

for the revolving field weighs 25 tons. The revolving field is 32 feet in diameter and weighs 185 tons, and the total weight of the whole alternator complete is 445½ tons. The external frame or yoke carries the armature windings, which for convenience of construction and handling is built up in six sections. The field poles and the rim of the revolving field are built of thin overlapping plates of sheet steel, each plate having a length equal to the width of two poles, and these plates are dovetailed into the spider, while the rim, the poles and their end-plates are bolted together. The driving rim is carried by two webs of steel plate, which are bolted to the cast-steel hub. It will thus be seen that the parts which are subjected to the heaviest stresses of a mechanical nature are formed practically of nothing but rolled steel. The field winding is made up of copper strap, wound on edge, insulating material being cemented in place between the turns, and the edges of the strap left exposed. The stationary armature consists of a huge cast-iron frame or yoke holding a built-up laminated ring, with slots on its inner face in which lie the windings. The construction of the yoke is shown clearly in our photographs.

The auxiliary equipment of the power house includes the employment of 250-kilowatt multipolar Westinghouse generators as exciters, and three 800-kilowatt rotary converters. There are nine 300-kilowatt transformers and 24 of 75-kilowatt capacity employed for various auxiliary purposes about the system. In the sub-stations there are 26 1,500-kilowatt rotary converters and 78 550-kilowatt transformers.

New Iron Mines at Michipicoten, Canada.

BY W. FRANK M'CLURE.

That the vast iron ore resources of the Lake Superior districts of the United States should find their counterpart just across in Canada is not altogether an unlooked-for development. It has long been a matter of wonderment in this country that Canada has been so slow to investigate the mineral resources of Algoma, in view of the favorable topography of the land, and the existence of the great ore bodies as near as Minnesota and Michigan.

To-day, the same capital from the United States that is building up the giant industries about Sault Ste. Marie, including the water power canals, is opening rich mines at Michipicoten. This will result in Canada becoming the location of her own steel and iron industries. Already this evolution is rapidly progressing, and the Midland, Hamilton and Buffalo furnaces are using ore from the Helen mine, the first of the newly-discovered properties. The new steel mill at the Sault Ste. Marie, when completed, will use the Canadian product exclusively, and four vessels of the Algoma Steamship Company are bringing Helen ore to Ohio ports, from whence it reaches the Pittsburg furnaces. Some 350,000 tons have already been shipped to the United States at a profit in spite of the duty of forty cents a ton.

For shipping the product of these new mines a harbor with extensive dockage has been established at Michipicoten, twelve miles from the Helen mine, and about 130 miles from Sault Ste. Marie.

The Helen iron mine is situated on Boyer Lake. The ore deposit has been exposed to the extent of 28,000,000 tons, and the limit has not yet been found in two directions. The Josephine mine, more recently opened, is in the same belt, but on Park Lake. This mine also is very promising. Then there are the Frances and Brotherton mines on the same range. The output of the new Canadian mines is about 5,000 tons daily, but this will be greatly increased next season. The mining facilities are of the best.

Mr. E. V. Clargue, a brother of Francis H. Clargue, the promoter of all the giant industries in Algoma, is in charge of the ore mining. He found, early in the mining operation, that the bulk of the ore taken from the Helen mine contained an average of about 61 per cent metallic iron and 0.08 phosphorus; also that at the point where the ore body comes to the lake a Bessemer ore is found running as low as .02 to .03 per cent in phosphorus and in sulphur from a trace to .05 per cent. The ore has a high grade in the market, also, on account of its low percentage of water.

The following from a report of Dr. Bell, of the Canadian Geological Survey, concerning the Helen mine, is comprehensive: "The ore is a hard, but somewhat porous or spongy, red hematite, with a specific gravity of about 5. The ore body, from which a layer of muck or peaty moss has been removed, forms a point dividing the head of the lake into two small bays. It has a lumpy surface, with a dark bluish-gray color. Small quantities of brown hematite (limonite) and yellow ochre appear in joints and cavities, but they do not form any appreciable portion of the mass.

