ENGINEERING.

According to statistics furnished by the United States Forest Service, the art of wood preservation in this country during the year 1908 called for the use of 56,000,000 gallons of creosote, 19,000,000 pounds of zinc chloride, with small quantities of corrosive sublimate, crude oil, and other chemicals. Of the creosote, nearly seven-tenths was imported, most of it from England and Germany.

The longest pipe line in the world is that which extends from the Oklahoma oil wells to New York harbor. At the present time the oil field of Oklahoma is the most active in the United States. It is not likely that the line will be put to immediate use for conveying oil over the whole distance. The completion of the system is regarded rather as a provision for emergency, and to meet the future conditions, when the Pennsylvania and West Virginia fields shall have been depleted.

The final dimensions of the great drydock which the United States navy is building at Pearl Harbor, in the Hawaiian Islands, show that the government is wisely building for the future. The dock will be 1,152 feet long from the coping to the outer sill, 140 feet wide at the top, and will have 35 feet of water over the entrance sill at mean high-water level. There will be a sill at the middle of the dock, for an intermediate caisson which will divide it into two docks, 575 feet and 532 feet long respectively.

On July 6th the United States Reclamation Service announced that the headings had met in the great Gunnison tunnel, which the government is building in western Colorado to carry the water of the Gunnison River into the Uncompahgre Valley, where it will be used for irrigation. The tunnel, which will be cement-lined throughout and will have a finished cross section of 10½ by 11½ feet, will be the largest underground waterway in the world. It is six miles in length, and will carry thirteen hundred cubic feet of water per second. Its cost will be over $2,500,000.

On July 19th the twin tunnels extending beneath the Hudson River from the Pennsylvania Terminal Station in Jersey City to the Hudson Terminal Building in Manhattan, at Cortlandt Street, will be opened for operation. Trains will run from a five-track station, eighty feet below the Pennsylvania Terminal, to a five-track loop station beneath the Terminal Building. As soon as sufficient cars can be obtained from the builders, the twin tunnel, running parallel with the Hudson shore line on the Jersey side, and extending from the Pennsylvania to the Lackawanna terminals, will be also placed in operation.

From every point of view the round-the-world cruise of the battleship fleet was a pronounced success, and the crowning indorsement of all has been the recent announcement of the Assistant Secretary of the Navy that the repairs to thirteen of the sixteen battleships that made the voyage have been completed at a total cost to the Engineering and the Equipment bureaus of $50,280, or less than $4,000 per ship. Many were the predictions of trouble, damage, and even disaster, at the time of the starting of the fleet; but not one has been fulfilled. On the contrary, the benefit to the navy in the increase of its physical efficiency and the improvement of its *morale* has been invaluable.

A test was recently made in England of a steam engine designed to work at pressures of as high as one thousand pounds per square inch. According to our contemporary, Engineering, the tests showed a steam economy of 13.5 pounds per brake horse-power per hour. The engine is of the inverted-V type, with eight cylinders, the high-pressure two inches, low-pressure five inches in diameter, each pair being arranged in tandem on two cranks. The stroke is four inches; the speed, eight hundred revolutions per minute. Forced lubrication is used, the oil being pumped into the steam on its way to the cylinders. In the test the steam pressure was five hundred pounds, temperature 720 degrees, the revolutions seven hundred per minute, and the brake horse-power developed 32.65.

With a view to enabling marine turbine engine propellers to work at higher efficiency, Mr. Yasuzo Wadagaki, in a paper before the Northeast Coast Institution of Engineers and Shipbuilders, proposes to use a metallic casing surrounding the screw propeller, the forward and aft ends of which are flared into bell-mouth shape, with a cross-sectional area gradually contracting from the two ends toward the screw propeller. By this arrangement the forward velocity of the water, which is imparted by the frictional pull of the ship's side, is accelerated, until at the most contracted part of the channel, where the water is acted upon by the screw propeller, the velocity rises to a maximum, the propeller operating "in water having a relative velocity much higher than the forward speed of the vessel." By this device Mr. Wadagaki believes the slip will be reduced and the screw propeller efficiency proportionately increased.

