

## ENGINEERING.

The British navy is proverbial for the high speed of its ships. An analysis of this subject shows that there are 26 armored ships exceeding 23 knots in speed, in addition to 16 unarmored ships, chiefly scouts. The list includes 3 armored ships of 24 to 25 knots and 3 of 25 knots and over.

The Brazilian government is planning the construction of about 10 miles of new docks at Rio Janeiro, which, with the two miles already provided for, will give this South American port some 12 miles of new dockage accommodation. The tonnage of the port is rapidly growing, having risen from about one and a half million tons in 1903 to two million tons in 1905.

A recent report by the Board of Trade on the street traffic problem of the city of London estimates it has a population of 7,323,000, residing within an area of 692 square miles. The number of passengers carried in 1907 by local railways, tramways, and buses was 1,281,000,000, and the average number of trips during the same year was 177½ per head of population.

The American Society of Mechanical Engineers has established its first student section by affiliating the Engineering Society of the Stevens Institute of Technology. The latter student organization has an interesting programme of activities for the winter, of which a lecture on "Skyscraper Construction" and the problems it involves was given on December 3, by Mr. C. G. Armstrong, architect of the Singer Building.

An interesting shipment of machinery was recently made, when the Curtis turbines which are being built for the Japanese battleship "Aki" and armored cruiser "Ibuki" left the works of the Fore River Shipbuilding Company for the home dock yards in which the ships are being built. The "Aki" is a 19,750-ton ship carrying four 12-inch, twelve 10-inch, and twelve 6-inch guns, and the "Ibuki" is a 15,000-ton ship mounting four 12's, eight 8's, and fourteen 4.7's.

One of the busiest centers of intersecting street traffic is the crossing at Forty-second Street and Fifth Avenue, New York. To break up the congestion, it is planned to depress Forty-second Street for one-half its width, and carry Fifth Avenue across the street on a viaduct of ornamental construction. Surface cars and heavy vehicles will use the depressed portion of Forty-second Street, while lighter vehicles will use the non-depressed portion crossing Fifth Avenue at street grade.

The advantages of a high-pressure water-supply system as a protection against fire, and as acting to reduce fire risk rates, is being realized in the city of San Francisco, where a substantial cut in the present rates is about to be made by the Fire Insurance Exchange. This action on the part of local fire underwriters is looked upon as a recognition of the security afforded by the new high-pressure system in New York against such conflagrations as have devastated Chicago, Baltimore, and Boston.

The Paris-Orleans Railway has built an unusually powerful compound de Glehn express locomotive, which possesses special interest for Americans because of the fact that it is of the "Pacific" type, which originated in this country and is just at present in great demand for heavy express work. The two high-pressure cylinders are 15½ inches, the low-pressure 25 3/16 inches in diameter, and the common stroke 25½ inches. The heating surface is 2,569 square feet, and the total weight of the engine alone about 100 short tons.

We note that Dr. Schlick's apparatus for preventing ships from rolling at sea has lately given fresh proof of its ability. One of his gyroscopes has been fitted on board the mail steamer "Lochiel," and tried on the ship's regular route between Oban and Buessan. While the vessel was rolling 16½ deg. on each side, through a total angle of 33 deg., the gyroscope was started, and immediately decreased the total angle of roll to 3 deg. The apparatus is driven electrically, and requires but little attention.

The good work done by the Public Service Commission in improving Subway conditions is shown by the recent increase of the capacity of the express tracks by about 14 per cent. This was secured by a rearrangement of the block sections and signals at the stations in such a way that trains can be run closer together, following one another at intervals of 1¼ minutes as against the former interval of 2 minutes. This acceleration has enabled the company to increase the number of cars that pass a given station from 240 to 272 in an hour.

There has recently been completed at Great Falls, Mont., a huge brick chimney for carrying away the fumes of the smelting works, which will take rank as one of the tallest structures in the world. It is 78½ feet in outside diameter at the base, and 53 feet 9 inches at the top. It extends 506 feet above the ground and 528½ feet above its lowest foundation course. Its total weight is 24,964 tons. The brickwork is 18 inches in thickness at the top and 66 inches at the base. It is lined throughout with a 4-inch wall of acid-proof brick.

