passed over the country after the war of the Revolution. As in the earlier instance, so in the later civil war, the return of afflicted soldiers from malarial regions was followed by a slowly developing malarial epidemic. The first cases among the stay-at-homes appeared along the railway traversing the shore of Long Island Sound. Gradually it spread into the interior, most rapidly along lines of public works. The upturning of new soil was supposed to cause the extension of the plague, though the same sort of work during the preceding forty years had never been followed by such results. It will be remembered that just after the war was a period of public improvement; in every thriving town streets were laid out and graded; public waterworks were introduced, and gas pipes were laid down in many villages—all requiring the employment of large gangs of laborers, recruited largely from the ranks of lately returned soldiers. It seems to us altogether more likely that the germs of the succeeding epidemic of "malarial" fever were imported by men who had taken the disease while on duty in the malarial regions of the South and West, than that they were developed or brought to the surface by the displacement of raw earth.

Very probably the interference with lines of natural drainage, incident to the construction of railways, waterworks, and the like, and the ponds and ditches left where earth had been taken out for embankments and roadways, furnished many appropriate places for the multiplication of the imported malarial germs. At any rate the progress of the epidemic was largely governed, if it was not hastened, by the progress of such works. Once widely prevalent, as it became in the course of four or five years along the main line of railway towns near the Sound, the natural movement of population sufficed to carry the epidemic into the interior.

Its progress up the Connecticut and other rivers and along lines of railway communication was traceable year by year, until there came a season, like the past summer, when the climatic conditions seem to have been specially favorable to the spread of the malady, and it became exceedingly prevalent, both as a distinct disease and an element complicating the symptoms of other diseases.

In the early part of the season the State Board of Health of Massachusetts undertook to investigate the subject, and has collected a mass of evidence which can hardly fail to throw a clearer light upon the nature and conditions of the epidemic. From reports in local papers it is clear that the troubles attributed to malaria have prevailed to an alarming extent, particularly along the Connecticut valley. Cases have appeared in every town from Connecticut to Vermont; and in Springfield, Holyoke, and other large places the number of cases has been very great. Heretofore this region has been not only a healthy one, but exceptionally free from troubles of this nature. In the Housatonic valley, in southwestern Massachusetts, around Barrington, for example, hitherto one of the healthiest districts in all the land, the malarial epidemic has been the severest ever known in New England. The disease is described by the visiting physician of the Board of Health as a genuine intermittent fever, many of the cases being very severe. The disease has attacked all classes of persons, some living at considerable distances from supposed malarial centers, and it counts its victims among the old, the middle aged, and the young, among new residents, old residents, and casual visitors.

The manner in which the epidemic sweeps through regions previously proverbial for their salubrity, seems to show that the disease is not of local origin and cannot be "in the air."

Before the results obtained by the inquiries of the Board of Health are compiled and digested, any opinion as to the actual propagation of the epidemic can be little better than a guess; nevertheless it may be safe to express the strong suspicion that wells and water courses, tainted by the fecal discharges of victims of the disease in one form or another, are more likely to prove the distributers of the poison than cold winds, night air, emanations from swamps, or any other purely aerial or malarial agency.

THE REVIVAL OF AMERICAN COMMERCE.

A commercial convention, called by the New York Board of Trade and Transportation, met in Boston, October 6, fifty-one important mercantile associations being represented. The chief subject proposed for consideration was the revision of the navigation laws under which the supremacy of our country in its own carrying trade has been lost. In 1855 American vessels carried $405,000,000, and foreign vessels $131,000,000 of our exports and imports. In 1879 foreign vessels took $911,000,000, and American vessels only $272,000,000. The greater part of our merchant marine is now engaged in the coasting trade, while its aggregate tonnage is more than a million tons less than it was twenty-five years ago.

The great question is, How are we to recover our commercial standing among commercial nations? At this writing but one session of the convention has been held. The problems which the delegates have in hand are of national magnitude, and of the most far-reaching importance. It is devoutly to be hoped that whatever decision they may arrive at may be such as will hasten the restoration of our mercantile marine to the honorable position it held before the war. During the past twenty-five years our mechanical industries have been pushed to the front rank among those of industrial nations. The next twenty-five years should see as marked an advance toward American commercial supremacy.

BENJAMIN PEIRCE.

