THURSDAY, NOVEMBER 15, 1883

THE "AUSTRAL" JUDGMENT

THE inquiry into the sinking of the mail-steamer *Austral* in Sydney Harbour has probably attracted more attention than any other case which has come before the Wreck Commissioner's Court since it was established. Not merely those specially interested in or connected with shipping but the public generally were desirous of knowing how it happened that a magnificent steamship of the most recent construction should have foundered at anchor in smooth water and in a dead calm. It is satisfactory, therefore, to find that the causes of the accident have been discovered, and that they do not affect the reputation of the ship, nor the credit of her designers. The circumstances of the accident are briefly these :—The *Austral* had completed her second outward voyage, had discharged nearly all her cargo, and had partially refilled her coal-bunkers. A collier came alongside to continue the coaling, and the work was proceeded with during the night. In order to facilitate coaling, and to keep the interior of the ship clean, coal-ports had been formed in the sides, the height of these ports above water when the ship was upright being about five feet. The coaling was rapidly done, and no proper supervision was exercised by any of the officers of the ship; consequently a considerable weight of coal was introduced on the starboard side without any corresponding weight being placed on the port side, and the ship was gradually heeled over. At length such an inclination was reached that the sills of the after coaling-ports were brought to the sea-level; water began to enter the ports and to pass freely into the interior of the ship, and in fifteen to twenty minutes from the time the alarm was given she sank. No one appears to have observed the dangerous proximity of the coal-ports to the water until it was too late to save the vessel. Had there been ordinary care and watchfulness the accident would not have occurred.

This last statement can be made with certainty in view of the scientific evidence respecting the stability of the *Austral* given in the course of the inquiry. After the vessel had been raised and brought home the owners commissioned a competent naval architect, Mr. Elgar, to thoroughly investigate her conditions of stability at the time of the accident, and under various circumstances. As a basis for this investigation an inclining experiment was made on the vessel, and the vertical position of her centre of gravity was ascertained. Simple calculations enabled the investigator to pass from the experimental condition of the ship to all other conditions brought under review, and to place before the Court ample materials for answering the question—Was she a stable vessel? This answer was distinctly in the affirmative; indeed there is no room for doubting that with proper management, and the occasional use of the water-ballast with which she was provided, the *Austral* possessed sufficient stability. It is unnecessary to enter into details as to her "stiffness" and range of stability in various conditions of lading; but it may be worth stating that, according to the evidence, had the coal-ports been closed and all weights on board secured, she would have been practically *uncapsizable* at the time of the accident.

It would be out of place here to discuss the finding of the Court as regards the responsibility or blameworthiness of the owners, officers, and other persons connected with the management of the ship. One broad general principle laid down by the Commissioner in his judgment may be considered with propriety, since it affects not merely the owners of the *Austral*, but shipowners as a body. Mr. Rothery is strongly of opinion that shipowners should cause investigations to be made of the stability of their ships, and should furnish captains with the results of these investigations for information and guidance. In the case of the *Austral* no such investigations were made until after the accident, and what happened with her is the common case with ships of the mercantile marine. There has been a remarkable advance in the applications of scientific methods to merchant-ship construction of late years, and the consideration of problems of stability has been forced upon the attention of shipbuilders and shipowners in many cases. But the adoption of the Commissioner's opinion would involve a much greater extension of scientific method and exact calculation than has yet taken place.

Shipbuilders necessarily have no control over the loading of the ships they build; and in most merchant ships the stability is practically determined by the nature and distribution of the cargoes carried. Up to the present time exceedingly little information is on record as to the actual stability of laden merchant ships; and their loading usually has to be done under very hurried and difficult conditions by men possessed of great practical experience, but having little or no acquaintance with the principles of stability. Owners have hitherto been content to depend almost exclusively on experience with previous vessels in determining the dimensions of new ships, and have not set much store on the result of scientific calculation. Builders, on the other hand, recognising their want of control over the working of the vessels, have refrained, for the most part, from making detailed calculations of stability. Even the leading firms have chiefly confined attention to experimental and other investigations which would be useful in preparing subsequent designs; and in most cases the owners have not had communicated to them any facts which may have been ascertained respecting the stability of ships. Mr. Rothery maintains that all this should be changed: that fuller investigations should be universally made, and the results furnished by the owners to the captains.

The great, if not paramount, importance of due consideration being given to the stability of merchant ships, and particularly of cargo-carrying steamers, is recognised by the most eminent authorities. Mr. Rothery in his recommendation indorses what has been said and written repeatedly of late years. But while there is a very general assent to the proposition that something should be done to secure a due amount of stability and to prevent improper or excessive loading, there is not a similar agreement respecting the means to be employed. For example some of the professional witnesses at the *Austral* inquiry expressed doubts as to the wisdom of placing in the hands of merchant-ship captains the results of calculations for stability expressed in the forms of "metacentric

diagrams" or "curves of stability." These gentlemen feared that to the average ship-captain such curves and diagrams would be unintelligible, and therefore of no practical value. It must be admitted that there is some force in this contention; but on the other hand it is obvious that a very moderate amount of instruction ought to suffice to make information of the kind intelligible and useful to an educated seaman.

