Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JUNE 30, 1900.

THE LATEST LIQUID AIR FALLACY.

Our readers will doubtless remember that about a year ago, when the liquid air craze was at its height, we published (SCIENTIFIC AMERICAN, April 22, 1899) a characteristic article from the pen of President Morton, of the Stevens Institute, exposing the fundamental fallacies underlying the claims which were being made for liquid air. This and other *exposés* that appeared in the contemporary technical press of the country went far to neutralize the pernicious effects of the liquid air promotion that was then rampant. After a period of comparative quiet, the public is again deluged with prospectus literature of the kind that is unfortunately only too successful in emptying the purse of the half-informed and all-too-easily-deluded investor.

The present exploitation, however, is being carried out under a new name, and with promises of profit that are as alluring as the most exacting prospectus-writer could demand. Liquid air no longer parades as a perennial source of motive power whose volume, so far from diminishing, grows larger the more we take from it; and as representing an inexhaustible source of refrigeration it has evidently lost its drawing power. We are now told, indeed, that it is to liquid air that we must look as our most profitable source of heat. Its oxygen is to be extracted, bottled up, and used in our steamships, locomotives and reducing furnaces in such magical fashion as to produce the usual "revolution" in the field of transportation and manufacture. This latest fallacy has been exposed in the very convincing article by President Morton, which, by the courtesy of The Stevens Indicator, we are enabled to reproduce in full in the current issue of the SUPPLEMENT.

The latest claim of the promoters is that, by distilling off its nitrogen, liquid air may be utilized as a means of producing oxygen gas in large quantities and at a relatively low cost. While it is admitted that pure oxygen could be obtained cheaply in this way. President Morton shows that as it costs, according to Mr. Tripler, twenty cents to produce a gallon of liquid air, and as it requires five gallons of liquid air to produce one gallon of oxygen, the cost of production must be one dollar per gallon, or about ten dollars per thousand cubic feet at atmospheric temperature and pressure. It is admitted that this is less costly than the present methods, but it is pertinently asked, "What shall we do with the cheap oxygen when we get it, the present uses for oxygen being very limited and chiefly confined to the lime light and some refined processes in metallurgy?"

The liquid air prospectus tells us that the oxygen is to be used as a substitute for air in the ordinary processes of combustion, as under steam boilers, in iron furnaces, and the like; but used under these conditions it would be in competition with free air, and the cost of the storage or transportation, as the case might be, would be altogether prohibitory. It is argued that the most conclusive way to test the value of this suggestion is to reduce it to a concrete case, with actually calculated proportions of parts, volumes and weights; and because the necessary data is easily obtained, President Morton takes as his text the case of a large transatlantic steamer. He argues that since every ton of coal requires 2½ tons of oxygen for its consumption, and as it takes about 2,000 tons of coal to carry one of these ships across the Atlantic, the transportation in storage cylinders of the 5,000 tons of compressed oxygen thus shown to be necessary for the combustion of the coal, would reduce the carrying capacity of the ship to practically nothing, the coal and the compressed oxygen aggregating a dead load of 7,000 tons, to say nothing of the weight of the storage cylinders.

If the gas were not compressed, each ton of coal would require 66,000 cubic feet of gas, and the whole 2,000 tons would require 132,000,000 cubic feet. Even if forty per cent of the fuel were to be saved, as claimed by the promoters, it would be necessary for the ship to carry twenty-two tanks of the size of the huge gas holders which form such a conspicuous feature in any distant view of New York city.

Your promoter, however, is nothing if he is not ready-witted, and he will, of course, suggest that the idea of storage was never in his mind, and that each vessel would carry the oxygen-manufacturing plant on board, and would make the gas as it was needed. It is sufficient to say that the necessary plant to produce the 1,250 tons of oxygen which would be needed per day for the 500 tons of coal consumed daily in the furnaces of the steamship "Campania" would call for boilers and engines that would rival in bulk and weight the engines and boilers that propel the ship.

Lastly, attention is drawn to the fact that the enormous intensity of the temperature produced by the combustion of fuels in oxygen would lead to the burning and melting down of the furnaces in which it was tried. A pound of coal burnt under these conditions would not yield a greater quantity of heat, but would simply develop the same quantity in less time, with a proportionate increase in the intensity of the heat.

ECONOMIC VALUE OF GOOD ROADS.

There is food for thought in the report of the Maryland Geological Survey for 1899. In the first place we are told that the people of Maryland have expended, during the last ten years, upon the so-called construction and repair of their own roads, the sum of no less than $6,000,000. It seems that the greater part of this money has been frittered away in the attempt to repair roads which have been poorly laid out in the first place, and for the lack of certain necessary engineering qualifications can, in the nature of things, never be made into good roads. As an instance of this it may be mentioned that many of the common roads have no natural drainage. We are told that most of them are in a poor condition for a part of the year, and some of them for the whole twelve months.

As the result of a careful estimate made by the survey, it is shown that the farmers of the State of Maryland expend $3,000,000 a year more on their hauling over the present poorly built highways than would be necessary if the hauling were done on first-class roads. These figures are to be compared with the information collected by the Department of Agriculture in 1895, when, as the result of data received from over twelve hundred counties in various parts of the United States, it was ascertained that the average cost of hauling one ton for one mile over country roads was twenty-five cents; which was just three times as much as the average cost of hauling over the improved macadam roads of six European countries. If this large sum of money represents the loss to the State of Maryland from poor roads, it is easy to say that the total loss throughout the whole United States represents a figure so great that it must have an important bearing upon the prosperity of the country at large, and particularly upon the farming interests as such.

