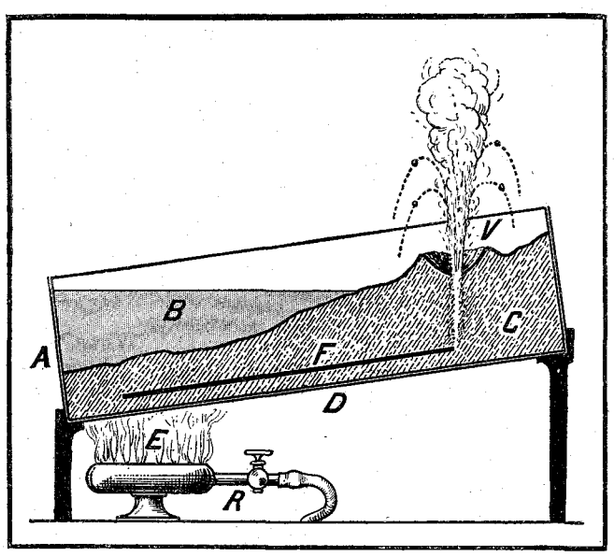
"Because most of the people follow agricultural pursuits, and also because of the inadequate systems of transportation, the buying and selling have been done at long intervals. This has caused the holding of fairs at which the people gathered in immense numbers. It has been estimated that 16,000 of these fairs are held annually, and that their sales exceed $500,000,000. Of course many of these are small and only of local interest, but some are of national importance and are known throughout the world."

The greatest factor in this tardy growth, the writer goes on to tell us, is now said to be German influence, which has dominated the Russian Government since Peter the Great. The Germans have secured the greater part of Russian trade largely through their willingness to adapt their methods to Russian conditions. In 1913 not only did Germany sell nearly $15,000,000 worth of machinery to Russia against the United States' $200,000, but the disproportion runs through all her trade, and German firms even sold to Russia two and one-half times as much American machinery and tools as was imported from us direct. We read further:

"The true reason for the slow growth of Russia seems to have been a lack of fuel and of capital. While the country has many large coal deposits, some of it is of an inferior quality and much that is of good quality has been inaccessible. Railroads are being built to these deposits, so that it is thought the fuel-supply will be sufficient for a long time to come. Plans are being made for the conservation of this supply by making as wide a use as possible of the water-power, of which there is an abundant supply.

"The Russian markets are increasing in size and importance and are demanding better articles than two years ago. During the war several ports have been developed and new ones have been built, necessitating the construction of new railroads, some through territory that heretofore has been inaccessible. Existing roads have also been extended and in some cases rebuilt, and with the increase in the manufacturing plants of all kinds the people have more ready money than ever before. Wages have been increased in some cases nearly 100 per cent., and in consequence the people are adopting a higher plane of living. Factories of many kinds are being planned and built, some under the direct supervision of American, English, Swedish, and other engineers. The choice of these men, who will largely determine the equipment that will be adopted, is often dependent on the source of the capital furnished for the factory.

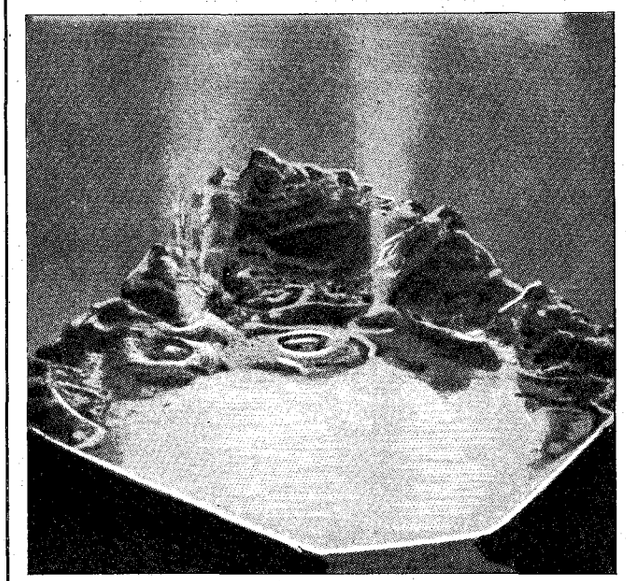
"One mistake that is being made in the published descriptions of the Russian conditions is to speak of the changes that are taking place as 'rapid.' Nothing with which the people of Russia have to do is rapid—quite the reverse. The introduction of modern methods of manufacture, the use of labor-saving machinery, the adoption of comforts such as we have in America, and a voice in their own Government will all be matters of education, and they will be slow; but they are all coming."



CROSS-SECTION OF THE "EXPERIMENTAL VOLCANO."