It may be worth while to mention what is the established practice in the Royal Navy in this matter. Each of Her Majesty's ships is provided with a "Statement of Stability," in which appears a record of the "metacentric heights," corresponding respectively to the "fully laden" and the "extreme light" conditions of the vessel. There is also a record of the calculations of stability at various angles of heel; the angle at which the stability attains its maximum and that at which it vanishes being noted. In cases where special precautions are needed special standing orders are given. For instance, in some low freeboard ships it is stringently ordered that a certain maximum load draught shall not be exceeded, because any diminution of the corresponding freeboard would cause an objectionable decrease in the range and area of the curve of stability. Again, in some vessels, as coals and stores are consumed, the stability is considerably diminished, and then orders are given that the ship shall not be lightened beyond a certain minimum draught, that draught being maintained if necessary by the admission of water-ballast. All these regulations are based upon careful experiment and detailed calculations. In the original design of the ships close attention is bestowed upon the question of their sufficient stability; and when the vessels are completed, an experimental check is put upon the intentions of the design, any necessary corrections being made in the original calculations. But it is right to remark that war ships are much more easily dealt with than merchant ships, because definite positions are assigned in them by the designer for all the weights carried—whether they be armour, or guns, or coals, or ammunition, or outfit. Hence it is possible to state distinctly what is the stability in the fully laden condition, and what are the extremes of possible variations in stability as coals, stores, &c., are consumed. In merchant ships, as was remarked above, the designer and builder have no corresponding control over stowage, and in practice very considerable variations in stowage necessarily occur. Leaving this difference aside for an instant, it may be stated that in the Royal Navy the information given on "Statements of Stability" is highly valued and well understood by naval officers. This result is, no doubt, attributable in a large degree to the fact that at the Royal Naval College for many years past classes have been arranged wherein naval officers receive instruction in the elements of naval architecture, and especially in the methods of interpreting the various statements and drawings issued by the Admiralty to the ships of the fleet. Similar instruction could not fail to be of service to officers of the mercantile marine, and the Admiralty have made provision in the Regulations for the admission of a certain number of such officers annually; but as yet no advantage has been taken of the permission. Either in this way or in some other, instruction must be obtained by merchant captains if they are to exercise an intelligent control over the loading of their vessels, and to insure the provision of sufficient stability.

It seems very probable that one result of recent occurrences and discussions will be the grant of greater freedom to shipbuilders in choosing the dimensions for new ships than has been customary hitherto. And it may be anticipated that increasing attention will be bestowed upon investigations of stability in connection with new designs. But whatever improvements may be made in the general practice of shipbuilders, the responsibility for management and loading must always remain with the owners and commanding officers of merchant ships. Ill-advised action on their part might render futile all the precautions of the designer. He may have secured what seems a good margin of stability, on the basis of some hypothetical arrangement of a certain dead weight which was supposed to be the maximum a ship would carry; and yet in practice some more critical condition of loading may arise which must be dealt with by those in charge of the vessel.

Having regard to the very considerable variations in the character of the cargoes carried by the great majority of merchant ships on their several voyages, it appears to be highly important that owners and captains should have placed in their possession full information respecting the stability of their ships; and that they should be able to make intelligent use of this information. One of the most valuable pieces of information which a captain could obtain for a laden ship would be her "metacentric height," and there seems no reason why an intelligent officer who had been furnished with a "metacentric diagram," and understood its use, should not experimentally determine for himself before leaving port what measure of "stiffness" his ship possessed, and at what vertical position the centre of gravity was placed (if the conditions of loading were of an unusual character). He would then have a more certain assurance of the sufficiency or otherwise of the stability of the ship than he could otherwise possess; and this assurance might easily be made to extend not merely to the initial stability but to the stability at large angles of inclination. It may be urged that it is too much to hope for any such experiments, or for such an advance in knowledge; and that in the stress of business time cannot be found for such elaborate inquiries. Possibly one may be too sanguine to indulge this hope; but inclining experiments of the kind indicated are neither lengthy nor costly operations, and their value as indications of the probable safety or danger of laden ships cannot well be over-estimated.

The necessity for carefully considering the stability of merchant ships is not a matter of dispute. All concerned may be assumed to desire some practical solution of the problems involved in securing sufficient stability. And on a review of the whole subject it will probably be admitted that all three classes interested—the shipowner, shipbuilder, and ship-captain—must accept their several responsibilities while working towards a common end. The shipowner may be presumed to know best the special requirements to be fulfilled in any new design. It is the duty of the designer to make sure that appropriate dimensions and proportions are secured in association with the fulfilment of these requirements, or to point out the impossibilty of such an association. And, finally,

upon the skilful and intelligent conduct of the captain must necessarily depend in a great degree the safety and success of the vessel during her career. In order that the best results may be obtained in face of the difficulties incidental to the design and management of many modern types of ships, the standard of knowledge must be raised in all three classes. W. H. WHITE

THE "ENCYCLOPÆDIA BRITANNICA"

Encyclopædia Britannica. Ninth Edition. Vol. xv. Loo-Mem. Vol. xvi. Men-Mos. (Edinburgh: A. and C. Black, 1883.)