## ELECTRICITY.

The Bureau of Equipment will open bids on January 5 for the long-distance high-power wireless station which, as was recently announced, is to be located near Washington. The station must transmit messages over a radius of 3,000 miles and must also be equipped with a telephone system sending to a distance of 100 miles.

In some experiments with a kite to determine the electrical conditions of the upper atmosphere, it has been found that an abnormally strong current will flow down the wire during a high wind. The cause of this has not definitely been determined. Two reasons have been suggested; namely, that the action of the wind would tend to cause a greater electrification by friction, or that the greater volume of air passing over the kite would supply greater surface from which to collect the electricity of the atmosphere.

A method of making glass which will conduct electricity is described in a paper read before the Royal Society of Edinburgh by Charles S. Phillips. The glass consists of 32 parts sodium silicate, 5 parts borax, 0.8 part lead oxide, and 0.2 part sodium antimoniate. This glass is not acted upon by acids, and has a resistance of about 1,000 times less than that of ordinary glass. It is used for the windows of electrometers and electroscopes, and in the latter instrument fibers of the glass have been used in place of the gold leaves.

The proposed tax on electricity in Germany is still receiving a great deal of criticism. The tax is to be levied on filament lamps in proportion to their watt consumption, and it has been pointed out that carbon filament lamps will be taxed to nearly 60 per cent of their market price, while metal filament lamps will be taxed only 9 per cent of their market price. Arc lamps are to be taxed according to the weight of the carbons, which is manifestly unjust, for the quality of the carbons should be considered rather than their weight.

The French Academy of Science is somewhat puzzled over the question of the influence exerted by a high-tension line on hailstorms. In a recent paper presented before the Academy the instance was cited of a chain of mountains which apparently attracted hailstorms, owing to the location of numerous valleys that diverted the storms along the line of the chain. Recently, a three-phase 45,000-volt line was built in this vicinity, and since then hailstorms have crossed the valleys and followed the high-tension line. Very evidently the transmission line exerted an influence on the storms, but the exact nature of this influence is difficult to explain.

After building several experimental single-phase locomotives and thoroughly trying them out with various trolley constructions over an experimental five-mile track, equipped with various forms of trolley constructions, the Pennsylvania Railroad has decided to adopt a third rail direct-current system for its tunnels under New York city. Three-phase twenty-five cycle current will be supplied at 11,000 volts from Long Island City, and at various sub-stations it will be converted into 600 volts direct-current. Steel motor cars and trailers will be used for the suburban traffic, while electric locomotives will be used for through trains. The design of these locomotives has not as yet been definitely decided upon.

A train staff system similar to that used in England, has been adopted on the Fort Wayne Division of the Ohio Electric Railway. The cars incoming and outgoing are required to pass each other at a switch on the outskirts of Fort Wayne, but owing to the fact that the cars pass through different streets in the city, and are not always liable to come in sight of each other, it was found necessary to provide some system whereby the arrival of the car at the switch could be definitely determined. For this reason a wire hoop with train numbers on tags attached thereto is given to the motorman at New Haven, and this he deposits at the siding at Fort Wayne, so that the car returning from Fort Wayne will know that his car has entered the city.

The advantages of small electrically driven refrigerating plants were discussed before the Franklin Institute last month. One rather interesting installation described was set up in a florist's shop. A large display case embracing about 500 cubic feet, was refrigerated by means of from 500 to 700 pounds of ice per day, this large amount being required by reason of the fact that the case was frequently opened during the day. A small electrical refrigerating machine of one ton capacity has now been installed and this serves to freeze a solution of brine contained in four tanks. The brine solution is very weak and has a freezing point of about 26 deg. F. The tanks are frozen solid each morning, and the machine is not operated again until toward evening. The system has been found to work admirably even though the door is constantly opened and the temperature may rise at times as high as 60 deg.

## SCIENCE.

Prof. Percival Lowell announces that spectroscopic proof has been obtained of the presence of water on Mars. This would seem to settle once and for all a moot Martian question in Lowell's favor.

