ENGINEERING.

On the last day of 1908 Wilbur Wright made a continuous flight at Auvours of 76.5 miles in 2 hours 9 minutes 33 seconds, at a speed of 35.5 miles per hour. By this flight, which was made over a closed circuit, he broke all previous records, and thus won the Michelin prize of $4,000 cash and a $2,500 trophy.

In the suit of the government against the anthracite coal-carrying railroads, Prof. Ritter, a mining expert and geologist, in testifying for the government, estimated that the supply of coal underground in the Pennsylvania fields was 2,230,000,000 tons. He gave it as his opinion that this supply, great as it was, would be exhausted in about eighty-four years' time.

Plans which have been received at Portsmouth, England, for the construction of the eighth "Dreadnought" of the British navy, to be known as the "Neptune," show that she will be 3,000 tons larger than the type ship. She is credited with a battery of ten 12-inch guns, and a numerous anti-torpedo armament of 4.7-inch guns. The "Neptune" will be 510 feet long, 86 feet wide, and of 20,250 tons displacement.

The Great Western Railway, England, is famous for its express trains. During the season of American travel, there are three expresses which run daily from London to Exeter, a distance of 173 2/3 miles, without a stop, in three hours, at an average speed of just under 58 miles an hour. A fourth express makes the same run at an average speed of 56 1/3 miles an hour. It is not unusual for the total load back of the tender and expresses to reach 400 tons.

Of interest to transatlantic travelers is the announcement that the construction of a large harbor and docks near Plymouth is to be commenced as soon as government permission is obtained. The site selected is near the entrance to Plymouth Sound. An area of 1,000 acres, having a depth of from 48 to 35 feet at low water, is to be inclosed by breakwaters, and drydocks and piers will be built for the accommodation of eight or ten liners of the largest size. The scheme includes the construction of two drydocks, 1,000 and 1,100 feet in length.

The United States revenue cutter service has recently added to its fleet the new life-saving tug "Snohomish," which has been built for service in the rough seas of the Pacific coast in the vicinity of Neah Bay. She is equipped with the Miller marine breeches buoy for life saving, and her sphere of operations will be confined to such stretches of the coast line as are not provided with any life service stations on shore. She will approach ships which are stranded in positions which are beyond the reach of the shot line, or in seas so heavy that no lifeboat could live.

The urgent need for naval colliers is shown by Rear Admiral W. S. Cowles in his annual report as Chief of the Bureau of Equipment. He says: "When it was decided to send the battleship fleet on its present cruise around the world, the question of supplying it with coal was a serious problem. The few colliers possessed by the navy were utterly inadequate, and the Bureau was unable to obtain American ships at any reasonable price. . . . Had foreign complications arisen, or had a combination been effected between foreign shipowners, our fleet might have had to remain helpless in some foreign port."

A launching device for ships' boats, which showed the requisite qualities of speed and safety of operation, was recently tested in this city. Although it was built from the design of a medical man, Dr. Charles Hunt, the device meets the special requirements of this difficult problem in a thoroughly "shipshape" manner. The gear, briefly described, consists of a hand wheel and drum, geared to a longitudinal shaft beneath the boat, at the ends of which is gearing, which serves to turn the davits and swing the boat outward. One man, by operating the hand wheel, releases the boat from the chocks, turns the davits, and lowers the boat on an even keel, the three operations being performed in sequence. When the boat reaches the water, it is released from the blocks and tackle by pulling a cord attached to a special releasing device.

An early instance of the use of the Walschaert valve gear in this country is recorded in the obituary of Mr. Alexander Mitchell, as contained in one of our contemporaries, devoted to the interests of the locomotive. In the year 1864 the Lehigh Valley, in taking over the plant of a smaller road which it had absorbed, secured two locomotives, built by the Niles Locomotive Works, of Cincinnati, which were equipped with the Walschaert valve gear; and Mitchell seems to have been the only employee of the road who understood the mechanism. It is well known that the Walschaert gear is of long standing, having been extensively used for many years in Europe. Its recent adoption in this country is due chiefly to the great increase in the power of our locomotives, and the unwieldy size to which the eccentrics and gear of the old Stephenson link motion has grown.