ARTIFICIAL VOLCANOES

WHILE FRENCHMEN on the Western front are busy counterfeiting the phenomena of volcanism—with bombs, choking clouds of gas, subterranean and submarine explosions—a countryman of theirs, Émile Belot, has succeeded in imitating nature still more exactly by means of a single agency—steam. That the activity of volcanoes is primarily due to steam from heated sea-water has long been believed by many geologists, tho it can not be said to be so universally accepted as to bear the stamp of orthodoxy. But Belot thinks that he has gone far toward silencing all objection by the exactitude with which he reproduces volcanic action on a small scale. Under the heading of "Experimental Volcanism," he writes thus in *La Nature* (Paris, October 28):



ARTIFICIAL VOLCANIC PHENOMENA.

Belot's volcano, showing a crater-lake in the middle; eruption in an early stage at the right, in a later stage at the left, and a dried crater in the left foreground.

"In a shallow basin about two feet square, we place a wet mixture of sand and clay in such fashion that the side *B* represents the sea and *C* the continent. The bottom *D* is inclined away from the continent. We heat the lower part of the slope as uniformly as possible. . . . Because of the metallic conductibility of the bottom we shall have practically an isothermal surface *D*. At the end of ten minutes or so volcanic phenomena begin to show at *V* in the form of fumaroles escaping from a volcanic chimney, the material thrown out accumulating to form a crater. The volcano *V* is always near the top of the slope, and we have the paradox of a surface *V* in ebullition while the 'sea' is completely cool at *B*, just over the heat.

"In nature it often happens that impermeable layers alternate with permeable ones. We may imitate this effect by placing a sheet of slate *F* at a little distance from the bottom *D;* thus several volcanoes may be produced, in line with the upper edge of the slate. The volcanic action may then appear very far from the source of heat *R*. We thus realize how linear groups of volcanoes form in nature, and why some volcanoes are found at considerable distances from the sea.

"The position and number of the slates may be varied; the volcanic action is always concentrated near the top of the slope. It may be seen that the submarine vapors concentrate or disperse as the impermeable surfaces have the form of a right or an inverted cone. Hence the following law: volcanism is proportional to the steepness of the slopes and to their convexity toward the sea. This explains why islands in the open sea are almost always volcanic and why the Atlantic coasts, being much less steep than the Pacific, are not volcanic."

Mr. Belot imitates tidal waves by placing his slate so that it touches the bottom of the basin at the upper edge, forcing the

steam to act on the "sea" at the lower edge. He has produced craters several inches across, which fill with water and form "crater-lakes" when the heat is removed. He produces "volcanic bombs" of mud, like those formed from lava in real volcanoes, and he has even noticed a phenomenon resembling the "blazing cloud" from Mont Pelée that destroyed St. Pierre, when the steam-column from his artificial crater sweeps the surface obliquely instead of ascending. By covering the whole surface with water he has a submarine volcano, which throws up islands like those off the Alaskan coast. By saturating his water with salt he gets other familiar volcanic phenomena. In fact,

"All who have seen the artificial volcano or the films that Mr. Gaumont, with his generous devotion to science, has made of them, are convinced that the sea is in submarine connection with volcanoes and that the cause that directs the internal vapors of the submarine fissures toward the coast is simply the inclination of the isothermal surfaces."

FRENCH EMANCIPATION FROM GERMAN CHEMISTS

ARE WE TO REMAIN DEPENDENT on Germany for the products of commercial chemistry? When the war is over, shall we give up our feeble attempts to fend for ourselves in this field? One would think so, to read the pæans of thanksgiving that arise whenever the *Deutschland* arrives with her small drop in the bucket of our chemical necessities. Whatever we may do about it, however, it is certain that the Entente Powers are trying hard to free themselves from the industrial as well as from the military *Octopus Teutonicus*. Their economists and scientists in the rear of the trenches are effectively working hand in hand with Nivelle, Haig, and Brussiloff. Prof. Alphonse Mailhe, of the University of Toulouse, in the *Revue Générale des Sciences* (Paris), devotes an illuminating essay to the industrial future of organic chemistry in France. The present state of certain of her chemical industries is by no means to be despised. No country, Professor Mailhe assures us, can compete with her in the fabrication of chemical fertilizer—she produces annually more than 1,000,000 tons of sulfuric acid, while her soda quota exceeds 300,000 tons. In the organic domain, however, she is, like us, inferior to Germany, altho Professor Mailhe assures us that the greater part of the world's chemical discoveries are of French origin. He says:

"Our progress in electrochemistry enabled us to lower the price of aluminum from $113 a pound in 1855 to $1.82 in 1890 and to 34 cents in 1898. The decline in the price of vanilin is still more remarkable: in 1876 a pound cost nearly $500; it could be bought in 1908 for $5.