F. von Strantz has obtained a German patent for a process of destroying insects on plants by the application of a mixture of lime water and the ammoniacal liquor of gas works. The patentee states that neither lime nor ammonia, used alone, is a certain insecticide in dilute solution, and that strong solutions are injurious to plants, especially green plants, but that mixed solutions of the two alkalies, too weak to do any damage to the plant, infallibly destroy all insect parasites.

The part played by sedimentation basins, or septic trenches, in the bacteriological purification of sewage is much disputed. Some writers assert that the basins serve only to retain part of the suspended matter, so that a less turbid liquid can be decanted which will clog the bacterial filter beds less rapidly than crude sewage, while other and more numerous authorities hold that a large proportion of the organic matter is decomposed, dissolved, and volatilized in the basins. Prof. Calmette, in a recent paper, shows the importance of this disintegrating action, which results in the solution of from 30 to 50 per cent of the organic matter originally held in suspension. Experience proves, furthermore, that the matter which is not thus decomposed is little subject to putrefaction, or that the sediment left in the basins has very little odor, can be handled without inconvenience and may safely be thrown, in small quantities, into large running streams.

A new watch has been invented for the use of physicians and nurses in counting the pulse. The watch indicates, without mental calculation, the number of beats of the pulse in a minute. It operates on the principle of a stop-watch. By pressing the push-button a large second hand is set in motion, and the counting of the pulsations begins. At the 20th pulsation the motion of the hand is stopped by another pressure of the push-button. The dial accurately indicates the exact number of pulsations per minute. A third pressure on the push-button brings the hand back to the starting point. The use of this instrument does away with the necessity of observing the progress of the watch while taking the pulse, and in addition insures an absolutely correct record. The instrument is also a chronographic counter, facilitating the making of observations, which are automatically recorded in minutes, seconds and fifths of a second. A small dial placed below the 12 records minutes from 0 to 30. The large hand records seconds and fifths of a second.

M. Fleissner, of the German Imperial Health Bureau, has investigated the formation and properties of the oxide, hydroxide, carbonate, sulphate, and chloride of lead, and has determined their solubilities in water by measuring the electrical conductivity of water impregnated with them. He finds that alkalies and baryta water precipitate the oxide from hot solutions, but the hydrated oxide from cold solutions of lead salts. The oxide forms grayish yellow scales of metallic luster, which yield a greenish yellow powder when ground. The same greenish yellow oxide is formed by the action of very highly oxygenated water upon lead, while water which contains little oxygen produces hydrates of lead oxide. The solubility of lead oxide increases with the degree to which it is hydrated. The solubilities of the lead compounds mentioned above expressed in milligramme-molecules per liter, are: oxide 0.31, hydroxide 0.45, carbonate 0.0002, sulphate 0.126, chloride 33.6. In other words, one million parts of water can dissolve about 64 parts oxide, 93 parts hydroxide, 0.04 part carbonate, 26 parts sulphate, or 7,000 parts of chloride of lead. All of the basic salts of lead are less soluble than corresponding neutral salts.

That the smoke which rises from the chimneys of a city in winter greatly diminishes the practical duration of sunlight is shown by a comparison of observations made in the center of London, at Kew, a few miles to the west, and at Greenwich, a few miles to the east. The annual number of hours of sunshine is at Kew 1,399 or 31 per cent of the maximum possible number; at the center of London 1,027 hours or 23 per cent, and at Greenwich 1,227 or 27 per cent. Hence the center of London enjoys 372 hours (8 per cent) of sunshine less than Kew, and 200 (4 per cent) less than Greenwich. In winter the deficiency of sunshine in the center of London rises to 11 per cent. The disparity between Kew and Greenwich is due to the fact that the prevailing winds are westerly, so that much of the city's smoke is blown over Greenwich, but very little over Kew. At Hamburg, observations extending over eleven years show an average annual number of 108 days without sunshine. At all seasons, but especially in winter, the air of Hamburg is filled with smaller or larger particles of soot. The result is that Hamburg annually enjoys only 1,236 hours of sunshine, or 28 per cent of the maximum possible number, while Berlin enjoys 1,672 hours or 37 per cent.