ENGINEERING.

The many improvements which have been made both in track and rolling stock, to say nothing of the introduction of block signaling, are beginning to tell in the direction of lowering the list of fatalities and injuries. The Pennsylvania Railway is to be congratulated on its remarkable record of the past year, during which, although it carried a total of 141,659,543 passengers, not one was killed.

As a result of the visit of the Secretary of War and the Chief of Staff to the Isthmus, tentative plans for the defense of the Panama Canal have been adopted, which embody the following features: There will be three batteries, located on the islands lying from ten to fifteen miles from the entrance; and other batteries will be placed on the coast line near the mouth of the canal. Six miles up the canal will be a battery for the defense of the Pedro Miguel lock. There will be a military post at Culebra. The Atlantic entrance will be defended by batteries upon the range of hills commanding the entrance. Altogether, sixty of the highest power disappearing guns will be mounted.

The army 16-inch gun, which is the most powerful weapon in existence to-day, is still at Sandy Hook mounted on the temporary carriage which was used for its trials. It has been proposed to ship the gun to the Philippines, and mount it in the fortifications which are now being built at Corregidor Island for the defense of Manila. The 12-inch gun is not able to completely command the channel; but the 16-inch gun could strike a blow, even at a distance of 11,000 feet, which, if it got fairly home, would probably disable any modern battleship. Although there is no likelihood of another 16-inch gun being built, this costly weapon should at least be mounted in some position where it can render effective service.

The United States Weather Bureau is making a study of evaporation at the Salton Sea, and an extensive plant has been constructed, with which a thorough research will be made of the question of evaporation of water in the open air over large lakes and reservoirs. The sea, which is 50 miles long by 18 wide, was formed, it will be remembered, by a break in the Colorado River, and climatic conditions are such as will render the data which will be secured particularly applicable to the reservoirs now being constructed by the United States Reclamation Service. Four observation towers have been built, each containing several platforms at different elevations. On these platforms are iron pans filled with water, observations of which are taken every four hours.

The great increase which has taken place of late years in the size of locomotives, has added greatly to the labors of the fireman. This has led to much experimental work, in an effort to produce a good mechanical stoker. The Chicago & Alton Railway have formally adopted the Strause stoker, with which they are equipping all their heavy freight and passenger locomotives. Coal is thrown into a bin, from which it is delivered to different parts of the grate by varying the speed of a plunger, which is controlled by a starting lever. The advantages are that air admission is controlled; small amounts of coal are fed at frequent intervals; and larger nozzles may be used and back pressure reduced. The results will be closely watched by the railroad companies.

The German government has decided to abolish magnetic compasses from German warships and replace them with the gyroscope compass invented by Dr. Anschuetz-Haempfe, which has proved "a brilliant success." The device consists of a 9-pound wheel, mounted with the usual compass card in a holder of quicksilver. An electric motor rotates the wheel at 21,000 turns a minute. After it has run for two hours, the instrument is set in the direction of the mathematical meridian, which position it keeps unchanged, being unaffected by neighboring iron and steel, and unsusceptible to vibration and rolling. On one occasion, during a nine months' cruise of the battleship "Deutschland," the magnetic compass, although left entirely to itself, maintained its true direction for a month.

The largest of all the schemes of reclamation contemplated by the government has recently been undertaken by the engineers in the Sacramento Valley. Its ultimate object is to control the flow from a watershed of over 4,000 square miles, and to improve the two great rivers of California. When the task is completed, over 600,000 acres of rich land, which at present is dry and sun-baked during eight months of the year, will have been brought under irrigation, and large areas of bottom land, which at present are subject to annual overflow and great destruction by the floods, will have been reclaimed. Furthermore, the works involved in this reclamation will involve the control of sufficient water power to provide electric light and power over the greater part of the Sacramento Valley which extends for 450 miles from Mount Shasta to San Francisco Bay, and at its widest part reaches about 100 miles from mountain range to mountain range.

ELECTRICITY.

