

tached by a rocker arm and connecting rod to an oscillating disk, as shown. The disk is oscillated by a horizontal shaft which is attached to a rocker arm actuated by the valve gear link motion. As this arm reciprocates it engages a pin on the disk and draws it forward, thereby swiftly removing the abutment from the steam space. The instant the abutment is clear of the cylinder, the horizontal arm is tripped and the disk under the influence of the dash-pot, which is shown below the disk, flies back to its normal position and swings the abutment into place within the cylinder. The arrangement and action of the valves and abutment indicate a careful study of the idiosyncrasies of the rotary engine, and in the matter of clearances at the abutment the design appears to be well up to the limit of possibilities of an engine of this particular type.

Repairing Vessels at Cavité.

Naval Constructor Hobson has some pertinent comment to make on the question of dry-docking facilities required by the government at Cavité, which he embodies in a report submitted to the Navy Department recently, on the question of the wrecked vessels raised in Manila Bay, which are now being repaired at Hong-Kong under his direction. Mr. Hobson contends that economy demands that the United States establish its own dock and repair station, and shows that large sums would be saved which are now paid private firms at Hong-Kong for overhauling American warships.

His report is an argument in favor of the maintenance in the Philippines of an important navy yard and dry dock, where the largest and most powerful vessels of war may be overhauled and attended to. The report states that in compliance with the bureau's direction the three vessels under reconstruction, the "Isla de Cuba," "Isla de Luzon," and "Don Juan de Austrias," are about 80 per cent completed. The value of the vessels when completed, exclusive of armament, will be about as follows: "Isla de Cuba," \$215,000; "Isla de Luzon," \$215,000; "Don Juan de Austrias," \$180,000. Total, \$610,000. Raising and refitting have cost about \$304,000, making a net gain to the government on the three vessels of \$306,000. The credit for this result is given to Naval Constructor Capps, who made the contracts. Thus the large engine parts were scarcely injured at all. This feature has an important bearing upon the wrecks still in Manila Bay which he is to examine with divers when the vessels now in hand are completed. The longer period that they have been immersed may not have seriously injured the principal parts, and there may be similar advantage to the government in further salvage, particularly as to the "Don Antonio de Ulloa" and the "Velasco," sister ships to the "Don Juan de Austrias," which, from all accounts, suffered less damage than those that have been raised.

Mr. Hobson adds: "There would be great advantage to the government in the establishment in the Philippines of a yard thoroughly equipped with docks and plant capable of doing all the work of docking and repairing of the navy. The British government is undertaking such an establishment here, though at great cost, involving the making and reclaiming of a large part of the land required. This would necessitate the employment of Chinese labor. This labor is not only unlimited, but it is equal to practically all the requirements of modern industry. Chinese do all the work inside and out for all the departments of the shipyard, white supervision being required only to show what is wanted. The Chinese have a remarkable natural aptitude. Their industrial capacity is simply marvelous. To the extent of my observations and inquiries, there is no place in modern industry which they cannot fill."

In his speech introducing the naval works bill in the Commons, Mr. Austin Chamberlain, in order to show the necessity for increased dock accommodation, stated that whereas, in the year ending March 31, 1889, the tonnage of the vessels built and building for the royal navy was 864,000 tons, on March 31 of this year it was 1,800,000 tons; more than double that of ten years ago. The longest battleship then was 345 feet long and the largest cruiser 400 feet. Now battleships of 400 feet in length are being built, and there are cruisers 500 feet long in commission.

The British government have in contemplation the immediate construction of five first-class docks for naval purposes solely. One of these new docks will be built at Chatham, and will be of sufficient dimensions to accommodate the largest ship afloat in the British navy. Another dock is to be built at Hong-Kong. This last named dock will be 750 feet in length and of dimensions to accommodate the ships of the "Majestic" class. At Bermuda another fine dock will be added to the one already at that important point. At Malta two docks will be laid down, and the latest improvements will be embodied in these docks, as also in the two to be built at Cape Town, Africa. These five docks are to be of stone and built in the most thorough manner and will cost an aggregate of \$5,000,000.—*Army and Navy Journal*.

