wheat-growing region, but the live stock country of Alberta, and that important section on which irrigation is being carried out on a large scale, as recently noted in the SCIENTIFIC AMERICAN.

THE ECONOMICAL SURFACE MINING OPERATIONS OF CUBA.

BY L. B. WARD.

In Cuba the natural mining facilities are such that the processes are extremely simple and free from the many dangers incidental to the usual mining operations. Because of the accessibility of the ore, and ease with which it is mined, Cuba's mines are fast becoming her chief source of wealth, and mining her chief industry. Gold, lead, zinc, and asphalt are known to exist; and copper and manganese are found in sufficient quantities to warrant their profitable exploitation; but iron is most abundant, and the ore is so accessible, that the iron mines are being developed rapidly and are yielding large profits.

The hilly province of Santiago abounds in minerals; and her iron ore deposits are as remarkable in their way as the fabulous mines of the Lake Superior region. Indeed, the ore is even easier of access. There is no shaft sinking, no tunneling (with the exception of an occasional exploration tunnel); in fact there is no underground work at all. Hence the miners are not exposed to the many dangers of the usual mines, such as cave-ins, floodings, fires, and explosions; nor is the expensive equipment used in the ordinary mines necessary.

The mining is all open-cut work and terracing. At Daiquiri, where the mines are already extensively developed, and new companies are starting operations, the iron ore occurs on the hillsides, and it is obtained by open-cut work and terracing. Viewed from some little distance, one would suppose the hill was being removed *in toto*, and never for an instant would the spectator imagine that he was viewing a mine in full operation.

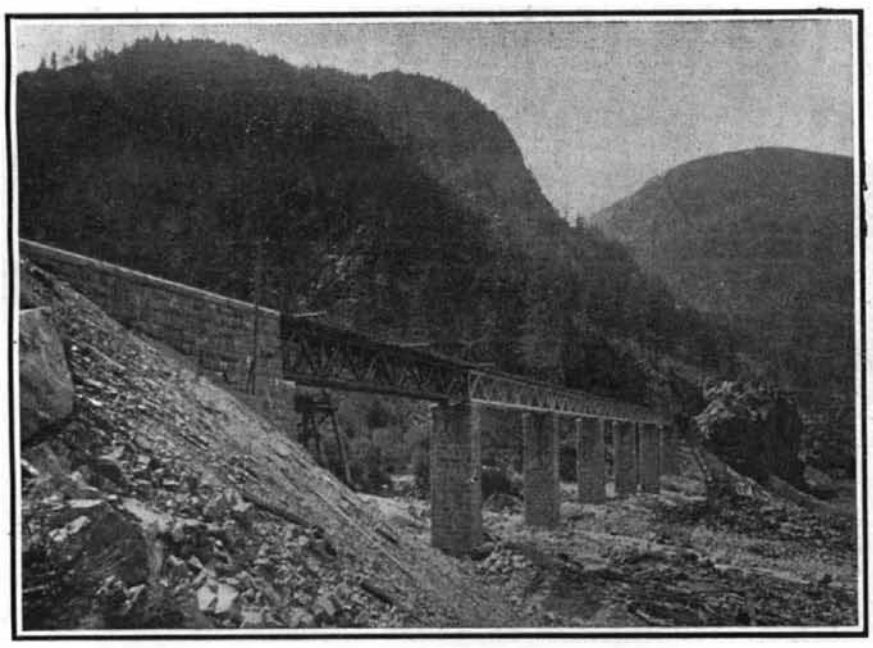
Each broad terrace ledge is laid with narrow-gage tracks, over which the ore is hauled to the regular main track and transported by rail to Santiago Bay, whence it is shipped to various points.

From the mines at Daiquiri 3,536,121 tons of ore were produced to December 31, 1906. The production for the year of 1906 was 510,500 tons. This ore has all been shipped to the United States, with the exception of 75,000 tons, which went to England, Germany, Belgium, and Cape Breton, Nova Scotia.