"We were the pioneers in dyestuffs: anilin red, fuchsin, diphenylamin, 'bleu de Lyon,' 'violet de Paris,' are French discoveries. The same is true of the perfume industry. . . . The principal cause, according to my views, of that German 'preponderance which had almost reached a point where the whole industrial world was becoming dependent upon the Teutonic output, must be looked for in the antagonism among us,' between the partizans of the atomic theory and its opponents. While Wuertz and Gerhard were vainly making desperate efforts to introduce the teaching of this theory into our schools, it was enthusiastically accepted beyond the Rhine. The Germans, with their tenacity and method, took full advantage of the new theory, and realized marvelous results in the field of dyestuffs. They were not afraid of experimenting with new compounds. Who can help admiring the indomitable energy with which the *Badische Anilin* conducted the experiments leading to the manufacture of sulfuric anhydrid and synthetic indigo? The former entailed an effort of five years and an expenditure of nearly $1,250,000; the indigo experiments lasted fully ten years and cost nearly $5,000,000. Our chemical companies, with their scant capital, could not think of experimentation on so vast a scale. Germany was aided in her industrial ascent by the thousands of young and able chemists which her universities, polytechnic academies, and special schools turned out yearly. Léon Vignon, in a recent report, stated that France had only seven chemists and England six to Germany's two hundred and fifty. Some of the German dyestuff-factories employ from one hundred to two hundred chemical experts! Under these circumstances some of our fellow citizens and our friends in foreign countries view with dismal forebodings our prospects of damming the Teutonic torrent in the triple field of dyestuffs, perfumes, and pharmaceutical products."

Taking up these three classes of substances one by one, Professor Mailhe shows that the Germans have not annihilated French industry in any of them. France is still struggling, and the chemical industries that remain are strong and were once preponderant. They may become so again. He tries to tell how in his concluding paragraphs, which we give as follows:

"We need five things to succeed: abundant raw material, sufficient capital, the necessary number of trained chemists, the protection of the law, and, finally, a first-rate commercial organization.

"We have the necessary coal for an annual production of 2,000 tons of pure anthracene, and thousands of factories now busy with the manufacture of war-material will, let us hope, soon be ready for more profitable occupations. Our capitalists ought certainly not to hesitate to invest their money when they consider that the *Badische Anilin* paid its stockholders in each of the last ten years a dividend of 24 to 25 per cent. The owners of our factories should grasp very quickly the wisdom of their German confrère who, when reproached by a friend with the great number of his spectacled scientists, replied with a smile: 'What do I care if ninety-nine out of one hundred produce nothing if but one earns for us an annual profit of 200,000 marks!' At the end of this war the fateful treaty of Frankfort imposed upon us in 1871, which forced us to treat our arch-enemy as one of our 'most-favored' nations, will be replaced by a high protective tariff; and a new patent law will safeguard French genius against unscrupulous exploitation by foreigners. As for the last requirement, a French chemical trust, covering all France and as solidly bound together as the German organizations, will be equal to it. We can produce as smart traveling salesmen as they, we can print as beautiful catalogs and produce as learned a chemical literature as our neighbors. In brief, we have all the elements necessary for a rejuvenation of French chemical industry."

OZONE FOR VENTILATION

IN POPULAR PARLANCE the word "ozone" is often used synonymously with "fresh air"; so that the use of ozone for purifying the air of buildings appeals to every one. Ozone, however, is a very definite chemical substance, a form of oxygen, with easily detected properties, including a strong, pungent smell and an irritating effect on the respiratory passages. It is stated by Dr. Felicia Robbins in *The Medical Review of Reviews* (New York) that the success of ozone-installations in ventilating-systems is due not so much to its chemical effect in eliminating impurities from the air as to the fact that its own pungent smell hides their objectionable odors. As to the direct effect of ozone on the health, she says, it is now generally admitted that this must be infinitesimal, as the ozone never comes into direct contact with the blood, being detained by the organic matter in the upper air-passages. Says Dr. Robbins:

"In discussing the influence of ozone in ventilation, Leonard Hill and Martin Flack arrive at the conclusion that its greatest usefulness lies in its altering effect upon the uniformity of the atmosphere, and the resulting stimulation of the cutaneous and olfactory nerves, as well as the respiratory system. 'There is no evidence that ozone reaches the blood or that it has any other influence on the body.'

"Ozone is altogether powerless to improve the heat and moisture of waste air, which can only be remedied by efficient ventilation, through which the odoriferous substances are removed at the same time. Moist air and dry air vary in their behavior to ozone, especially in regard to its practical utilization. Air that has become contaminated through the sojourn of many people has also become moist; meanwhile, the irritative properties of the ozone are not so evident in moist air, so that larger quantities of the gas may be added than when the air is dry,