THE MEASUREMENT OF EQUIVALENT TEMPERATURE.

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(With 1 Figure in the Text.)

1. In a previous paper (1933: *J. of Hygiene*, **33**, 349–352) it was shown that the equivalent temperature of an environment can be determined by means of a pair of special kata-thermometers with surfaces of different emissivities, and an alignment-chart was described which enables the equivalent temperature to be readily computed from the cooling times of the two thermometers. The bulbs of the thermometers were made of copper with a very thin lining of glass and were filled with mercury to ensure that the surface was at the same temperature as the thermometric liquid.

It was suggested in the paper that alcohol-in-glass thermometers, which would be somewhat more portable, might possibly be used. This possibility has now been explored and, to simplify the computation, a special face has been fitted to an ordinary stop-watch which enables the equivalent temperature to be evaluated by the mere addition of two numbers.

2. A series of determinations with alcohol kata-thermometers in nineteen widely different environmental conditions has been compared with the corresponding determinations of equivalent temperature made with a eupatheoscope and has been supplemented by seven observations (in a water-jacketed metal box) in still air, with air and walls at the same temperature.

Table I shows the cooling times, B and S, for the twenty-six environments and the corresponding equivalent temperatures in degrees Fahrenheit as computed from an empirical formula, $75{\cdot}2 - 546\left(\frac{2{\cdot}35}{B+3{\cdot}5} - \frac{1}{S}\right)$, and as measured with a eupatheoscope.

Although the environments were chosen with a view to the inclusion of extreme conditions, the probable error of a determination is only $\frac{3}{4}°$ F.: this is regarded as highly satisfactory.

3. The bulb of each thermometer is 2 in. long and $\frac{3}{4}$ in. in diameter and the cooling range is nominally from $75\frac{1}{2}°$ to $74\frac{1}{2}°$ F. The thermometers have been compared with an N.P.L. certificated mercury-in-glass thermometer and the graduations of the black thermometer correspond to 75·2 and 74·2 and those of the silver thermometer to 75·3 and 74·3° F.

Ordinary kata-thermometers differ somewhat in size and thermal capacity and, for the determination of cooling power, each instrument has its own factor. It would seem reasonable to allow for this difference by a variation in the actual cooling range: every instrument would then have the same factor and cooling powers could conveniently be read directly upon a standard scale provided on an ordinary stop-watch.

Table I.

Cooling time		Environmental conditions		Equivalent temperature	
Black B sec.	Silver S sec.	Air Velocity ft./min.	Air Temperature °F.	Computed °F.	By eupatheoscope °F.
16·6	19·5	190	55·2	39·3	40·5
17·0	19·2	350	59·1	41·0	40·6
22·4	34·5	0	41·0	41·5	(41·0)*
18·8	21·4	270	58·1	43·2	44·2
17·0	17·8	300	58·3	43·3	44·8
26·8	39·8	0	45·0	46·5	(45·0)
22·0	25·2	360	63·1	46·6	47·8
24·8	29·8	80	56·6	48·2	47·2
26·8	33·0	100	58·3	49·4	49·2
32·2	50·7	0	50·0	50·0	(50·0)
27·1	30·8	140	59·9	51·0	51·2
39·5	59·2	0	54·7	54·6	53·5
41·4	66·6	0	55·0	54·8	(55·0)
33·7	38·0	290	66·3	55·1	55·1
41·7	63·7	0	56·7	55·4	56·8
44·0	69·0	0	56·3	56·1	55·3
57·4	92·0	0	60·1	60·1	(60·1)
42·0	35·4	120	62·6	62·4	64·4
40·7	33·0	620	68·5	62·7	60·6
69·0	105	0	63·2	62·7	63·3
90·2	153	0	65·2	65·1	(65·2)
58·0	40·0	270	67·3	67·0	67·5
84·0	76·0	0	62·8	68·6	69·2
149	250	0	69·2	69·0	(69·2)
81·0	49·7	140	67·4	71·0	68·3
158	66·0	150	69·9	74·9	75·1

* Temperature of water-jacketed metal box.

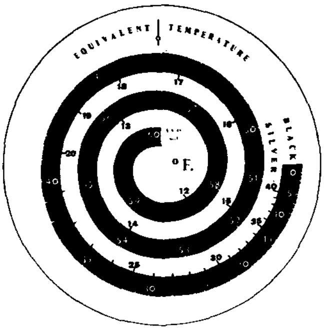

Fig. 1.

4. The stop-watch face shown in Fig. 1 is for use in conjunction with the pair of kata-thermometers described. The scale for use with the black thermometer is graduated as $67-546\left(\frac{2\cdot35}{B+3\cdot5}\right)$ and that for the silvered one as $8\cdot2-\frac{546}{S}$. The sum of two readings is therefore $75\cdot2-546\left(\frac{2\cdot35}{B+3\cdot5}-\frac{1}{S}\right)$ and gives the equivalent temperature in degrees Fahrenheit.

(*MS. received for publication* 19. VIII. 1933.—Ed.)