

ENGINEERING.

Some details have lately been made public of the instrumental work on the Gunnison tunnel, recently completed by the government, which will bring some 200,000 acres of land under cultivation. The tunnel from entrance to entrance is six miles in length. The survey lines at the point of meeting differed 0.32 foot in level, 0.04 foot in alignment, and 0.86 foot in distance.

For two years past, the Pittsburg & Lake Erie Railroad has been testing a car wheel that was designed by the chief engineer of the Carnegie Steel Company. Although the Pittsburg & Lake Erie Railroad carries an unusually heavy freight traffic, the wheel has stood up so well under the trying service that the company has announced that it will build a \$3,000,000 plant at Homestead for the exclusive manufacture of the new wheel.

Rumor has it that another long step forward has been made in the art of armor plate manufacture. It is stated that the new plate, which is fabricated from a steel alloy, combines great toughness with extreme hardness of face, and that in a recent test a 6-inch plate stopped a 9-inch capped explosive shell. We doubt it; but if it was done, the new armor must be even more superior to Krupp armor than Krupp armor is to that made under the old Harvey patents.

During the month of June the total excavation on the Panama Canal was 2,895,793 cubic yards, which is slightly less than the total for the month of May. The mean rainfall was 11.85 inches for the month as compared with 9.82 inches in May. There were 366,998 cubic yards of material placed in the Gatun Dam, and 10,668 cubic yards of concrete were laid in the floor of the spillway.

The advantage of having the White Star Line steamers call at Holyhead was shown on a recent trip of the "Cedric," when mails and passengers were landed at 1:30 P. M. and reached London at 7:15 P. M. Those passengers who went on to Liverpool were not disembarked until 10 P. M., being detained by the state of the tide in the Mersey. The passengers who landed at Holyhead, therefore, reached London three hours before their fellow passengers were landed in Liverpool.

So rapid has been the extension of block signaling on the lines of the Pennsylvania Railroad Company, that they have established signal schools to train men specially for the signal service. Apprentices serve a three years' course. The first year is spent in mechanical work with the construction gangs; the second year in the office of the supervisor of signals; and the third year will be devoted to outside work on electric and other signal appliances.

Some idea of the scale of the Hudson-Fulton river parade may be had from the fact that over 800 vessels, big and little, are expected to take part in it. The Atlantic ports from New England to Norfolk have been drawn upon for reinforcements, and it is stated that not a single licensed passenger steamer remains unchartered for the opening day, September 25th.

Another shocking submarine disaster has happened, this time in the British navy. The cruiser "Bonaventure" was convoying a flotilla of eight submarines, when the cargo steamer "Eddystone" ran through the flotilla, ramming the submarine "C 11" and sending her to the bottom. Of the sixteen men in the submarine thirteen were drowned. A similar accident occurred a few years ago off Portsmouth, England, when a submarine was struck by an outbound liner, which, coming up from astern, ran over the craft and sent it to the bottom.

If Henry Hudson could have come back in the flesh last week and seen the "Half Moon," or rather a modern version of it, lifted bodily from the deck of a steamer by a floating derrick and lowered into the water, he would have realized what great strides have been taken in marine architecture during the three centuries which have elapsed since his tragic death in the waters of Hudson Bay. The "Half Moon" looked small even beside the navy yard tugs; and seafaring men, as they looked at the tiny craft, conceived a high respect for the courage of those early navigators in submitting themselves to the perils of long voyages over boisterous seas and along shores of which no chart existed.

Much has been said of late years about the ease with which a lock canal could be destroyed by the malicious use of dynamite or other high explosive. Engineering News calls attention to the fact that an attempt made in 1900 to wreck the Welland Canal in this way produced surprisingly small results. After two weeks' examination, the two men concerned selected lock 24, and each lowered a satchel containing dynamite and a fuse to the water behind the gate at each end of the lock. Both charges were exploded; but the dynamite failed to carry away the gates. Although the explosives blew a hole about a foot in diameter through each gate and loosened the hinges, the gates remained in position, holding back the water.

