

possible. This might be arrived at by using gearing as in the geared locomotives or motor carriages, or by using a gearless locomotive in which an elastic connection is employed between the driving axle and the motor; but the committee had no opportunity of experimenting with a locomotive of this type. In the trials carried out the motor cars were found to have an advantage in freedom from vibration over the geared locomotive. So far as the Central London Railway is concerned, the committee are confident that by adopting motor cars in place of the original locomotives the vibration produced by the running of trains can be reduced so as to cause no serious annoyance, although it is possible that the sound of the trains may still be detected, especially in the night. They are able to speak positively as to the motor cars, but they entertain little doubt that any method of driving in which the unsprung-borne load on each axle is reduced to a similarly small quantity might also be used with impunity. On the question of the best form of rail and sleeper the committee had no decisive evidence. They were disposed to prefer a stiffer rail than that in use on the Central London Railway, and advise in new undertakings that sufficient room shall be allowed for the introduction of a deeper rail.

Prize for Method of Drying Potatoes.

The German association of alcohol manufacturers and the association of agriculturists have jointly offered a prize of 30,000 marks (\$7143) for the best method of drying potatoes for feed for cattle, etc.

German agriculture has been increasing its potato crop very largely. The technical progress made in cultivating potatoes and the choice of certain kinds yielding a larger crop have made it apparent that Germany will continue to have a surplus of this vegetable.

Already, 40 per cent of the total crop is used as fodder; but as potatoes deteriorate after six or seven months, they must be fed within that time. Transportation also, is expensive, on account of the large percentage of water they contain. Three and one-half tons of fresh potatoes yield a ton of dried ones. It is predicted that a good method of drying potatoes will greatly benefit German agriculture, and it is intended to use the process on a large scale.

Particulars for this prize contest can be had by applying to the "Institut für Gährungsgewerbe," Berlin, N. 65 Seestrasse.

The Current Supplement.

An important article on the Braun-Siemens-Halske wireless telegraphic system which is so strong a rival of the Slaby-Arco system in Germany opens the current SUPPLEMENT. The article is illustrated not only by clear diagrams, but by handsome half-tone illustrations. Havelock Ellis, who is well known as one of the foremost living biologists and psychologists, tells us something of the mysterious plant mescal and of the peculiar visions which it calls forth when taken into the system. An article on volcanoes is of timely interest. Archaeologists will be pleased to learn something of the excavations in Crete and of the work done by the German Archaeological expedition at Babylon. Prof. S. P. Langley, in a thoughtful lecture, discusses the laws of nature. "Sleep-Producers" is the title of an essay by Dr. Kellogg. The recent paper read by Bion J. Arnold at the convention of the American Institute of Electrical Engineering on the practicability of using electric power for traction on the New York Central Railroad within the limits of New York city, is published in full. The Consular Reports and Selected Formulæ are given as usual.

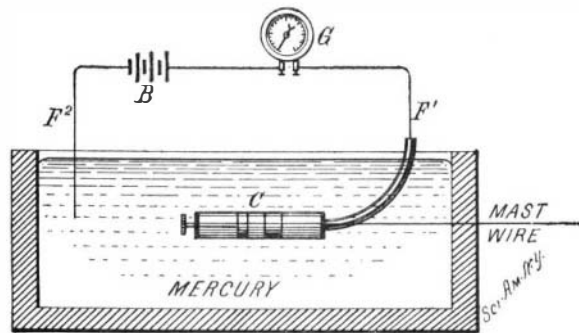
Shot by an Eskimo Hunter.

Wild geese and brants are known to travel, during the migratory season, very far south. Recently a large wild goose was killed not far from Spokane City, Wash., which had evidently winged its way from the remote Eskimo lands. When the hunter picked up the bird he was surprised to observe a slender piece of ivory protruding from its breast just below one of its wings. With much difficulty he succeeded in pulling out the piece, for the flesh had grown tightly around it. It proved to be an arrowhead, about eight inches long, which had some queer carvings on the stem where it had been fastened to the shaft. The carvings were delicate, though quite distinct. On a careful inspection by some Klondike miners the carvings were pronounced to be of Eskimo origin. No arrowpoint of that kind was ever known to have been used by the Indians of Washington or British Columbia. The head was of fine ivory, no doubt carved from a walrus tusk. Evidently the goose had been shot by an Eskimo hunter in the Arctic regions, the wound had healed, the flesh had grown around the weapon, and in its long flight the bird had no doubt broken off the arrowshaft.