Correspondence.

Can Insects Count?

To the Editor of the SCIENTIFIC AMERICAN:

That insects have some idea of numbers is claimed by Lieut.-Colonel Delauney in *La Nature*, Paris, July, on the base of a single observation made upon what seems to have been a small bug allied to *Corisa*, in New Caledonia. It was noted that this species was gyrating upon a leaf, first in one direction, then in the other, beginning with six turns and coming down in order to one. This was done once only, and no other specimens were observed. That the insect could count from six to one is thus considered proved upon what seems to one who has observed insects remarkably slim evidence.

The gyrating habit is a common one in insects and especially among some of the smaller moths or Tineids, who rarely come to rest after alighting without first turning several times in one or both directions in succession. Sometimes, without apparent cause, they will begin a dance that lasts for some time, almost exactly as described by Colonel Delauney, save that I have never noted the regular decrease in the number of turns. I cannot in the least believe that the insects have any real idea of number connected with these turnings; but I am nevertheless convinced that some insects do count up to considerably more than six.

An interesting illustration came under my notice in July, while collecting on the New Jersey side of the Delaware, at the V^{er}er Gap. At the foot of the cliff, along the line of the railroad, all the old sumach canes were used by the little wasp *Odynerus ornatus* for breeding purposes, and from three to six brood chambers were found in the canes. The cells were stored with the larvæ of the locust leaf beetle, *Odontata suturalis*, then about full grown, and as a matter of curiosity I counted those in the cells of one stalk, finding ten in each store. To ascertain whether this was uniform I cut all that I could find at that spot and invariably ten larvæ were contained in a completed cell. The little wasp begins by putting in one larva and then lays an egg upon or at the side of it. Nine additional larvæ are then brought in, one at a time for the larva is almost as large as the wasp, and then the cell is capped. Now this insect can not only count up to ten, but it can carry the idea of numbers for some appreciable time. After three or four larvæ have been placed in the cell the bottom one is lost to view and counting from above becomes an impossibility. The insect must, therefore, keep tab on its trips so as to neither over nor understock its cell. It is not a question of length of cell and simply filling a given space, for the diameter of the stalks varied, and as the diameter became greater the length of the cells became less.

It is worth noting that the habits of this little wasp have not been recorded, heretofore; but I have no doubt its allies with similar habits will be found to have the number sense equally well developed.

JOHN B. SMITH, Sc.D.

Rutgers College, New Brunswick, N. J.,
August 25, 1899.

Wood Seasoning by Electricity.

In a recent issue of a European trade journal, there is a description of a new process of seasoning wood and timber by electricity, known as the Nodon-Bretoneau process, which must be a commercial success, for it is claimed that the company's shares are now at a premium of nearly 600 per cent, says E. Theophilus Liefeld, United States consul at Freiburg. The effect of the electrical treatment seems to be to expel the sap and replace it by insoluble matter which will not putrefy, and to increase the tenacity of the wood and its resistance to vertical compression.

This is said to be the first industrial application of the principle of electric osmose, viz., if the electrodes in an electrolytic solution are separated by a porous partition and a current passes, the volume of the liquid in contact with the positive pole diminishes, while that in contact with the negative pole increases.

The process is about as follows:

The positive pole of a dynamo is connected with a lead grating, upon which the wood to be treated is placed. A solution, which is kept at the uniform temperature of 100° F. by means of a steam pipe underneath the grating, is poured into the vat so as to almost cover the log of wood treated. At a public demonstration, the solution used contained 10 per cent of borax, 5 per cent of resin, and three-fourths of 1 per cent of carbonate of soda, the borax being used on account of its antiseptic properties and the carbonate of soda to help dissolve the resin. A porous tray, the bottom of which consists of two sheets of canvas with a sheet of felt between, is placed over the log, and a sheet of lead connected with the negative pole of the dynamo is placed above this.

