equivalent resistance 1 ohm, actual resistance ½ ohm) it is only necessary to multiply the readings in scale divisions by the factor given on Professor Callendar's certificate, to reduce to calories per square centimetre per minute. To obtain the total number of calories in any given time multiply the average reading (as determined by the planimeter or by counting squares), by the number of minutes in the time interval considered.

The reduced planimeter reading gives 120 scale divisions of the wheel for 24 hours, at an intensity of 10 divisions on the record sheet. Thus the planimeter reads one small scale divisions for Factor x 12.

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