

ENGINEERING.

Steel manufacture by the electric furnace is making good headway. At the present time there are in operation about 80 furnaces of the electric type, namely, 19 of the Héroult system, 14 of the Kjelling, 10 of the Stassano, and the same number of the Roechling-Rodenhauer and Girol, the other twenty-seven furnaces being of eight other systems.

During the Hudson-Fulton Celebration week, the Interborough Rapid Transit Company of this city carried in the course of one day 2,200,000 persons without accidents, blocks, or other detriment to its service. The traffic was about equally divided between the elevated roads and the subway. Considering the crowded condition, this is a truly marvelous feat of city transportation.

At last the Atlantic has been crossed by a steamship at a speed of over 26 knots an hour, the "Mauretania" on her last trip to the westward having covered the course from land to land in 4 days, 10 hours, and 51 minutes, at an average of 26.06 knots, reducing her last record trip to the westward by 44 minutes. Although she did not reach her highest previous day's run, she maintained a steady high speed on every day throughout the course.

The monthly report of the Acting Chairman of the Panama Canal to the Secretary of War, dated September 15th, states that during the month of August, the total amount of excavation done on the Panama Canal was 2,755,178 cubic yards, the average rainfall being 9.27 inches. From now on there may be a diminution in the totals of excavation, due to the fact that portions of the canal have been finished, and that as the excavation grows deeper, the number of shovels that can be employed will be reduced.

The tests which are about to be made of the new army 14-inch gun at Sandy Hook will be followed with close interest; for upon the success of this gun will depend the character of the future armament of our sea-coast defenses. The new piece weighs about the same as the present 12-inch gun, but fires a heavier projectile with lower velocity and a greater curve of trajectory. Its great advantage is that it can fire 250 to 300 rounds without serious erosion, as compared with the limit of 80 to 85 rounds for the 12-inch gun.

The Bath Iron Works are to be congratulated on the remarkable speed made by the new torpedo-boat destroyer "Reid" during her standardization trials on the Rockland mile course, when she reached a maximum speed for one mile of 34.55 knots. This is about a knot faster than the speed, which was itself a record for a torpedo-boat destroyer, of the "Flusser," which made over 33½ knots. The mean of the high-speed runs of the "Reid" was 33.75 knots, which is an eighth of a knot better than the average of the "Flusser." The shaft horse-power was 15,000.

The Japanese armored cruiser "Ibuki," which is equipped with the Curtis reversible turbine built by the Fore River Company, has recently undergone successful steaming trials in Japan. In the six-hour trial under full power, the steam chest pressure was 239 pounds, and the exhaust shell vacuum was 25.7 inches. At 250.5 revolutions per minute the brake horse-power was 27,142, and the water rate per brake horse-power was 15.03; corrected to contract conditions, it was 13.88 pounds. The "Ibuki" carries four 12-inch and eight 8-inch guns.

The consulting engineer appointed by the city to pass on the plans and safety of the new Manhattan Suspension Bridge, Mr. Ralph Modjeski, has found everything to be satisfactory. The main tower foundations are good and sufficient, and although the foundation of the anchorages could have been improved by driving inclined piles, the fact that careful observation for the past sixty days failed to reveal any appreciable movement, leads him to consider that the foundations are safe and sufficient. The structure has been carefully designed and well built and will be amply strong to carry the heaviest traffic, as well as any reasonable addition in the weight of properly regulated traffic that it may have to carry for many years to come.

One of the most important works connected with the Panama Canal is the spillway in the middle of the Gatun Dam for regulating the height of the water in the lake. Usually it is preferred to locate the spillway in a position more or less remote from the dam; but in the present case the existence at the center of the site of the dam of a hill, which provided a rock surface at about sea level, proved the deciding factor, and led to the choice of the present site. The spillway consists of a concrete dam, whose crest is to be built on the arc of a circle, with its face convex to the lake. The crest will be at 69 feet above sea level. Above this, and placed between thirteen concrete piers built at the crest of the dam, will be fourteen gates, whose tops, when they are closed, will be 87 feet above sea level. These gates will give absolute control of the lake level under all possible conditions.

