

ENGINEERING.

Every day in New York city about twice as many passengers travel vertically by elevator as travel horizontally by elevated, subway, and trolley car. Figures given in a paper recently read before the Electrical Engineering Society of Columbia University show that the 8,000 passenger elevators in the Borough of Manhattan carry approximately 6,500,000 per day; whereas the last report of the Public Service Commission states that the number carried daily by the surface, elevated, and subway cars in the entire city of New York is 3,500,000.

Health conditions at Panama continue to show steady improvement. The death rate among employees during the month of February, 1909, was 10.98 per thousand, as compared with 12.72 for the same month in 1908, 25.62 in 1907, and 43.00 per thousand in 1906. The death rate per thousand for the whole population of the canal zone was 40.20 in 1905; 38.09 in 1906; 36.07 in 1907; 21.40 in 1908; and 18.59 in 1909. These are the smallest death rates, both among employees and among the whole population, in February since the United States took possession of the work.

The United States army will make tests this summer of a new 3-inch shell of novel design, which combines in itself the qualities of a solid shot and a shrapnel. In tests which have been already made excellent results were obtained, masonry being thrown to the ground and targets representing artillery completely destroyed. The solid steel head of the shell contains a charge of high explosive, which is detonated on impact. Back of this is the shrapnel chamber, containing 120 bullets and a charge of high explosive. The shrapnel portion can be timed to explode above a body of troops, leaving the solid head of the shell to pass on and strike an independent blow.

It has been definitely decided to install on the new battleships of 26,000 tons batteries of twelve 12-inch guns, instead of ten 14-inch guns. The latter was an alternative proposal that came before the Navy General Board, which has decided that there would be no material gain in the adoption of the 14-inch gun for the main batteries. The army ordnance officers, however, are building five sea-coast rifles of 14-inch caliber, but of the low velocity of 2,150 feet per second. One of these is of the wire-wound type, and the other four are of jacketed construction. Preparations are now being made for the manufacture of four additional wire-wound 14-inch rifles. The destination of these guns will be the new coast defenses of the Philippines.

The latest available figures regarding the two huge ships projected or building for the White Star Company indicate that they will not be quite so large as was commonly supposed, although they will yet be considerably larger than the "Mauretania" and "Lusitania." They will measure 860 feet between perpendiculars and 890 feet over all. The beam will be 92 feet, and they will have a molded depth of 64 feet, which is four feet more than the depth of the "Mauretania." The motive power will consist of two reciprocating engines of 15,000 horse-power driving the wing propellers, and a 10,000-horse-power turbine driving the central propeller. This combination will be sufficient to drive the ships at a sea speed of 19.5 knots.

Before the electrical equipment of the Sinclair tunnel was accepted by the railway company, a thorough test of the electrical apparatus under operating conditions was made, during a period of several months, by the contractors. It was found that the electric locomotives were capable of hauling 1,000-ton trains, as against 700-ton trains hauled by the steam locomotives. The 27.3-car trains, which was the average size of the trains hauled by the electric motors, required ten minutes to pass through the electric zone. The average size of the steam trains was 19.7 cars, and it took the steam locomotives fifteen minutes to haul them over the same distance. The steam locomotives burned per month, \$5,000 worth of coal, costing \$6 per ton; the electric service, burning soft coal costing \$2 per ton, required only \$1,150 for fuel for the same period.

In the construction of the new Catskill aqueduct it has been planned to cross the water courses and rivers which intercept the route of the aqueduct by siphons rather than by bridges, or pipe lines laid in the bed of the rivers. One of these siphons will be carried beneath the Hudson River at Storm King, and the present indications are that it will have to lie at least 700 or 800 feet below the surface of the river. Another important siphon, not so deep, but of much greater length, will be constructed below Rondout Creek. Because of the disturbed condition of the strata underlying the Rondout Valley, the siphon will have to be carried down to depths of between 400 and 500 feet before a sufficiently solid rock is found for the construction of the tunnel. The total length of the siphon between the end shafts will be approximately four and a half miles, and it will have a diameter throughout of 14½ feet.