ELECTRICITY

The United Railways and Electric Company of Baltimore celebrated on July 26th the fiftieth anniversary of the inauguration of its street railway service. This company also started one of the earliest electric car lines in the country in 1885.

Canadian doctors having reported frequent cases of slight injury or strain to passengers alighting from electric cars, the Toronto Railway Company at the request of the Railway and Municipal Board has made some experiments with both two and three steps below the car platform level. The latter were found to project too far from the side of the car, but the two-step pattern has been adopted.

An electric rail grinder has been devised by the Albany & Hudson Railway for use in grinding the wing rails of frogs to insure smoother passage of car wheels. A motor is carried on an ordinary hand car, a sort of small barrow carrying the emery wheel being suspended from a crane overhanging the end of the car, and the operator supplying the necessary pressure upon the grinding wheel through the handles of the barrow.

A new use for the oscillograph is described by Mr. K. Simons, in the *Elektrotechnische Zeitschrift*, in the investigation of the oscillations which occur when switching off a continuous current in an inductionless circuit. A record is obtained photographically showing most clearly simultaneous variations of different amplitudes. It is suggested that a valuable application of the oscillograph to wireless telegraphy may be made in this way.

An additional advantage claimed for electric welding of rails is the reduction of corrugation of the surface by traffic and resultant noisy riding of the cars. Electric railways in Berlin, Hamburg, and Bremen claim that the welding of a strip of soft iron to the rail surface not only prevents the corrugation but actually reduces the noise due to corrugations already made, but the experiment is not old enough to prove whether the relief is permanent.

A curious accident occurred at the No. 3 power house of the Niagara Falls Hydraulic Power and Manufacturing Company on Sunday afternoon, July 25th, by which two employees were injured. The casing of one of the new 10,000-horse-power turbines burst and a large piece of casting was thrown across the station, which was partly flooded by the outrush of water. The turbine was under the normal head of about 165 feet of water, but had been tested to a much higher pressure.

The "boosters" of the town of Montgomery, Ala., have erected a monster electrically illuminated sign bearing the name of their community on the roof of a factory facing the railroad. The sign is 75 feet high and 85 feet long, lit by 2,600 lamps, and bears an immense key and the inscription "Montgomery, Your Opportunity," with a sky-rocket effect. The idea is to impress the name on thousands of passengers going by on the railroad and possibly ignorant even of the name of the town.

The advantages of lifting magnets for the handling of all kinds of loose material—piles of turnings and other scrap, castings of awkward shape, and rails, etc., requiring to be compactly bound in order to be handled by a crane—have won rapidly increasing recognition of late. Lifting magnets are in use at the immense new plant of the United States Steel Corporation at Gary, Ind., capable of lifting the entire top layer of a pile of 60-foot rails "lock section" (alternate rails inverted so as to hang together) with an aggregate weight of 15 tons.

The use of transformers as choking coils is suggested by Mr. J. D. Coates in a paper read before the Institution of Electrical Engineers (Brit.). He excites the core with direct current in addition to the alternating current and employs, to prevent alternating current being induced in the direct-current circuit, a second transformer inducing an E. M. F. in the direct-current circuit equal and opposite to that induced by the first transformer. Choking coils so made are used for the testing of single-phase and polyphase alternators.

Some interesting experiments are being conducted by the South Park commissioners of Chicago in the lighting of the boulevards under their control. Several different types of lamps have been installed on temporary posts in order to observe the comparative illuminating effect and determine how high the lamps should be hung and how far apart, and similar considerations. The lamps under test or about to be tested include incandescent gas lamps, inclosed arcs, magnetite arcs, flaming arcs, and incandescent tungsten lamps. The commissioners hope to obtain valuable data, both as regards illumination and economy, from these trials, the latter being an important factor, as it is estimated that 1,000,000 kilowatt hours per annum will be required for the lighting of Grant Park alone. The tests are under the supervision of Mr. J. A. Radford, consulting engineer to the commission.

