After the death of General Hazen and during the administration of General Greely, the computers of the Study Room became junior professors at a higher salary and were assigned to official duties of a broader aspect. In the course of such duties, Professor Hazen frequently took his turn as forecast official (beginning with October, 1887), and as editor of the *Monthly Weather Review* (beginning with December, 1888), while also acting as assistant in the Records Division. In July, 1891, in accordance with the terms of the transfer to the Department of Agriculture, he was appointed one of the professors of meteorology in the Weather Bureau, where he was at once assigned to regular and congenial duties in the Forecast Division.

Having shown that 'the Hazen thermometer shelter' was much better than the large close double louver formerly used, his form was adopted by the Bureau in 1885 and still remains in use. His experimental work with the sling psychrometer and dew-point apparatus was executed with great care and refinement, but the resulting psychrometer formula differs from those in current use in that it rejects the important term depending on the barometric pressure. Among his larger publications were: *The Reduction of Air Pressure to Sea-level* and *The Climate of Chicago.*

In addition to his official work in the Weather Bureau, Professor Hazen was a frequent contributor to meteorological and other scientific journals. He was one of the supporters of SCIENCE during the years 1882–89 and of *The American Meteorological Journal*, 1884–96. He also, published independently his 'Meteorological Tables,' and 'The Tornado,' and possibly other works. A complete list of his published writings would include several hundred titles.

It must be confessed that a peculiar temperament sometime led him to beliefs and statements in scientific matters unacceptable to his colleagues, but to which he adhered and on which he acted with such pertinacity that to some he occasionally appeared obstinate and headstrong; this was simply a result of the intense earnestness of his own convictions, which so completely absorbed his mind that there was no place for further considerations. However, the amiability of his character always prevented any enduring unpleasant feeling between himself and his associates.

C. A.

SCIENTIFIC BOOKS.

Annual Report of the Bureau of Steam Engineering of the Navy Department; 1899. Washington, Government Printing Office. 1899. Pp. 89. Many illustrations and working drawings.

The annual report of the Chief of the Bureau of Steam Engineering of the Navy Department, made up in advance of the compilation of the annual message of the President and reports of the heads of department for the information of Congress and the people of the United States, always contains interesting matter bearing upon applied science, although mainly devoted to the purely technical side of the work of that bureau. Admiral Melville is equally positive, direct and effective, whether at the Lena Delta seeking lost heroes, or in his office at Washington, and his report illustrates his character as well as his work. Passing over the purely technical accounts of the condition of the mechanisms of the naval war-engine, and of the fleets, the first subject of general interest is that of the recent consolidation of the two great corps, the engineer and the line officers, as effected by the 'personnel bill' of last year. Without explicit assertion of the fact, it may fairly be inferred, we think, that the Chief of Bureau is apprehensive lest the terms of the bill and its purpose may fail of complete accomplishment, the Department lacking that firmness and determination to obey and to make successful the conclusions of Congress regarding this important experiment. It is obviously an experiment and is no less obvious that it

may be made to succeed or to fail, accordingly as the officers of the Government, from the President and the Secretary of the Navy down to lieutenant and ensign, combine to insure its success or conspire to insure a failure. It will only be when every watch-officer, whatever his grade, is made an efficient officer, both above and below decks, that the modern naval fighting machine can be made of maximum efficiency under the existing system. Any disinclination of either of the old types of officer to become efficient in either old line of duty, results in serious, perhaps very dangerous, inefficiency, and a liability to failure at critical times. The conversion of the navy from a sailing to a steaming fleet, from an aggregation of sailing craft into a collection of floating machines of wonderfully complicated mechanism, cannot be reversed; but the change may prove most disastrous during the period of transition if every officer in the service does not display sufficient patriotism to insure rapid and safe metamorphosis. It is here that the real risk lies and the overcoming of confirmed habits, of prejudice, and any indolence of the personnel, by reason, sense and patriotism, must be relied upon to insure success.

The structural work of the navy has been greatly promoted by the introduction of a new structural material—nickel-steel; which alloy is now regularly furnished in any quantity and in parts of any size, from five pounds in a rifle-barrel to many tons in the shaft of a transatlantic or Naval steamer. This is an alloy of 'mild' steel, ingot-iron, with a small percentage of nickel, resulting in greatly increasing the limit of elasticity and the ultimate resistance of the metal, without sacrificing its ductility.

Electrically driven machinery has come to be an important and very extensive element in the construction and installation of details of the machinery of every man-of-war. The advantages, where allowable or applicable, are great ease of operation, convenience of energy-transmission, and especially avoidance of heat due to the transmission of steam to steam-driven machinery about the ship, and a considerable gain in economy, in many cases. The disadvantages are stated to be excessive weight, great delicacy, lack of adaptability to the conditions of everyday work at sea, and the occupation of spaces below the protective deck, where space is particularly valuable and difficult to secure for the apparatus of battle. The admiral thinks the advantages of electrical transmissions on shipboard somewhat exaggerated and that, within the machinery compartments, at least, 'steam-drives' are preferable. He refers to the curious fact that, in the navy, it has been the custom, very generally, to entrust the machinery of the electric transmissions to the non-expert departments of the organization. The experts in engineering are apparently called in only when the responsible amateur gets into trouble. As the presumably best-informed man in the navy, on this subject, the Engineer-in-Chief is entitled to most respectful consideration and a full hearing, when discussing these matters of fact and principle in engineering.

The transformation in type of the marine steam-boiler, from the older forms to the 'modern', 'sectional,' 'safety' or water-tube type, appears, in the judgment of the responsible expert authority of the navy, to have been practically accomplished—a change which was compelled as soon as the steam-pressures needed to insure the now common and high thermodynamic efficiencies of naval steam-engines had attained figures beyond the safe standards for 'shell' boilers of the old forms. Now that steam pressure is carried at from 15 to 20 atmospheres, the safer forms employed by Fulton and Barlow in 1798, by John Stevens 1804–5, by Trevithick in 1810, by Gurney and Hancock in 1830–35, and by them made successful in earlier generations and by Babcock and Wilcox and Root later, have come permanently into use. It is somewhat remarkable that they should have been first accepted so generally in the navy, where it has been a tradition that the traditional is best. The change is perhaps in part due to the introduction of a progressive spirit with steam, and certainly largely through the appearance on the scene of the young element now coming up from the great technical and professional school at Annapolis, where it has become imbued with the scientific spirit of the time.

R. H. T.