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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


## A PRECAUTION AGAINST WATER FAMINE.

With drinking water retailing at thirteen cents a gallon and farmers driving their cattle six and eight miles for water, the inhabitants of the Hudson valley, at least, will realize that those who have spoken of the possibilities of a water famine in New York city have not been crying "wolf" when there was no wolf. Thanks to the fact that the extraordinary rains of last winter filled all the reservoirs of the Croton watershed to overflowing, there was no immediate danger, in spite of the recent extraordinary drought, of a scarcity of water in this city. But had the past season chanced to be as dry as the present one, conditions would have been very different.

The average daily consumption of water in New York is 325,000,000 gallons daily, and it is increasing at the rate of about 15,000,000 each year. The average daily flow of the Croton River, from which New York gets its water, during the forty years in which observations have been taken, is 402,330,000 gallons; but during that time, in six different years, the average daily flow has been less than the present daily consumption. In 1872 it was 260 million gallons; in 1880, 205 million gallons; in 1883, 230 million gallons; in 1885, 295 million gallons; and about the same amount in 1892. Another dry year occurred in 1895, when the average daily flow was only 263 million gallons; or over 60 million gallons less than the present daily consumption. These dry years are, of course, offset by correspondingly wet years, and it is by building dams in the watershed and impounding the water, that the deficiencies of the dry years are compensated by drawing on the water thus stored to meet the city's demands.

During the past forty years the city has built successive dams on the various branches of the Croton River to meet the growing demand of New York for a larger reserve, until at the present time there are in the Croton watershed nine separate dams, with one under construction, which, together, will have a total storage capacity of 104 billion gallons. During the past winter, from the 6th of November to the 15th of March, all the reservoirs on the watershed were full and overflowing, and there was an overflow over the new Croton dam (located about 2 miles from the point where the Croton River empties into the Hudson), which continued uninterruptedly for eight months, during which time over 80 billion gallons of water ran to waste.

With a view to increasing the storage capacity in the watershed, the engineers of the Aqueduct Commission recently made a careful survey of the one remaining section of the watershed which has not as yet been fully developed and where a large amount of additional storage can be secured at a relatively low cost for the dam and accessory works. The site on the east branch of the Croton River above the present Sodom or East Branch reservoir, selected for the new dam, is decidedly favorable for cheap storage, the bottom being broad and flat, the sides steep and abrupt, and the closure of the valley requiring the construction of a comparatively short, low, earthen dam, which could be built in two seasons of work. The construction of this dam at a cost of about $3,250,000, would provide for an additional storage of 20 billion gallons of water.

Now the question may be asked, Why should an additional dam be built in the Croton watershed when we have under construction the great Catskill project which is designed to bring ultimately an additional daily supply of 500 million gallons into the city? The answer is that the most sanguine estimates, based upon the present rate of progress, place the period which will be required to render the new water supply available at about six years; while, judging from the obstacles which have been encountered in the survey for the great siphon below the Hudson River, the time may be easily two or three years more than that. Now taking the average daily increase in consumption during the next 7 years as 17 million gallons (a conservative estimate in view of the rapid growth of New York city), it will be seen that, before the Catskill supply is available, the average daily consumption will be 43 million gallons greater than the average daily flow of the Croton River during the past forty years; and it might well happen that two successive dry seasons, such as have occurred in the past, might find the city with empty reservoirs and a daily river flow that was less than the daily consumption.

As to the probability of the proposed dam becoming filled in any particular year, it can be said that the records of the past forty years, except during the time that was required for filling the new Croton reservoir on its completion, show that a very large amount of water ran to waste, every year, past the Croton dam, a quantity which has varied from 35 billion gallons to more than 200 billion gallons.

For the above reasons it seems to us that the securing of an additional supply of 20 billion gallons for the relatively low expenditure of $3,250,000 is a proposition which should commend itself to the authorities.

## CARNEGIE MERIDIAN ASTROMETRY EXPEDITION.

Astronomers are very much interested in the meridian astrometry expedition, which has been sent out by the Carnegie Institution in charge of Prof. Boss of the Dudley Observatory.

The party sailed for Buenos Ayres a few days ago, where a temporary observatory is to be built in the Argentine Republic, at San Luis, on the edge of the Andean plateau. This locality has been selected on account of its clear, calm nights and the purity of its atmosphere.

This gigantic task of star measurement in the science of exact meridian astrometry consists of a series of observations of about 25,000 stars that have been frequently observed with precision in the southern heavens.

