Cal. This was followed by the opening of the big plant at Folsom, Cal., which at that time was the largest in the world. The first current that flashed along its wires carried 400 horse power 21 miles at a voltage of 11,000. Years were spent in the work at Folsom. An immense masonry dam 650 feet long, 24 feet wide at the crest, 87 feet wide at the bottom, and 89 feet high at the highest point had been thrown across the American River. The dam contains 50,000 cubic yards of granite and creates a reservoir three miles long. At either end are massive head gates to contract the passage of the water into canals, which give a flow of 85,000 cubic feet a minute. The water supply is sufficient for the irrigation of 300,000 acres of land, including large areas on both sides of the American River. The work on the Folsom plant five years ago was only second to that at Niagara Falls, and the great plant already furnished 45,000 horse power, transmitted a distance of 24 miles to Sacramento for use by street car lines, electric lighting companies, and in factories and machine shops. The success of this great plant was only made possible by the fact that the year after it started a dynamo was invented which made electric power available for manufacturing purposes. The first plants could employ their currents for lighting and for the propulsion of street cars alone, but here was a new application which made the patronage and the profits of the concerns doubly sure. The demand for electric power and the field for its operations in California are proved by the alacrity with which it has been caught up by consumers all along the power lines. All plants are running full power, with the whole current in use and more in demand. Very lately the large Folsom plant was found inadequate to supply Sacramento with a sufficient current and additional power was obtained from Colgate. All electric power companies strive for a business so regular that it will take a full supply all the time, for a full line will furnish just so many horse power a day and it costs as much to maintain a line whether it is supplying a full current or half its possible current. In industries which call for a regular supply of power, electricity has largely supplanted steam in San Francisco.

At the present time the power of the mountain cascades is being rapidly harnessed and a new industrial era has sprung up upon the Pacific coast. There are now twenty electric power plants upon the Pacific coast, and of those yet unmentioned is that now in process of construction at Redding in northern California, at the base of Mount Shasta. New York, San Francisco, and Buffalo capital is back of this enterprise to the extent of $6,000,000, and when completed it will be the greatest electrical power plant in America outside of Niagara. Another large plant which when completed will hold the world's record for long-distance transmission is being constructed upon the Kern River, 27 miles from Bakersfield, Cal. A corps of engineers and a gang of laborers are hard at work. Then, too, there are the big Yuba County power plants and that of the Mount Whitney Power Company. There is a big plant at Truckee, Cal., which sends 1,500 horse power to the Comstock mines, the great mines which made millions for the Stewarts, Mackays, Flood, and Fair families and which are still paying dividends. The Blue Lake Water Company is another important plant. The South Yuba Water Company, in which Senator C. N. Felton and Dr. Charles Van Norden, of New York, are largely interested, will develop a 30,000 horse power plant. The company controls a number of large storage reservoirs and twenty large lakes in Placer and Nevada counties, California. They now have 400 miles of flumes and a storage capacity of five billions of cubic feet. They now furnish 5,000 horse power to the small cities and mines in that district.

In utilizing the power of mountain streams to run street cars, ship yards, mines, canning factories, gold dredgers, to illuminate, to propel machinery, and even to heat buildings in far-away cities, the value of the streams is not diminished, for most of the water upon issuing from the turbine is re-diverted for the purpose of irrigation. In fact the use of water for power does not consume one drop of the fluid, but employs only the energy furnished by its fall. Thus the two go hand-in-hand, and wherever the resources for irrigation are tapped, a double return for the capital employed may be obtained through the installation of electric power plants.

Altogether, 140,000 horse power has been converted into electrical energy in California. It is conservatively estimated that the waterfalls alone have close to 300,000 horse power, exclusive of that which will arise in the building of dams in torrential streams. There are now in the neighborhood of $10,000,000 invested in these plants, and several thousand men are at present engaged in as many as a dozen different projects to convert the vast, almost inexhaustible power of the flowing streams into a force that shall be commercially valuable.

Correspondence.