"The horizontal dimensions of the exposed ore are about 500 feet in every direction, and its greatest height above the lake is 100 feet. The ground rises steeply all around the head of the lake, so that the ore lies at the bottom of an amphitheater, open on the

west or lake side. A drift has been run at the level of the general surface of the ore, southward into the hill, and this penetrates similar hematite for 250 feet, thus giving a known breadth of about 750 feet from north to south. During the winter of 1899-1900, by taking advantage of the ice on the lake, a number of holes were bored in the bottom along a north and south line, which passed the extremity of the point of ore at a distance of 250 feet to the westward. On this line and abreast of the point the lake had a depth of 100 feet, including 10 feet of soft mud, and at 250 feet below the bottom, where the boring ceased, the drill was still in hematite, like that on the dry land. A bore-hole from the surface of the exposed ore was sunk to a depth of 188 feet below the level of the lake without reaching the bottom of the hematite. The ore-mass has thus been proven to have a continuous depth of 300 feet, and as this follows the plane of the bedding, which is vertical, the probability is that the depth is very much greater. The general strike is parallel to the axis of the pond, which is about east and west. The railway approaches the mine from the west along the foot of the hill on the south side of the lake."

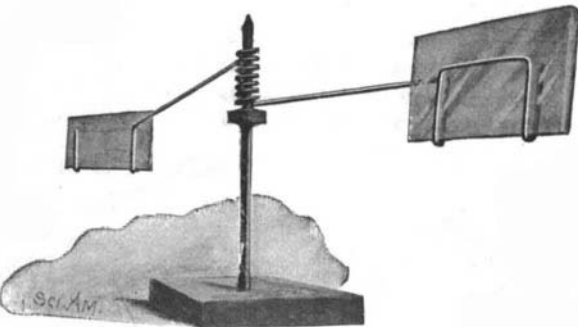
It has been figured by experts that at a shipment of 3,000,000 tons a year it would require a decade to exhaust the ore above ground at the Helen mine. Mining-men from Minnesota are taking a great interest in the new territory. They are of the opinion that the deposits there are equal to those of Minnesota.

At Michipicoten harbor, vessels are loaded with ore at the rate of 1,000 tons per hour. Each ore pocket has a capacity of fifty tons. In all there are 500 feet of chutes, and more building.

A CONTRIVANCE FOR COLLECTING ATMOSPHERIC DUST FOR MICROSCOPIC EXAMINATION.

BY THOMAS R. BAKER.

In the accompanying illustration a simple and inexpensive apparatus for collecting atmospheric dust is



AN ATMOSPHERIC-DUST COLLECTOR.

shown, which will probably be of some interest both to bacteriologists and amateur microscopists.

The apparatus consists essentially of a wire, the middle portion of which is coiled into a spiral to fit over and turn on a vertical support. One end of the wire is bent so as to hold a strip of glass, and the other end is bent so as to clamp a piece of cardboard, serving the purpose of keeping the plane of the glass at right angles to the direction of the wind. The support comprises a tenpenny nail driven into a block of lead. Soldered upon the head of the driven nail is the head of a second nail. The heads thus placed in juxtaposition serve as a shoulder upon which the coil of wire rests.

The glass plate is smeared with glycerine upon which the dust adheres. The apparatus can be set in any convenient place where the wind blows, and the plate examined from time to time.

The First Interurban Line in Italy.

The Milan-Monza electric road, which has recently commenced operation, is the first interurban line to be installed in Italy. It is 10.2 miles long, and forms an extension of the Milan tramway lines. The whole system uses the energy furnished by the falls of the Paderno, 20 miles from the city. The interurban line is supplied with current at the Milan end by the tramway station, and along the route it is fed at different points by three lines coming from a sub-station which has been installed at Cesto. Here the 3-phase current from Paderno at 13,500 volts is transformed first to 340 volts and then changed to 550 volts direct current by two rotary converters. The rolling stock comprises 14 motor cars and 10 trailers. The former, which are roomy and of handsome design, have two 50 horse power motors of the General Electric 57 type and carry 48 passengers. The electric equipment has been carried out by the Thomson-Houston Company. This road has only been running for a short time, but it has already absorbed nearly all the passenger traffic between the two cities, which are, however, connected by railroad. As an example of the amount of traffic on the line, it may be mentioned that on special occasions it has carried more than 8,000 passengers in one day, without accident or detriment to the material.