The Carnegie Institution hopes to reach an accuracy which has long been the problem of fundamental work in astronomy, that of making reciprocal observations on the same stars with the same instruments alternately used in two hemispheres. About 1,688 stars have already been catalogued, all from the north to the south pole of the heavens, and this work has resulted in interesting conclusions in reference to star streams, the solar motion in space, and other stellar problems.

The progressive conception of astronomical work by the Carnegie Institution is cognizant of the imperative need of further observations upon the stars of the far southern constellations.

There are but few observatories in the southern hemisphere, therefore the astronomers of that hemisphere are in need of reinforcement.

In connection with this expedition it might be recalled that the astronomical world is in debt to an American astronomer, in a great measure, for all that is known of the southern heavens; for there stands in the Argentine Republic the Cordoba Observatory, a splendid national institution, due to the scientific genius and energy of Dr. Benjamin A. Gould, an eminent American astronomer, who resided there for fourteen years and made a vast number of valuable observations.

Prof. Lewis Boss, who is in charge of this great astronomical work, is splendidly equipped for the work, and the world will watch with eager interest the result of his five years' observation of southern stars.

## DETECTION OF CARBON MONOXIDE IN THE AIR.

Poisoning by carbon monoxide is of frequent occurrence, for this gas is extremely poisonous and it is generated in many ways. The danger of poisoning is increased by the fact that the gas is colorless, odorless, and tasteless. Its toxic power is sixty times that of carbon dioxide. It is absorbed in appreciable quantities by the blood from an atmosphere containing it in the proportion of one part in 5,000. When air containing one part of carbon monoxide in 2,000 is inhaled, the blood absorbs as much carbon monoxide as oxygen, and death ensues.

The presence of carbon monoxide in considerable proportions may be detected by drawing some of the suspected air, with an aspirator, through a solution of silver nitrate. If the air contains much carbon monoxide the liquid soon assumes a grayish tint, due to the reduction of the nitrate to the metallic form. This method is only qualitative and not very sensitive, but it is very convenient for discovering leaks in furnace pipes and flues and in ascertaining whether the latter have been sufficiently ventilated to be safely opened for cleaning.

MM. Lévy and Pécoul have devised a method and apparatus by which as small a proportion of carbon monoxide as one part in 100,000 can be detected, and very small quantities can be determined quantitatively by persons entirely inexperienced in chemical manipulations. This method is based on the power of carbon monoxide to decompose iodic acid, with the liberation of iodine, which is betrayed by its color.

The apparatus, which is arranged compactly in a wooden case, comprises an aspirating bottle of known capacity, a test tube containing chemically pure anhydrous iodic acid (iodic anhydride, $I_2O_5$) and a long air tube, part of which is immersed in a water bath heated to 144 deg. F. by a small spirit lamp. The air first traverses the heated coil, then bubbles through the iodic acid, to which it gives a red tint of intensity proportional to the quantity of carbon monoxide, and finally reaches and fills the aspirator. At the end of the operation the proportion of carbon monoxide in the air can be estimated by comparing the liquid in the test tube with a color scale, in which each tint corresponds to a definite proportion of carbon monoxide. Still greater precision can be obtained by using a scale of colored liquids in sealed glass tubes.

Iodic acid is so sensitive to the action of carbon monoxide that this method is not suitable for air containing more than one part of carbon monoxide in 10,000. If the proportion is greater than this the suspected air must be diluted with pure air, in definite or indefinite proportions, according as a quantitative or only a qualitative analysis is desired.

As a prolonged exposure to an atmosphere containing even one part of carbon monoxide in 20,000 is injurious to health, tests of this character should be frequently made in all establishments in which there is danger of contamination of the air with this poisonous gas, all leaks should be promptly discovered and repaired, pipes should be thoroughly ventilated before they are entered for cleaning, men should not be compelled to remain long at posts where the air is unavoidably contaminated, all conduits which may contain carbon monoxide should be painted red, and workmen should be strictly forbidden to remain in their vicinity except when actually at work there.