When the current is turned on, the solution is drawn from the bottom and the sap driven out, and its place taken by the borax and resin. The time required for

a 10-inch log is about seven or eight hours, and then the wood is slowly dried, which takes in the open air in summer several weeks or even months. It was stated that a unit of electrical energy was required for every six cubic feet of timber treated.

Commercial Education in Russia.

Commercial education is continually receiving more attention and encouragement in Russia. Not only the government, but also commercial institutions, large firms, and even private individuals, are opening new commercial educational establishments, varying from the engineering college (polytechnic) opened by the government at Warsaw last year, where young men who wish to become civil, mechanical, chemical, or electrical engineers, architects, or surveyors, can obtain a thorough theoretical and practical technical education, to the simple evening artisans' class, designed to give apprentices a certain amount of theoretical knowledge of their trade to supplement the practical knowledge gained at their work. Consul-General Murray says that between these two extremes come commercial schools, where boys can get a thorough commercial education as clerks or commercial men, and artisan schools, where the sons of workingmen can get a preliminary education at certain trades, such as carpentering, locksmiths, etc. It thus only remains for the parents, and the boy himself, to decide what line he will take, and how much time can be given to his education, for which facilities are at hand from the time he first goes to school until he has finished at the engineering college at 22 or 23. The two branches of commercial education which appear to be the most neglected, as compared with Germany, are shorthand, it being extremely difficult to get a clerk who can take down a letter in shorthand, and then print it off on the typewriter, so common an accomplishment elsewhere, and the careful special training of commercial travelers, which is carried to such a pitch of perfection in Germany, has little attention paid to it in Russia.—*Journal of the Society of Arts*.

Igniting a Jet of Hydrogen.

C. G. Hopkins describes a method by which a jet of recently generated hydrogen can be ignited with absolute safety and without loss of time. As soon as the action begins, collect the escaping gas in a test-tube, and, when the latter is thought to be full of pure gas, remove it two or three feet from the generator and ignite the hydrogen in it; then immediately attempt to light the jet of hydrogen with the hydrogen flame contained in the test-tube. If the gas is explosive, it will explode in the test-tube and leave no flame. If, on the other hand, a flame remains in the test-tube with which the jet can be ignited, it is certain that the gas in the generator is no longer explosive. By adopting the precaution, therefore, of never lighting the hydrogen jet except with the hydrogen flame obtained as described above, absolute safety can be insured. Attempts may be made to ignite the jet by this method as often as thought proper, and if the hydrogen is properly generated, the gas will be ignited in less than a minute.—*Journ. Am. Chem. Society*.

Extinguishment of Fires in Mines.

An account of the application of liquefied carbonic acid gas to extinguish underground fires was given by Mr. George Spencer at the recent meeting of the Institution of Mining Engineers, says *Nature*. At a colliery with which Mr. Spencer was connected a fire occurred in a heading, as the result of a fall of roof and sides on steam-pipes. The heading was built off with as little delay as possible, but notwithstanding all efforts to shut out the air, sufficient reached the seat of fire to keep it burning slowly. It was therefore decided to apply carbon dioxide, and for this purpose six cylinders of liquefied gas were successfully used. It is not claimed that the method described can be successfully applied to all fires, but there are undoubtedly many cases which might be so treated. In case of fire on shipboard, the use of carbon dioxide would no doubt prove invaluable, as it could be quickly applied, and would not cause the same damage to cargoes as water.

"City of Rome" Strikes an Iceberg.

The recent collision of the "City of Rome" with an iceberg brings forcibly to mind one of the many dangers to which transatlantic navigation is exposed. The vessel at the time was in latitude 48° 30' N. and longitude 48° 44' W. The weather was foggy and a rain had just ceased falling when an iceberg was sighted near at hand, and the ship was slowed down to quarter speed. Shortly after this a massive berg loomed up over the bow of the liner, and before the engines could be reversed she struck, and her bow lifted several feet, the vessel finally sliding back into the water again.

Fortunately she sustained no damage beneath the waterline, the only marks of the encounter being her crushed figurehead and a bent bobstay.