J. MAYNE BALTIMORE.

EXPERIMENTS WITH ELECTRO-MAGNETIC WAVES ON MONT BLANC.

M. Charles Nordmann, in a paper read before the Académie des Sciences, gives an account of some experiments which he made at the Mont Blanc observatory in order to determine whether waves of an electro-magnetic nature are given off by the sun. It seemed possible that a source of luminous and calorific energy should emit electro-magnetic waves, as these are now recognized to be of the same nature. M. Nordmann chose an elevated point for carrying out the researches in order to eliminate as much as possible the absorbing action of the atmosphere, and especially that of water vapor, and installed an experimental post at the Grands-Mulets, a point at 9570 feet altitude. To receive the waves he used a horizontal mast wire 550 feet long which was laid along the Bossons glacier upon wood insulating supports so that the sun's rays would fall directly upon it. The choice of the glacier for the support was of considerable importance. The ice can be considered as a reasonably good insulator; M. Janssen has shown this in his recent experiments on Mont Blanc. Ice is transparent to the electro-magnetic waves. The ice in this case was 80 feet thick and the sun's rays (at the autumnal equinox) were inclined from the vertical, thus avoiding a possible error arising from interference. Nordmann used a coherer which was placed in a vessel of mercury which formed an opaque medium for outside disturbances. The coherer, *C*, has one pole in contact with the mercury and the other, *F*, insulated from it and passing above to a galvanometer and battery circuit, with a return wire, *F'*, to the mercury. The wire, *F*, is surrounded by a metallic sheath which acts as a screen. The mast-wire is uninsulated and passes through the mercury to the coherer. Thus the coherer was carefully sheltered from any external disturbance. It was then regulated while still under the mercury by a regulating screw and the galvanometer brought to zero. The mercury was then allowed to run out by a tap and the coherer left free. Under these conditions the experiment was repeated several times on the 19th of September during fine



NORDMANN'S APPARATUS.

weather, but all the results were negative and no deflection of the galvanometer could be obtained. This seems to prove that the sun does not emit such electro-magnetic waves as can be propagated along a wire and act upon a coherer; or in the contrary case such waves must be absorbed by the sun's atmosphere or the upper atmosphere of the earth. It is well known that rarefied gases have a powerful absorbing action upon such waves, but the object of the experiment was to see whether a part of the waves did not escape this absorbing action and penetrate to the surface of the earth.

Periodic Comets of 1902.

Astronomers expect the appearance of two periodic comets during the present year. The first of these was discovered by Temple at Marseilles on the 27th of November, 1869, and returns every 5.5 years. Its period was only known, however, after the rediscovery of the comet on the 11th of August, 1880, by L. Swift, for in 1875 it was not favorably placed for observation, and the same on its return in 1886 and 1897. In 1891 it was but feeble, and was observed for the first time on its return by Barnard on the 27th of September, with the Lick telescope. It will be in a better position for observation in the first part of December next, when it is expected. The second of the periodic comets has an interesting history. It was discovered by Swift on the 20th of August, 1895, and calculation assigns it a period of about seven years. It is remarkable that this comet seems to be identical with the one discovered on the 14th of June, 1770, at Paris by Messier, who was called the "ferret of comets," because he had observed a greater number than any astronomer of his time. Lexell had calculated its orbit and supposed that as its period was 5.5 years it would come back at the end of 1775; but he did not find it, in spite of all his searches. Schulhof is of the opinion that the comet in passing near the planet Jupiter, whose mass is considerable, has undergone great modifications in its movement, and that the comet described by Swift is the same as the so-called "lost comet" of Lexell. Its return is expected in November, when it will be near the sun and in a good position for observation.

Correspondence.

Cheap X-Ray Tubes.