## THE FALLACY OF ARTIFICIAL FOOD.

In these days of concentrated foods prepared from natural sources—such as condensed and dried milk, concentrated albumen, beef extracts, etc., there seems to be a tendency to sacrifice the pleasures of the table to convenience, portability, and time saving; and the question might arise, Would it be possible for us to exist entirely on artificial food? According to Francis Marre, it appears to be improbable that this consummation, whether devoutly to be wished or not, will come into effect. The human stomach is not merely a chemical laboratory, but also a creature of habit, that calls for work. It demands a certain bulk of material, out of which the intestines can take the nourishing constituents, while rejecting the innutritious. As soon as the intestines are relieved of the necessity of seeking out the necessary and rejecting the unnecessary portions of food, the digestive function is suppressed. Further, certain bacteria must be introduced into the digestive tract, whose co-operation is absolutely necessary to proper assimilation of the food. Chemically-pure artificial foods would be free from all bacteria. The human system is accustomed to be nourished by various kinds of aliments, no one of which is alone sufficient to promote life. In order to imitate these constituents, the chemical foods would have to be prepared in an extraordinary degree of variety and complexity. Eating is not merely a matter of introducing into the system a certain weight of materials, which will develop a certain number of heat units. The reception and digestion of food must be accompanied by a certain degree of pleasure, in order to permit it to be properly assimilated. Experiments made with a dog show that the secretion of those stomachic juices which are necessary to the commencement of the digestive processes, ceases immediately, and remains absent during several hours, as soon as a feeling of displeasure is excited in the animal.

The twelve new torpedo boats under construction for the German navy are to be driven by steam turbines. According to Engineering, it is planned to try four different types of turbines. The three boats which the Vulcan yards near Stettin are constructing are to be equipped with turbines of the Curtis type. The four boats which the Schichau yards of Elbing and Danzig have undertaken to build, will have Melms and Pfenninger turbines. Of the five torpedo boats under construction at the Germania yards at Kiel, four are equipped with Parsons, and one with Zoelly turbines.

## ENGINEERING.

**The "Kaiserin Elizabeth"** has recently been completely modernized. Her old 9.4's have been replaced by 6-inch guns, and several of the other 6-inch mounted in different positions. The rig has also been changed.

**Rear Admiral Holiday,** Chief of the Bureau of Docks and Yards, recently spent three weeks in investigating the new naval base at Pearl Harbor in the Hawaiian Islands. He states that there are 5,000,000 cubic feet of coral and sand, which must be dredged out to provide the required depth. The estimated cost of the completed harbor, which is to be finished by 1912, is $5,000,000. Mare Island and Bremerton yards on the Pacific coast, are also to be greatly enlarged.

**The Hudson River** tunnels have now been in operation for sufficient time to enable detailed figures to be given as to their earning capacity. The present gross earnings per car mile are almost twice as great as those of the Subway and Manhattan Elevated lines, the Hudson tubes earning 40 cents per car mile as against 21½ cents and 21 cents, respectively, for the Subway and the Elevated roads. The higher rate is due to the shorter distance between termini of the tunnel lines.

**The thriving city of Seattle** is engaged in reducing the heavy grades which occur in certain sections of the city by a process of sluicing, which is giving good results. Both salt and fresh water are being used for the purpose, and the contractors, Lewis & Wiley, are using it to the extent of 25,000,000 gallons a day, one half of this being taken from the bay, and the other half being obtained by purchase from the city or directly from Lake Washington. To date, there has been sluiced into Elliott Bay the total of 1,800,000 cubic yards of material.

**The president** of the Fore River Shipbuilding Yard, Francis T. Bowles, lately chief constructor and a rear admiral of our navy, is to be congratulated on having created a new record for quick shipbuilding in this country. Our first American "Dreadnought," the "North Dakota," which will be launched November 10, will be about sixty per cent completed when she takes the water. It was plainly Mr. Bowles' agitation for the construction of warships in government navy yards that started the present era of the rapid construction of ships by private builders in this country.

**The rapidity** with which England builds her warships is shown in the remarkably short time occupied in the construction of each of the six "Dreadnoughts," which she will have afloat by next month, when the "Collingwood" has been launched. The average time of construction, from the time of laying the keel to the launch, was seven and one-third months. With this rate of building and the large number of government and private dockyards at her disposal, she could pretty well replace the wastage of war, as it occurred, with new ships, if she should ever be forced to a protracted struggle.

**Although** it is early as yet to compare the cost of operation of electric and steam locomotives, enough has transpired to indicate that the electric locomotives cost considerably less. It takes 30,000 miles of running to wear down the tires of an electric locomotive 1/32 of an inch, whereas that amount of wear will take place in from 8,000 to 9,000 miles on steam locomotives. It is not necessary to give the electric locomotive a roundhouse inspection at the end of every day's work. They are inspected at the end of every thousand-mile run, and the work can be done in about three and a half hours. According to J. P. Kelly, speaking before the Traveling Engineers' Convention, the roundhouse examination consists in blowing out the electrical apparatus with an air blast; examining the motors; cleaning the commutators, contactors, switches, and controllers; gaging the contact shoes, and oiling the journals. The inspection can be commenced at once, since there is no fire cleaning, coaling, or watering to be done.