In the death of Professor Benjamin Peirce, October 6, in the forty-seventh year of his professorship at Harvard College, America loses one of its ablest mathematicians and scientific men. Prof. Peirce was born in Salem, Mass., in 1809. He was graduated at Harvard in 1829; became tutor in 1831, University Professor of Mathematics and Natural Philosophy in 1833, and Perkins Professor of Astronomy and Mathematics in 1842. Between 1836 and 1846 he published a series of mathematical text-books, which, though never widely adopted in schools, have had a marked influence upon the mathematical teaching of this country. The founding of the observatory at Harvard was brought about by his lectures on the comet of 1843. His investigations in connection with the discovery of Neptune in 1846 made his name known and honored the world over. In 1849 he was appointed Consulting Astronomer to the "American Ephermis and Nautical Almanac," for which he prepared a volume of lunar tables in 1852. The results of his labors on Saturn's rings were published between 1851 and 1855. His valuable services in connection with the United States Coast Survey led to his appointment as superintendent of that important work in 1867, an office which he held until 1874.

His "Treatise on Analytical Mechanics" appeared in 1857, and in 1870 was published an edition of 100 lithographed copies of "Linear Associative Algebra," a workremarkable for the power and boldness of its reasoning. More recently he delivered a course of Lowell lectures on "Ideality in Science," in the course of which he made the remarkable statement of problems of cosmical physics printed in this paper about a year ago.

FIREPROOF FERRYBOATS.

The repeated demands of the public for the use of fireproof material in building passenger steamers for inland navigation seem likely at last to be complied with. A company has been formed with a capital of $10,000,000, to build excursion steamers for use in the waters around New York. They are to be not only indestructible by fire, but also impossible to sink. The use of fireproof material for the upper works and water-tight compartments in the hulls should be made compulsory in the construction of all new steamers carrying passengers on the inland waters of the country. In view of the fearful accidents that have happened ever since steam navigation became general, it is strange that such conditions have not long since been required of our shipbuilders; but evidently this greatly-needed reform will be brought about by the operation of that much-abused doctrine, the "survival of the fittest;" for if the public is offered a choice between a floating fire-trap, liable to be sunk like an egg shell, and an equally elegant but fireproof and non-sinkable craft, the fire-trap will soon cease running for lack of patronage.

But the excursion steamers are not the only vessels for which these reforms are urgently demanded. The ferryboats plying in the North and East Rivers, sometimes carrying more than a thousand passengers at a trip, are equally important subjects for radical treatment. It is true that there have been few serious accidents attended with large loss of life on these craft; but the possibility, yes, the extreme probability of such accidents, cannot fail to strike any one; built of light wood, thickly painted, oiled, or varnished, they would burn with great rapidity even with little draught; but when it is remembered that they are so built as to create the strongest kind of a draught throughout their whole length, it will be seen that within 20 minutes of an outbreak of a fire, there would be nothing left to burn. The greater part of the passengers would be burned or drowned, and there would be only a small number saved under favorable conditions; but if, for example, the fire started while the boat was in a pack of heavy ice midway in the river, there would be hardly a score escape alive. Such an accident happened on a Philadelphia and Camden ferryboat several years ago, but by great good luck the fire broke out on an early trip in the morning, when very few persons were on board, so that the loss of life was small.

Even a false alarm of fire would cause many deaths, since the panic that would result on board a ferryboat of the present style would drive a large number overboard. Some would voluntarily spring into the water to escape death by burning, while others would be forced over the side in the struggle of those in the center to get out.