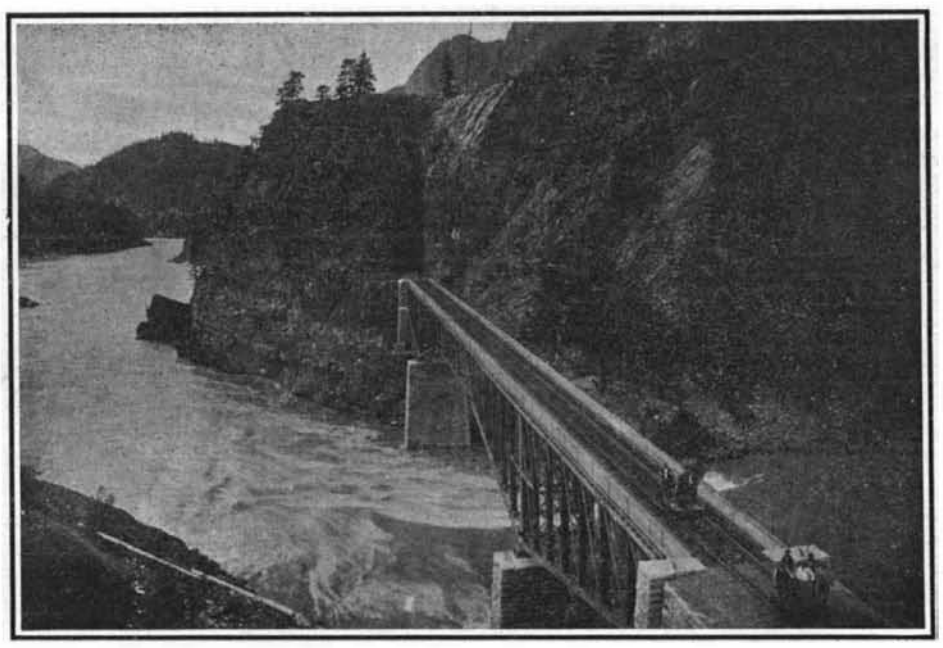
There are also several large iron mines on the north coast, in the Mayari Mountains back of Nipe Bay, that are being extensively developed, and a broad-gage railroad is under construction from the mines to the bay at Cagimaya, where are two wharves and other necessary equipment for handling the ore economically and shipping it to the United States. It is estimated the shipments from these mines will amount to over 1,000,000 tons annually.

An American company, operating not far from Daiquiri, shipped its first ore in 1884, since when 5,000,000 tons have been produced, and the bulk of this output has been shipped to the United States.

The copper mines of southern Santiago are of high value, and at one time they were worked extensively. During the war of 1898, however, the works were entirely destroyed. For the twenty-three years prior to that date the output of copper was valued at $50,000,000.



Canadian Pacific Bridge Across White's Creek, Fraser Canyon.



