is to again turn it over slowly, when the mercury in the tube F will fall into the enlarged part E, and from thence into the other tube, rejoining the portion in the bulb, after which it rises or falls in the tube as the temperature increases or decreases. The bulb of the thermometer is protected from pressure by an outer bulb partially filled with mercury.

"From this description it will be seen that the instrument consists of two parts—the thermometer for recording the temperature, and the machine for rotating the thermometer at any required depth. The contrivance for turning the thermometer over may be described as a vertical propeller to which the instrument is pivoted. So long as the instrument is descending the propeller is lifted out of gear and revolves freely; but as soon as the ascent commences the action of the propeller is reversed, and it falls into gear with a pinion connected with the thermometer, and by these means the thermometer is turned over. After one revolution it becomes locked, and remains immovable. The woodcut (fig. 29 A) shows the general arrangement—T being the thermometer, S a metal screw connected with the frame of the thermometer by a wheel and pinion movement at W; S+ is the stop for arresting the movement of the thermometer when it has made one revolution. It was found in practice that the propeller being arrested, after it had turned over the thermometer, brought such a strain on the cogwheel W as to twist it off the spindle and cause its loss.

"This defect was remedied by Mr. Ferguson, the Chief Engineer of the Challenger, who applied an ingenious apparatus by which, when the thermometer has made one complete revolution, the pinion is lifted clear of the cogwheel, and thus the propeller is allowed to revolve as freely in its ascent to the surface as it did in its descent. Fig. 29 B shows Mr. Ferguson's improvement. The pinion Z is lengthened considerably, and is connected to the rod L which turns the thermometer by a key on the rod and a slot in the pinion, allowing it to move up and down the rod. M is a brass nut attached to the rod L, and movable up and down that portion of it which has a screw; from this nut two arms descend, and are attached to a collar round the upper part of the pinion Z. The nut M is kept from revolving by being lengthened sufficiently to clasp one of the supports of the apparatus. As the instrument descends, the wheel W is lifted clear of the pinion as before; directly it is reversed it falls into gear, but, as the pinion and rod revolve, the nut M is raised on the screw part of the rod lifting with it the pinion, and as long as the rod revolves the pinion is rising; the length of the pinion is so arranged that when the thermometer has made a complete revolution the lower part of the pinion is just lifted clear of the upper part of the cogwheel, consequently the screw S and cogwheel W can then revolve freely. The apparatus, as thus improved, has been found to answer admirably.

"Several thermometers for use in the apparatus were forwarded from time to time. A great number were found broken when they reached the ship, owing either to imperfect packing or negligence in the transport, but a sufficient number arrived in safety to admit of their having a fair trial.