Leaflet No. 81

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THE JOLY MELDOMETER

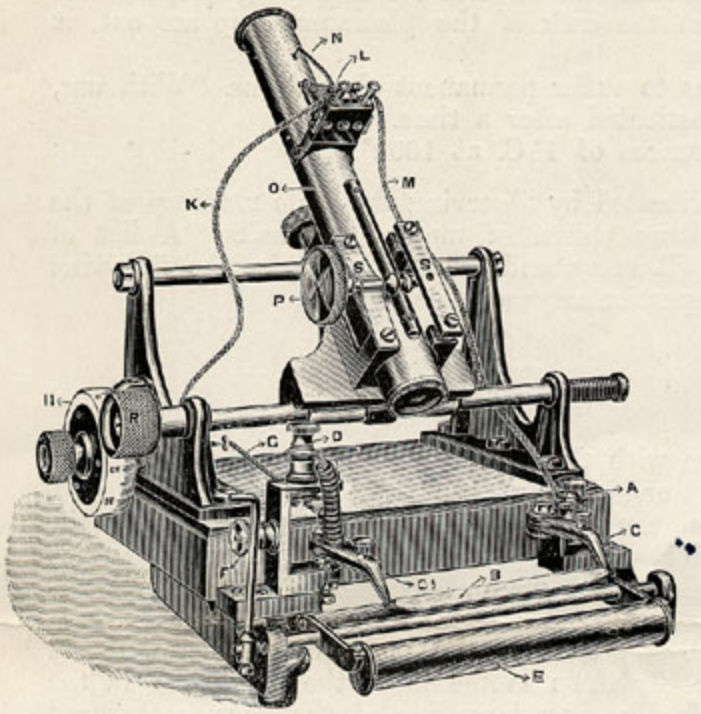

Fig. 1. The Joly Meldometer.

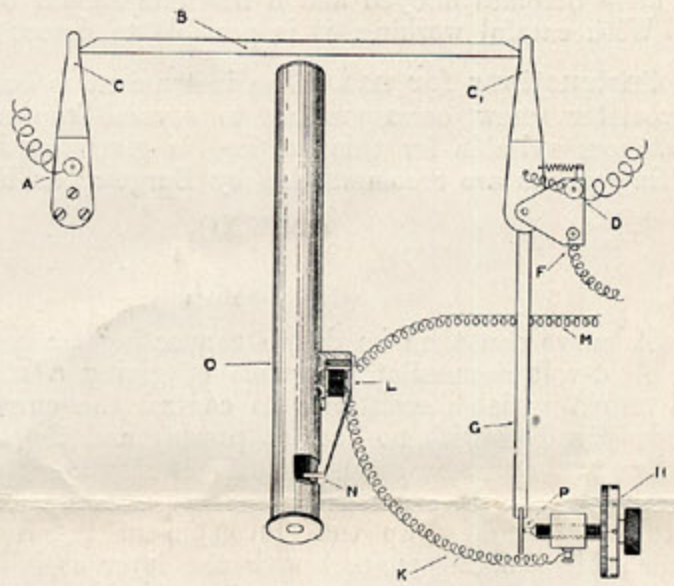

Fig. 2. Diagram of the essential parts of the Joly Meldometer.

General. This instrument was originally designed by Professor Joly[1], F.R.S., for determining the melting points of minerals, metals, &c. The special feature of the instrument is that it only requires a very small quantity of the substance whose melting point is to be determined, and therefore the substance may be obtained in a high state of purity; or in the case of minerals, fragments can be chipped off museum specimens without destroying their value.

Description. The instrument depends on the linear expansion of a strip of platinum with temperature. The substance to be investigated is placed in the centre of the platinum strip, the strip being heated by an electric current until the substance melts. The length of the strip at the moment of fusion is a measure of the temperature which it has acquired, and therefore indicates the melting point of the substance.

Referring to Figs. 1 and 2, *B* is the platinum strip 10 cm. long, 4 mm. wide and 0·01 mm. thick, which is held in tension between spring clips *C* and C_1. The heating current enters at the terminal *A*, passing through the fixed clip *C* to the platinum strip *B* and then by the movable clip C_1 to the terminal *D*. The movable clip C_1 is pivoted, and a light spring causes it to maintain a slight and constant tension on the platinum strip. The lever arm *G* forms a continuation of the clip C_1 and magnifies the actual extension of the strip in the ratio of 2 to 1. This extension is measured by a micrometer screw of 0·5 mm. pitch fitted with a divided head *H* divided into 100 divisions. By estimation of one-fifth of a division, it is therefore possible to measure the movement of *G* to 0·001 of a millimetre, which corresponds to an actual extension of the strip of 0·0005 mm.