AMONG the most important scientific articles in vol. xv. of the new edition of the "Britannica" are those on Medicine, Mechanics, and Mammalia.

The concise but comprehensive epitome of the history of medicine which Dr. Payne has contributed is the only history of the kind in the language. In Germany there are in this subject, as in almost every other branch of learning, excellent text-books; and the author acknowledges his obligations to Häser's "Lehrbuch der Geschichte der Medicin und der epidemischen Krankheiten." In France, Daremberg's "Histoire des Sciences Médicales" is also well known. But in England there has been no serious attempt to write a history of medicine since the publication of Freind's letters to Mead (1725); even these only dealt with a portion of the subject, and were written or at least begun under the disadvantage of confinement in the Tower. There have been a few valuable contributions to the subject, such as Dr. Greenhill's articles in Smith's "Dictionary of Classical Biography," and Dr. Munk's Roll of the College of Physicians, but nothing more.[1]

Is this neglect justifiable? In other branches of natural history and natural philosophy an acquaintance with the successive steps by which modern knowledge has been won is almost necessary for clearly comprehending the result. A history of astronomy, of electricity, or of physiology would be not only of interest but of practical value to the student of each of these subjects. But a history of medicine, however important as a chapter in the development of human intellect and the progress of civilisation, is scarcely any help towards understanding either the principles or the practice of the art of healing. A modern physician finds some knowledge of chemistry and of physics indispensable; botany and zoology are not without important bearing on his professional studies; a knowledge of German is of great practical use; but he may be ignorant of all medical literature above fifty years old without any loss, except the loss of the intellectual pleasure which every educated man should take in the past history of his profession.

That this is the case seems evident from the utter neglect of the older medical classics in medical education, notwithstanding occasional murmurs from the few who have earned the right to murmur by having read them, and from others—a neglect which exists not only in practical England and America, but no less in the learned German and the conservative French schools. This neglect is only confirmed by occasional glimpses of the said classics, and it is illustrated by the fact that we owe even the sketch of the labours of two thousand years which forms the subject of this review to the demands of an encyclopædia.

Nor is the reason far to seek. Modern medicine has scarcely anything but its aim in common with the art of the ancients. The attempt of the older physicians was to find some comprehensive explanation which would account for all the diseases of mankind, and their practical method was the application of certain remedies, recommended by the crudest experience, or more often by some such dogmatic criterion as that of "signatures." The authority of the ancients was regarded as independent of proof. In like manner naturalists used to study the worthless gossip of Pliny, and Milton recommended Columella as a school-book because of the practical importance of husbandry; indeed in England we still teach geometry from an ancient Greek text-book, and Euclid will be the last to follow Aristotle and Galen, Dioscorides and Celsus, into learned oblivion. But the object of modern medicine is not to explain but to investigate, to ascertain what is amiss, and to deal with it as directly as possible, on the principles of physics and of chemistry, guided by experiment and checked by skilled statistics. Homœopathy is only the last of the "systems" of medicine; not more arbitrary than many others, and, like the rest, not so much a wrong solution of a scientific problem as an answer to a question which cannot reasonably be put.

The art of rational medicine must therefore depend upon a knowledge of the body and its functions, on the power of discovering its physical conditions, and on acquaintance with the physico-chemical laws to which it is subject; just as the art of navigation depends on a knowledge of astronomy and of meteorology. But even the rough outlines of anatomy were only made out during the sixteenth and seventeenth centuries, and the discovery of its minuter details, so well begun between 1650 and 1700, was only resumed and carried to its present degree of completion by the achromatic microscopes of the last fifty years. Morbid anatomy dates from Morgagni. Physiology had no true existence before Harvey's discovery of the muscular contraction of the heart and the circulation of the blood in 1628. It was retarded rather than helped by premature application of mechanical laws, and did not make important progress again until the birth of chemistry in the last thirty years of the eighteenth century. If anatomy may be dated from the dissections of Vesalius, physiology from the vivisections of Harvey, and chemistry from the laboratory of Lavoisier, we cannot fix the beginning of modern medicine earlier than the introduction of mediate auscultation by Laennec in 1819.

Interest, however, will always belong to the history of medicine, apart from the practical value of the older medical literature. The study of the dreary succession of the Greek "sects," of the Galenical and Arabian "schools," and of the subsequent iatro-chemical, iatro-mechanical, Brunonian, and other "systems," is of service to warn too eager speculation from the errors of

[1] Dr. Edward Meryon's "History of Medicine" was never finished. Dr. Adams's editions of Hippocrates and of Paulus Ægineta, Croke's of the "Regimen Sanitatis Salernitanum," and Payne's of Linacre's translation, "De Temperamentis," are scholarly works. "Lives of British Physicians" and "The Gold-headed Cane" are not ungracefully written. "The History and Heroes of the Art of Medicine" is a very poor compilation. A brilliant essay on the subject will be found at the end of "Poems" and other remains of the late Dr. Frank Smith (Smith and Elder, 1879).