ELECTRICITY.

The Postmaster-General of the United Kingdom has secured for the government telegraphic system all the Marconi wireless telegraph stations in the British Isles.

A new combined electric lamp and shaving mirror has been produced, in which the reflector can be arranged to throw the light only upon the face below the eyes, no light falling upon the mirror or the eyes.

The British Antarctic expedition now in course of preparation will carry wireless telegraphic equipment sufficient to enable messages to be sent to New Zealand from the ship and from stations established at bases of supplies on land or ice.

The Russian crown steel works at Slatons in the Ural district have secured the right to manufacture steel electrically by a process owned by a German company and using induction furnaces. An electric plant will be immediately installed by the Siemens-Halske Company, and the product will be marketed directly.

The electrified suburban system of the New South Wales State Tramways at Sydney, N. S. W., showed a profit of \$357,000 for the year ending June 30th, 1908, after paying all working expenses and interest on capital, as compared with a net loss of \$15,500 a year for the steam lines owned by the State. This encouraging result will probably cause extensive electrification in Victoria and other adjoining States.

The Commonwealth Edison Company of Chicago has been most successful with its plan of introducing electric flatirons. Ten thousand 6-pound irons were distributed up to March last on loan for six months without charge. At the end of that period the used irons were offered for sale at a reduced rate to the users, most of whom were only too glad to retain the irons at so low a price, while the demand for used irons returned has been greater than the company can supply.

It is reported that a large wireless telegraph and telephone station is to be erected at the Omaha shops of the Union Pacific Railroad, where Dr. Frederick H. Millener will conduct wireless telegraph and telephone experiments. Dr. Millener hopes to develop wireless telephony to such an extent as to permit railroad officials to keep in touch with trains, and thus govern their movements from sixty to one hundred miles from Omaha. If the system is developed as he expects, it will be possible for passengers on moving trains to carry on telephonic conversation within a radius of one hundred miles of Omaha.

The rapid progress of aviation has caused attention to be drawn from a new direction to the dangers of atmospheric electricity. In an article in the *Elektrotechnische Zeitschrift* Mr. L. Zehnder discusses the danger to balloons and aeroplanes of electrical disturbances, and the methods of avoiding disastrous effects. He points out that the electrical conditions of the air are subject to great variations during thunder storms and that the atmospheric charges may change suddenly in sign. In clear weather an ordinary balloon without metal parts is not exposed to any danger so long as it floats in the air; but in the modern dirigibles much of the framework consists of conducting materials, which add to the danger. Also a balloon may be charged with electricity and a spark produced when contact with the ground is made, setting fire to the gas.

An ordinance was introduced at a meeting of the City Council of Chicago making it compulsory for all railroads operating within eight miles of the city hall to use electricity on their lines in place of steam. There is every prospect that this ordinance will be passed, as there appears to be considerable popular agitation in favor of it. The ordinance requires that within a year after its passage and publication, all railroads shall submit plans to the Commissioner of Public Works, and within six months after the plans and specifications have been approved they shall commence to electrify their roads. If this ordinance is passed, it will result in abating the smoke nuisance in Chicago to a large degree.

The long lead in hydro-electric work maintained by the Pacific coast, which, with exceptional natural advantages, was early in the field, is illustrated by the new power plant of the Great Western Power Company at Big Bend on the Feather River, Cal., the electrical equipment of which is described in the *Electrical World*. The penstocks are the largest ever built for so great a head, the turbines themselves are of record size, 18,000 horse-power per unit, and are operated by what is certainly a record head of water for any turbines, 525 feet. The transformers also are of record size, being three-phase units of 10,000 kilowatts capacity, with 100,000 volts on the high-tension side. Another big plant described in the same issue is that of the Grand Rapids-Muskegon Power Company, which is remarkable for its high voltage generation, 110,000 volts being the highest yet attempted, as well as for the simplicity of its arrangement.

SCIENCE.

Dr. F. A. Cook has decided to submit to American scientific and geographic organizations duplicates of the proofs which are at the University of Copenhagen. A simultaneous announcement is to be made in Denmark and this country as to whether he had furnished adequate proof that he had reached the North Pole.