SCIENCE.

Prof. William G. Anderson, director of the Yale gymnasium, is carrying on a series of experiments on the heart action of athletes. More than 600 experiments have been made for the object of determining which sports exert the most harmful effect upon the heart. Moreover, the effect of oxygen on the heart during exertion is also being carefully studied. A report is promised in October.

The French parliament has passed a law which provides that, in transactions relative to diamonds, pearls, and precious stones, the term "metric carat" may be employed to designate a weight of 200 milligrammes (3.086 grains Troy), and prohibits the use of the word carat to designate any other weight. As many other governments are ready to enter into the reform and unification of the carat and have only been awaiting the initiative of France, it is reasonably certain that the metric carat of 200 milligrammes will, within a few months, be the only carat recognized by law in the majority of countries interested in the trade in gems.

Doelter has published the results of experiments on the action of radium rays on the colors of precious stones, and those of dyed fabrics in atmospheres of oxygen and of nitrogen. The effect of hydrogen dioxide, ultra-violet rays, and elevation of temperature, on the color changes caused by radium was also studied. In these changes neither organic colors nor the rare earths played any considerable part, the oxides of iron, chromium, and manganese being, in all probability, the principal factors. The hypothesis that the colors, like those of rock salt, are due to traces of colloidal metals, which are ionized by the radium rays, appears worthy of consideration. Most mineral dyes, however, appear to be unstable, even the sub-oxides.

Modern military exercises are designed with a view of increasing the efficiency of the individual soldier. The same idea is carried out in the equipment. Gaudy uniforms have been replaced by dull and almost invisible tints of gray and khaki, and the weight of the gun and kit has been reduced for the sake of mobility and increased ammunition-carrying capacity. The art of utilizing natural cover and of maneuvering under cover is taught by long and varied practice. In the execution of these maneuvers crawling or creeping is usually necessary. To facilitate this movement Gustav Mueller of Stuttgart has invented and patented a device, consisting of wheels, rollers, or runners, attached to a frame or to tent poles, knapsacks or other suitable parts of the equipment. The utility of this invention remains to be proved by practical experience, but there can be no question of its novelty and originality.

A discovery of great interest has been made not long since at Pompeii, where the excavation work is being steadily carried on. Under the ash deposits there was found an extensive villa of a handsome construction and ornamented with very fine frescoes. The villa contains statues and other works of sculpture both Greek and Roman, besides very rich furniture which is well ornamented and also many vases of different kinds. There were also found coffers filled with gold and silver money. In the basement are great amphoræ which were used for storage purposes, and in the triclinium the tables were prepared for a banquet of thirty persons. An abundance of silverware is one of the features of the discovery, and it is said to be equal in weight and artistic character to the silverware discovered in the villa of Boscoreale and now possessed by the Louvre. Some of the silver pieces seem to have been taken out at a previous epoch, for there are traces of clandestine search which was made at a former date.

Neuberg has recently completed a comprehensive study of the changes produced in organic compounds by light. These compounds, in great variety, were employed in the form of 5 per cent aqueous solutions containing small quantities of uranium salts, which act as catalyzers, probably by absorbing the luminous rays and conveying their energy, in another form, to the surrounding medium. All of the solutions employed remained unaltered so long as they were kept in the dark, but exposure to light produced a great variety of changes in color and odor, and caused the formation of new chemical compounds, often within a few minutes. Alcohols were converted into aldehydes and acids were transformed into aldehydes or acetones containing an equal or smaller number of atoms of carbon. Cane sugar and other di-saccharides were inverted. Glucosides were hydrolyzed, or separated, with absorption of water, into the glucose base and the acid characteristic of each glucoside. Glycerides, or fats and oils, were partially saponified, and albuminoids were partially hydrolyzed. In general, chemically inert substances are converted by light into chemically active compounds, such as aldehydes and acetones. This fact may account for the therapeutic value of light baths in certain diseases.