**In the tests** conducted at the fuel testing plant at St. Louis, Mo., and Norfolk, Va., to determine the values of different kinds of fuel for use in the gas-producer, the United States Geological Survey obtained some interesting results with a bone coal which is found in West Virginia. Although the fuel was found to be of little value under the steam boiler, it gave good results in the gas-producer, where it developed a brake horse-power for each 1.65 pounds of coal consumed in the producer. The lumps of coal were 8 and 10 inches in diameter. Some consisted of a high-grade bituminous coal, others appeared to be simply lumps of a heavy and very hard rock. All of these lumps, except the largest, burn entirely through in the producer. There is no tendency to clinker or coke, and very little stoking is required. There was a high percentage of about forty-five per cent of ash. With proper crushing and suitable attention the deposits of this fuel will prove to be decidedly valuable for producer-gas plants.

## ELECTRICITY.

**The life** of a 4-inch trolley wheel averages between 8,000 and 10,000 miles, while a 5-inch wheel will run between 20,00 and 25,000 miles, as shown by extensive tests with trolley wheels in Baltimore. The results of these tests were reported by H. H. Adams before the Interurban Railway Engineering Association.

**A new postal transport system,** which will render the service independent of railways, is interesting the postal authorities of Milan, Italy. It is proposed to construct an underground tube for small electric trains consisting of an engine and two or three postal cars, which will run at over 90 miles per hour. The wheels would have leather tires and run on cement rails. The line would run between Milan and Genoa, a distance of about 100 miles.

**An automatic** grade-crossing gate has recently been installed on the Montreaux-Bernese Oberland electric railroad in Switzerland. At a certain distance from the grade crossing a parallel line close to the main trolley wire is connected with the power by means of the trolley bow. This energizes the motor which lowers the gate across the highway. At the same time an electric bell is sounded and a couple of electric lights are lighted as a warning that a car is approaching. The gates are lowered in about twenty seconds. After the car is passed they are raised by a counterweight.

**By photographing** the spectrum of an ordinary spark on a rapidly-moving photographic film, T. Royds, writing in Electrical Engineering, London, has been able to determine the constitution of the electric spark. He finds that at first there is an almost instantaneous luminosity, due to the initial air discharge, after which the light of the spark comes mainly from the metallic vapor produced. Streamers of luminous vapor appear at both the positive and the negative electrodes; and when the self-inductance of the spark is increased, several streamers start from the electrodes during a single oscillation.

**The rectifying effect** of an alternating-current arc has been studied by J. Sahulka, writing in the Elek. Zeit. He finds that ordinarily the lower carbon of the arc is positive, but that this depends upon the temperature of the electrode. The cooler carbon is always positive, so that by using carbons of different thickness, the thinner one, which would necessarily be hotter, would be negative. The author has used the arc for rectifying purposes by having one of the electrodes consist of a rotating carbon disk. The current in the external circuit would then flow from the stationary electrode to the relatively cooler rotating electrode. In this way he obtained a direct current of one-seventh the strength of the alternating current.

**To increase the resistance** of the tungsten filament, and thus permit the use of a shorter filament in the lamp, a new process of manufacture has been evolved, which consists of mixing thorium oxide with the tungsten. The tungsten and thorium oxide are combined in various proportions and mixed with thirty-five per cent of an alloy consisting of cadmium, bismuth, and mercury. This alloy is vaporized in the course of manufacture. It is claimed for the resulting filament that with the addition of twenty per cent of thorium oxide its resistance is increased fifty per cent. As much as fifty per cent of thorium oxide may be used, but a higher percentage renders the filament too brittle.

**It is found** that in an ordinary room, from which sunlight is excluded, the brightness of the daylight commonly runs as low as 1/10, or even 1/100 candle-power per square inch. The intrinsic brightness of nearly all artificial lights is much greater than this, which accounts for the injurious effects they produce on the eyes if located within the range of vision. In a paper read before the Illuminating Engineering Society of Philadelphia, J. E. Woodwell discussed this subject, arriving at the conclusion that the best illumination is a diffused light of from 2/10 to 1/10 candle-power per inch. Although ultra-violet light has heretofore been held accountable for strain and other injury of the eye, he points out that there is less ultra-violet light in the rays of various incandescent illuminants than in direct or even reflected sunlight.