Correspondence.

A Universal Language.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the letter of your correspondent "Arcadius Avellanus" on the above subject, in your edition of December 7, allow me to state that he evidently forgets that the Latin tongue was once practically the universal language of the world, and that was, as every schoolboy knows, in the palmy days of the universal sway of the Roman Empire, when her legions swept everything before them and established themselves as conquerors in all the countries of the then known world.

Now it is fair to presume that that being the case, if the Latin tongue had been able to maintain its supremacy, it would have done so; but any one versed in the grand science of comparative philology knows that the inherent difficulties of Latin—I mean the case endings and the conjugations—have undoubtedly caused its rejection by the people at large as the universal tongue.

With regard to the universality of the English language, which oddly enough seems "unfortunately" to give your worthy correspondent much uneasiness, that is doubtless an established fact; for although on the one hand it is the most difficult language—on account of its irregular orthography—yet at the same time it is the most easy of all the modern tongues to acquire as a means of speech. And I believe any fair-minded, educated person will readily concede the truth of this statement, especially when it must be acknowledged that the children of foreign-born parents "pick up" the English and drop their vernacular even before their entrance into the primary schools.

GEORGE WRIGHT.

Observing the Circulation of the Blood.

To the Editor of the SCIENTIFIC AMERICAN:

As far as I know from information gathered among physicians of this country (foreign and native), the classical method for observing the circulation of the blood in living animals stands at present, where it stood thirty and odd years ago, confined to limited parts of certain organs in the frog and other batrachians, the wings of the bat, the transparent parts of embryos of mammals, etc.

It may be that the means I am to describe has already been applied and been known anywhere out of my notice and that of the physicians I refer to, but if it is still unknown, I hope it will be of some use to students of biological phenomena.

It is about 17 or 18 years since for the first time I had an opportunity of observing under the microscope the embryo of a small fish that swarms in the lake of Managua, in this country. This fish, about 6 to 7 centimeters long, 1 centimeter wide and 5 to 6 millimeters thick, lays its eggs on weeds and roots of plants growing along the lake shores, toward the beginning of the dry season, from November to March. The eggs are spherical, near two millimeters in diameter, transparent, and of albuminous appearance, and are furnished with a few hairy appendices by which they are fastened to the weeds or roots under water, clustered like grapes in bunches of many hundreds and many thousands, tied together. Being so numerous and laid in different days, embryos of different grades of development may be had for observing the circulation of the blood.

The eye catches at a glance a beautiful sight of the whole circulatory system, and follows with delighted attention the stream of blood starting from the heart, running in the arteries and veins, and returning to the heart, whose beatings are conspicuously seen.

The elongated globules of the fish's blood are distinctly seen, forming inside the blood vessels something like a stream of beans.

F. J. MEDINA.

Corinto, Nicaragua, Central America.

The Current Supplement.

The current SUPPLEMENT, No. 1358, is opened with the second installment of a most interesting illustrated article entitled "The Building of a Modern Locomotive." "The Jig Habit in America" is by Oberlin Smith. "Practical Building of Lowland Protections" is continued. "The Position of the Engineer in Municipal Service" is by Alex. Dow. "Direct-Driven Continuous-Current Generators for Lighting and Power" illustrates a large direct-driven generator. An abstract of the Report of the Secretary of Agriculture is most interesting. "The Silent Chain Gear" is by J. O. Nixon.

According to Commercial Intelligence there is an immense future for the development of motor-van traffic in Italy. Ten days is the average time for goods by a slow train from Milan to Genoa, a distance of one hundred miles. Motor cars that could do the distance there and back in twenty-four hours would never lack a full load.

