will be of service to him; but as to years being spent in exercises long relegated to the past, when even the most assiduous application will enable one to keep pace with modern developments, such a policy as has been pursued in the past is little short of suicidal. The British Admiralty is at least determined that the younger officers shall not waste their opportunities, and has directed, in a recent order, that in future "midshipmen shall be ordered only to 'mastless ships.'" This is to enable the time that might have been taken up by spar and sail drill to be devoted to studies important to the duties of modern naval officers.

There appears to have developed of late considerable duty for naval forces ashore. This is seen in the recent operations of British naval battalions in Egypt, of French naval forces in Tonquin, of the Germans on the east coast of Africa and in the Pacific, of the Portuguese forces on the west coast of Africa, of the Italians in the north, and of our own forces on the Isthmus of Panama and out in the Pacific. The duty of a man-of-war's man of to-day is essentially that of a soldier; the clouds of canvas which were once his delight have disappeared, even the masts themselves, and there is now left but the grim row of guns, the armory floor-like deck, and the piles of rifles, cutlasses, and revolvers. But there lacks yet the proper infusing of the military spirit. The aversion in bygone years to all pertaining to a soldier's still apparent among the older officers, as a part of the teachings of the old school. As a result, young officers are seen even now hurriedly going through a company drill, caring little, except that it enables an account to be put in the reports that such drill has been performed. One seldom sees attention paid to detail, except so far as to insure a fairly good showing when the ship is called upon to send an infantry company to "parade."

As to small-arm firing and target practice, the men know little or nothing. The navy regulations specify that so many rounds (twenty) shall be fired in a year, but the number allowed is far too small to produce any good from the practice. But little encouragement is offered to men for extra exertions, and there are no prizes, as in the British and French service, for special skill. The crews of the American war-ships are, as a rule, disciplined crews, but as crews trained in all pertaining to modern warfare they are sadly deficient.

It will become imperative, now that ships without masts are to come into service, that an expedient be devised for the exercise lost in "activity aloft." The long, broad decks of the new ships, especially those of the "Chicago," "Baltimore," "Newark," "Maine," and "Texas" type, offer every facility for the erection of gymnastic apparatus. Officers and men can alike do regular duty in this line, which will serve greatly to shake off the apathy that seizes hold of a crew little drilled. There cannot be too much attention paid to the development of the individual sailor, both to obtain a trained factor and a physically perfect one. There has been, no doubt, much odium cast on the crews of the American war-ships because of the great numbers of foreigners allowed to enlist, all of which has served to lessen the interest that officers should take in the men. It is well known that this foreign element must be got rid of before the navy will become a popular service, and there is no surer way of accomplishing both ends than by making the naval establishment a thoroughly military one. The sooner the service awakes to a realizing sense that the navy of to-day is a modern institution, a fighting factor devoid of all the romance of the past, the sooner the country will be prepared to resist all inroads from hostile sources.

G. L. CARDEN.

IV.

WILL OUR COAL SUPPLY EVER BE EXHAUSTED?

TIME was when the carbon and hydrogen which form practically the whole of our supply of fuel and the principal part of our food were inorganic—no more capable of sustaining combustion or animal life (if we except certain microcopic forms which decompose carbonic acid) than granite or slate. For vegetable life, however, the supply of food was at its maximum. Vegetable life came, generated in some unknown way by the solar energy which poured through the atmosphere and the heat energy which penetrated the earth's crust from within. Through the unimaginable ages

of the Carboniferous period a gigantic flora fed on the rich atmosphere, assimilating its carbon and hydrogen, and thereby setting free its oxygen, until it could sustain its animal life, at first in the lowest, then successively in the higher, forms.

This gigantic flora, with its enormous potential energy of chemical separation from oxygen,—an energy derived chiefly from the solar energy of that period, easily admitted and tenaciously retained by the atmosphere,—is now stored up in the earth as fuel for the future generations of our race. Future, I say, for tremendous as the annual consumption of coal, petroleum, and natural gas for a generation has been, we have as yet only begun upon the great store. Hitherto Mother Earth has been able to supply her children's needs by expending only her current income. In this latter day, however, their demands have multiplied so rapidly that she has been obliged to draw upon the capital stored up during the long ages of her maidenhood. How long will that capital last at the terrible rate at which we have begun to squander it? Is her children's prodigality actually making her poorer? or has she the power to nullify the effects of their extravagance? and are her diminishing resources due only to the decreasing energy of her natural supporter and protector, the sun?

However prodigal man may be in his use of earth's treasures, he can never annihilate one atom of her substance or transport it beyond her domain. In his "wasteful" consumption of fuel, he is only restoring its elements to their primeval condition as constituents chiefly of the aërial and aqueous oceans which surround our globe. It follows, then, that the more rapid the combustion, the richer becomes the atmosphere in its power to sustain and force vegetable growth. If it were possible for that period, so often predicted, to arrive, when the 6,000,000,000,000 tons, more or less, of fossil fuels now stored up in the earth's coal-bins, shall have been consumed, the atmosphere will simply have returned to its primeval condition, that which preceded the Carboniferous period. The only essential difference, therefore, which will mark the two remote geologic periods, the past and the future, will be due to whatever reduction will have taken place in the sun's energy. But whether that condition is destined ever to return to earth or not, one thing is certain: *it will not be through human instrumentality.* Ages before its arrival the percentage of carbonic acid in the atmosphere will have passed the point possible to the continuance of human life.

If not through human agency, then how is it to come? Certainly not by any of the processes now in operation. The percentage of carbonic acid in the atmosphere does not materially vary. This fact means simply that somewhere on the earth's surface vegetation is taking up the enormous surplus of carbonic acid constantly pouring forth from our millions of furnaces, and thus restoring it to the form of available fuel. The weight that is constantly sinking is thus being constantly relifted by the daily conversion of solar to vital energy.

Only some stupendous convulsion of nature, like those dreamed of by John of Patmos and Lord Byron, in which "the elements shall melt with fervent heat," can undo the work of the Carboniferous ages,—some tremendous upheaval in which the subterranean stores of fuel shall at once be laid bare and given over to the devouring oxygen. Then would a new cycle begin, another carboniferous era, in which the store-houses would be again slowly filled for future generations of men. Again and again might the cycle return, until the diminishing energy of the sun should fail to uplift the fallen weight, to reorganize the inorganic.

EDWARD P. JACKSON.