occasioned amongst women was one cause of the great and rapid spread of vaccination. There is not a woman in existence who would not risk any possible damage to her health or constitution if it would save her from the disfigurement produced by confluent small-pox. There is another point too: the dread of the disease often causes people to take it, and makes it fatal when taken. The protective influence of vaccination, therefore, has a double action, physical and mental.

For these reasons I cannot, in the present state of sanitary science, or rather ignorance, see how vaccination, voluntary of course, can be given up in Europe, or in thickly-peopled countries like North America.

ART. LXIV. *Brake-Fins: A Proposed Appliance for the Better Handling of Ocean Steamers.*

By the Rev. PHILIP WALSH, Waimate North.

[*Read before the Auckland Institute, 24th August, 1891.*]

WHEN we contrast the modern ocean liner with the old sailing-packet that many of us are able to remember, we cannot but be amazed at the giant strides that have been made within a very few years in the numerous arts and sciences upon the correct application of which a safe and prosperous voyage depends. The confined space on deck, the stuffy cabins, the rough-and-tumble of slippery planks and flying tackle, the salt diet, and the hazardous cookery—all these have given way to a new order of things, and a sea-voyage is now looked forward to as a prolonged picnic in a floating palace furnished with all the conveniences of a first-class hotel, instead of a tedious imprisonment, during which every element contributed its share of discomfort. But the improvement, astounding as it is, has not been uniform; the advance has not taken place along the whole line: indeed, in some departments there has been a positive standstill, if not actual retrogression.

The most noticeable instance of this deficiency is that which regards the handling of vessels under certain important and inevitable conditions. Given plenty of sea-room, when the only question is how to get over the ground—or, rather, the water—in the shortest possible time, there is no comparison between the modern ship and all those that have preceded her, whether impelled by sail or steam; but when it is

necessary suddenly to alter the course or to come to a full stop the modern ship is at the greatest disadvantage. The sailing-vessel, with anything like a breeze, would come round on her heel or could be hove-to in an instant, by a turn or two at the wheel and a pull at the yards; and the comparatively short and wide build of the old paddle-steamer, especially if she were fitted with side-wheels of independent action, gave her a great advantage whenever any rapid manœuvre was required. But with the "greyhound" of the Atlantic or Pacific it is quite different. Her immense length and the extreme fineness of her lines cause her to forge ahead in spite of engines stopped and reversed, and increase the radius of the arc on which she will come round. In fact, the very qualities which give her a proportionate advantage when all is clear and straightforward become a corresponding element of inconvenience and danger when it is necessary to navigate a tortuous channel or avoid a suddenly-apprehended obstacle.

In spite of every advance in the science and practice of navigation, there will always be a certain number of dangers to be avoided or overcome. These may be divided into two classes—namely, those which are, so to speak, constant, and those which are on the increase. To the former class belong those which result from the ordinary vicissitudes of wind and weather, and other natural causes, which will continue to tax the skill and resources of the navigator to the end of time; while to the latter must be put down those which are incidental to new modes of structure and equipment, and to the growing extension of ocean traffic, of which the most important is the risk of collision, which is daily becoming more imminent, and which, from the build and tonnage of the ships, and their increasing rate of speed, is fatal to a degree hitherto unknown.

The actual event of a collision has to some extent been foreseen and provided for—that is to say, certain provisions have been made in the structure and equipment of the ship which are intended to reduce the damage and loss of such a catastrophe to a minimum, as, *e.g.*, watertight bulkheads, deck-rafts, and improved boat-lowering arrangements. But, so far as I am aware, beyond the careful use of the ordinary appliances no steps have been taken for the avoidance of the catastrophe itself; and it seems to me that it is precisely here that the weak spot is to be located.*

The object of the present paper is the suggestion of an apparatus which I cannot but think will in some measure

* The twin-screw may perhaps be quoted as forming an exception to this statement. Its adoption, however, is by no means general, at least in the merchant service, with which we are chiefly concerned at present, nor is it materially effective in attaining the desired result.

supply the obvious want, and which I offer in all becoming modesty for the consideration of those who are interested in the subject.

The questions to be solved are two—(1) How to bring a ship going at full speed to a standstill in the shortest possible time; and (2) how to rapidly change her course at a comparatively acute angle.

In a pulling-boat these objects are accomplished (1) by the simultaneous backing of all the oars, and (2) by holding water on one side, while her "way," or existing impetus, maintained by the oars on the other side, carries her round. And, though it is not, of course, to be expected that these manœuvres could be accomplished with the same ease and perfection in the case of a ship of large tonnage as in that of a small boat, still I think that by means of the apparatus I propose they might be effected to such a degree as would be of material assistance in attaining the desired result.

The apparatus I propose consists of a system of strong metal plates, set in pairs at the sides of the vessel, to which they are attached by hinges at their forward ends, and which could be forced outward to any desired angle. In order to be effective in checking the way they should be placed at various depths, and well below the water-line, where they would encounter a maximum of resistance; and to insure the greatest steering-power one pair at least should be well aft of amidships. These plates I have designated brake-fins, as the name seems appropriately to describe their structure and functions. To bring the fins into action would, of course, require the exercise of a very powerful pressure from within, which should be capable of instant application. This I would propose to supply by means of hydraulic chambers fitted with pistons on the principle of the hydraulic jack, the water being supplied by steam-pumps whose action could be controlled from the bridge.*

The actual operation of the apparatus would be precisely similar to that of the oars in the boat before described. The fins would simply act as so many drags on the vessel, and would serve either to assist in bringing her round, or in reducing her speed, according as they were projected on one or both sides. When not in use they could simply be shut back in depressions made for the purpose, so that their outer surfaces would be flush with the external plating.

There are several important questions which would have to be worked out in order to insure the successful operation of the apparatus—as, *e.g.*, those regarding the best form, the

* It is possible, also, that compressed air might be used for the purpose.

relative dimensions, and the most advantageous location of the plates, as well as those relating to the connecting machinery, and the most economical application of the power employed. These, however, are but questions of constructive detail which do not affect the object of this paper, which is merely to establish the principle involved.

It is, of course, only by actual trial that the practicability of the idea could be demonstrated. Still, the advantages of such a contrivance, were it capable of being carried into effect, are so obvious that it would be well worth while to make a series of experiments, in the first instance with a vessel of small dimensions, of which the cost would be comparatively trifling considering the interest at stake. And, though we may never expect that the action of the brake-fins on a ship will equal that of a Westinghouse brake on an express train, or even that of the oars on a skilfully-handled boat, still, if they will shorten by a cable's length the distance at which she will bring up, or reduce to any considerable degree the angle at which she will come round, they may be the means of giving many a "man overboard" a chance for his life, and help to minimise the increasing chances of one of the most appalling of disasters, a collision at sea.

Art. LXV.—*Mill on Demonstration and Necessary Truth.*

By William Carlile, M.A.

[*Read before the Wellington Philosophical Society, 8th July, 1891.*]

If any one should endeavour to ascertain what is the received doctrine in England at present with regard to the basis of mathematical demonstration, the true nature of the definitions of Euclid, and the ultimate evidence for the axioms, he would find himself met by a very remarkable diversity of opinion on the part of those who have been recognised as the highest authorities on psychology and metaphysics during the past half-century. To find anything like consistency, indeed, he would have to go back to the philosophers of the pre-Kantian age.

Hume's opinion was that the truths of pure mathematics were to be put into one class along with identical propositions, and that truths of matters of fact were to be put into another and altogether different class. However certain the latter might be, their certainty, in his view, depended upon an en-