A Jointed Snake.

To the Editor of the SCIENTIFIC AMERICAN:

Being a reader of your paper, of course I notice the snake stories; and having been raised on a farm in Missouri, while a boy killed many rattlesnakes, also other kinds, among them what was known to me as the joint-snake, that by striking would fall into sections about one and one-half inches in length; and the head end, about four inches long, would run away and hide until it thought the enemy had gone, then return and gather itself up, and be as good as new. In discussing snakes with a friend, born and raised in New York, now living in Ohio, I was unable to convince him that there was such a thing as a joint-snake. Since the statement that I have made is strongly disputed, it is but natural that I should be anxious to find an authority for my statement regarding the present or past existence of the joint-snake in the United States. Will you look the matter up, and give it a little space in your next issue?

NORMAN S. DONNELLY.

[Our correspondent refers to a creature which has puzzled many an observer and given rise to as many stories as the "milk-snake" and the "toad in the solid rock." It is fair to say that a large percentage of the farmers of the country believe that there is a "jointed" or "glass snake," which can disjoint itself and break up, to come together later; and it is difficult to find a boy brought up in the country who will not testify that he has seen the miracle time and again; and the most interesting feature is that they all firmly believe it. To give the deluded ones credit, the actions of the "jointed snake" are so remarkable, so extremely unconventional, that there is little wonder that the sharpest observer is deceived; but there is a vast difference between what one really sees and what one thinks he sees, and herein lies the mystery of the "jointed snake."

To start fairly, there is no animal known to science as a jointed snake. What the credulous observer believes to be such is a lizard known scientifically as *Opheosaurus ventralis;* a well-known low form common east of the Mississippi River and south of the Ohio River. That it is considered a snake is hardly to be wondered at, as it has no feet; and when alarmed, darts away with the peculiar gliding or wriggling motion of a snake, and to any one but a naturalist it would, doubtless, be considered a snake. But the animal is a lizard, and the long cylindrical tail, *twice as long as the body,* to the untrained observer appears to be the body. This slender tail is the cause of the many fables prevalent regarding the marvelous powers of the "glass-snake," which is so brittle that it cannot be touched without breaking; but the fact is that the vertebræ, or bones of this long tail, are so delicately adjusted or connected that it is almost impossible to lift the animal by it without breaking it. Any violent jerk or strain will throw the tail into one or more pieces, which lie on the ground wriggling with a convulsive movement, while the head and body crawl away. In a word, it is not the body of the lizard, but its long tail which breaks up—a very common trick among lizards. The tail thus thrown off is deserted, the lizard having no more power to reattach it than has a man to assume his amputated leg. But the lizard has this advantage: a new tail begins to grow at once, and the glass-snake is in a short time itself again, and may break up and be renewed an indefinite number of times, so far as known. In a collection of lizards caught at random in the San Gabriel Valley, Southern California, fifty per cent had new tails in all stages of growth from one to four inches in length, being darker and readily recognized as new and growing tails. This faculty of reproducing lost parts or limbs is common among crustaceans, and the casting of tails is so deftly carried out among lizards that the conclusion is irresistible that it is intended to deceive the pursuer or enemy. Another "glass-snake" is the lizard of the genus *Anguis.* The "blind worm" often throws off its tail at the slightest danger, and it is almost impossible to catch and retain one without the loss of this member.—ED.]

The New English Torpedo Boats.