All these dangers would be avoided if every passenger knew that the boat could neither burn nor sink; under such circumstances the cry of "fire" would produce no panic, and even in the most serious collision the passengers would know that there was no danger after the first shock. For these reasons it is evident that the proposed reforms in excursion steamers should be hastened into effect upon the lines of ferryboats also. But it is here that they will be slowest to make their way. The ferry routes are monopolies; their proprietors fear no competition such as threatens the owners of excursion steamers; they have large amounts invested in their present craft, and they will not voluntarily abandon these boats and go to great expense for others unless compelled to do so. If resort be had to Congress or the State Legislature to compel the needed change by statute, the companies have both money and influence enough to delay long, if not wholly to prevent, the passage of the requisite laws; consequently they can be reached only through their pockets or through the influence of an overwhelming public opinion. As before stated, they are independent of competition, and therefore it is difficult to touch their pockets; hence public opinion alone is likely to bring about the desired change. Now, if they are called upon to abandon their present boats and build others of far more expensive types, they will stand a great deal of pressure from that indefinable force known as public opinion before they will yield—the great loss and expense involved will have the greater weight; but if any one can devise a plan by which their present fleet of steamers can be rendered fireproof and non sinkable for a moderate outlay, there is little reason to doubt that they would be apt to regard such an improvement favorably. For example, the light woodwork of these boats has one advantage over iron; it will float if detached from the hull containing the boilers, engine, etc. Hence, if it can be rendered fireproof, the problem is solved at once. All that will be necessary will be to have all that portion containing the cabins, roadways, etc., detached from the hull, so that, no matter what might happen, the most important portion would readily float with all the passengers. Panics could be averted by numerous signs: "This boat can neither burn nor sink." The hull of the ferryboat should extend to the guards, which should project, as at present, beyond the upper works. These latter could be removed, made fireproof, and replaced at no great cost. The upper portion should then be built upon a heavy flooring, which should be wholly detached from the hull. To prevent displacement of one upon the other, vertical bolts should be used which would keep the two parts in position, but offer no resistance to a separation on account of a downward strain. The shafts, wheels, and walking-beam should be so arranged as not to have any connection whatever with the upper works, and in case anything should happen to cause the hull to sink, it would go to the bottom, and leave the great box containing the passengers floating on the surface.

The inventor who can render wood fireproof without seriously impairing its buoyancy, will have not only the ferryboats, but the whole fleet of wooden passenger steamers, to remodel. If the new company successfully carries out its present programme, the old craft must conform to the new condition of absolute safety or go out of business. There is no more profitable field open for an inventor than a solution of the problem: How can a wooden steamer be rendered fireproof and non-sinkable at the least cost?

DESIGNS PRODUCED BY CRYSTALLIZATION.

A French inventor noticed the manner in which watery vapor in a warm room congeals against the glass during frosty weather and forms needle-like crystals, interlacing one another like the threads of a tissue. This observation gave him the idea of producing designs for textile fabrics by crystallizing various salt solutions on a sheet of clay. He first tried the sulphates of copper, zinc, iron, alumina, and magnesia. He covered five clean glass plates, each with the solution of one of these salts, placed them in a horizontal position, and allowed them to crystallize slowly by evaporation. He found further that the crystal form became more suited for his purpose when he added albumen, gum, starch, or gelatine to the solution, while at the same time the crystals became more resistant. He found also that different temperatures influenced the forms of the crystals, and that he could produce fantastic trees, flowers, stars, arabesques, roots, and even insects of interesting design. He went through many experiments, and ended by making the figures obtained permanent by electrotyping, for which purpose he caused the solutions to crystallize upon strong plates of copper or German silver. A clean sheet of lead, placed on the finished crystallization, gave, by hydraulic pressure, a metallic counterpart of the same. Or he used sheets of softened gutta percha, which received the impression and could be used in making a copper deposit in the electric bath.

The great problem, however, was to produce a continuous design which would fit around the rollers with which the patterns are printed on woven fabrics. The detached productions of the crystallization on his plates did not satisfy this condition. He substituted, therefore, in place of his flat plates, metallic cylinders similar to those used for producing the rollers for calico printing. By slowly turning them around their axis, while the solution on their surface evaporated, he obtained a design which satisfied the wants of the printer and the weaver for a continuous design without break in the whole length of the cloth.

There are, however, some objections left. The crystallization is capricious and not sufficiently even and uniform, often leaving blanks which are larger than are agreeable to the purchaser of the fabric; but this may be overcome by experience and precaution. Another objection, however, appears impossible to correct. The two sides of the patterns do not match when different widths are joined at the selvedge of the cloth. It is argued that this is of minor importance, as generally dressmakers and tailors pay no attention to it.

Jacob Boll.

Prof. Jacob Boll, of Dallas, Texas, died September 29, while engaged in scientific exploration in Wilbarge County, of that State. Prof. Boll was a Swiss naturalist and geologist, a favorite pupil of Agassiz, and a man of distinguished scientific reputation. His name is honored in the Harvard Academy of Science, in Philadelphia, Paris, Geneva, Berlin, Zurich, and other seats of learning in Europe. In Texas, in the absence of a State geologist, for six years past his labors have been of great value to science and to the State.