Ten grammes or about one-third of an ounce of radium chloride, equivalent to one gramme of pure radium, is the total output for eighteen months of the Joachimsthal mines. After the hospitals and scientific institutions have been supplied, the remainder will be offered for sale at \$75,000 a gramme, or 15½ grains.

Analysis of the natural gas coming from the Caucasus wells, which is used for heating purposes, was made by M. Meuschen as to the gas from the Bibi Eybat territory. He finds the following composition in per cent: Methane, 54.80; hydrogen, 13.58; saturated carbides, 1.20; nitrogen, 20.42; oxygen, 7; carbonic acid, 3. Another sample gave only 0.80 hydrogen, 60.0 methane, and 25 nitrogen, with the rest about the same.

In a recent issue of the *Astrophysical Journal* Mr. Walter S. Adams of the Mount Wilson Observatory station summarizes the results of a study of the Mount Wilson photographs of sun-spot spectra. A discussion of the various elements whose lines are strengthened or weakened in the spot spectrum indicates that the changes observed may be best accounted for on the basis of a reduced temperature in spots. A detailed study of the spectrum of iron furnishes especially strong evidence in this direction, and the weakening of the "enhanced" lines in the spot spectrum is also most simply explained on the same basis. The presence of the spectra of titanium oxide, magnesium hydride, and calcium hydride is sufficient to account for the greater part of the unknown fluting and band lines appearing in the spot spectrum. The discovery of the existence of a magnetic field in sun-spots by Mr. Hale provides a ready and sufficient explanation for the widening of large numbers of lines in the spot spectrum for which there is no marked change of intensity.

An apparatus for making enlarged tracings of sound-waves from a cylindrical graphophone record, the magnification ranging from 150 to 2,500 times, was described by F. Proctor Hall before the British Association. In the sound-waves two elements are distinguished, impulse and resonance, which are illustrated by waves from the cornet, violin, bugle, etc. Vocal waves are found in groups regularly repeated. Each group contains a single impulse from the vocal cords, together with one or more sets of resonance waves produced by vibrations of the air in the vocal tubes. Pitch is determined by the number of impulses per second—i. e., by the number of wave groups—and is not affected by the character of the waves within the groups. The vowel quality of vocal sounds is not perceptibly affected by the number or form of the resonance waves, but is dependent upon their periodicity. The rate of the resonance waves may be calculated from the length of the air-tubes upward from the vocal cords. The calculation shows, for example, that the sounds *m*, *n*, *ng*, all contain a resonance wave whose period is about 530. The mean rates found from measurements of the enlarged waves are for *m* 550, for *n* 535, for *ng* 580. The observed rate for the sound of *a* in the word "great" is 420, and for the sound of *o* in "mat" 770 waves per second.

Mr. Durand, United States Census Director, has made an appeal to farmers all over the country to assist him in securing accurate agricultural returns at the coming census. He trusts that farmers will keep or provide some sort of written record of their operations during the year 1909. Each person in charge of a farm will be asked to state the acreage and value of his farm—that is, the acreage and value of the land kept and cultivated by him; the area of land in his farm covered with woodland, and, finally, that which is utilized for specified farm purposes; the acreage quantity produced and value of each crop, including grains, hay, vegetables, fruits, cotton, tobacco, etc., raised on the farm in 1909; the number and value of all domestic animals, poultry and swarms of bees on the farm on April 15th, 1910. He will also be asked to state the number and kind of animals sold during 1909 and the receipts from such sales, the number purchased and the amount paid therefor, and also the number slaughtered for food, and the value of such animals. The census act provides that the information shall be used only for statistical purposes for which it is supplied. "No publication shall be made by the Census Office whereby the data furnished by any particular establishment can be identified, nor shall the Director of the Census permit any one other than the sworn employees of the Census Office to examine the individual reports." Furthermore, the information reported on the agricultural schedule will not be used as a basis of taxation or be communicated to any assessor.

The Employment of Liquid Air and Carbon Dioxide in the Treatment of Diseases of the Skin.