ELECTRICITY.

When a telephone line is electrostatically charged, the telephone acts as a condenser. The winding serves as one plate of the condenser, the frame of the receiver as the dielectric, and the person who is holding the receiver to his ear as the other plate of the condenser. In order to prevent this condenser from discharging through the person, a German inventor provides a grounded metallic cover for the receiver, the capacity of which is somewhat greater than that of the body.

As it has been aptly put by W. R. Cooper before the British Institute of Electrical Engineers, cooking in the ordinary kitchen range might almost be said to be "a by-product of wasted heat." It seems odd that the coal so wastefully used in the kitchen range cannot be converted into electricity in the power station, and be transmitted to an electrical stove in the kitchen with a saving of cost to the householder. The only thing that can be said in favor of the coal range seems to be that it provides a constant supply of hot water.

A large power station is being built in Japan to furnish current for Tokyo, Yokohama, and adjacent cities and towns. The capacity of this station will be 60,000 horse-power. The power will be derived from a 600-foot head of water on the Oi River. Six generators directly coupled to vertical waterwheels will be installed. The generators will be of the three-phase, 25-cycle type. The waterwheels will develop 13,500 horse-power. The 6,600-volt transmission line will be carried on steel towers 50 feet high and spaced 450 feet apart, over a distance of 105 miles.

Bare aluminium wire may safely be used in coils without any insulation except between successive layers, owing to the existence of a film of oxide on the surface of the aluminium. The film in its natural state will resist 0.5 volt; but by exposing it to the air at a temperature about 100 deg. C. it is possible to get rid of the hydrates contained in the film, and thus increase its resistance so that it will withstand a high voltage. The insulation between the layers of the coil should be non-hydroscopic, and the coils should be covered with insulating paint to prevent moisture from entering.

The effect of electric current on concrete has recently been studied by U. James Nicholas. The conclusions at which he arrived, as recently published in the Engineering News, are as follows: 1. That electrolytic corrosion of structural and reinforcing steel, imbedded in concrete, takes place at the anode. 2. That even neat cement is no protection against this corrosion. 3. That the cathode is not affected by oxidation. 4. That cement and concrete in brine will crack when carrying an electric current to or from imbedded steel and cannot, therefore, under these conditions, be regarded as an insulator in any sense. 5. That the concrete undergoes electrolytic, and not metallic conduction. 6. That as small a current as 0.1 ampere continuously flowing will accomplish the results indicated above. 7. That the resistance of concrete is an inverse function of the percentage of sand.

The use of windmills to develop electric power is receiving considerable attention abroad. Prof. La Cour, working under the auspices of the Danish government, is the pioneer in this work. He finds that the best windmill for the purpose is one which has four wings, arranged at right angles to each other, and with adjustable sheets having an inclination of from 10 to 35 degrees. A storage battery is used in connection with the dynamo driven by the windmill, and between the battery and the dynamo is an automatic device, which prevents discharge of a battery through the dynamo when the speed of the windmill falls. W. O. Horsnail, in England, uses a dynamo provided with a few turns of series windings in a direction opposite to that of the shunt winding, so as to retard the rise of potential under sudden spurts of speed due to puffs of wind.

A danger to which many hydro-electric plants are subject is described in the current issue of the General Electric Review. A power house in Gaffney, S. C., was flooded with water, which completely submerged two 125-kilowatt exciters, and largely covered the generators and transformers. As soon as the water subsided, the bearings of the generators were cleaned and the machines were started. After the water had been fanned from the coils the armatures of the generators were short-circuited, and the fields were excited with low voltage from the exciters, so as to raise the temperature of the coils and thoroughly dry them. With the exciters some difficulty was experienced, and it was found necessary to disconnect the shunt winding and short-circuit the armature through the compound winding. By regulating the speed of the machine, the temperature of the field coils was controlled. The transformer coils were dried by short-circuiting the secondaries, and permitting a sufficient current to flow through the primaries to give the proper temperature.