THE United States torpedo boat "Talbot" is being fitted with machinery for the use of liquid fuel and the work is being done at the Norfolk navy yard.

Science Notes.

A Labrador mail steamer reports that the Peary expedition steamer "Diana" has been met and hailed and that all on board are well. The "Diana" expected to reach Disco, Greenland, on July 29.

Major Ross, who was sent to Sierra Leone by the Liverpool School of Tropical Diseases to discover the malarial mosquito, has wired home that the malarial mosquito has been found and to send help to carry on further investigations.

Stonehenge, on Salisbury Plain, is for sale; 1,300 acres of surrounding land are offered for \$625,000. It is to be hoped that the British government will see fit to purchase Stonehenge, which is one of the most remarkable archæological monuments in the world.

The use of homing pigeons by the United States navy has become quite important, and we have already illustrated the system employed. Birds are now being educated by means of Long Branch steamers, in order that they may be used when Admiral Dewey arrives.

The recent explorations which have been made at Carthage have resulted in very important finds. The sanctuary of Jupiter Ammon has been discovered, and the current SUPPLEMENT and the issue for next week will both contain illustrations descriptive of the discoveries made in the Punic Acropolis.

The French surgeon, Dr. Doyen, has exhibited to numerous doctors and students at the Kiel University cinematograph pictures showing various surgical operations. The doctor advocates the use of such pictures for the education of students, saying they are far more effective than the most elaborately written descriptions.

Dr. Sven Hedin has departed on a new expedition to Central Asia, and expects to be absent about two years and a half, chiefly in eastern Turkestan and northern Thibet. The Russian government will give his expedition free passage over lines of railway and will provide him with an escort of Cossacks whenever he may require them.

The mining exhibits at the Paris Exposition will be most interesting. There will be two realistic representations and demonstrations of the art of mining. A shaft 5 feet in diameter will serve regular mine workings, and all of the machinery will be of the regular type in actual use in mines. Visitors will also have the opportunity of visiting the catacombs under the city.

The International Commercial Congress to be convened at Philadelphia, October 10, 1899, during the International Export Exposition, will be the first of its kind in all commercial history. Its members will be made up of delegates from the Chambers of Commerce, Boards of Trade, etc., and will come from Latin America, Africa, Australia, India, China, Japan and other countries.

The Director of the Geological Survey has just issued a pamphlet entitled "Maps and Descriptions of Routes of Explorations in Alaska in 1898, with General Information concerning the Territory." There are ten maps which are admirably executed. The pamphlet contains special reports on various expeditions and general information concerning the Territory by geographical provinces and some very valuable tabulated information, including the gold production of Alaska. The various routes and means of transportation are clearly shown. The publication is intended for widespread distribution, and copies can be obtained by the aid of Congressmen.

In the United States the drug store seems to be the one place in which Americans get something for nothing: postage stamps at government rates and free directories are the universal rule. Some New York druggists have decided to institute a reform in the matter of the directory at least, and have placed the book in an open box so that it can be reached by the dropping of a penny in the slot. The entry of the coin releases the spring, the lid may then be lifted and the book consulted. Many city druggists do not go to the expense of purchasing a new directory every year, but with the aid of a device of this kind it is probable that new directories would be forthcoming every year, and the proceeds might be devoted to charity and the druggist relieved of the "free directory" nuisance.

J. A. Brashear has just completed one of the pair of large astronomical camera doublets for the observatory of the University of Heidelberg, Germany. They are next to the largest ever made. They are 16 inches clear aperture and 80 inches focal length. Two of these doublets, each consisting of four lenses, are to be made and are to be used almost exclusively for the photographic discovery of asteroids. The reasons for making two cameras and objectives is to serve as a check. The track of an asteroid on an 8x10 plate is only about one-twentieth of an inch long for a three hours' exposure. As the curves of the lenses have necessarily to be very deep, the casting of the great disks was found to be very troublesome. The fund for the equipment was given by Miss Catherine Bruce, of New York city.