The first of the new type of torpedo boat destroyers, for the British navy, the "Erne," has been launched from the yards of the Palmer Shipbuilding Company, of Jarrow-on-Tyne. This improved class has been rendered necessary by the loss of the "Cobra," and the buckling in heavy seas of other vessels, consequent on too light construction of the hull. In the "Erne" class, a forecastle is provided in lieu of the turtleback deck, thereby providing a much higher bow for driving against a rough sea. The structural length of the hull has also been increased, whereby a considerable addition to the displacement is made above that of the 30-knot type boat. As a matter of fact, speed has not been sought after so much as strength in the "Erne," for the maximum speed is only 25½ knots under the usual loading conditions. In this vessel somewhat of a reversion is made as regards speed to the first type of torpedo-boat destroyers, the speed of which was 27 knots. In subsequent vessels a speed of 30 knots was attained, but only by the sacrifice of structural strength. The dimensions of the "Erne" are: length, 222 feet; beam, 23 feet 6 inches; and 7,000 I. H. P. The armament, however, is the same as that of the 30-knot boats, comprising one 12-pounder, mounted on the conning tower forward, and five 6-pounders, four of these being on the broadside and one on the raised central platform aft, and two 18-inch torpedo tubes. With regard to the armament of future destroyers, the Admiralty has made an important alteration. Boats of 27-knots speed are to carry only one instead of two torpedo tubes, while the first-class torpedo boats will be fitted only with a view to enable this type of vessel to move with greater celerity in night attacks. The "Erne" is to carry a crew of 70 officers and men. The machinery consists of twin-screw triple-expansion engines, steam being supplied by four of Reed's water-tube boilers.

The Historical Novel and Its Value in Trees.

The flood of novels which has incessantly poured in upon us of late years, more than ever emphasizes the truism that of the making of books there is no end. A decade ago it was the so-called "psychological novel" that enthralled us; now it is the judiciously advertised historical novel that holds our rapt attention. Through the ingenious refinements of modern advertising the sales of fiction have been increased so prodigiously that a novel can hardly be called a "success" unless it has been sold to the extent of a hundred thousand copies.

The newspaper tales of the enormous editions of historical novels are by no means as fantastic as they may read. A list, carefully compiled from publishers' returns which are absolutely without reproach, shows that the sales of nine recently published novels have reached astounding proportions. Of one book, over 400,000 copies have been sold. Another is in its 325 thousand. Less successful books have attained only a paltry sale of 100,000, while a few minor ones hardly exceed a disappointing 80,000.

It is not our purpose to dilate upon the relative merits of these volumes of fiction, but simply to show what it costs to satisfy the public appetite for tales of wild adventure.

Books are made of paper. Paper in turn is made of cellulose, of which the chief source of supply is timber. In order to describe the romantic career of a seventeenth century gentleman of the rapier, it is necessary to fell a few hundred trees; the publication of many narratives in which the exploits of other cavaliers are dwelt on, may therefore entail the destruction of a forest.

The nine novels to which we have referred had a total sale of over 1,600,000 copies. Since the average weight of each book sold was probably twenty ounces, a little calculation will prove that these 1,600,000 books contained approximately 2,000,000 pounds of paper. We are assured by a manufacturer of paper that the average spruce tree yields a little less than half a cord of wood, which is equivalent to about 500 pounds of paper. In other words, these nine novels swept away 4,000 trees, and they form but a small part of the fiction so eagerly read by the American public. Some books are worth more than 4,000 trees. What may be the tree-value of the modern historical novel it is not within our province to decide.

A National Club House for Engineers.

Through the munificence of Andrew Carnegie, who has agreed to give financial aid to the extent of one million dollars or more, a national club house for engineers may be erected in the city of New York. The building proposed will occupy a plot extending from 39th to 40th Streets, between Fifth and Sixth avenues, upon a small portion of which the Engineers' Club of New York now stands. According to the present plans, the Engineers' Club will occupy one portion, and the remainder will be used by the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Society of Electrical Engineers, and the American Society of Mining Engineers provided the separate organizations decide to take advantage of Mr. Carnegie's offer.

More News About Nova Geminorum.

The light of Nova Geminorum appears to be fluctuating like that of Nova Persei No. 2. On the evening of May 1 it appeared that its light had increased about half a magnitude during the preceding twenty-four hours. Since the measures described in the Bulletin of April 22, similar measures were obtained on April 24, 25, 27, 28, 29, 30 and May 1, and gave the magnitudes 9.37, 9.67, 9.71, 9.81, 9.61, 9.76, and 9.26 respectively.

