REVERSING THERMOMETERS

by

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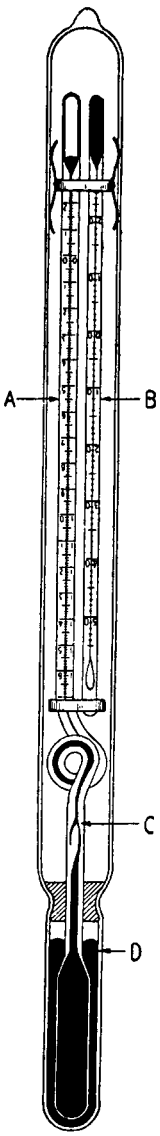

All reversing thermometers, as opposed to their mountings, are of the same general type.

Above the bulb there is a constriction, with an appendix-shaped cul de sac branching off it, which helps the column of mercury to break when reversal takes place. Above this again is a loop, of larger cross-section than the remainder of the tube, which acts as an overflow sump after reversal. Above the loop is an ordinary thermometer tube, graduated, however, upside down (from top to bottom, to give direct reading after reversal). In new models this tube is ground and polished to a flat face and backed with an opaline layer, to enable very fine graduations to be read clearly and to diminish errors of parallax. At the top of the tube is another, smaller, bulb.

When lowering the instrument it acts as an ordinary thermometer. After leaving it at the required depth for 5 minutes, for the mercury to attain equilibrium, the thermometer is tripped by raising it or by despatching a messenger along the wire according to the type of frame in use, and the reading is automatically fixed as follows :

The reversal of the thermometer causes the column of mercury to break at the constriction, and the separated part runs downwards into the smaller bulb. The (new) top of this column gives the temperature, the graduations being marked, as already stated, so as to give a direct reading of this figure. Should any more mercury from the large bulb be forced past the constriction on account of the thermometer passing through warmer water on its way to the surface, the excess is trapped in the loop-shaped reservoir, which is large enough to hold as much mercury as could possibly escape in this way.

The smaller bulb is very small in comparison with the main tube, and the change in volume of the mercury relied upon for the reading, on account of the change of temperature during recovery of the apparatus, is therefore negligible except for precision work. It can be compensated for by applying a correction based on the difference between the temperature shown by it and that shown by an auxiliary thermometer (a small ordinary one) mounted alongside it.

There are two types of reversing thermometers, protected and unprotected. The former are similar to the latter except that the whole instrument is sealed into a thick glass outer tube to protect it from the pressure due to depth. The space between the protecting tube and the large bulb of the thermometer

is filled with mercury, to transmit the water temperature quickly to the bulb. This outer mercury is given room to expand freely.

If a protected and an unprotected thermometer are sent down together, the former will give the true temperature, and the latter a fictitious reading owing to the compression of the glass at the time of reversal. The difference between these temperatures (after the necessary corrections have been applied) is thus a measure of the pressure, and hence the depth, at which reversal took place.

Good reversing thermometers should be accurate to a hundredth of a degree centigrade.

The calibration curve retains its shape as the thermometer ages, but moves to new positions parallel to its original one. As it is comparatively easy to determine the displacement of the zero point at any time, the curve can thus easily be kept up to date. But in course of time the sharp edge of the glass between the main tube and the appendix becomes blunted, and rupture of the mercury becomes irregular.

REVERSING FRAMES.

These may be designed to take one or two thermometers, or to combine the thermometers with water-sampling bottles. In both cases the principle is the same.

The thermometer is mounted in the frame on trunnions, these being at or near the bottom of the thermometer, so that when released the thermometer describes a semi-circle and hangs bottom up.

It is released by withdrawing a catch, and sometimes small springs are also fitted to give it a start in turning over.

The catch is worked by one of two methods :

(1) A small propeller is fitted above the thermometer. When descending, this propeller is free to rotate at will. When the frame is raised again, the propeller screws itself on to a bolt which it finally withdraws within a few feet of its starting point, this bolt releasing the catch.

(2) A messenger is allowed to slide down the wire, and this actuates the catch directly. Where several thermometers are mounted serially on the same line, the gear is arranged so that each frame, as it reverses, releases another messenger which in turn works the next frame below it.