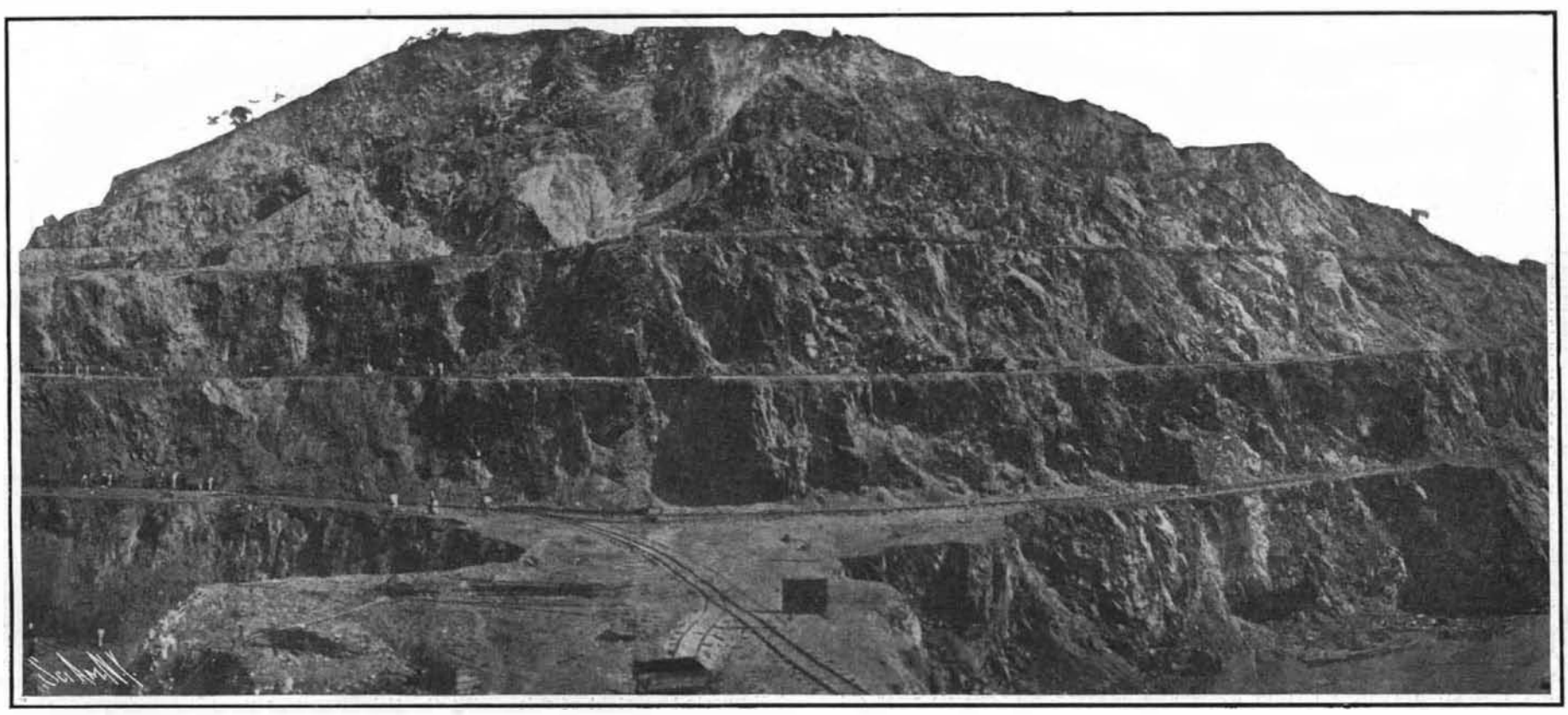
The Cisco Cantilever Bridge Across the Fraser River.

NEW RAILROAD CONSTRUCTION IN CANADA AND THE NORTHWEST.

An Electrolytic Transformer.

Alternating currents are at present used preferably in electric plants both for power and lighting purposes, and electric energy is usually distributed in Europe to consumers in this kind of current, though for certain special purposes, a conversion to continuous current is found desirable. As the devices constructed for this purpose are far from being satisfactory, endeavors have been made from time to time to design an electrolytic transformer based on the principle that in an electrolytic trough comprising an aluminium and a lead electrode. The current will be allowed to pass only in case the aluminium forms the cathode or negative electrode, while it is arrested in the opposite case by the layer of aluminium oxide formed by the current. A rather promising apparatus embodying this principle was demonstrated a short time ago by its inventor, O. de Faria, before the French Physical Society. The drawbacks inherent in all previous apparatus of the same kind, viz., polarization of the electrodes and excessive heating of the electrolyte, are eliminated by a convenient choice of the electrodes and liquid. Furthermore, an automatical circulation of the electrolyte is obtained by means of convection currents in the liquid mass. Sodium phosphate is used as the electrolyte, and pure commercial aluminium and antimony-lead as electrode mass. Owing to the circulation of the liquid, the temperature cannot exceed certain limits, while any polarization is entirely done away with. The efficiency of the apparatus varies between sixty-five and seventy-five per cent in watts. The main uses of the apparatus are the charging of accumulators and operation of induction coils, arc lamps, mercury lamps, continuous-current motors, electroplating plants, etc.

