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THERMISTOR ANEMOMETER

Since the operation of a thermistor as an anemometer is based entirely on principles of hot wire anemometry, it is inevitable that the sensing element, *viz.*, the bead, should be kept hot, *i.e.*, at a temperature much higher than the ambient temperature. If it is felt that the direct electrical heating of the bead is detrimental to the life of the thermistor, it is equally undesirable to operate the bead hot by applying heat from an external heating coil.

While discussing the use of a thermistor as an anemometer, one should clearly distinguish between the two methods of operation, the direct and the indirect heating. In the directly heated types, the minimum operating current should be above the optimum value at and above which the dissipation from the bead is such as to produce a definite heating effect—the bead is then said to be operated "hot". For use as a thermometer, the operating current should always be less than this optimum. Hales — to whom Poornachandra Rao (1956) has referred in his note—has done extensive work on the use of thermistors (manufactured by the Bell Telephone Laboratories) as instruments of thermometry and anemometry and has presented curves showing the variation of optimum current with ambient temperature. These curves indicate that the optimum current increases with rise of the ambient temperature so that what may be a heavy current at low temperatures will be a safe operating current at higher ambient temperatures.

In the indirectly heated types, the heating of the bead is brought about by an external coil carrying an electric current; in other words, since the environmental temperature around the bead itself is higher, the current that can safely be passed through the bead for operation in a bridge circuit will also be higher. In both cases the maximum current is only limited by the current-carrying capacity of the resistance coils of the bridge. It is in the light of the above remarks that Poornachandra Rao's statement that "only a current which does not heat the beads was passed" should be examined.

Although the arrangement used by Poornachandra Rao is very satisfactory from many points of view, the heater winding employed is not the most efficient since the heat produced is not effectively concentrated on the bead and the gap between the heater winding and the bead introduces lags that may be seriously large.

I may point out that the Standard Telephones and Cables Ltd., London, are also manufacturing another type of thermistors, the L-types, which promise to be of immense use for anemometry in micrometeorology. In these types, the heater coil (about 100 ohms in resistance) with a negligible temperature coefficient of resistance is wound around a tiny lump of ceramic material at the centre of which is embedded the thermistor bead— Fig. 1(a). There is no air gap between the heater and the bead and this arrangement ensures maximum concentration of heat from the coil on to the bead; the main advantage here is that the lag coefficient is very small and therefore the sensitivity is much higher. In the external heater type employed by Poornachandra Rao, the air stream to which the thermistor is exposed has got to cool the outer hot coil whose reduced dissipation, acting through the glass walls and the air gap, lowers the temperature of the bead. Inevitably, therefore, this introduces undue lags which might make the instrument quite unsuitable for use in the study of short period fluctuations of wind.

In the B-type thermistors—Fig. 1(b)—also manufactured by the same Company and which are identical in construction to the type L, even the space within the glass tube is evacuated and gettered thus producing a high vacuum thermistor; this type is more sensitive than its gas filled counterpart, the L-type. For still greater

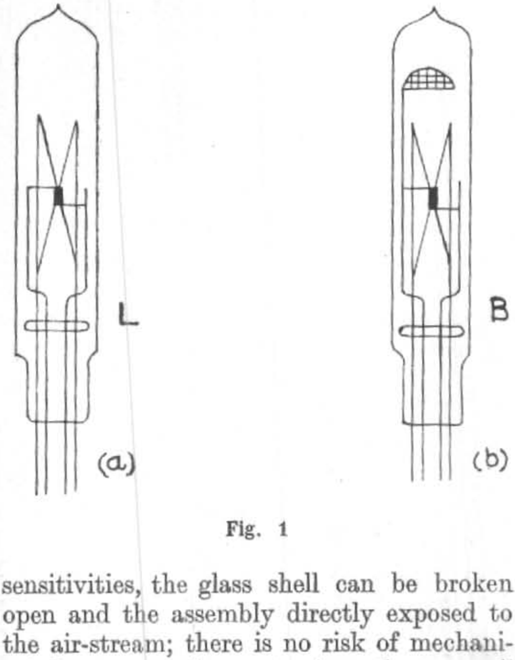

Fig. 1

sensitivities, the glass shell can be broken open and the assembly directly exposed to the air-stream; there is no risk of mechanical damage to the parts since they are all strongly supported on stout wires.

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