

## The Clinical Thermometer.

By MISS EDITH MAY BUNYARD.

How many thousands of nurses use the clinical thermometer without giving a thought as to its usefulness, its mechanism, even its beauty; and the time, ingenuity, and care it has taken to invent and make.

A thermometer is an instrument used for the registering of heat or cold of the atmosphere; a clinical thermometer records accurately the temperature of the body, the interior of the body, its blood heat, and is used exclusively medically. The word clinical is derived from a Greek word, signifying "a bed," "pertaining to a bed," *i.e.*, to sickness, serious enough to confine the patient to bed. So the clinical thermometer ascertains the elevation or depression of temperature, consequent upon diseases, accidents, or operations, as a guide for the physician or surgeon in diagnosing and treating the case.

Fahrenheit's thermometer is always used in the British Isles, the Centigrade universally on the continent of Europe, Réaumur's is almost obsolete. Their modes of graduation are easily convertible, that of Centigrade being reduced to that of Fahrenheit by multiplying by nine and dividing by five, then adding thirty-two to the result; that of Fahrenheit to Centigrade, by reversing the process. Thermometers are made of the finest quality of glass into two distinct parts—(1) the stem, containing the "bore"; (2) the bulb, the receptacle for the mercury.

The "bore" is an infinitesimal tube, up which the mercury runs to indicate temperature. A certain quantity of molten glass is taken on the end of a blow-pipe, to form the glass tubing or stem, and quickly blown into a hollow ball; more and more glass is added till it is nearly thick enough, when it is handed on to another workman, who adds more glass to it, and rolls it very rapidly on an iron kneading board, so as to keep its shape and heat. Now a third man comes along and attaches his blow-pipe to the bottom of the ball, and both continuing to blow, gradually recede from each other, drawing the ball out till it forms a tube of the right size; these drawings are frequently as long as 300 ft. When cold they are cut into even lengths, tempered, straightened, and sealed at both ends with wax to prevent dampness getting into the "bore." At this stage they are called "canes." Any variation in the "bore's" diameter would render it unsuitable for the production of an accurate thermometer; therefore it is examined by a most skilful artisan, aided by a powerful magnifying glass. It is so fine that it is practically impossible to see it in a cross section, and in a half minute thermometer quite impossible to insert a human hair.

An equally skilful workman is required at the

blow bench in attaching and forming a bulb which will have such relative capacity to the "bore" as to produce the correct scale—95 deg. to 110 deg. The exact quantity of mercury, from two to three grains, must be contained in the right-sized bulb required to produce the scale allowed by the size of the stem. The thermometer of the present day is self-registering, and was first introduced by Casella, who made and constructed it. He let a small quantity of air into the tube, so separating a small part of the mercurial column from the rest, and preventing it from falling back into the bulb, thus making its own index. This method has been superseded by what is called "the indestructible index." A small expansion of the "bore" is made just above the bulb, and melted in by an intensely hot and very pointed flame; it is called a "chamber," and forms an arch over which the mercury on applied heat has to flow; it gets divided, that above remaining in the stem to mark the degree of temperature to an exact fraction, that beneath returning to the bulb on exposure to a lower temperature.

Owing to certain molecular changes taking place in the glass after manufacture, more particularly in the bulb, thermometers are kept for two years before being finished off; in spite of this precaution, continual use causes still more contraction, hence the advisability of sending them at stated intervals to be tested by a standard instrument—in Britain they can be sent to the Kew Observatory. To locate the scale, also the exact range of scale upon the stem, a standard thermometer of absolute accuracy is placed in a testing bath, the water being kept in continual motion and gradually heated. When it reaches the testing point (95 deg.), the other stems, which were immersed at the same time, are marked with a delicate line at the top of the mercury column. The same process is pursued in arriving at the two other test points, 100 deg. and 105 deg. Then the rest of the scale is graduated by a machine made for the purpose, and can be adjusted to make a finer or coarser scale, to suit each individual tube. Before this they are dipped and receive a thin coating of varnish, which is cut through by the graduating machine in making the divisions. After this process, the figures and arrow are etched on the varnish; then any varnish coating which may have become accidentally removed is made good, and the instruments dipped in hydrofluoric acid, which eats into the glass when it is not protected by the varnish. The lettering is then filled in with the required coloured varnish, black, red, &c. The finished tubes are again tested by the additional point, 110 deg., and any not quite accurate rejected.

The ten degrees are marked by long lines. The spaces are called "points," each representing two-tenths of a degree. The normal temperature is notified by a small arrow pointing to the second space or point above deg. 98, being then 98.4. The

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