Official Tests of Alcohol Motors.
BY OUR PARIS CORRESPONDENT.

An interesting series of tests of alcohol motors has been recently carried out at Paris by a commission of experts under the patronage of the Minister of Agriculture. The object of the tests was to find out as nearly as possible the present status of the alcohol motor, both in the stationary type and especially as applied to automobiles. The competitors for the latter class were advised to look for a good all-around vehicle, and not seek for exaggerated speeds. Most of the motors used a 50 per cent mixture of alcohol and gasoline or other carburetant, while some used pure alcohol. The fixed motors were put through a series of tests at the Agricultural Testing Station at Paris, with indicator and brake. Each had generally three tests, one with no load for quarter of an hour, one at half-load for one-half an hour, and one at full load for one hour. The constructors furnished data as to diameter and stroke of piston, compression volume, flywheel, etc., besides general dimensions and drawings. The following measurements were made: 1. Power, effective and indicated. 2. Revolutions per minute. 3. Number of explosions per minute. 4. Regularity of running. 5. Time required for starting. 6. Consumption and heating of refrigerating water. 7. Consumption of alcohol per horse power. 8. Ignition. The following table gives a few specimen data out of the large number of motors tested, from 2 to 16 horse power. The general value of the motor is indicated by a certain number of points of merit, of which the maximum is 200. These depend upon the following conditions: Proper utilization of alcohol; this is defined by the product of the consumption per effective horse power and the percentage of carburetant in the liquid. Thus a motor is better as it uses a smaller amount of liquid as well as one richer in alcohol. Another point is general good working under normal load, regularity, etc., also its performance under variable loads, then ignition and ease of starting, general construction, simplicity and keeping in order. In the table for alcohol consumption it should be observed that all the figures are brought to the basis of a consumption of 50 per cent alcohol for the sake of uniformity. The liquids were analyzed at the Pasteur Institute laboratory.

The most valuable tests are those of the automobiles, shown in the following tables, which give the consumption of alcohol under actual performance on the road and upon the track. In making these tests the automobiles were taken from Paris over about 60 miles of route in the neighborhood. This course included a test upon the race-track of the Agricultural Park at Achères, about midway on the route, in which the machines were run at about 20 miles an hour over the track, and their performance and consumption of alcohol noted.

ALCOHOL AUTOMOBILE TEST TABLE.

	Horse Power	Weight		Mean speed on track. Kilom per hour	Nature of alcohol	Consumption of alcohol in cubic centimeters per ton-kilometer		Points of Merit.
		Empty	Loaded			For total course.	On track	
<i>1st Section.—Moto-cycles and light vehicles up to 250 kilogrammes.</i>								
M. Lamaudière (motorcycle)	13½	54	134	38.0	50%	158.1	214.5	161
Darraeq & Co. (quadricycle)	3¾	205	350	37.2	pure*	195.7	223.7	151
<i>2d Section.—Voiturettes of 250 to 400 kilogrammes and vehicles from 400 to 650 kilogrammes.</i>								
Geo. Richard Company (1 cylinder)	4	496	712	34.0	50%	110.7	129.9	185
Darraeq & Co. (" "	6¾	493	845	34.4	50%	118.3	132.0	177
Delahaye Company (" "	6	623	931	31.0	pure*	137.5	122.9	172
Gillet-Forest & Co. (" "	5	569	709	31.2	50%	140.0	122.2	163
Gladiator Company (" "	6½	532	820	32.6	50%	137.5	129.6	160
<i>3d Section.—Vehicles of 650 to 1,000 kilogrammes and over.</i>								
Delahaye Company (2 cylinders)	7¾	1,042	1,352	35.8	50%	95.15	93.15	187
Bardon (" "	5	840	1,105	28.8	pure*	96.15	82.9	183
Vilain (1 cylinder)	6	766	1,070	30.8	pure*	98.2	114.0	177
Société Nancéenne (2 cylinders)	12	999	1,250	33.3	50%	115.8	82.16	172
Martha (" "	4½	1,193	1,540	33.2	50%	122.5	108.36	170
Gobron-Brillie (2 cylinders)	14	1,094	1,477	42.8	50%	123.8	135.4	167