ELECTRICITY.

In a recent lecture before the Royal Institute, London, Prof. W. E. Dalby showed that for long distance traction at speeds under 55 miles per hour steam is much more economical than electric drive. Electricity possesses an advantage for high speed travel because the power is limited only by the number of axles to which motors may be applied.

The largest electrically-controlled switch tower in the world has just been put into service at Providence, R. I., on the New York, New Haven & Hartford Railroad. The tower is equipped with 77 switch levers, providing 266 combinations. Elaborate precautions are furnished to prevent the giving of a wrong signal. The power used is taken from the feed wires of the railway, but as a precaution two other sources of power are provided, which may be drawn upon in case of emergency.

The old-style gasoline lights which have been used in Central Park are to be displaced with 1,400 or more than twice as many electric lamps. A very artistic lamp post has been designed for the new lamps. One of the objections to the gasoline lamps was the fact that the leakage of the oil ruined the grass around these lamp posts. Furthermore, the lamplighters did much damage by making short cuts through the flower beds along their routes from one lamp to another.

From time to time we hear of some enterprising amateur driving an electric generator by means of a windmill, and thus obtaining electricity without cost except that of the installation, and with it lighting his house and operating various household machinery. Recently a German company has gotten up a special electric generator equipment adapted to be operated by wind power. The installation comprises a dynamo and a storage battery, the latter serving to store the excess power until such time as it is required. The apparatus is entirely automatic, and requires absolutely no attention except in time of storm, when it is necessary to reduce the sail area of the wind wheel. A special regulator used with this apparatus automatically keeps a constant pressure on the lighting circuit, this being entirely independent of the number of revolutions of the dynamo or the condition of the storage battery.

One of the large new steamers of the Orient Steam Navigation Company plying between England and Australia has been provided with a model electric equipment, even including an electric laundry. The wash is first boiled in a tank, where the water is kept at boiling point by means of steam pipes; thence it is carried to a pair of washing machines driven by an electric motor. The clothing is dried by means of a hydro-extractor driven at 640 revolutions per minute by a 2-horse-power motor. There is a Decoudon machine driven by an electric motor, which is provided with a safety device to prevent the operator's fingers from being caught under the rollers. If the fingers come too near the roller, the motor which drives the machine is automatically stopped. The laundry is equipped with an electrically-driven ironing machine and with several electric irons.

Many hospitals in England are provided with a special apparatus for extracting iron and steel fragments from the eye by means of powerful electro magnets. The magnet employed has a core three feet long and six inches in diameter of the best Swedish soft iron. Two hundred pounds of insulated wire are wound in two coils about the core. The end of the magnet is threaded to receive terminals of different shapes to suit various conditions. The magnet is mounted on ball bearings, and can be moved in any direction. The strength of the magnetic field may be varied at will by means of a rheostat. When used at its maximum power, the magnet exerts a pull of 30 pounds per square inch at a distance of an inch. A special type of apparatus is provided for reclining patients. In this case the magnet is mounted on trunnions, and is tilted by means of suitable gearing operated by a hand crank.

A new form of electrical vacuum meter has recently been devised. It possesses a distinct advantage over other electric vacuum meters in the fact that it requires no instrument for measuring the current resistance or intensity. The device consists of a glass tube which communicates with the vessel in which the vacuum is formed. A wire passes through this tube, and forms part of a circuit through which a current of constant pressure is fed. At the center of the tube a small weight is attached to the wire. The current passing through the wire heats it to a certain degree, dependent upon the intensity of the current, and also upon the amount of heat carried off by the gas surrounding the wire. As the gas is rarefied it dissipates less and less of the heat, causing the temperature of the wire to rise. The increased temperature expands the wire, making it sag. The glass tube is graduated so that the extent of the sag may be observed, and thus the degree of rarefaction is determined.

SCIENCE.

