

(2.) NOTES ON THE KATATHERMOMETER.*

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This is an instrument for ascertaining a *general measure* of the cooling effect of air on the body when every physiological means of promoting heat-loss is brought into play (Haldane). The ordinary thermometer is of very little use in indicating what the body requires, because it only gives the average temperature of the surroundings, and does not show the influence of wind, which is the most potent thing in cooling persons or animals. The wet katathermometer shows the influence of wind and humidity.

The katathermometer† was invented by Dr. Leonard Hill, F.R.S., before the war, and was described by him in a Local Government Board Blue-book, No. 100 of the medical publications of 1914, also in Part I of the "Science of Ventilation," by Dr. Hill, being series 32 of the Government Medical Research Committee, 1919.‡

This instrument consists of a large-bulb spirit-thermometer graduated from 100° to 95° F. It is heated up in hot water until the spirit comes up into the top bulb in excess of 100°. For such heating a thermos flask is very suitable.

The time required to cool between the above ranges is measured with a stop-watch. This figure divided into a coefficient or factor number for each instrument (stated on the back of each instrument) gives the cooling-power expressed in millicalories per square centimetre of cooling-surface per second. The instrument can be used either dry, or wet with a small glove on it of very thin material. Generally both observations are necessary, for when it is dry it cools by convection and radiation, and when wet it cools by convection, radiation, and evaporation. The difference gives the cooling by evaporation.

As an example, assuming an instrument having factor number§ of 488 and that it took 100 seconds to cool, 100 divided into 488 gives 4·8, and the cooling-power would thus be 4·8 millicalories per square centimetre per second. There are no means as yet of expressing the exact relation between cooling-power and the physiological effect, and the approximate table hereunder is the best that can be done at present to indicate this relation approximately.

Wet *kata* Cooling-power in Milli-
calories per Square Centimetre
of Wet Surface per Second.

5	Extremely oppressive condition, inducing profuse perspiration. There is very little evaporation from the respiratory track, and a severe strain on the heat-regulating mechanism.
10	Oppressive.
15	Lower limit of satisfactory conditions unless no physical work is being done.
20	Best conditions; the higher figure necessitating a fair amount of clothing, or the performance of physical work.
30	Upper limit of satisfactory conditions; induces a feeling of cold; and danger of chill unless the body is well clothed or physical work is being done.
35	Uncomfortably cold unless hard work is being done or winter clothing is worn.
40	Heavy winter clothing necessary.

This table is a rough approximation, and is subject to reservations. For instance, if certain of the components, such as high air-velocity or excessive dryness, are extreme the conditions may be unhealthy, notwithstanding a satisfactory cooling-power. Further, the amount and condition (*i.e.*, wet or dry) of the clothing, even if there is only one thickness worn, profoundly affect the cooling-power of the air on the body. The dry katathermometer is warmed up by the wind, and the wet katathermometer is cooled by the wind. It could be used as an anemometer in very low velocities.

The influence of barometric pressure even at altitudes up to 5,000 ft. is so small that it may be neglected in *kata* computations.

The katathermometer, no doubt, will be further tested under mining conditions, and more exact relations between the cooling-power and the physiological effect will be ascertained. It will be of material advantage in ascertaining the necessary velocity of mine-air in warm working-places for healthful working-conditions, and will probably supersede the thermometer as a statutory measure for ascertaining the physiological conditions in a mine.

* Price 18s. 6d. each (postage extra) from Mr. S. Hicks, 8 Hatton Garden, London E.C.

† *Kata* (Greek) equivalent to "anti"—the "katathermometer" being observed with a *descending* column.

‡ Price 10s., published by H.M. Stationery Office, Imperial House, Kingsway, London E.C.

§ The factor number for each instrument is determined by the makers in a small still-air chamber surrounded by a water-jacket. The temperature of the chamber is read, also the cooling-power in seconds; and by a formula (?) which the inventor had evolved, using a small copper calorimeter of the same size as the *kata* bulb, the factor number of the instrument was found.