Engineering Notes.

The "Oceanic" started from Liverpool on September 6, at 7 P. M., for her maiden voyage to New York. It is expected she will arrive at New York at 7 A. M., September 13.

Nicholas Rigenbach, the engineer for many of the funicular and rack and pinion railways of Switzerland, died recently. He directed the construction of the Righi Railway.

The Boston and Albany Railroad are now running trains into the new South Station at Boston. The trains of the Providence Division will run into the station.

The "Kaiser Wilhelm der Grosse" has lowered the time of ocean passage from Cherbourg to New York by two hours and fifty-three minutes. It covered a course over the northern route of 3,049 knots at an average speed of 22.08 knots.

The Baltimore and Ohio Railroad has appointed an "Industrial Agent" whose duties are to advise manufacturers and others as to desirable locations for business enterprises. It is believed that this system will tend to develop the resources of the territory contiguous to the lines of the company.

A Providence company has recently made an emery wheel 39 inches in diameter and 12 inches thick. It was built up on a special iron center 31 inches in diameter, which ran on a 3 3/8 inch shaft. According to The Iron Age, the whole affair weighed over 1,200 pounds. The machine was designed for grinding wooden balls.

A commission appointed some time ago to consider the feasibility of construction of a mountain railroad to the top of Mont Blanc has made a favorable report, and it is possible that the enterprise will be carried out. If so, the line will start from Chamonix and extend almost to the apex of the great mountain, a length of 6 1/4 miles.

The Baldwin Locomotive Works have secured a contract to supply twenty compound locomotives for the Saxon State Railway of the German Empire. The price quoted is 54,760 marks each. One firm in Breslau made an offer of 220 marks lower, but they required much longer time to make the locomotives, so the contract was given to the Philadelphia concern.

The Chicago Drainage Canal is to be opened next December, and the trustees are now spurring on the contractors, and extra prices are to be paid to certain of them who will guarantee the completion of their work in December. It is desired to have the canal completed and opened before Congress meets, in order to avoid the opposition that will be made at the next session.

One of the most important American exhibitions at the Paris Exposition will be a model, some twenty feet long, of the Chicago Drainage Canal. In connection with this will be shown models of all the great variety of excavating and conveying machinery which was used in this important engineering work. The models will be shown in operation, and it is believed that it will be one of the most interesting of all the engineering exhibitions at the Exposition.

Following the wake of our Navy Department, the British Admiralty is about to add a modern steel floating dock to its docking equipment. The naval work bill, which recently passed its second and final reading in Parliament, contains an item for a first-class floating dock at Bermuda. Messrs. Clark & Standfield, designers of the naval 18,000-ton dock now being built at Sparrows Point, will draw the plans of this new dock of 17,500 tons lifting capacity. At present they are building in England, from their own designs, a steel floating dock for the Siberian Railroad, which will be sent out in sections to Yalienwan and there put together.

Nelson's old flag-ship, the "Foudroyant," was built in 1789 and was launched in 1793. She was wrecked at Blackpool in 1897, and part of her keel is now embedded in the sands at that place, and the remains of the vessel, her timbers, etc., are still in a yard at the place. At the Birmingham mint there are forty tons of copper from the vessel. Notwithstanding the fact that this ship, and the "Victory," were the only two remaining vessels which remind us of the famous sailors of the great fighting era, the Admiralty decided in 1892 to get rid of the relic, and she was sold to a German firm of ship breakers. Such an outcry was made that she was re-purchased, but in a curious hurricane on June 16, 1897, at Blackpool she broke from her moorings and driving shoreward became a total wreck. She was sold for \$1,250, and the purchaser began the work of breaking her up. The first blast killed a woman who was passing on the beach, and this so disheartened the owner that he resold her to a syndicate. Some idea of the lively actions in the days of 80 gun ships may be seen from the data of powder and shot from the "Foudroyant" expended on the "Guillaume Tell." This was 162 barrels of powder, 1,200 thirty-two pound shot, 1,240 twenty-four pound shot, 100 eighteen pound shot and 200 twelve pound shot.