To the Editor of the SCIENTIFIC AMERICAN:

It may be of interest to some of your readers to know that experimental X-ray tubes can be made out of ordinary lamp globes. The two electrodes are made of sheet aluminium, and are about $\frac{7}{8}$ inch in diameter. The aluminium may be got for these from any dentist's supply house. About No. 20 gage is best, and should be soft. They are hammered out until they very nearly fit the tube. Then they are shellacked onto the outside of the tube at as nearly opposite points as possible, and held in that position by weights until they are dry. After it is perfectly dry, the tube should be run until the shellac is melted, and then allowed to cool, while the electrodes are pressed tightly against the tube. After the shellac has solidified, the tube may be run for short intervals until it is working properly and generating X-rays.

These tubes work best on a high-frequency coil, although they may be run on an induction coil. When run with the latter, the anode should be a little larger in diameter than the cathode. The connection to the coil is best made by means of stiff wires held by binding posts. An ordinary socket will serve as a support for the tube while it is being used. With a tube made from a 32 C. P. globe (it would make no difference if it is burnt out) the bones of the arm and hand may be plainly seen.

M. EASTHAM.

Oregon City, Ore., June 9, 1902.

Lord Kelvin on the Molten Earth.

To the Editor of the SCIENTIFIC AMERICAN:

I have doubted if many of us have recognized the deep significance of Lord Kelvin's contention that, "when the earth was in a molten state, it was surrounded by an atmosphere of nitrogen and carbonic acid gases, but with no free oxygen." I for one am happy to take this learned man's word on this problem, for he seems to have unlocked the gateway into a marvelous field for the scientific adventurer.

If the earth had no free oxygen during the igneous era, we stand face to face with the time and place of primitive oil-making. Assuming that the earth's immeasurable fund of carbon and hydrogen, which it now has in store, was in that great world-furnace then, how are we to avoid the conclusion that it was the one grand opportunity for the formation of a world's hydrocarbon such as we find in the earth's crust to-day?

The less oxygen our furnaces and coke ovens get, the greater the deposit of sooty, oily carbon matter in our smokestacks, which as miniature oil and fuel depositories, take fire and burn. From this it is but a scientific step to the conclusion that a vast amount of the carbon and hydrogen of a world, made hot by the implacable heat of chemical and mechanical processes, went, through mineral fire-mist, to the terrestrial heavens as an unburnt hydrocarbon fuel. Even with free oxygen present it could hardly have prevented the molten earth from posing as a smoking world, which means oily carbons sent to the skies.

Now we find an almost limitless fund of unconsumed allotropic carbon among the aqueous formed strata, and I presume Lord Kelvin knows this as well as anyone, but the great problem was, and is, how to account for the existence of these igneous distillations so far above the igneous beds. If we can leave old paths long enough to see all these and other fiery exhalations sent to the skies and formed into a Saturn-like annular system, as a revolving earth appendage, where they lingered till the earth grew cold and then came back in grand installments as the ages rolled on, the first decade of this twentieth century may see a happy solution of this tantalizing problem. As annular world-deposits they are philosophically in place to harmonize with Kelvin's matchless deductions.

In the strictest sense this is not a secession from the current school of geologic thought. It is simply a hesitation longer to follow the empiricism which makes the organism the only source of the hydrocarbons, discarding the basic fact that millions of years before a fish or mollusk lived in the seas, there was an all-competent oil-making furnace, as far ahead of the secondary organic source as the energies of a molten earth surpass the puny efforts of the decaying organism. The contest is between Lord Kelvin and the organic school.

ISAAC N. VAIL.

Pasadena, Cal., May 26, 1902.

The Western Automobile Endurance Test.

The Automobile Club of Chicago will conduct a 100-mile endurance test open to all kinds of self-propelled vehicles on July 12. The course will be along the shore of Lake Michigan to Waukegan and return. The endurance run will be the first to be held in that section of the country, and it should offer excellent opportunities to the many new Western automobile firms to demonstrate the good qualities of their machines in an actual test on the road.

Science Notes.