The government is calling for bids on a concrete tower 600 feet high, and tapering from a base 50 feet in diameter to 8 feet at the top. This tower is to be used for the 3,000-mile wireless telegraph station which is to be built for the Navy Department. The tower will be situated in Rock Creek Park, Washington, D. C., and it is hoped from this station that the Navy Department can keep in touch with vessels of the navy at any point on the North Atlantic Ocean.

A recent press dispatch speaks of a secret invention of Sir Percy Scott, whereby the large guns of warships may be electrically controlled. According to the report, this system was recently tried out with very satisfactory results on the British cruisers "Good Hope," "Argyl," and "Arrogant." It is said that by this system a broadside may be trained and fired without the presence of a gunner, the entire mechanism being operated from the conning tower.

It is beginning to be realized that forced draft is quite a necessity in the smaller sizes of direct-current motors. In the alternating-current motors it has been the practice to use artificial ventilation, even in the small sizes; but in the direct-current motors with their solid armatures, it is even more necessary that some steps be taken to dissipate the heat generated. In Germany some of the electrical concerns are constructing their direct-current motors with artificial cooling systems.

A very convenient electrical stove has recently been devised, which is adapted to be placed on the table where breakfast dishes may be prepared and served hot. The stove is provided with a steel top, over which a wire grid may be placed so as to convert it into a toaster. When the grid is removed, the steel top may be used for cooking muffins, cakes, and the like, or the top may be inverted, forming a flat dish with a narrow marginal rim, which serves to retain fluids on the plate. The handle of the stove is arranged to serve as a pancake turner.

An ingenious burglar alarm, devised by a Dresden engineer, is described in a recent Consular Report. The apparatus consists of a curtain, which is drawn across the window or door, or around the safe that is to be protected. In the curtain are a large number of fine wires with small metal knobs, which connect the wire conductors at intervals. An electric current passes through the wires, and in case the curtain is disturbed in the slightest degree, the metal knobs are thrown out of contact with each other, thus actuating the burglar alarm. The curtain may also be used as a fire alarm in identically the same way.

Before this number issues from the press the Alaska-Yukon Pacific Exposition will have been opened by President Taft. The opening will be effected by the touch of a golden telegraph key in the White House, which will be connected by means of trans-continental lines with the Fair grounds at Seattle. The impulse which arrives from the White House will release a time device, whereby a large bell will be sounded to announce the opening of the Fair. At the same time two large whistles will proclaim the fact in the city. As soon as the bell ceases to sound, a flag 36 feet wide and 104 feet long will unfold at the rate of 10 feet per second, and at the end of each second a dynamite bomb will be exploded. In the mean time two photographs of the audience in the amphitheater of the Fair will be taken at an interval of fifteen seconds, by means of a relay which will automatically open the shutter of a camera.

Electric locomotives appear to be going through a process of evolution similar to that of steam locomotives. At first the motors of the electric locomotives were placed below the floor line. Now that large motors are being used, they are being placed above the floor, and connected to the driving wheels by means of driving rods similar to those of the steam locomotive. It used to be thought a low center of gravity was necessary for a steam locomotive, but it was found that the side blows tended to injure the track, whereas with a high center of gravity these blows were taken up by the springs, and converted into a downward pressure rather than a side pressure on the rails. The same principle applies to electrical motors. In a discussion of this subject in a recent number of the Electrical Journal, the following conclusion is reached: That the only part of the locomotive not completely spring-supported should be the wheels and axles and any connecting rods used in conjunction therewith; that the center of gravity of the machine should be raised to about one and one-tenth times the width of the gage; that all the heavier parts of the locomotive should be placed longitudinally within the length of the driving wheel base, so that no heavy masses will be at either end of the locomotive; and that the motors should be rigidly fastened to the main frame of the locomotive, where they would be much more accessible. They could be of a partly open type, thus allowing better ventilation. Possibly forced ventilation would be necessary.

SCIENCE.