The lack of specific remedies for many diseases of the skin has caused a diligent search for new remedies more efficient or less disagreeable than those in common use. An epoch in dermatology was marked by the introduction of Roentgen rays, which exert a curative action in many cases of eczema attended with profuse exudation and intense itching, in psoriasis and in many fungous diseases of the skin and hair. Cathode rays have proven beneficial in numerous cases of lupus and, quite recently, malignant tumors of the skin have been cured by these rays.

But in many cases treatment with rays failed to effect a definite cure, and the experiments with other physical and chemical agencies were resumed. An American physician tried liquid air and carbon dioxide and obtained more or less success in cases of tuberculous abscesses, moles, pimples, and superficial cancer of the skin. The method of treatment is as follows: Cotton wool, wound tightly on the end of a rod, is dipped into the double-walled glass flask of liquid air and then pressed lightly on the affected part of the skin. The skin freezes and becomes inflamed and in from 10 to 20 days the morbid growth sloughs off.

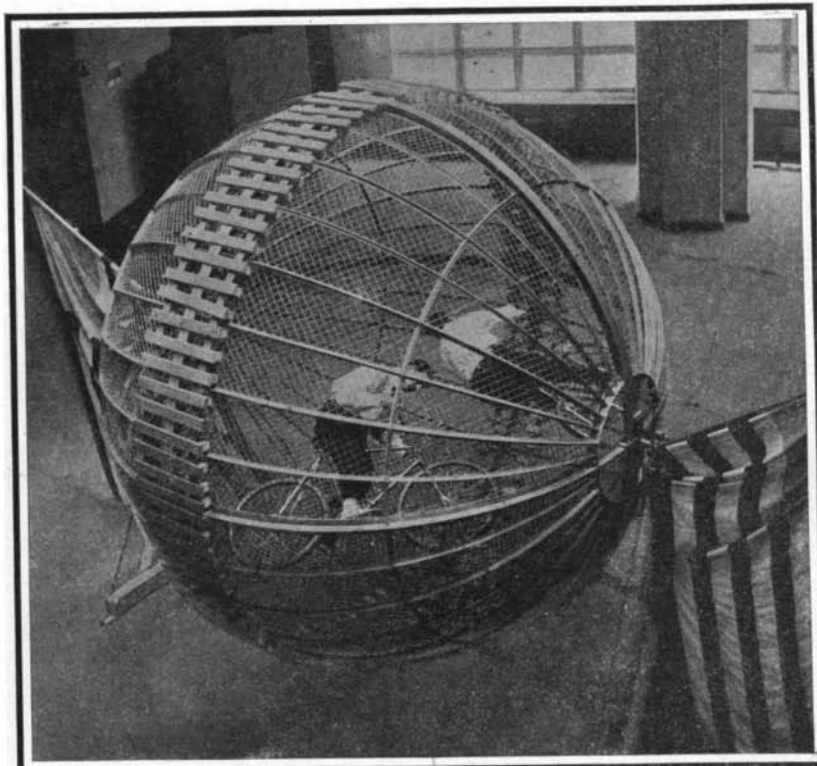
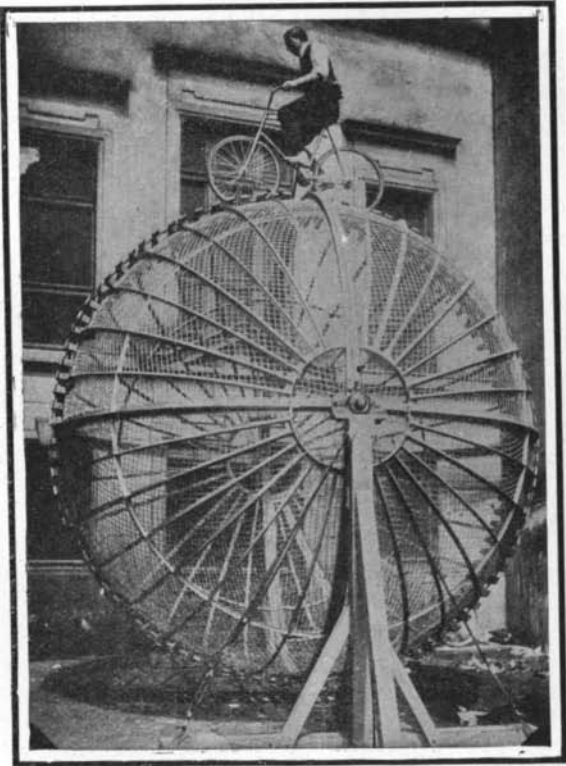
But liquid air is expensive and it also acts too energetically. An equally efficient, but cheaper and more manageable agent is carbon dioxide, which was first employed for this purpose by Pusey. From the steel cylinder which contains liquefied carbon dioxide, the vapor is allowed to escape into a glass tube. Here it condenses into snow, which is compressed by a piston into a hard mass. This can be trimmed to the size and shape of the morbid growth to which it is to be applied, and thus the freezing of the surrounding healthy skin can be avoided.

