an accident is sure to occur. Where steam power is not available for heaving up, the wire possesses a very great advantage, for it can be easily worked, even at very great depths, by hand.

Captain Belknap of the U.S.S. "Tuscarora," who in 1874 sounded out the route from San Francisco to Japan, and in so doing surveyed the deepest water in the world, did all his sounding by hand. His successor Captain Sigsbee, the author of the admirable volume on deep-sea sounding and dredging,[1] devised and constructed an elaborate wire-sounding apparatus with steam power, especially adapted for scientific work. More recently, Captain Magnaghi, Hydrographer to the Italian Navy, has fitted his ship the "Washington" throughout with wire, not only for deep-sea work, but for ordinary harbour surveying, all the boats used in this work being fitted with small stages for the wire sounding reel.

It is evident, then, that in the twelve years which have elapsed since the Challenger cruise began, the use of wire for sounding purposes has received enormous development. For purposes of deep-sea investigation, however, which includes actual sounding only as one of its items, good hemp sounding line is still indispensable. It is of course necessary to have steam power for working the line. With it in depths up to 500 or 600 fathoms hemp is better for all purposes than wire, and is equally expeditious, for a sinker can be used to make it descend nearly as quickly as wire, and with instruments attached it can be hove in with safety more rapidly from such depths than wire. Deep-sea thermometers which have been carefully compared with a standard, and which have been used in many soundings, are instruments of very great value, and if lost, are not replaced by the purchase of new ones. Further, it is important at every station to observe the temperature at as many different depths as possible. Where wire, with its liability to break, is used, it is very imprudent to use more than one or two valuable thermometers at a time, while with hemp, which is almost absolutely free from risk of rupture, eight or ten thermometers may be sent down at once. Therefore to obtain, with safety, the same number of observations with the wire, would require the operations of sinking and heaving in to be repeated a greater number of times than with the hemp; and as a thermometer must be allowed a certain time to take the temperature of the water, it is evident that for such work the wire is in the end not more expeditious than the hemp.

With regard to *dredging*, which formed so important a part of the Challenger's work, there can be no doubt of the great superiority of wire over hemp rope. The advantage in point of rapidity of work and of saving in stowage is much greater than in the case of sounding. Here we are indebted for a scientific instrument to the enterprise of those engaged in the manufacture of telegraph cables, for it is owing to the development of this industry that there is now a regular manufacture of the beautifully flexible steel-wire hawsers which are now to be found on board almost every well-appointed ship.

[1] Sigsbee, Deep-Sea Sounding and Dredging, Washington, 1880.