	Horse Power	Weight Kilogrammes.		Load carried kilom.	Mean speed over total course.	Nature of alcohol	Consumption for total course		Points of Merit.
		Empty	Loaded				Average per ton kilom.	Per ton kilom. of load.	
<i>4th Section.—Industrial vehicles, delivery wagons, tractors, etc.</i>									
Société Nancéenne (large hauling wagon) 2 cylinders	10	2,506	5,877	3,371	9.1	50%	96.3	167.8	194
Panhard & Levassor (hauling wagon) 4 cylinders	8	2,300	4,640	2,340	7.6	50%	119.7	237.3	179
Panhard & Levassor (small hauling wagon) 2 cylinders	6	1,020	1,933	913	14.45	50%	105.6	223.6	179
Bardon (delivery wagon)	4½	968	1,430	462	14.9	pure*	92.4	286.1	170
Gillet-Forest & Co. (small hauling wagon) 1 cylinder	6	660	1,402	742	16.7	50%	144.1	272.2	179
Peugeot Company (postal wagon)	4½	720	924	204	15.4	50%	153.6	831.4	166
De Dietrich & Co. (large delivery wagon)	9	1,340	2,396	1,056	8.6	pure*	321.2	723.7	149

* figures brought to a basis of 50 per cent alcohol.

This series of tests was followed by an exposition of alcohol motors, automobiles, lighting and heating apparatus, in the Grand Palais, lasting from the 16th

to the 24th of November. It was formally opened by President Loubet, who, it is well known, takes a great interest in the utilization of alcohol and the development of this national industry. Some of the leading features of the exposition will be described in a subsequent article.

Report of the Secretary of Agriculture.

The Fifth Annual Report of the Hon. James Wilson, Secretary of Agriculture, is considerably larger than former years, extending over some 113 pages. It reflects the growth and development which has attended this important department of the government, and urges Congress in the strongest terms for appropriations which will enable the Secretary to obtain the best men who can be found to fill the important positions in the Department.

The Department of Agriculture has reached farther than ever into sympathy with the industries of the people during the past year. It has identified itself more intimately with the experiment stations of the several States and Territories and what pertains to the interests of their people. It has gone farther in foreign lands to find many things that will be valuable to our producers. The grouping of related sciences into bureaus has economized time and contributed to efficiency. The process could be advantageously extended to other divisions and offices that are growing beyond their present environment. The education of student assistants and scientific aids in their several specialties goes on satisfactorily under the scientists in charge, giving promise of high efficiency in the future personnel of the Department.

The forecast field of the Weather Bureau is extended, and it now includes reports from certain points in the British Isles and on the continent of Europe, from the Azores, Nassau, Bermuda and Turk's Island. The Atlantic forecasts which are based upon these reports now form part of the regular forecasts which are issued at Washington. The extension of the forecasts to farmers through rural free delivery is contemplated. Important experiments in wireless telegraphy have also been carried out under the direction of the Bureau. The total export of animals and animal products during the year exceeded \$250,000,000, and this great foreign market is only preserved by the efforts of the Department and the rigid inspection which is exercised through the Bureau of Animal Industry, which inspected for export 385,000 cattle, 228,000 sheep and 48,000 horses and mules and nearly 1,000 vessels carrying live stock. Imported animals to the number of 342,000 were also inspected. The inspection service involved the examination at time of slaughter of nearly 37,000,000 animals. The Bureau of Plant Industry has brought together in one group investigations in plant physiology and pathology, botany,