To Remove Oil Paint from Tin Goods.—In the case of fresh paint, rub off with oil of turpentine or petroleum. Otherwise, use hot, saturated solution of potash, hot water afterward. The most powerful means is caustic soda lye.



This Mountain of Rich Ore Is Being Mined by the Simple Process of Excavation in Terraces, Upon Which the Tracks Are Laid, and the Cars Loaded for Shipment Direct to the Docks.

THE REMARKABLE SURFACE MINES OF CUBA.

Household Tests for Oleomargarine and "Process" Butter.

Every householder should know how to distinguish between genuine butter on the one hand and oleomargarine and renovated, or "process," butter on the other, and also to distinguish between the two last named; for despite restrictive legislation, the public is often imposed upon. Renovated or "process" butter is often substituted for the genuine article, while oleomargarine is made to take the place of renovated butter. So clever have the manufacturers of these articles become, that in the absence of some tests the differences are difficult of detection.

The real harm begins when the "process" is sold as genuine butter, for they are not the same thing. While the fats in the two are practically the same chemically, the nitrogenous quantities are not. Moreover, since the article known now and for ages past as "butter" is an article the last step in whose manufacture is the churning of the cream, it is evident that the product of an elaborate subsequent process, a process entirely foreign to the manufacture of "butter," should be designated by a distinctive name, and many of the States have enacted laws which require the distinctive labeling or branding of the "process" product. The same requirements safeguard the sale of oleomargarine.

A boiling test has been found most practicable for household purposes in distinguishing between genuine butter and the renovated article. The test consists simply in boiling briskly a small portion of the sample and observing its behavior the while.

The test can be made in the kitchen, and requires only a few minutes' time. Using as the source of heat an ordinary kerosene lamp, turned low and with chimney off, or a gas jet turned low, melt the sample to be tested (a piece the size of a small marble) in an ordinary tablespoon and hasten the process by stirring with a sliver of wood. Then increase the heat and bring to as brisk a boil as possible, and after the boiling has begun, stir the contents of the spoon thoroughly two or three times at intervals during the boiling, always shortly before the boiling ceases.

Renovated or "process" butter boils noisily, sputtering (more or less) like a mixture of grease and water when boiled, and produces no foam, or but very little. Genuine butter boils usually with less noise, and produces an abundance of foam. The difference in regard to foam is very marked as a rule. Rarely is a butter found which yields an uncertain result; such a butter should receive the benefit of the doubt.

To distinguish oleomargarine from renovated and genuine butter, the required utensils are:

A half-pint tin "measuring cup," common in kitchen use, marked at the half and quarters, or a plain half-pint tin measure, ordinary narrow form; or an ordinary small tin cup, two and three-quarter inches in diameter and two inches in height, holding about one gill and a half; a common kitchen pan, about nine inches in diameter at the base; a small rod of wood, of convenient length for use in stirring; and a clock or watch. With this simple outfit proceed as follows:

Half fill with sweet skimmed milk the half-pint cup or measure, or two-thirds fill the smaller cup mentioned, measuring accurately to the gill of milk when possible; heat nearly to boiling, add a slightly rounded teaspoonful of the fat (butter or butter substitute), stir with the wooden rod, and continue heating until the milk "boils up." Remove it at once from the heat and place in the pan (arranged while the milk and butter or substitute are heating) containing pieces of ice with a very little ice water, the ice to be mostly in pieces of the size of one or two hen's eggs (not smaller, as small fragments melt too rapidly) and sufficient in quantity to cover two-thirds of the bottom of the pan; the water to be in quantity sufficient, when the cup is first placed in the pan, to reach on the side of the cup to only one-fourth the height of the milk within; any water in excess of that amount must be removed. (This is a cooling process, and refers to the condition at the beginning; later, as the ice melts, the water will naturally rise to a higher level.) Stir the contents of the cup rapidly, with a rotary and crosswise motion in turn, continuously throughout the test, excepting during the moment of time required for each stirring of the ice and water in the pan, which must be done thoroughly once every minute by the clock. This is done by moving the cup about, in a circle, following the edge of the pan. Proceed in this manner for ten minutes, unless before that time the fat has gathered or has allowed itself to be easily gathered, in a lump or a soft mass, soon hardening. If it so gathers, the sample is oleomargarine; if not, it is either genuine or renovated butter.