ELECTRICITY.

While 60,000 volts was considered a maximum tension for transmission lines a few years ago, we are now using 72,000. An 80,000-volt line 13½ miles long is now building, and a line has been built designed for 100,000 volts.

With a view to supplanting the horse cars of crosstown lines in New York, the receiver of the Third Avenue Railroad is experimenting with two cars, one an electric storage battery car using the new Edison storage battery, and the other a gasoline-electric car in which a gasoline engine is employed to operate a dynamo that furnishes current to motors on the car axles.

A novel type of trolley car has been built for the South Manchurian Railroad. The car is divided into first and second class compartments by a vestibule and steps at the center of the car. As these steps must not project outside the car body, they cut into the side sills and necessitate a special construction of framework. The first-class compartment is fitted with upholstered seats, while slat seats are provided in the second-class compartment.

A simple method of improving the efficiency of a moving coil galvanometer has recently been discovered. It consists in the use of a piece of soft iron wire which is attached to the coil outside the strongest part of the magnetic field and at right angles to the lines of the field. In the experiments tried by the inventor the wire was about 6 centimeters (2.36 inches) long and 0.33 millimeter (0.013 inch) in diameter. Another method is to fasten a magnetized steel wire parallel with the field, but with its poles reversed. In this way it is possible to increase the sensitiveness of an instrument many fold.

A new type prepayment car is being tested by the Pittsburg Railway Company. The car is adapted to single-end operation, the passengers entering at one end of the car and leaving at the center except in case of a crowd, when the door at the forward end of the car may be thrown open to provide an additional exit. The conductor is stationed near the center of the car at the head of an aisle, formed by a partition running to the entrance platform. This virtually divides the car into two compartments. Passengers entering the car must pass up the aisle and after paying their fare may enter the main body of the car, or the compartment formed by the partition.

It would be quite an advantage to the automobilist if he could communicate by wireless telephone with his garage or the nearest automobile station in case of accident. A. Frederick Collins, who is developing a system of wireless telephony, recently made experiments with portable apparatus to determine the range of service of the instrument. He was able to communicate over a short distance with a garage in Newark, but at a distance of 8 miles the apparatus failed. Apparently wireless telephony will have to be developed far beyond its present efficiency before it can be of service to the automobilist. The chief difficulty is that only a short transmitting antenna can be used requiring an enormous expenditure of energy to reach a city garage because of obstacles in the way such as steel buildings, trees, wires, etc.

An interesting electric railroad is being operated between Stockton and Lodi, Cal., in which direct current is used at 1,200 volts. The present length of the road is 15 miles, but it is planned to build several extensions. For two miles out of Stockton the current is collected from a trolley wire at 550 volts, and beyond this point the higher tension is collected from a third rail. The dynamotors used on the cars are provided with a commutator at one end of the armature, for receiving the high-tension current, and the other for delivering current at 600 volts for operating the auxiliary apparatus. When the car passes from the 1,200-volt rail to the trolley circuit, the dynamotor ceases to operate automatically and the auxiliary apparatus receives its current direct from the trolley when the motorman closes the circuit of the 550-volt contactor. When passing from the 550-volt section to the 1,200-volt section, the 550-volt contactor drops out automatically.

With the purpose of studying enormously high voltages a short experimental transmission line has been built in Sweden which is adapted to operate at 500,000 volts. A special form of transformer is used to furnish this high electro-motive force. Circulating oil is used for insulation between the high and low tension windings. The line is supported on the suspended type of insulators which are hung at a distance of 11 feet apart. Tests of the surface discharge showed that a wire of 10 square millimeters (0.0155 square inch) cross section would discharge at 35,000 volts, of 20 square millimeters at 50,000 volts, of 100 square millimeters at 200,000 volts, and of 250 square millimeters at 390,000 volts. As the tension was raised to 480,000 volts, the noise grew very loud and sparks leaped from the insulators. At night the glow of the discharge could be seen two and a half miles away.