Electrical Notes.

The Odeon Theater, Buenos Ayres, is heated by electricity. This is not the first theater in the world to be so heated, but very few large public buildings have been warmed in this manner.

Electricity has been used to some extent for glass making. It is said that with the electric arc, a pot of glass can be melted in few minutes, which, in the old process, would require hours.

Herr A. Adt has found that magnets made from wolfram steel are more powerful than those made of other steel, but on the other hand, they lose their magnetism faster than some of the others.

Marconi's experiments have been so satisfactory to the British Admiralty that a complete set of apparatus for wireless telegraphy has been supplied to the "Defiance," the torpedo schoolship at Devonport, for future experiments by naval officers.

The Paris, Lyons and Mediterranean Railway Company has undertaken the construction and operation of an electric railway between Fayet and Chamonix. The power is to be furnished by the river Arve. Each car will be supplied with its own motor.

The New York, New Haven, and Hartford Railway are, it is said, contemplating the putting in of the third rail system electric line for passengers between the Harlem River and New Rochelle. Their other experiments in this line have proved very satisfactory.

The second section of the Jungfrau railway has been opened by the company. It is only half a mile long and consists of a tunnel with a continuous gradient of 25 per cent. After the line reaches the Eigerwand station, work will probably be stopped until more capital is subscribed.

The London County Council has authorized the expenditure of \$50,000 for the construction of an experimental system of underground electrical traction. The underground trolley is used so successfully in the United States that it hardly seems necessary to spend \$50,000 in demonstrating the value of a system which is already conclusively proved.

The manufacture of carbons for electric light is very interesting. The plastic mass is driven out through a small aperture with the aid of a hydraulic press. They are then baked in furnaces and are automatically electro-plated with copper. The plating operation is particularly interesting and is described and illustrated in the current issue of the SUPPLEMENT.

At the Paris Exposition the central power station will be 1,200 feet long and 120 feet wide. There will be 45,000 steam horse power and 25,000 electrical horse power. The steam will be supplied at a pressure of 142 pounds per square inch. Electricity will be supplied at voltages of 125, 250, and 500 for direct, and 2,200 for alternating currents. The price for steam power will vary from 1.68 cents per horse power to 0.57 cent per horse power, depending upon the size of the engine.

The third rail has claimed its first victim in Brooklyn, N. Y. A track inspector, while looking over the tracks of an elevated road, noticed that a screw in one of the rail clamps had worked loose. He was stooping to examine it, when he slipped on the ties and fell face downward on the electrically-charged third rail. In falling he thrust one of his feet backward and the lower part of his leg rested on the tin roof of the stairway leading to the street, thus establishing a complete circuit, and the full force of the current passed through his body. It was found that he had been horribly burned on his face, hands, and legs.

According to The Electrical World, Prof. W. L. Bryan, of the University of Indiana, and Mr. N. Harter, telegraph superintendent, have been investigating the mental processes in acquiring proficiency in the use of the Morse code. The investigators concluded, after a variety of tests, that the study of telegraphy is analogous to that of learning to read and of acquiring a foreign language. "There is the same rapid improvement at first, the same dispiriting level just below the ability to understand ordinary conversation, the same rapid ascent into usable knowledge of the language, and the same long struggle, seldom completed, before one has freedom in the language."

We have already referred to electrically propelled ferryboats, which are to be used between Philadelphia, Pa., and Camden, N. J. At first sight it seemed as though there was no necessity for having electric ferryboats, but it should be remembered that with the ferryboat the service is not continuous, and for this reason is not economical. The engines and boilers can only be used part of the time, but with an electrical equipment the charging of the storage batteries may be continuous while the boat is in the slip. A vast amount of space will be saved, and the storage batteries may be placed near the keel. The charging may be done while the boat is in its slip at the end of each trip. There will be no dust or odor, the attendance will be lessened, and there will be no time lost in making signals to the engineer, for there is no reason why the steersman cannot operate the motors from the pilot house.