EDWARD C. PICKERING.

Harvard College Observatory.

Engineering Notes.

The Russian navy has been augmented by a useful vessel, the "Ocean," which is to be utilized entirely for the training of engineers and firemen for water tube boilers, so that they may become acquainted with the peculiarities and characteristics of the various types of boilers of this class. This particular vessel is equipped with four distinct designs of water tube boilers—the Belleville, Schulze, Yarrow, and Niclausse. The vessel will be supplied with 4,000 tons of coal, and will carry a class of 400 men. She will then sail for the East, the men being instructed during the passage, so that by the time the "Ocean" reaches Chinese waters, the men will be sufficiently competent to be transferred to the various warships of the Russian squadron operating in those waters.

The Russian government has completed the first stage of the construction of the southern section of the railroad to Turkestan between Orenburg and Tashkend. About two-thirds of the length of the embankment have been carried out and only 25 miles of the first section await the finishing touches. Four thousand artisans have been employed upon the work. The stonework of the first two sections is nearly finished, and temporary bridges have been built over the rivers Salar and Keles, as the permanent bridges have not yet been constructed. The telephone poles have been erected as far as Turkestan, and telephone stations established. Further on the telephone wires have been attached to the telegraph poles already in use as far as Perovsk. Depots for materials and dwellings for the persons employed on the line have been established along the five sections and at the bridge of Tchinaga. There are also temporary workshops for the repair of the rolling stock including the locomotives.

An overhead railroad of the Elberfeld (Germany) suspension type is projected for London by a syndicate of German, American, and English financiers and engineers, and the necessary Parliamentary sanction is to be sought for this session. It is proposed to construct the railroad above the River Thames, as with the river Wupper in Germany, though owing to the greater width of the Thames the railroad will be constructed upon the southern shore. The line is to stretch from the city to the southern western suburb Barnes, and is to follow the course of the river throughout its entire length, approximately eight miles. The plan of construction will be similar to that over the Wupper, the rising angular lattice girder supports being fixed to concrete foundations sunk into the river bed. It is contemplated to erect fourteen stations. Electricity will be the motive power, and it is proposed to cover the complete journey, including stoppages at each of the intermediate stations, in 23 minutes. The railroad would be raised to a sufficient height to cross above the bridges, at each of which the stations would be built as far as possible, access being obtained to the stations therefrom by means of lifts. It is proposed to erect the girders supporting the track at intervals of 200 feet. Only one class of carriage would be provided, and a uniform fare of four cents would be charged for any distance. It is estimated that the cost of the project will be about $25,000,000 and it will occupy five years to complete.

A series of experiments have been carried out upon the railroad between Chateau de Loir, in the Sarthe, and Chateau-la-Villiere, in Indre et Loire, France, with a new system for the prevention of collisions between railroad trains traveling in opposite directions upon the same track. This system is the invention of a Spanish engineer, Señor Basanta. When a train is either stationary or in motion upon a certain track, and another train is approaching upon the same track, information of the fact can be transmitted between the two trains by an electric current, which rings an electric bell upon the engines. This alarm given, the engineers of the two trains can establish telephonic communication and thereby avert a collision. In the cab of each engine is fitted a telephone and alarm bell, and along the rail of the track a wire is placed. Connection between this rail wire and the engine telephone is obtained by a sliding shoe, while a second wire called a conductor of protection extends between the disks and the stations, for the purpose of affording communication between the train and the station immediately behind or in front, whichever the case may be, where telephonic posts are provided for such communication with the train. To one axle of the train a dynamo is attached, and the train must be traveling at a speed of at least six miles an hour to exert sufficient current to actuate the signaling arrangements. When the train is stationary a magneto machine operated by hand is utilized. The invention works somewhat upon the block system, the bell automatically ringing when two trains are in the same block. The contrivance was severely tested upon the French railroad, and is to be subjected to further experiments with a view to simplifying the mechanism and working arrangements of the device.

Electrical Notes.