The boiling test ("spoon test") enables one to distinguish between genuine butter on the one hand and oleomargarine and renovated butter on the other; the test last given enables one to distinguish between oleomargarine and renovated butter; and so, by the use of the two tests, one can determine in every instance which of the three he has in hand. There are those who are able to recognize oleomargarine, almost without fail, by taste and smell alone. To those possessed of this power the "spoon test," which is performed with almost no trouble, will serve every needful purpose.

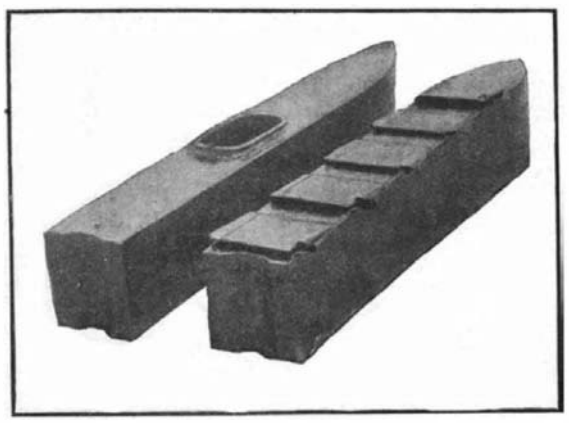
WATER-WALKING SHOES.

Frederick A. Oldfield, of Memphis, Tenn., has invented a pair of water-walking shoes with which he hopes to cross the English Channel some time during the present summer. Each shoe consists of a beechwood box four feet in length, eighteen inches in depth, and one foot in width. In order that the shoes may skim easily over the surface, five planes are secured to the bottom of each shoe. The shoes are fastened to the foot by means of clamps such as those used on roller skates, the foot being inserted through a hole in the top of the shoe, and the ordinary leather boot being clamped in place. A covering of rubber around

THE INVENTOR EXPERIMENTING ON THE MISSISSIPPI RIVER.

the opening protects the wearer of the shoe from splashing of water. The shoes weigh five pounds each.

Mr. Oldfield has just completed a trip from Cincinnati to New Orleans, which consumed forty-one days, twenty-four more than the time in which he expected to fulfill the task. In the photographs here presented, Mr. Oldfield is pictured in the Mississippi River off



THE WATER SHOES, SHOWING THE TOP AND BOTTOM. THE FIVE PLANES ON THE BOTTOM ACT AS HYDROPLANES.

Memphis. He has just completed the feat of turning a circle.

The Massachusetts automobile traffic is so heavy that it has caused marked wear on the State highways, and the commission having charge of these roads states in its last annual report that the destructive effect is "extraordinary." Practically all the main roads are thus affected. It has been noticed that the binder is swept from the road, and the stone from ½ to 1½ inch in size has been disturbed, in some cases standing on the surface, and in other cases being left in windrows along the roadside. The effect of wear of this sort is such that the commission is satisfied a material change in the methods of maintaining stone roads must be made. The report indicates that the commission believes some kind of treatment with tar will probably be successful.

Plant Lice Preventive.—Boil 250 parts by weight of quassia wood chips in 5,000 parts by weight of soft water and strain. 1,000 parts by weight of common soft soap dissolved in 5,000 parts of hot water. Mix both solutions, add 40,000 parts of water, and use it for washing leaves and stems.

SANTOS DUMONT'S COMBINED AEROPLANE AND AIRSHIP.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Aeronautic affairs have continued to be very active in and about Paris during the last three or four weeks, though the rainy weather which prevailed during the spring prevented the trials of aeroplanes and other fliers which are now constructed. Most active in the field of aeroplane work are MM. Santos Dumont, Bleriot, Vuia, and Delagrange, and we have already given an account of some of the newest fliers and the experiments which have been made with them. It will be remembered that Santos Dumont made several trials with an aeroplane which he built at St. Cyr, in the neighborhood of Paris, but up to the present he has not been very successful with it, and found that it would need to be remodeled according to the results of the tests he carried out. He expects eventually, however, to perfect it sufficiently to make long flights with it.