and plants. Investigations in plant physiology and pathology have been devoted to the study of cotton diseases, diseases of orchard fruits and forest trees and construction timber. Good work has been done in botanical researches with special reference to seeds, the improvements of crops and the methods of crop production in our tropical possessions and the prevention of losses of cattle in the West by eating poisonous plants. Four thousand five hundred pounds of high grade tea was grown at Summerville, S. C., during the year. Great activity has characterized the introduction of valuable seeds and plants from abroad. During the last three years the Department has introduced Japanese rice, and our imports of this product have decreased from 154,000,000 to 73,000,000 pounds. Macaroni wheats have been introduced in the past two years very successfully into the Dakotas and also into Kansas and Nebraska. Progress is reported in the introduction of Egyptian cotton. The imports of this product now amount to \$8,000,000 yearly.

The Division of Soils has recently been made a bureau and has received increased resources, which enable it to extend its scientific investigations as well as its practical operations. The area surveyed and mapped during the year exceeds 3,500,000 acres, making a total of nearly 6,000,000 acres surveyed during the past two years. The experiments made by the bureau in the growing of a fine type of Sumatra leaf in certain soils in the Connecticut Valley have been most successful. The Bureau of Chemistry has carried on investigations on the composition, nutritive value and adulteration of food products, the work of the year being specially devoted to the study of preserved meats. The work that the Bureau of Chemistry is doing for other departments of the government is considerable and is constantly increasing.

Among the newly organized bureaus is that of Forestry, and this bureau is co-operating with several States and many private owners in their handling of forestry lands. Assistance has been asked for the handling of forestry lands. And the inspection has been asked for 52,000,000 acres. During the year nearly 800,000 acres under private owners were examined by official representatives. The Office of Experiment Stations reports that the work of the stations is becoming better understood by the farmers, and that a broader and deeper foundation of scientific inquiry is being made each year, and the value of this co-operative method to the agricultural interests is very generally acknowledged. An increase in college extension work in agriculture is noted, and stress is laid on the movement for the establishment of secondary schools of agriculture and the introduction of the elements of agriculture into the rural schools. Dietary studies and experiments in cooking, digestion and metabolism have been conducted in various parts of the United States in co-operation with experiment stations, agricultural colleges and universities. The results of these investigations should, in the opinion of the Secretary, be practically and beneficially applied to the feeding of men wherever a considerable number of persons are to be fed on a systematic plan. The report devotes considerable space to the discussion of irrigation investigation.

The Division of Entomology has been very active during the year in carrying out work along several lines. The division is now ready to supply fig-fertilizing insects to any grower after he has succeeded in raising to the bearing stage the Caprifig and Smyrna fig trees. A natural enemy of the San José scale has been discovered in a ladybird beetle, and steps will be taken to acclimate this important species. The Biological Survey is engaged in mapping the natural boundaries of the crop belts of the country. A fiber plant closely related to the Mexican Tampico plant has been found growing in great abundance over a large part of the Sonoran zone. The Texas species is likely to prove of considerable value. The Survey is now conducting experiments in the Dakotas, Nebraska, Kansas and Texas with a view of destroying prairie dogs. The Survey is charged with carrying out the provision of the Lacey Act and other game laws. Good work has been done by the Division of Statistics and the office of Public Road Inquiries and the Division of Publications. During the year 606 separate publications aggregating nearly 800 copies were issued by the division. A special building has been rented to be devoted exclusively to the storage and shipment of Farmers' Bulletins, of which no less than 7,000,000 will have to be printed this year.

The highest record which has been previously attained in the export of agricultural products (1898) was surpassed by over \$90,000,000, when a value of over \$950,000,000 was reached. Of the merchandise sent abroad during the year, 65 per cent originated on the farm. Of foreign customers, the United Kingdom takes nearly 50 per cent of our agricultural products exported. Our imports of agricultural products from Cuba, Porto Rico and the Philippines exceeded our exports by \$30,000,000. An abstract of the Annual Report of the Secretary of Agriculture will be found in the current issue of our SUPPLEMENT.

grasses and forage plants, pomology and experimental gardens and grounds, including the experimental farm at Arlington, and the introduction of foreign seeds