The Western Union Telegraph Company has begun the work of stringing new No. 11 copper wire on its poles between New York and Montreal. The work was commenced at Albany, and continued to Whitehall, at which point it was taken up by the Great Northwestern Telegraph Company, and will proceed at the rate of nearly eight miles a day to the Canadian capital. The section between New York and Albany will be completed at an early date, and it is expected to have the entire work finished by the end of the winter. The distance from New York to Montreal is 400 miles.

In order to familiarize the people with the domestic uses of electricity, and at the same time increase the demand for the current, a Chicago electric company has adopted the idea of using small cottages of a portable nature and erected at different points through the city for short periods of time. The cottage is brilliantly illuminated outside and in, for the purpose of attracting attention at night, and the interior is fitted with all the devices which can be operated by electricity that are designed for use around the home. There are about seventy-five different electrical contrivances of this nature, including fans, sewing machine motors, cooking and toilet utensils, and all the different kinds of lamps which are available for home use. Visitors are allowed the greatest freedom, and even encouraged to handle the things on view and ask questions about their use. It is said that about 125 persons visit the cottage on an average each day.

What may be paraphrased as "wordless telegraphy" is to be the next development in practical telegraphy. We get the first intimation of this from the introductory remarks to a code book, just published, entitled "Pantelegraphy, Section PAPE," by A. C. Baronio, which is in point of fact a commercial skeleton code of 273 pages, framed on entirely different lines from what has been the practice hitherto. The author claims that it has cost him many years of study and labor in order to bring his invention to the present practical shape and simplicity; and the originality of the system (for Section PAPE is but a part of a complete telegraphable system of short-hand) briefly stated, consists in reducing the present Morse alphabet to only ten short characters or sounds, which are so manipulated by a key as to express anything and everything by them in such a way as to give the public greater privileges while at the same time immensely reducing the work of the telegraph operator, even assuming that no alteration is made in the instruments of today. A set of automatic instruments is now being perfected, it is claimed, which will render pantelegraphic messages so cheap that most of the important communications that have to be sent by mail now, on account of the almost prohibitive rates under present conditions, may be telegraphed in future.

An electric tramway is to connect the Naples traction system with the small incline which is located on the slope of Vesuvius. This will be of great convenience to tourists, as at present they are obliged to climb part way up the mountain in carriages or on horseback. The small incline was installed some time ago by Cook & Co. and passes from a point half way up the mountain to the summit. The new traction line is to start from the outskirts of the city and ascend by an easy grade to the Observatory, then reaching the lower station of the incline. The line will have a total length of 4½ miles. Over a length of some miles on the mountain slope, where the grade reaches 25 per cent, the rack-and-pinion system will be used to secure adherence. The rest of the route has grades of only 8 per cent. The generating station will be placed at the foot of the rack-and-pinion section. It will contain two gas engines of 90 horse power each, which will drive two direct-current dynamos working at a voltage of 550 to 770. A storage battery will be provided as an accessory to the dynamos. The cars are to hold twenty-four passengers seated and six standing. A locomotive of special construction will draw the trains. The latter will start eventually at 17-minute intervals, but at first a 35-minute interval will be used. The electric installation, including the central station rolling stock and line, will be carried out by Brown, Boveri & Co., the well-known Swiss firm. The gas engines and mechanical part of the locomotives will be constructed by the Winterthur Locomotive Works. Another new traction system is that which will soon be constructed for the city of Leghorn, it having decided to adopt the electric system in the city and also on the interurban line to Montenero. The power station is to have three steam engines, each of which drives a direct-current dynamo of 400 amperes and 600 volts. The trolley system will be used throughout, with motor cars of 25 horse power for the city lines. On the interurban line where the grades are heavy, the motor cars are more powerful and will contain two 30-horse power Schuckert motors; in this case the trolley line is double. The central station is capable of supplying 500 horse power.

Gasket and Insulation Troubles in Gas Engines.

BY A. E. POTTER.

