use of to restore the auxiliary valve to normal position and close the receiver. The carrier is placed in the tube by moving valves connected with an air lock.

The power for this system, which is over ten miles in length, is compressed air, the service requiring about 1,400 cubic feet per minute, the pressure varying from 1¾ pounds to 2 pounds. Before entering the compressors the air passes through a tank filled with calcium chloride, which effectually removes all moisture. This tank is open to the atmosphere, and the pipe connections are so arranged that the air of the incoming line passes through the tank and returns to the compressor. Only such air has to be dried as is lost through leakage or used for operating the machines. The compressors are duplex belt-driven with 21-inch x 12-inch cylinders. There are two each at the main, South End, and Roxbury stations, and one each at Dorchester and Back Bay. The compressors are driven by 50 horse power, three-phase induction motors of the internal resistance type.

The system has been found to be an excellent substitute for wagons and other methods of delivery, and is largely used by merchants for sending parcels to the residence districts where sub-stations are located. At these they are sorted and distributed to the houses of the customers by teams and messengers. It is found that the average time required to deliver packages from the main station to any portion reached by the service is ten minutes, where from forty-five minutes to an hour would be required by the usual method of delivery.

The pneumatic postal tube system of New York city has been fully described and illustrated in the columns of the SCIENTIFIC AMERICAN.

Correspondence.

Interest in the Jane Naval War Game.

To the Editor of the SCIENTIFIC AMERICAN:

I beg to congratulate you on your energy and enterprise in securing the right to publish the series of Jane's Naval War Game. You not only deserve credit for supplying your readers with such an intensely interesting subject, but you deserve credit for drawing the attention of the nation to a critical state of affairs.

It is true we may never go to war with one of the powerful European nations; but the best way to make sure of that is to have a fleet that they would dread to encounter. Owing to our late "expansion," we now need two fleets; one in the Atlantic second only to England's, and one of considerable power in the Pacific.

The "War Game" shows how greatly we would have to weaken our Atlantic fleet if an attack should be made on the Philippines—and there is where it would be made—as far as possible from our home base of supplies.

If civilians are allowed to join the new Naval League I would like to have the honor of becoming a member. Can you kindly give me any information about that? I have been looking for some professional criticism of the "Battle of Manila." There seem to be some lessons of great importance in that engagement; though I think the Americans were not given credit enough for gun fire and probable skill in action. One of the lessons is—modernize the "Oregon" class by substituting 12-inch guns for the 13-inch, lowering the 8-inch turrets so the guns can fire on a line with the keel, and using the weight saved by adding more 6-inch guns. All 13-inch guns ought to be replaced by 12-inch. Some "semi-battleships" carrying two or four 10-inch guns and not less than twenty 6-inch guns would make a welcome addition to meet such vessels as the "Kaiser" class. B. D. MERCHANT.

San Jose, Cal., March 5, 1903.

Safety of Railway Travel in England.

To the Editor of the SCIENTIFIC AMERICAN:

The awful accidents which one hears of almost daily in this country would be comparatively few if the railroads were operated on the same basis as those of England. There is not a railway in England that is not fitted out with a complete block signaling system, which is worked by an army of trained men, most of whom enter the railway service as boys at fifteen and sixteen years of age, and usually start in the signal boxes or cabins as telegraph learners. They serve two, three, and even four years, until they are thoroughly acquainted with the telegraph instrument and the working of the signal box, when they are drafted out as relieving signalmen, and are appointed signalmen whenever a vacancy arises. A man when once appointed to a box usually holds the same position for quite a number of years, so that he is able to get thoroughly conversant with everything around him. He has to have good eyesight and hearing, being examined for this about every two years. The signals and points mostly all work together by means of an interlocking arrangement, so that when the switch or point is pulled the signal is pulled at the same time. Nearly every country station has its signal cabin or box with signalmen always on duty. These usually have twelve-hour shifts, but in busy yards they work on eight-hour shifts. On single-line roads, or what are termed "branch lines," they work by what is called the "train tablet system." With this system it is impossible for two trains to be at the same time in one section. The train tablet is worked by an electrical arrangement from one signal box to the other, and the enginemen of the trains before starting on their journeys on a single road are compelled, under penalty of instant dismissal, to see that they have the train tablet handed to them by a responsible person and fixed in a secure position on the footplate, where they can see it. When they reach the next section they have to deliver one tablet and receive another. Trains running in an opposite direction they pass at stations booked in their time table book, or, if trains are running late, arrangements are made accordingly; so that under this system it is almost impossible for a collision to occur. In nearly every branch of the railway service a man has to start at the bottom and be trained up to the more responsible positions; but at busy times when traffic is heavy, most railways employ supernumeraries to do less important duties. The hours of enginemen and firemen are not to exceed ten to twelve hours on duty, so that there is no chance of their being overworked. The officers of the various departments have to draw up weekly reports of hours worked by railway servants and these are sent in to the Board of Trade authorities.

Now as to the keeping up of the roadbeds, bridges, culverts, etc. There are district engineers appointed for so many miles of road, which is divided up into so many sections. Each section is kept in good working order by five men, the foreman, platelayer or "ganger," as he is termed, and four men to work under him. One of the ganger's most important duties is to traverse the entire length of his section every day to see that everything is all right and to report any serious defect in the road or bridges, etc., to his district engineer, who then informs the heads of the various departments, who issue out printed forms to all persons concerned, so that they can be on the lookout and be prepared to stop if required to do so. On nearly every railway there is a man to about every mile of road, so that it gives them a good chance to keep the road in thorough repair. Should a collision or railway accident of any kind occur, there is a Board of Trade investigation, presided over by Major Marinden or Colonel York, to determine the cause and the persons responsible for it. The very few accidents that take place around London, where the traffic is so thick, especially at Waterloo Station, during the Derby, Ascot, and Kempton Park race days, when trains are arriving and departing every minute or so, is truly remarkable, particularly since London is subject to heavy fogs. These, however, they are always prepared for, by having the platelayers do their part as ground signalmen to lay the detonators or torpedoes when required, so as to warn enginemen when they cannot see the signals, etc.