The Andrew Carnegie gold medal for 1902, of the Iron and Steel Institute, has been awarded to Dr. J. A. Mathews, of New York, for research carried out by him as the holder of an Andrew Carnegie Research Scholarship during the past year. The medal has been designed by Mr. G. W. de Saulles, of the Royal Mint. Dr. Mathews previously received a Fellowship for the encouragement of scientific research from Columbia University in this city, where he has been working under the guidance of Prof. H. M. Howe.

Verily the German is ingenious. The astronomical loot carried off by the men of Count von Waldersee, and sent to Berlin from China, is regarded by the astute Teutons in the light of a "present." Such at least was the view set forth in the recent speech by the Imperial German Chancellor before the Reichstag, who remarked that: "The instruments have not been restored because the Chinese government attaches no importance to their possession, and in reply to German inquiries it placed them at the disposition of the German government. Another consideration is that, in accordance with the peculiar views of the Chinese, the great mass of the people would have supposed that the instruments were restored by order of the Chinese government, which would have damaged German prestige in East Asia. The Dowager Empress of China, a very clever woman who understands the political situation, would have been distinctly offended (why? we ask), while the masses would have thought that Germany had sustained some terrible defeats. The instruments ought now to be placed in the category of presents from government to government, which has long been customary on both sides in our intercourse with China." Assuredly, this would make the great Napoleon, who, it will be remembered, had a very nice taste for art treasures, and did not scruple to carry them from the Vatican into France, turn green with envy.

A valuable discovery of far-reaching importance to the cotton-manufacturing industry has been made by Dr. W. H. Perkins, of the Owens College, Manchester, whereby cotton and other similar highly inflammable materials can be rendered permanently fireproof. The discovery has been achieved after two thousand experiments extending over many months. With the exception of explosives, there is no article that flares up so quickly as cotton when it comes into contact with a light, especially in those particular goods which are made of heavy yarns and "combed out" on both sides in order to give the appearance of flannel. The fireproofing process consists of "asbestinizing" the fabric, by which means permanent immunity from burning is assured, but the exact manner in which it is achieved is not divulged. In order to realize the full importance of the discovery, it should be understood that "asbestos fabrics" can be washed and washed, and yet retain their non-ignitable quality. From this it will be seen that the process is not that of merely putting upon the material a chemical that for the time being renders the fabric non-inflammable, but rather that, as in the case of "mercerizing," the very character of the material is changed. From the scientific point of view much interest attaches to this feature. Already inquiries are coming from Germany as to the process, for in Europe these highly inflammable cotton goods are largely produced. It should be added that "asbestined" cloths are perfectly hygienic, and can be safely worn next to the skin.

A few years ago the Russian Prince Abemalak Lazareff, during his visit to the ruins of ancient Palmyra, discovered a large block of stone, about 12 feet long and 8 feet wide, containing a well-preserved bilingual inscription, i. e., Greek and Palmyrene, which is supposed to date from the third century of our era. The inscription is said to contain the tariffs of custom duties and taxes levied during that period, divided into three tables. Last year the authorities of the Imperial Russian Museum at St. Petersburg sent Prof. Uspensky, of the Russian Archaeological Institute, who resides at Constantinople, to Palmyra, with other experts, to report on the inscription and to ascertain whether it was possible to cut it out from the huge block. The professor having reported on the feasibility of the undertaking, the Russian government obtained the Sultan's sanction to remove it to Russia. Accordingly, an expedition was sent to the spot last summer, composed of workmen under the superintendence of a Russian consular official, and after cutting the block of stone into three parts separated the inscription from each, and it is now on its way to the Russian capital. Palmyra, or Tadmor, as it is now called, is famous for the ruins of the Great Temple of the Sun. It was an important commercial place, being a depot for silk and other Asiatic and Indian products; and, on account of its copious spring, it must always have been a halting place for caravans passing through the Syrian Desert. It attained the height of its glory and prosperity in the third century, under Queen Zenobia, wife of the Emperor Odenathus.

Automobile News.