The temperature of carbon dioxide snow is -130 deg. F., while that of liquid air is about -290 deg. F. The snow is cold enough, however, to freeze the skin into a hard, white mass in a few minutes. Too long an application may cause necrosis, or death, of the underlying tissues. The skin subsequently becomes slightly inflamed and a blister, similar to that caused by a burn, is produced. In general, freezing and burning produce similar effects on the skin. In two or three weeks the part that has been frozen falls off as a scab, revealing skin of quite normal appearance or marked by a slight scar. The application of this remedy is not attended with great pain. In the treatment of facial blemishes especial care must be taken not to freeze the skin too deeply. The field of application of carbon dioxide snow is extensive. Hitherto good results have been obtained chiefly in cases of lupus, but small tumors, callosities, moles, pimples, etc., have also been treated with success.—Dr. Berg-rath in Die Umschau.

CYCLING TRICK IN A BERLIN VARIETY THEATER.

The accompanying illustrations picture a trick performance which recently attracted much attention in Germany. In the first photograph a cyclist is shown traveling outside a globular cage on a narrow wooden path. He uses an ordinary bicycle wheel of 28 inches diameter, and that of the globe is ten times as great, viz., 280 inches. The circumference is consequently $280\pi = 879.6$, or roughly 880 inches. The globe is rotated by the friction of the cycle wheel on the top. Every minute it makes 30 revolutions, or 1,800 in one hour. Any point of the equator travels a path equal to 880 times 1,800 in one hour, or 1,584,000 inches.

As one mile is 63,360 inches, it means that $\frac{1,584,000}{63,360} = 25$ miles are covered in one hour. The cyclist must be very careful to keep in the center of the path. By far the greatest difficulty lies in the fact that his



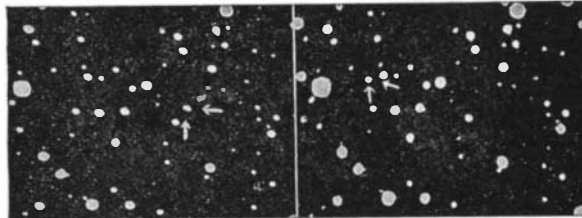
THESE TWO ILLUSTRATIONS REPRESENT A REMARKABLE BICYCLE TRICK WHICH ATTRACTED CONSIDERABLE ATTENTION IN GERMANY. A GLOBULAR CAGE 280 INCHES IN DIAMETER IS FRICTIONALLY ROTATED AT HIGH SPEED BY AN ORDINARY BICYCLE.

weight constantly draws him down the slope in front as well as backward. In other words, he must not only keep his balance right and left, but also forward and backward. The latter feat he accomplishes by accelerating or retarding his bicycle.

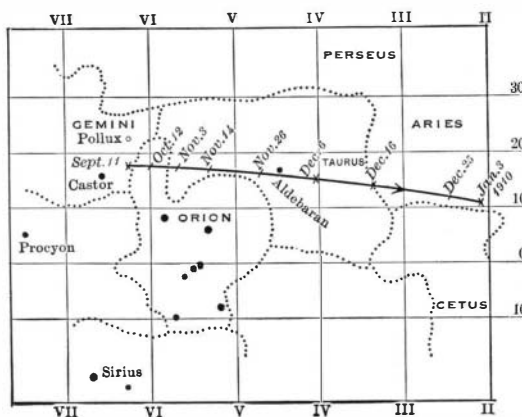
The other photograph shows two men inside the cage. They rotate the globe through the frictional contact of their wheels with the globe.