Many manufacturers of gas and gasoline engines experience considerable difficulty from gaskets and insulation blowing out. I have seen cases where it seemed absolutely impossible to make and keep joints tight, and in every case of this kind I have found serious unevenness of surface, which had to be remedied by scraping to a surface plate, or planing off the top end of the cylinder and refacing the cylinder head.

In casting about for the reasons existing for such marked unevenness, I have decided that there are usually two primary causes. The first and principal one is that the traveling facing tool, when cutting in line with the parting of the spindle bearings of the lathe, gives way slightly from a little side play, and leaves two high ridges at diametrically opposite points. The further from the center the cut is made, the more spring there is to the tool, which accounts for the tendency to a "dishing" finish. The other cause is the distorting of the cylinder by the clamps that hold it rigid to the lathe carriage, when it is being bored and faced. The open or head end would be squeezed out of shape more easily than the lower, or crank case end, and as soon as the pressure of the clamps was relieved, it would return to its original shape. If, however, the cylinder head, not water-jacketed, were to be perfectly flat and planed off, instead of faced on a lathe, it might be possible to draw the two surfaces sufficiently close together to hold the gasket. But where a one-quarter inch to one-half inch shoulder is left projecting down below the edge of the top of the cylinder, into the latter, it prevents the head springing to conform to the inequalities of the cylinder top, and if the head has been finished on the same lathe as the cylinder, there are liable to be two ridges on it also, whereby the difficulty is doubled. I think it would pay in the end to plane off both surfaces when this is possible; and if two thicknesses of one-sixty-fourth inch asbestos paper soaked in boiled linseed oil, dusted with fine graphite, are used for a gasket, followed down when the engine gets heated up, with care, it will be found that one gasket will allow the head to be removed many times without the necessity of cutting a new one every time. I prefer to use the one-sixty-fourth inch rather than one-thirty-second inch thick, for there is less liability of the thinner paper running uneven in thickness.

A serious defect in igniter insulation and construction can also be remedied very easily and cheaply. Drill a one-half inch hole through a brass plug made one-half inch longer than usual, with a hexagonal lock nut to fit it. Through this pass a seven-sixteenths inch stud with a lock nut and washer at each end, with room at the top for a binding nut. Between the washer and ends of the plug put mica washers, and around the stud wrap flexible mica, or tubing made of the same material, and screw lock nuts up tightly. In adjusting the firing pin, loosen the lock nut outside, and screw the brass plug itself, instead of loosening the firing pin. It will be found that mica insulation secured by this means will never blow out, and will last and give good results indefinitely, and tightening up the wire connections on top of the firing pin will not disturb the insulation. The hotter the brass bushing or plug gets, owing to greater expansion than the pin, the tighter it will be.

Magnetic Rotation in a Variable Electromagnetic Field.

Another case of magnetic rotation in a variable electromagnetic field has lately been recorded by N. Orlow before the Russian Physico-Chemical Society. In investigating the mechanical effects of a variable magnetic field, the author happened to observe that a small iron cylinder, placed horizontally within a copper solenoid, would start rotating about its axis when the solenoid was placed beside the pole-pieces of the core of an electromagnet traversed by an alternating current. The same phenomenon was observed when the solenoid was replaced by a horizontal tube of any material. A possible explanation is suggested by the fact that the iron cylinder will tend toward the points of the field, where the force is highest, and some similar cases are recorded.

Trials of the Lebaudy and Santos-Dumont Airships.

The dirigible balloon of the Lebaudy brothers started from Moissons on May 8, in cloudy weather and with a northerly wind, for Mantes. There the airship made several circles around the tower of St. Maclou and the church of Notre Dame, and then returned to Moissons against the wind. M. Juchmes, who piloted the balloon, and M. Rey, the machinist, say they covered the distance of 37 kilometers in one hour and thirty-six minutes. The highest altitude reached by the airship was 300 meters.

M. Santos-Dumont made his first trial of the steerable balloon "Santos-Dumont No. 9" on May 7. He declared himself as being perfectly satisfied with the test.