

surface the friction of the water forces down the sliding disc D on to the top of the cone B and prevents any of its contents being washed out.

*The Valve Lead* (see fig. 18) is an ordinary deep-sea lead, fitted at its base so that an iron cylinder A with a butterfly valve B at the bottom can be screwed on to it. It was found to be by far the best form of lead for ordinary sounding work, and the cylinder unscrewing enabled the contents to be collected expeditiously and without loss.

*Wire Rope*.—At the time when the Challenger was fitted out, Sir William Thomson had revived the subject of sounding in deep water with wire in place of hemp, and before the ship left England an apparatus of his was put on board. During the absence of the Challenger on her voyage, this method was energetically and successfully developed by Sir William Thomson, and being adopted by the American surveyors in the "Tuscarora" under Captain Belknap, and later by Captain Sigsbee, it is now universally used for rapid sounding in deep water. The great extension of oceanic telegraphy rendering detailed surveys of the various routes necessary, materially assisted in this development, and for this purpose the method is admirably adapted. The advantage which the wire possesses over the hemp is the rapidity with which the operation can be conducted, owing to the very slight friction of the wire against the water. In telegraph ships this is taken advantage of to its utmost limits, and as nothing is risked but a sinker and a length of wire, but little heed is paid to the parting of a wire. The work of the Challenger, however, was very different. It is true that at every station the depth had to be ascertained, but this was only a small part of the work, and a saving of half an hour in the operation, even if it could have been effected without risk, would have been unimportant. On the same line with which the depth was ascertained were attached deep-sea thermometers and piezometers, also one, and sometimes two, water bottles, together making up a heavy and valuable load, the loss of which, though only occasionally, would not have been compensated by any saving of time. In view, therefore, of the special character of the work assigned to the Challenger, and of the great value of the instruments used, and also of the fact that the captain and officers of the ship were thoroughly acquainted with the use of hemp for sounding and other investigations at great depths, while the programme of the voyage did not admit of time being spent in the development of a method adapted for a different style of work, hemp line was invariably used throughout the cruise, and with unvarying success. After the rejection of the No. 2 sounding line, there were few accidents, and during the last two years of the voyage neither a fathom of line nor an instrument was lost in deep sounding. The great disadvantage of wire arises from its liability to break, owing to circumstances independent of the strain to which it is exposed. A hemp line may be bent and twisted in any way without its strength being at all affected. With wire it is otherwise; it must never suffer a sharp bend, twist, or kink; if it do its strength is gone, and if the damaged part be not cut out