A minute fragment of the substance to be tested is placed in the centre of the platinum strip, and shielded from draughts by the hood *E*, which is not illustrated in Fig. 2, but is shown lowered in Fig. 1, and which can be raised so as to almost completely surround the platinum strip. A microscope *O* is then focussed on the specimen, the milled head *R* (Fig. 1) giving a longitudinal movement parallel to the strip in order to bring the substance in its field of view, and a second milled head *P* (Fig. 1) giving the necessary focussing adjustment. For this adjustment, Lucas's patent

[1] Joly. *Proc. Royal Irish Academy*, 3rd Series, II. 1891, p. 38.

[P. T. O.

slow motion mechanism is used, in which a small brass roller having a V-groove turned in its periphery is forced by steel band springs *SS* on to a steel rod which is fixed in the side of the microscope.

To make an experiment, it is necessary to have a rheostat with a fine adjustment to control the current in the platinum strip and this current should be gradually increased.

The observer watches the specimen through the microscope to see when it melts, and at the same time keeps the micrometer screw *H* just in contact with the lever *G*, so that at the moment of fusion the reading of the micrometer screw indicates the linear expansion of the strip.

To secure accuracy and speed in working, a small electromagnet *L* is fixed to the microscope and the armature of this electromagnet has a pointer *N* which moves in the eyepiece of the microscope.

The current is only completed through the electromagnet when contact is made between the micrometer screw and the lever arm *G*, the pointer of the electromagnet serving as an indicator in the microscope itself to show when contact is actually established.

A single dry cell is sufficient for this contact circuit, or it may be operated from the 4-volt battery which is used to heat the platinum strip. The current enters at *M* passes through the electromagnet *L*, to the wire *K*, and from this through the platinum tipped micrometer screw to the lever arm *G* and terminal *F*.

The capabilities of the instrument. The instrument can be used for measuring temperatures up to 1400° C. and owing to the special shape to which the ends of the platinum strip are cut, it glows uniformly to within a few millimetres of the clips.

At a temperature of about 1500° C. the strip begins to suffer permanent elongations. With use, the strip becomes alloyed and a new one should be substituted after a time.

With careful working, it is possible to detect differences of 1° C. at 1000° C.

Instructions for use. The instrument is best calibrated by observing the scale readings of the micrometer screw corresponding to several known melting points of metals and salts. A list of substances suitable for this purpose is given by Joly[1], Ramsay and Eumorfopoules[2]; the following melting points are recommended by Burgess[3] as being particularly suitable:

KNO_3	399° C.
KBr	723° C.
K_2SO_4	1071° C.

A curve can then be drawn connecting temperature with the linear expansion of the strip.

A 4-volt accumulator capable of giving a steady current of at least six amperes is required, and also a variable resistance to control the current in the strip. A reading is first taken on the divided head *H* with no current passing and the micrometer screw just touching the lever *G*. With the hood *E* over the strip the current is then switched on and gradually increased. Whilst this is being done the specimen is continually watched through the microscope and the micrometer head *H* is turned to follow up the movement of the lever *G*, and so that the point of the screw keeps momentarily making contact with the lever as indicated by the movements of the pointer *N* in the microscope. As soon as the substance is observed to fuse a second reading of the micrometer head is taken and the difference of the two readings gives the expansion of the strip. From this the temperature can be obtained from the curve. After the second reading has been taken the micrometer head should be screwed back to its original position before the current is switched off and the strip allowed to contract.

The advantages of the Joly Meldometer may be summarised as follows:

(1) *The working is simple.*

(2) *It requires only a very small quantity of the specimen, so that this may be obtained in a high state of purity; or the melting points of museum specimens may be ascertained without destroying their value.*

(3) *The instrument is accurate and quick in working.*

(4) *It is very sensitive. Differences in temperature of* 1° *C. may be detected at* 1000° *C.*

PRICES.

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7200	**Joly Meldometer**, complete with three spare platinum strips	25	0	0	*Meltingly*
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[1] Joly. *loc. cit.*
[2] Ramsay and Eumorfopoules. *Phil. Mag.* XLI. 360, 1896.
[3] *High Temperature Measurements* by H. le Chatelier & O. Boudouard, English Edition by Dr G. K. Burgess, 2nd. ed. p. 257.

Cambridge: 3000 *Printed at the University Press.* July, 1910.