THE FIRST PHOTOGRAPH OF HALLEY'S COMET.

The accompanying photographs of Halley's comet were printed from negatives made with the Yerkes two-foot reflector by Mr. Oliver J. Lee on the nights of September 24th and September 26th, astronomical, or



In this photograph of Halley's comet the arrows indicate the position of the comet. At present the comet can be seen only through a powerful telescope.



The path of Halley's comet from the date of its discovery to January, 1910.

THE FIRST PHOTOGRAPH OF HALLEY'S COMET.

on the early mornings of September 25th and 27th, civil. The photographs are here published by permission of the director of the Yerkes Observatory, editor of the Astrophysical Journal, in the October number of which magazine these pictures are appearing, together with photographs taken on other dates. On September 24th the exposure was from 13h. 12m. to 15h. 42m. central standard time; on September 26th, from 14h. 47m. to 15h. 47m. central standard time. The arrows

shown on the original plate are about twenty-five thousand times as faint as a sixth-magnitude star, the limit of naked-eye visibility. The comet's motion in the sky at this time is comparatively slight, and will be very much greater later. The comet was "retrograding," or going westward, at this time, as seen from the earth (to whose motion this retrogression was wholly due), having ceased its eastward motion a few days before.

The comet has been micrometrically observed on several nights with the forty-inch Yerkes telescope by Profs. Burnham and Barnard. On the 26th it was estimated by Prof. Barnard to be of magnitude 14 or 14.5, with a diameter measured as 10 sec., but without definite boundary. The presence of strong moonlight is likely to prevent the observation of the comet, either visually or photographically, for several nights after September 27th.

A High School of Aerial Navigation in France.

It is due to the energetic efforts of Commander Rocher, who has succeeded in enlisting the assistance of a committee, the members of which are all well known in the scientific world, that a special high school of aerial navigation has been organized in France on the following basis:

1. All former students of the polytechnical schools, the schools of bridges and highways and mining engineering and of naval construction will be admitted as a matter of course. Graduates of science (in general physics and mechanics) will be admitted upon passing examination in the drawing of machines. Other places will be awarded upon open competition.
2. The course of instruction comprises one scholastic year.
3. The principal courses of instruction will be in all branches of aerial navigation, aerostatics, and aviation, and about motors, especially gas motors. The annual lectures about the various topics are arranged in such a way that the students will be kept posted about all evolutions in aerial navigation and of the sciences relating to it.
4. Independent of these courses of instruction, the students will have to execute practical work relative to aerial navigation and to motors.
5. To students who have completed all the courses as well as the technical work, and have successfully passed the examinations, the diploma of engineer of aerial navigation shall be awarded.
6. Besides the regular students, any person may attend one or several courses, without, however, participating in the technical work and without being entitled to examinations or to the award of the diploma.
7. The tuition fee for regular students is \$200. The fees for other persons vary, according to the number and the importance of the courses which they desire to attend.

It seems only logical that France, having been the first country to promote aerial navigation, shall also be the first one to organize a higher course of instruction in same on a thorough and rational basis.

Another new hydroelectric plant is to be commenced shortly in Canada on the St. Lawrence River near St. Timothee, Quebec. The main features of the initial development are a canal intake and headgates about 3,200 feet below the present intake, enlargement of the Beauharnois Canal from the intake to the station site, a distance of 32,000 feet, and turbines of 21,600 horse-power capacity. The generators will consist of three 4,000-kilowatt turbine units, two 250-kilowatt exciters, and there will be three 4,000-kilowatt transformers. A transmission line 27 miles long to Montreal will be constructed, with transformer substations and distribution system there. The present developments are expected to cost \$4,000,000, the contract being let on the cost plus commission basis.

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