NOTES ON KATA THERMOMETER
OBSERVATIONS
ITS USE IN VENTILATION INVESTIGATIONS.
By A. Lewis.

The Kata thermometer in its present form is an adaptation by a British scientist, Professor Leonard Hill, of an early principle. In the 1860's a British heating engineer, Mr. Hood, used an ordinary thermometer heated to 120 deg. F., and allowed it to cool in a stream of air at 68 deg. at varying velocities. The time required for cooling was found to vary inversely as the square root of velocity and the data obtained was used as a basis for calculation of heat losses in moving air.

The modern instrument is essentially an alcohol thermometer with liberal sized bulb and narrow stem graduated at 100 deg. and 95 deg. F. For use it is heated to slightly above 100 deg. F., and then placed in a position for which an observation is required, and the time taken in cooling from 100 deg. to 95 deg. is noted, as is also the air temperature. As the same amount of heat is given out in cooling, the rate of cooling depends upon temperature difference and air movement, and the instrument is justly described by its inventor as a comfort meter and evaporimeter for measuring the efficiency of ventilation.

It may be used to determine the cooling power of the air, and to indicate comparative air movement.

In a public building in Melbourne argument and experiment had been carried on for nearly half a century as to most suitable means of admitting and extracting air. Local stuffiness and cold and hot spots had been suggested, smoke tests had been carried out with various systems, which indicated a general movement of air in the room. Tests with the Kata thermometer about the room indicated pockets where the air movement was practically negligible, while readings differed by 500 per cent. in various parts of the room; two particular pockets were noted, and additional means of local extraction provided, which resulted in a better distribution of air, more equable temperature and less complaints.

In a large building provided with air conditioning plant, with forced ventilation and natural exhaust, the Kata thermometer was used to determine the air movement across the room. Conditioned air was admitted along one wall near ceiling, and provision for natural exhaust was made along floor on opposite wall.
The designed air movement corresponded to that calculated from the amount of air entering room, but the velocity across room, as measured by the Kata, approximated three times the average velocity, and indicated that the air travelled across room practically horizontal, rebounded from wall and returned to other side, again rebounded and returned to outlet registers, or alternately dropped to floor at inlet registers, picked up heat at centre of room and thence passed to ceiling over outlet register, and was then drawn down to extraction register.

In measuring air velocities the ordinary anemometer with gearing and indicating dials is suitable for velocities from five to 30 ft. per second, and the low speed gearless anemometer with small dial disc is suitable for velocities of 1 to 5 ft. per second.

The hot wire anemometer is the most modern instrument for measuring air movement. It consists of metallic wires exposed to the air through which a current from a battery is passed, the resistance of the wire varies as the cooling effect, and the instrument presents some difficulties in calibration such that for the time being will prevent its general use.

The range of the Kata thermometer is from 8 ft. per minute to upwards of 50 ft. per second.

The judicious use of the Kata thermometer in conjunction with anemometer and smoke sticks to trace out direction of currents is required in ventilation problems.

In some cases the Wet Kata Thermometer gives a better comparison as regards cooling of the human body, and the instrument may be used either as a wet bulb or dry bulb instrument. It may also be used in drying problems to determine the heating or drying effect in a process room, in which case the time taken in heating from 95 to 100 deg. is taken for comparison.

It has been suggested that the Kata is unreliable in measuring descending currents of air, and this feature is common to any method of measurement by cooling, the convection currents set up by heating the air opposing the downward currents and assisting the upward currents.

The Kata reading represents a good average figure, the time taken in cooling under normal conditions being in the region of one minute, and it is usual to average at least three readings at the same spot.
In investigation of comfortable conditions for human occupancy the convection currents set up by the Kata Thermometer are similar to those set up by the human body.

(A Kata Thermometer was exhibited at the meeting.)

Mr. R. J. BENNIE said that he presumed the makers of the thermometer shown by Mr. Lewis had provided corrections for the humidity of the atmosphere, because the rate of heat transference would depend upon the specific heat of the gas by which the thermometer was surrounded. The specific heat of air would vary according to the moisture. The thermometer would be an ideal instrument for comparing the comfort of different climates. As to the use of the thermometer for measuring velocities of currents of coal or flue gases, specific heat would enter into the problem. Were there any instructions for use with the thermometer dealing with humidity?

Mr. LEWIS said he had seen the thermometer used a great deal as a dry value instrument. He had used it in a more or less equable temperature. He did not think it had been calibrated for gas, although it could be used for that purpose.

Mr. BENNIE said it still remained that the specific heat of the gas would alter the register. The correction of the humidity should be introduced in order to obtain correct readings in dealing with movements of air under different conditions of humidity.
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