SCIENCE.

News comes from Pasadena that the great 100-inch glass for the Mount Wilson Solar Observatory is defective. After the first grinding began, a large flaw was found, so that a new casting will have to be made. This will delay for many months the construction of the great eight-foot reflecting mirror on the peak. The casting of the great glass disk was done in Goblain, France, and the cost was $50,000.

By a German patented process, starch is made insoluble in hot water by treating it, in the cold, with formaldehyde and a moderately strong acid. The product is distinguished from that obtained from starch and formaldehyde at a high temperature by the fact that the starch grains remain unaltered and quite permanent. It is not only insoluble in boiling water, but it is not attacked by soda lye or other strong alkalies. It may be employed as a filler in plastic compositions, as a dressing for fabrics and in the manufacture of paper.

By Neufeld's process (patented in Germany) solid and compact objects are built up of successive thin layers of chrome-gelatine, each layer being exposed to light before the next layer is applied. Each layer is coated with a reflecting substance and the next layer is then attached to it with the aid of chrome-gelatine solution. In this way the entire mass is thoroughly exposed to the action of light, so that it is uniformly strong and elastic throughout. When a large mass of chrome-gelatine is cast in one piece the light cannot penetrate sufficiently to harden the mass uniformly.

The ancient Tyrian purple was obtained from mollusks of the genera Murex and Purpura. The art of dyeing with this color was completely lost in the Middle Ages and the subject was not investigated until the eighteenth century. It has been proved that the color is produced by the action of light on a colorless secretion of special glands possessed by the mollusks. It is probable that the action of the enzyme also contributes to the result. Chemical investigations have indicated the presence of indigo blue in the dye. Friedlander has made a new study of the famous dye and concludes that it is closely related to indigo but is not identical with either indigo blue or thio-indigo. Only qualitative tests could be made, because only a small quantity of the color could be obtained—2 1/3 grains from 750 mollusks!

The name Neanderthaloid has been used to denote an extremely ancient race of men, of which remains were first found in 1856 in the Neander valley (Germany). Since then an entire skeleton of an adult woman of the same type was found in Dordogne (France) in 1905, and only a few months ago, near the same place, Mr. O. Hauser unearthed the skeleton of a youth showing the typical characters of the race—strongly developed supraorbital ridges, powerful maxilla, large teeth, etc. The wisdom teeth were still in their alveoli. The lower jaw was prognathous to an extent almost calling to mind the muzzle of an animal. The canine teeth were not very highly developed, as in anthropoid apes. The bones of the limbs were entirely in accord with the type known to us in paleolithic man, the femur massive and stubby, the radius curved. Near the human remains were found those of *Bos primigenius:* The attitude in which the body was placed seemed to indicate that it had been placed there for burial. This is of special interest, as it has hitherto been somewhat generally held that primitive man did not bury the dead, and that this was an indication of his entire lack of all religion.

The excavations which were undertaken in the island of Delos by the French Archæological School of Athens under the direction of M. Homolle and pursued by M. Holleaux, uncovered a portion of alluvial ground. The alluvium had been deposited in the northern part of the island by the Inopos, an ancient torrent, now reduced to a rivulet. At the quaternary epoch and at the beginning of historic times the stream brought down sand which contains fragments of pottery coming from historic epochs. While the archæologists were making excavations here, Homolle sank some shafts on his own account and found a molar tooth of a fossil elephant. Prof. Boule, of the Paris Natural History Museum, considers that it is a tooth of the *Elephas antiquus.* The discovery of a tooth of this species is for the present the only point which we possess as to the last phases of the history of the Ægean continent. The smallness of the island, which measures at most 3 miles in length and often less than 0.16 mile in width, proves that a mammal of the size of the *Elephas antiquus* could not live upon such a limited space. Consequently, the island of Delos, that is, the central part of the Cyclades, must have been still connected with the continent at that epoch. The separation of the Ægean continent into islands thus appears as a relatively recent event in the history of the eastern Mediterranean region, a deduction borne out by the observation of the volcanic phenomena of the region.