SCIENCE.

Lassa, the mysterious capital city of Tibet, which so long remained closed to European influence, appears to be in the way of civilization. A Calcutta newspaper states that a commission from that city has received from a large convent in Lassa an order for numerous objects of European manufacture, including one hundred brass musical instruments. Apparently occidental culture will make its entrance with a brass band.

P. A. MacMahon proposes the determination of the diameter of a star by measuring the time taken for its occultation by the dark limb of the moon. With a star of parallax 0.10 sec., and of same actual diameter as the sun, this occultation time would be about 1/500 sec. From other photographs Dyson has found that a star of magnitude 1.0 might possibly be photographed in about 1/780 sec. If this can be secured by means of a rapidly-moving film the problem might be solved.

One of the most surprising results of the cross motion of the fixed stars, as projected on the background of the sky, is the gradual falling to pieces of the familiar constellations. The stars are moving in all sorts of directions, some faster and some slower, and the inevitable consequence must be that in a few centuries the whole face of the heavens will be so changed that if we could come back again to our earthly life we should not recognize them. Of course, a very long period of time will be required to produce a very great transformation.

A German patent has been granted for a process of making fertilizers by the combination of lime with materials containing silica and alumina. Either natural materials (clay, loam, marl, etc.) or artificial materials (household refuse, rubbish, soft coal ashes, etc.), kiln-dried if necessary, are mixed with slaked or unslaked lime and, in some cases, treated with superheated steam. Compounds of potash, phosphorus, and nitrogen are also added, according to the character of the other materials and the kind of fertilizer desired. The advantage claimed for the process is the cheap production of certain compound silicates which greatly increase the fertility of the soil.

Prof. W. H. Pickering, of Harvard University, has devised a scheme which he hopes will settle once and for all whether or not Mars is really inhabited. If \$10,000,000 were placed at his disposal, he would construct a system of mirrors arranged to present a single reflecting surface toward that planet. The mirrors would be so turned as to make a complete revolution every twenty-four hours. They would occupy an area of more than one-quarter mile, in order that sufficient light would reach the Martians. Even this huge reflecting surface would be invisible to the Martian observer unless he were equipped with a powerful telescope.

Flemming has recently made a number of ascensions, in a free balloon, for the purpose of studying the radio-activity of the upper strata of the atmosphere. As no earth connection was possible, the ordinary method of experiment was modified, the electric field being established between two wires, suspended from the balloon and connected with the poles of a dry battery of about 2,000 volts. The radio-active matter accumulated on the negative wire. The loss of charge was measured during the flight, immediately after the wires were hauled up. The difficulties of observation due to the oscillations of the balloon were minimized by a special suspension of the apparatus. Radio-active emanations were detected at all elevations attained by the balloon, which ascended more than 10,000 feet above the earth. The strongest radio-activity was found in the fourth ascension, which was made in a storm, but further observations will be required in order to determine the existence or non-existence of a causal connection between the atmospheric conditions and the degree of radio-activity.

Gilpin and Cram have published in the American Chemical Journal an account of their experiments in the separation of the constituents of petroleum by capillary action. This phenomenon was first discovered by Day, who observed that some separation occurred in the filtration of petroleum through fuller's earth. Subsequently, Engler showed that the separation was due to mechanical causes and that no oxidation of the oil took place. From a long series of experiments Gilpin and Cram deduce the following conclusions: When petroleum rises in a tube filled with fuller's earth a separation of its constituents takes place, so that the oil at the bottom of the tube is heavier than that at the top. The hydrocarbons of the paraffin series rise to the top of the tube, while the unsaturated hydrocarbons remain at the bottom. Only about two-thirds of the oil absorbed by fuller's earth is expelled by the application of water, and the portions successively expelled differ in constitution. Many clays possess a separating power similar to that of fuller's earth, but less intense. This power is not possessed by pulverized bricks made of the clay.