At first sight it seems incredible that in a country so progressive as ours the condition of the common roads should be over a half century behind that of the old world. It is true that the vast extent of the United States, and the great mileage of our roads in some States relative to the density of the population, may be offered as an excuse for our backwardness; but while this plea may hold good as regards the thinly populated Western and Southern States it cannot be applied to the older, more populous and wealthy sections of the country.

COMMERCIAL EXPANSION AS A SCIENCE.

Our last issue contained a letter in which the writer contrasted the business methods of German and American merchants, and proved how, in many ways, Germans showed more business sagacity in dealings with South American firms. According to our correspondent, the secrets of German success are not far to seek. The inability of many American commercial travelers to speak the language of the country to which they are sent; the elaborate American price lists and catalogues, with their complex and useless system of discounts from list prices; the refusal to extend credit; and the inability or unwillingness to humor the customer, go far to offset the superior quality of American goods.

But there are still other reasons why Germany in many parts of the world is slowly but surely outstripping her sister nations in the struggle for commercial supremacy—reasons which are apparent only to him who has made a careful study of German industry on its native heath. Such a study is to be found in the work of a Frenchman, Maurice Schwob, which bears the dramatic title, "*Le Danger Allemand*." The book has forcibly brought home to Frenchmen the necessity of very radically modifying their commercial system, if they desire to regain even a tithe of what they have lost in foreign trade. Fortunately, the American business man is far more energetic than his French *confrère* for which reason Schwob's criticisms of his countrymen can hardly be applied to us. Nevertheless, his analysis of German methods is so instructive, is based upon facts so little known, as to warrant a brief review of his book.

"The German Danger" is discussed by Schwob in five sections—"The Sea Danger," "The Industrial Danger," "The German System," "German Advertising," and "The Conquest of Markets."

"The Sea Danger" for France lies in the decline of the shipping interests of her ports. Besides the successful competition of Hamburg with Liverpool, Schwob notices the development in shipping at Antwerp and Rotterdam, both of which cities owe their unexpected commercial good fortune to the fact that they are outlet ports for the Rhine, by which the products of Frankfort, Mannheim, Mayence, Düsseldorf, and other river towns are transported to the sea. The benefits to be derived by shipping to Antwerp were found to be so advantageous to Frenchmen that the head of the Department of Meurthe-Moselle stated that not only was a part of France thus annexed to Belgium, but that Germany and Belgium together threatened commercially to incorporate the whole of France.

"The Industrial Danger" has also given Schwob much concern. The German government, he finds, understands thoroughly the making of commercial treaties which enable home industries to thrive despite the keenest foreign competition. The revenues obtained from the taxing of imports are not all swallowed by the national treasury; but a certain part of the money received is paid out as premiums for the exportation of German goods. The bureaucratic political system of France, says Schwob, renders a co-operation of the government authorities and merchants impossible. Tariff systems are made and unmade in a day. Laws, ill timed and badly framed, go into effect, which, although designed to check foreign invasion, really cripple French industries. Officials are "politicians" in the very sinister sense which that much-abused word has acquired in the United States. In Germany, on the other hand, the government and the merchants work in harmony. Bills are introduced and passed in the Reichstag exactly when they are most needed, and are so broad in their scope that the hands of the exporting manufacturer cannot be tied by official red tape. Schwob cites a striking example of this intelligent co-operation. For years, German shipbuilders had been purchasing their iron and steel from English foundries. At a convention of German ironmongers and shipbuilders, it was decided that German foundries were thereafter to deliver the steel required by the shipbuilders. It was found necessary to reduce the railway freight-charges on iron; the government immediately provided lower rates, "of its own accord" (*spontanément*), writes Schwob maliciously, for in France the officials rarely act "*spontanément*." And the shipbuilders agreed to pay from three to five per cent more for German than English iron, in order that the home industry might flourish. No protective tariff was established.

Germany's method of "conquering markets" is due primarily to the "floating expositions" sent to all parts of the world. A syndicate of merchants charters a steamer, loads her with goods carefully selected for foreign buyers, sends her from port to port, in accordance with a schedule prepared with characteristic German attention to detail. Representatives of the firms are sent ashore at the various cities. Each man speaks the language of the country fluently; he studies the needs of the population; he distributes samples and intelligently compiled catalogues, and takes orders for goods; in a word, he does everything in his power to further the interests, not only of his firm, but of German commerce as well. When his report has been handed in, a swarm of commercial travelers settles down in the country visited, all of them thoroughly familiar with the business methods of the people, and ready to build on the foundations laid by their predecessor.

Second in importance only to the "floating expositions" are the export associations that, for the last ten years, have maintained trade museums or bazaars for the purpose of exhibiting their wares, and for sending expeditions to all parts of the world, in order to accustom the people to the use of German products, to distribute catalogues of samples, lists of export houses and the goods sold by each. Is it any wonder that one can pick up everywhere so many articles of manufacture that bear the familiar inscription "Made in Germany"? Is it any wonder that not only Africa and South America and the countries of the Orient have been thus commercially conquered by the "indomitable German," but also Norway, Denmark, Holland and Russia—"countries," says Schwob, "that are our friends, and hate and fear Germany."

Although it is primarily intended for his countrymen, Schwob's study contains many a lesson by which American merchants may well profit. Our exports, it is true, have never been so large as in the last ten years; and at the close of each year the records show that there is not a single branch of industrial activity in which we have not made some progress. What we have gained has been gained not so much by concerted action as by the efforts of individual firms. Our progress has been great; but it should be still greater. And only by systematic aggression, by the establishment of more institutions similar to the Philadelphia Commercial Museum, and by arranging more exposi-