Prince Henry, brother of the German Emperor, is the inventor of an automatic window washer. Lest it be supposed that the device is a household improvement, let it be stated that it is intended for the purpose of wiping off moisture from the glass wind-break of an automobile, so that the rider's vision may be clear at all times.

Word has been received from Dr. Charcot, in charge of the Pourquoi-Pas Antarctic expedition, that he reached Deception Island on December 22nd, 1908. Charcot hopes to establish his winter quarters on Alexander Land, the name given to the region lying to the south of Graham Land in about 70 degrees south latitude. Deception Island is a circular volcanic island, the crater of which forms a magnificent roadstead of great depth, which is entered by a narrow opening between two cliffs.

In an address delivered before the Manchester and Salford Sanitary Association, Mr. H. W. Norman stated that during the war in South Africa it was found necessary to send back 3,000 soldiers who were unable to bear the rigors of the campaign, solely on account of the condition of their teeth. They were not able to chew "bully" beef and hardtack. Teeth seem to have deteriorated, judging by a comparison of the dental apparatus of the modern young person with that of his ancestor's skull in anthropological museums.

As a result of the work of the National Physical Laboratories and International Electrotechnical Commission, it seems likely that an official international candle will eventually be adopted. Such a step will substitute for the various standards of luminous intensity which are used in the various countries of the world, and which vary from the English sperm-candle standard and pentane gas flame to the French colza-oil flame and the German amylacetate flame, a single standard which will enable illuminating engineers to talk intelligently about the same thing.

The compilation of the great map of the sky under the auspices of the Paris Observatory will be a colossal task. Seventeen observatories—those of Greenwich, Rome, Catania, Helsingfors, Potsdam, Oxford, Bordeaux, Toulouse, Algiers, San Fernando, Tacubaya, Santiago de Chile, Cordoba (Argentina), Perth, Capetown, Sydney, and Melbourne—have been at work in their respective spheres for the past twenty-two years charting the portion of the heavens under their observation, by means of photography. No fewer than 22,054 negatives have been taken, and over 2,000 of them have now been engraved on copper.

Alfred H. Harrison in an article recently published in the Nineteenth Century sets forth his belief in the success of any expedition which will simply drift across the North Pole. Calculations based on the drift of casks convince Mr. Harrison that he can float right across the center of the Arctic Ocean within easy reach of the Pole, and that he will finally emerge somewhere near Spitzbergen. He argues that an expedition when drifting can house itself in Eskimo huts, and that it can maintain itself by means of provisions safely *cached* on the ice. It is his idea to start at Pulen Island in October of this year or in 1910. Three years' supplies are to be placed on the ice.

A very curious application of the properties of calcium carbide has been made in Australia; namely, to the quick and easy determination of the quantity of water contained in wool, before shearing, an operation which is impracticable with very wet fleeces. A little wool is clipped off, weighed, and mixed thoroughly with an excess of calcium carbide, in a suitable apparatus. The acetylene produced by the reaction of the carbide with the water in the wool is determined by measuring its volume at constant pressure or its pressure at constant volume, by means of a scale so graduated as to give directly the proportion of water in the wool.

According to Nature, the Council of the Röntgen Society has decided to act upon the advice of the committee, appointed in 1906, to consider the possibility of preparing a standard for the measurement of radio-activity. This committee recommends that "The γ-ray ionization from 1 mg. of pure radium be regarded as a standard, and called a unit of radio-activity." Three sub-standards of $RaBr_2$ are to be prepared, and comparison will be made with a specimen of the purest $RaBr_2$ at the Victoria University, Manchester. The quantity of radium in other specimens will be capable of accurate measurement by comparison with the sub-standards. It is anticipated, therefore, that by this means the exact description of medical, physical, or other work with radium will be facilitated, and that the possibility of fraud in the sale of expensive radium preparations will be eliminated. The council proposes to lend the sub-standards to any competent person desiring to measure the amount of radium in his possession, or to arrange for authoritative tests to be made.