M. Serpollet has sold his famous "Easter Egg" racer, with which he made the record at Nice, for \$11,000, and is already at work designing a new racer for 1903. He wishes to prove by this type that he was right in devoting so much energy toward the problem of steam as applied to the automobile, and expects to establish it by a striking demonstration. His new racing machines are to weigh less than 2,200 pounds, and will make seventy miles an hour as an ordinary thing. The voyage from Paris to Bordeaux could thus be made in five hours, and the machines would only need to stop for provisions every 300 miles or so. It is to be hoped that the distinguished inventor will be able to carry out his promise.

The Russian Etat-Major is continuing its tests upon automobiles for army service. During the maneuvers of the Russian army in 1901, a 6½ horse power machine was used in the operations which took place in the neighborhood of Siedletz in the Warsaw district. The ground was in very bad condition. According to the report which was made on this vehicle, it was only able to circulate over a single route. It was used for transmitting orders from the rear of the column to advance-guard or for the transport of the chief of the detachment in order to reconnoiter his own positions or those of the enemy. The average speed over the road was 12 or 13 miles an hour. During the ten days of the maneuvers the automobile covered a total distance of 640 miles, running day and night. It had to stop for repairs twenty-eight times. According to the report, the army will make a more extensive series of tests during the present year.

A road locomotive for military use is to be made the subject of a concours organized for next year by the Minister of War and Minister of Agriculture of Germany. The tractor, which is to utilize alcohol, is to be constructed on the lines of the now-existing steam tractors, and is designed for the transport of cannon or other military supplies. The conditions under which it has to operate are particularly hard, as will be seen from the following requirements. The tractor is to carry a load of 7½ tons on one axle and 5 on the other, and must be able to draw a gross weight of 15 tons up a 10 per cent grade at the rate of 3 miles an hour. On a level it must make 5 miles an hour and be able to cover 42 miles in a day's journey, carrying all the supplies necessary for the trip. The tractor must be able to mount alone a 20 per cent grade, and be provided with a hoist by which it can draw up the trailers after it; its own weight is to suffice for this operation without requiring an anchorage. The tractor must be able to run upon bushy or plowed ground, snow and ice, etc., and sink in the ground no farther than will allow the mechanical parts to clear the soil. It must also cross streams having 16 inches depth. The motor is to use pure alcohol, but a small amount of gasoline is allowed for the starting. It must be adapted for other liquid combustible by a change in the carbureter. This competition is not international, as one of the stipulations is that the tractor must be of German make. It will be submitted to a three weeks' test under the direction of competent authorities. The tractor, besides, must fulfill in general all the requirements of military service. As will be remarked, the conditions are unusually difficult.

Some instructive data as to the imports and exports of automobiles in France are given in the Bulletin of the Chambre Syndicale de l'Automobile. The values for the imports (obtained from the weight by allowing \$2 per kilo, or 2.2 pounds) are as follows for the four years, 1898-9-1900-1901: \$79,000, \$94,600, \$103,400 and \$135,600. The increase in the importation thus follows the general increase of the automobile industry. The imports, which are relatively small, come principally from two countries, Wurtemberg for the petrol vehicles and America for the electric. The Daimler Company at Canstatt, near Stuttgart, sends into France petrol automobiles *de luxe* at a price of \$3,000 to \$4,000 each. Two American companies, Columbia and Riker, send electric automobiles to France, both complete machines and also trucks carrying the motors. The latter are valued at \$600 to \$800 each. The carriage work for these trucks is put on in France. This latter importation is due to the fact that the American trucks are made on standard pattern and in quantities at a low price. As to the figures for the exports of automobiles from France, the following figures show the increase for the same four years: \$350,000, \$852,000, \$1,883,000 and \$3,156,000. The figures for 1901 are thus 60 per cent in advance of the preceding year, and show the increasing popularity of the French automobile and the good condition of the trade. The rate of valuation above used is somewhat small for the racing machines and *voitures de luxe*, which while weighing only 2,000 pounds, sell for \$5,000 to \$6,000, but it is about correct for the current types of automobiles which form the largest part of the exportation. It is estimated that the number of workmen employed upon the vehicles for export alone reaches 7,000, and in 1902 it will doubtless be much greater.

Electrical Notes.