A new parasite which attacks the vine at the root was discussed at the Académie des Sciences by M. Guignard, chief of the College of Pharmacy. It is designated "clandestine," as it is quite invisible in general, so that it is all the more dangerous. The parasite is believed to be a fungus of the phanerogam family. Experiments upon it are being continued at the biological laboratory of Nantes.

The New York Aquarium has acquired an octopus after considerable expense and difficulty. The specimen was captured in Bermuda waters, and conveyed to this city in a large tugboat, which was specially chartered for the purpose. During the forty-eight-hour trip from Bermuda to New York, seamen were kept busy pumping water into the tank which contained the octopus.

The Smithsonian Institution of Washington will erect on the very summit of Mount Whitney, Cal. (altitude 14,500 feet) an observatory which will enable investigators to study atmospheric conditions at great elevations, in dry air, and in clear skies. The observatory will be erected from the Hodgkins fund, and will comprise a three-room structure of stone substantial enough to stand for centuries.

Dr. Osler has stated that the question of preserving the teeth is more important than the liquor question. No doubt much dyspepsia is due to decayed and defective teeth, which preclude complete mastication of the food (even if anybody in America had the time to eat properly). Dentists, like doctors, are now beginning to realize that their true mission is not "a general rebuilding system," but a systematic and well-considered effort to prevent and overcome the decay and loosening of human teeth.

A French microscopist has devised a method of detecting and recognizing traces of blood on knife blades and other opaque objects even when the stains cannot be seen with the naked eye. The light of a Welsbach burner is concentrated upon the part of the object under examination through a tube which is placed obliquely above the object glass and which carries an iris diaphragm, a condensing lens and a total reflection prism. A photographic camera may be substituted for the eyepiece.

The freedom from corrosion and other properties of tantalum suggested the employment of this metal as a material for pens, but tantalum pens have failed to pass the test for durability which is applied (in France) to steel pens. This test consists in loading the pen with a weight of 180 grammes (6 1/3 ounces) and moving a band of paper beneath and in contact with a pen, at the ordinary speed of writing, until 10 kilometers (6¼ miles) of paper have passed. The loss in weight of the pen should not exceed 0.7 milligramme (0.0108 grain). The tantalum pens were found to lose more than twice this amount, but the loss has been reduced to 0.8 milligramme (0.0123 grain) by slightly oxidizing the tantalum.

A recent issue of the Gazette Astronomique of Antwerp announces that the great telescope of the Paris exposition of 1900, with two objectives, visual and photographic, 47¼ inches aperture, a coelostat mirror 6½ feet in diameter and various accessories, the whole costing more than $150,000 to construct, is offered for sale by the receiver of the exposition. On this announcement, Cosmos, which had vainly endeavored to find out what had become of the monster telescope, makes two comments; first, that the receiver has not been unduly precipitous in converting the assets into cash, and secondly, that here is an exceptional opportunity to procure an extraordinary instrument, probably for less than one-tenth of its cost, as there will be few purchasers for a telescope which requires for its housing a building more than 130 feet long.

A bulletin recently issued by the United States Department of Agriculture sets forth the results of a long series of experiments carried on by Dr. Benedict and Mr. Carpenter with the remarkable respiration calorimeter at Wesleyan University, which in the hands of Atwater and Benedict has added so much to our knowledge of metabolism. As a result of these investigations, it seems that the human body is a machine of such wonderful efficiency that one-fifth of the energy expended by it can be utilized as work, and that this efficiency is more or less the same in men of all types. The longest and most thorough training does not change this ratio. The professional athlete, if he is able to outstrip the novice, does so, not because he has better muscles, but because he is able to put more energy in the shape of tissue change into action. Training, besides preparing the heart to stand great strain, acts to increase the subject's power of using up his tissse, and by giving him more muscle tissue to use rather than by teaching him to conserve his energies. In other words, the professional has a more powerful engine because he is able to use more fuel, and not because he wastes less steam, if we may employ a mechanical simile.