While waiting to do so, however, he decided to carry out some experiments which he had in view in regard to the stability of aeroplanes. For this purpose he set about constructing a new flier which differs from anything built up to the present in this line, since it is a combination of a balloon body with a couple of aeroplanes suspended beneath it. The whole machine is, however, heavier than air; and, should it succeed in flying, it will do so largely on the aeroplane principle. It is one of the smallest fliers which has yet been constructed, the balloon body having a capacity of but 99 cubic meters (3,496 cubic feet). The "Santos Dumont No. 16," as it is known, is merely an experimental apparatus, and as yet it has not made an actual flight, having had an accident which was not serious, and the damage resulting from which will soon be repaired. The balloon consists of a fusiform envelope having a length of but 21 meters (68.89 feet) and largest diameter of but 3 meters (9.84 feet). It has a long pointed shape, as can be seen from the diagram and photograph. The surface of the balloon is 151 square meters (1,620 square feet). As the total weight of the balloon body and the lower framework exceeds the lifting capacity by 120 kilogrammes (264½ pounds), the apparatus acts upon the "heavier than air" principle, and is of interest as a combination of a balloon body and an aeroplane. Inside the balloon is a small ballonet, *B*, of canvas, which measures 2 meters (6.56 feet) in diameter.

Instead of using suspension wires to hold the framework to the balloon, the frame is hung from a long bamboo pole attached directly to the bottom of the envelope by two overlapping flaps of canvas. The frame is very simple in character, consisting as it does of a series of steel tubes. The main piece forming the bottom of the frame is attached at either end to the bamboo pole and runs down to a point under the middle of the balloon, giving space for the two movable planes, the motor, and the aeronaut's seat. In the middle and widest part is mounted the motor with its propeller placed directly on the end of the crankshaft, and the frame gives just sufficient clearance to allow the propeller to revolve inside of it without touching the under side of the balloon. The frame of tubing is braced by steel wires.

The motor, *M*, is an Antoinette 50 horse-power of the light-weight, eight-cylinder type, and is held somewhat above the center of the frame upon a light steel rod support. Directly against the motor and in front of it is fixed the paddle-shaped propeller, *H*, which measures 2.05 meters (6.72 feet) in diameter, and has a pitch of 1.70 meters (5.57 feet). At the rear of the motor is the radiator, which consists of two sets of long flat copper tubes placed at a slight angle and extending upward on each side of the motor. The aeronaut's seat is a simple motor-cycle saddle, *S*, fixed upon the lower part of the steel frame.

As to the aeroplane part of the apparatus, this is formed of two flat canvas-covered frames of same size mounted at either end of the main frame. These will be noticed at *P* and *R*. Both the frames can be inclined at the proper angle by means of wires within reach of the aeronaut. The frame *P*, in the front part, measures 3 meters (9.84 feet) in length across the balloon and 0.50 meter (1.64 feet) in width, having a surface of 1.5 square meters (16.14 square feet), while the second plane, *R*, measures 4 meters (13.12 feet) by 1.20 meters (3.93 feet) with a surface of 4.8 square meters (51.66 square feet). Mounted in the rear of the main frame and under the balloon is the rudder, *G*. It is of hexagonal form and covered with canvas in the usual way, the diameter being 2 meters (6.56 feet). It can be worked from the aeronaut's seat by a set of wires.

The whole apparatus is arranged to run upon the ground, and to enable it to do this, it is mounted upon a pair of bicycle wheels about two feet in diameter, so that the lower point of the frame nearly touches the ground.

This very curious flier has not as yet shown what it can do, inasmuch as the first experiment, which was made in the Bois de Boulogne on the 7th of June,