**The success** of the electric system on the New Haven Railroad was discussed recently by an electrical engineer of that line. He states that train delays at the present time are less than those occurring during steam operation. The advantage of using locomotives consisting of two individual half units and operable individually, or as a pair, by single crew, has been demonstrated. Seventy-five per cent of the traffic is operated with half-unit locomotives. A pound of coal burned at the central station produces twice the drawbar pull of a pound of coal in the steam locomotive. But the greatest value of the electrification is that it increases traffic capacity, owing to the facility it offers of making rapid main-line and yard-train movements. In other words, the electrification permits a tremendous increase of traffic without an increase of track mileage.

## SCIENCE.

**Seeds of wild fruits** and vegetation growing in Central China are to be forwarded to Luther Burbank to see if he can cultivate them and produce luscious fruit and useful trees and foliage in places rarely penetrated by white people.

**Fossil Eggs Found in a Mine.**—Fossil eggs, some of them large as a man's head, which were recently found in the 2,000-foot tunnel at Copperreid, Nevada, have been pronounced genuine by Prof. Horace Chapman, of the University of Pennsylvania faculty. The eggs were found by blasting in the end of the tunnel. The adjoining strata indicated to the discoverers that the fossil eggs had been buried to a depth of about 7,000 feet. The specimens show that minerals have displaced the contents of the eggs.

**At the end of this year** (December 22-23) there will be a total eclipse of the sun, visible only in the southern hemisphere. Astronomers have been endeavoring to find a spot from which the eclipse can be observed. Bouget Island, situated in latitude 54 deg. 22 min. S. and longitude 3 deg. 1 min. W., has been suggested, but M. W. Downing, director of the British Nautical Almanac, points out the important fact that this island lies 10 minutes south of the southern limit of the zone of totality, so that only 0.988 of the sun's diameter will be eclipsed.

**A research party** from the American Museum of Natural History, headed by Barnum Brown, has discovered part of the skeleton of a Tyrannosaurus Rex, a prehistoric animal, in the Bad Lands several miles south of Glasgow, Mon. The fossil, which is 40 feet long and 22 feet high, has a perfect skull, an entire set of ribs, back bone, and hip girdle and practically supplements the specimen discovered in the same section in 1902. The first fossil had good hind limbs but incomplete back bone. The museum will now be enabled to mount a complete animal.

**Balloonists** and mountain-climbers have long known that the temperature of the air falls as the altitude increases. It has recently been discovered that this decrease in temperature has its limits. "Sounding" balloons, freighted with automatic recording instruments, have been sent to heights far exceeding those which any balloonist can hope to reach. The records obtained show that at a height of about eight miles the thermometer ceases to fall, and may even rise. The distinguished French meteorologist Tisserane de Bort claims also to have discovered that at a certain level, the air above the poles is warmer than that above the equator, an anomaly which must be more fully demonstrated than is now possible, before it can be accepted.

**It has long** been known that sea water contains gold in solution, but in quantities so small that all attempts to extract it have proven unremunerative. Luther Wagoner has recently revived the hopes of the gold seekers by demonstrating that the quantity of gold varies greatly in different parts of the ocean, the ratio between the extremes being 1 to 30, and that the richer specimens of sea water may repay working for gold. In the first place, Wagoner finds that both gold and silver are more abundant in sea water taken from great depths than in the shallow waters near the shore. The following table shows, approximately, the number of grammes of gold and of silver that he finds in a cubic yard of deep-sea water from various localities:

| Locality. | Gold. | Silver. |
|---|---|---|
| East of Georges Bank..... | 3.9 | 23.1 |
| South of Georges Bank..... | 1.8 | 4.4 |
| Delaware Bay..... | 1.7 | 11.9 |

It would be difficult and costly to bring these waters to land, but possibly floating extracting establishments could be used.

**The volcano of Kilauea** is exhibiting phenomena never before known in the eighty years during which it has been closely observed. The activity in the central pit of the crater is of an explosive and spasmodic type never before noted there. The molten lava rises from the central pit from 10 to 400 feet within a few hours, and then as suddenly or more suddenly drops again, to rise and fall in the same way—unprecedented so far as this volcano is concerned. When it is considered that the area of this central pit is from 40 to 50 acres, the amount of matter that rises in it and then falls and rises again—squeezed out of it as it were, to be sucked back again—is enormous. The only hypothesis so far suggested for this unusual action is that in the movements that have been going on within the earth's crust at that point, a great cavity has formed like a Titan's trap, which gradually fills up with gases, which force the molten lava up into the pit until the gases accumulate to such an extent as to fill the trap and escape, allowing the lava to flow back into the trap. The earthquake of September 20, which was at first believed to have emanated from Mauna Loa, is now thought to have come from Kilauea. It has created a line of fissures extending for miles from Kilauea—first southeast and then northeast, through the sparsely settled districts of Puna.