Schmidt, in comparing the economical value of coal and electricity as sources of energy, arrives at the conclusion that on the average only 30 per cent of energy is utilized in the former case, whereas in the latter case this percentage is 90 per cent. For this reason he recommends that electrical heating be used in the manufacture of water gas, instead of the usual process of supplying the necessary heat by direct combustion under air blast. He bases his calculations on the economical conditions existing in Switzerland, and expresses the opinion that it would be easy to adapt carbide furnaces to the manufacture of water gas.

The telephone exchange at Hamburg, one of the largest in Germany, is equipped with a horizontal switchboard, which is said to have many advantages over the ordinary upright type. The principal advantage claimed for it is an economy in the number of jacks required and the length of board, and consequently in the space occupied. As the sections are horizontal instead of vertical, operators can work from both sides of the board, and, theoretically at least, each section can carry twice the number of answering jacks that a vertical board can. It follows, therefore, that for a given number of lines a horizontal board is only half as long as a vertical board, although it must occupy more ground space breadthways. These horizontal boards are made by a German firm, who have supplied a large number for the Imperial German Telephone Department. It will be remembered that the Glasgow municipal board is of this horizontal type.

Some time ago it was stated that the Edison magnetic ore extraction process was to be installed by certain English steel manufacturers in the various iron ore districts of Norway. Arrangements have now been completed for the erection of a complete magnetic apparatus at Dunderland, Norway. In this district there are immense deposits of iron ore, but it only averages about 40 per cent of metal to 60 per cent of gangue. It would not be lucrative to ship the raw ore to the smelting furnaces of England, but it will be possible to work the ore profitably by the Edison extraction process. Each unit of the apparatus contains two 250 magnets of varying powers, and is capable of dealing with a ton and a half of crushed ore per hour. The employment of this process will exercise a far-reaching influence upon the iron and steel industry of the United Kingdom. For some time past the home supplies of iron have been getting shorter, and there have been indications of deterioration in the quality of the iron ore from Spain, whence a large part of the crude metal is obtained. With a practically inexhaustible supply of pure iron from Norway, at a relatively cheap rate, British iron and steel makers will be in a position to compete more successfully with this country and Germany than they have recently. As freight charges are reduced 60 per cent by the elimination of 60 per cent of dross, the carriage of which in the form of ore has to be paid for, the pure iron will be accessible to the English iron and steel makers at a price which will make them independent of any other source.

Herr Ewald Rasch describes in the *Elektrotechnische Zeitschrift* an arc light obtained by the use of solid refractory electrolytic electrodes which have to be heated to start with as in the case of the Nernst lamp. With electrodes 2.5 mm. diameter a pressure of 50 volts and a current of 2 amperes, 630 Hefner candles (horizontal) was obtained, and with electrodes 5 mm. diameter and 5.3 amperes at about 42 volts, 900 candles was given out, or about 4 candles per watt in each case. Experiments were made with 2.5 mm. electrodes, varying the current. With 1.1 amperes at 65 volts the candle power was 146. The current was then gradually increased to 5 amperes when the voltage dropped to 45 and the candle power increased to 1,012, but at this stage the electrodes fused; in fact, it was advisable for steady working to keep the efficiency down to from 3 to 4 candles per watt. The author points out that Tumlriz, in his paper on "The Mechanical Equivalent of Light," gave the ideal efficiency as 5.21 candles per watt, and as a result of these experiments it was found that the highest efficiency obtained was 5.2 when the metal fused. It must, however, be pointed out that the electrodes become convex so that probably the greatest illumination would be horizontal. No tests of the spherical candle power are given in the paper. Dr. W. Nernst, referring to this article in the *Elektrotechnische Zeitschrift*, attaches considerable importance to this point, which in his opinion militates against the employment of Dr. Rasch's electrolytic arc, and makes its efficiency no longer phenomenal. He further remarks that no figures are given in Dr. Rasch's article for rate of consumption of the electrodes. His own experiments, with electrodes of a material similar to that employed in his incandescent lamp, showed that the negative and not the positive electrode burns away the quicker (a phenomenon which he thinks may have an important bearing on the theory of the arc), and that the quick consumption would prevent the construction of a practical lamp on these lines.