Now as to the important duties of the enginemen. The engineer is supposed to keep a strict lookout for all signals, and the fireman is to assist him in doing the same when not engaged in firing up or putting water in the boiler, etc. The rules require firemen to do these duties as far as possible between stations, especially on express trains, and to be on the lookout for signals on approaching stations and junctions, so that if the engineer did not catch sight of the signals the fireman would, especially when traveling by night. Then again there are issued, every three months, time table books for the drivers and firemen. At the head of each leaf of the book the following is printed: "Time must not be made up in running down inclines, and the men are supposed not to take any chances whatever." When an engineman is leaving a station with his train he is supposed to look back and see that the entire train is following and be prepared to stop if signaled to do so. All these things go toward making the safety of the traveling public complete as shown by the fact that not a single life was lost on British roads last year. ALFRED T. LANCASHIRE.

Little Valley, N. Y., March 7, 1903.

A Coal Substitute.

To the Editor of the SCIENTIFIC AMERICAN:

As a coal famine is subject to occur in the future, possibly the following regarding cheap fuel might be of use to the public in districts where the material is found to exist.

While living in South Wales we used to send to a neighboring pit for a horse load of slack coal, costing 60 cents. This we mixed with two-thirds clay (dug up near the house) in the form of mortar, and then turned it out by hand into balls three or four inches in diameter. These, when dry or nearly so, we placed on already started coal fires for heating rooms, coal at the time being extremely cheap and handier for cooking. They became like balls of red-hot iron, giving out great heat and lasting about twenty-four hours, when they crumbled to ashes. The fire was renewed by placing more on top and making a fuel, as may be seen, costing only 20 cents the ton.

Now it occurs to me this peculiar clay (no doubt some vegetable substance) must exist in many parts of the North American continent, probably in large quantities, possibly beneath the entire prairies, among mountains, beneath some kind of swamps, and overlying coal fields. Also that it can be made to burn by a mixture with some other material, such as sawdust, peat, or finely chopped straw or cornstalks.

For those living inconvenient distances from coal mines or wanting cheap fuel, I would suggest experimenting with any kind of clay they think might have these properties. It will cost little time or trouble. It would be easy for the government to import one or two hundred pounds from the same spot for analysis. To any one communicating direct I will give such further information as lies in my power.

HENRY TAYLOR.

Chaworth, London South, Ontario, February 14, 1903.

The Designing of the "Connecticut."

To the Editor of the SCIENTIFIC AMERICAN:

In view of the fact that the General Board of the Navy has unanimously advised Congress to have our future battleships follow the lines of the "Connecticut" class, it would be interesting to examine this design and see if advantageous changes are possible. The design for the "Connecticut" is probably the finest piece of work of its kind that has ever been turned out here or abroad and the action of the English Admiralty in discarding completely their own previous designs, and practically copying the "Connecticut" for their latest and largest battleships, is a great compliment to our designers.

In looking first at the armament of this battleship, it shows up both enormously powerful and excellently proportioned; nevertheless it looks like a mistake to reduce the length of her 8-inch guns from 45 to 40 calibers, and 100 rounds per 7-inch rapid-fire gun does not seem sufficient.

The writer thinks that these two items should be changed, even if it should be necessary to omit two or even four of the 3-inch guns and their ammunition supply. This could be done without materially impairing the fighting efficiency.

In regard to the protection, the results do not appear to be quite so satisfactory. The larger part of the side is covered with 6-inch armor only; and in view of the fact that foreign navies are increasing the sizes of their broadside guns, and that the thickness of the casemate armor on the latest designs in England is 9 inches and 7 inches, this is too light.

It would be possible, by slightly modifying the plans, to carry a casemate belt of 7½-inch uniform thickness extending from the main belt to the main deck, with athwartship armor of the same thickness by proceeding as follows:

Stop the lower casemate belt at the same point that the upper stops at now, and carry the lower athwartship armor across to meet the barbettes just under the upper. This will result in a saving in length of both the lower casemate and lower athwartship belt, and on one side of the ship would amount to about 545 square feet of 6-inch armor, equivalent to 3,275 square feet of 1-inch armor.

Next dispense entirely with the 2-inch nickel steel protection to the 3-inch guns; battle experience having shown this class of armor to be dangerous, it not being sufficiently thick to exclude common shell from guns of 6 inches and above, and would only serve to make the explosion of such shells more disastrous. This would save about 700 square feet of 2-inch armor or 1,400 square feet of 1-inch, making a total saving of 4,675 square feet of 1-inch armor.

To increase the thickness of the casemate and athwartship belts to a uniform 7½ inches, would require about 2,420 square feet of 1½-inch armor and 1,630 square feet of ½ inch, equivalent to 4,450 square feet of 1-inch armor.

This process would leave a margin of 225 square feet of 1-inch armor for each broadside, and for the whole ship would save about 8 tons in weight.

The barbettes would have to be changed to meet the above conditions, making the face outside of the 7½-inch armor 10 inches thick, and the portion inside 6 inches thick.

This would involve a very slight increase in weight, which could be deducted from the surplus 8 tons.

The proposed changes would lower the position of the center of gravity of the masses involved about 5 feet, and would apparently add to the efficiency of the ship.

Note.—The above discussion is based on the plans submitted by Admiral Bowles to the Society of Naval Architects and Marine Engineers at their last annual meeting. G. B. M.

677 Washington Street, W., Bath, Me., March 2, 1903.