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(Illustrated articles are marked with an asterisk.)

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For the Week Ending May 25, 1895.

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ELECTRIC LIGHTING AND HEATING.

The tendency of the education of the scientist and engineer is to develop in his mind a dislike for the waste of energy. One of the favorite aims of the steam engineer is to lower the pounds of coal burned per horse power hour. The greatest rivalry exists among the builders and designers of pumps—each one striving to produce a pumping engine of more efficiency or giving higher duty than his rivals. In this and similar races for simple fuel efficiency the question of capitalization is apt to be overlooked. Many an instance of a high duty machine might be found where the interest charges greatly overbalanced the fuel economy. A low duty machine is often the cheapest to run.

In electric heating, which is one of the latest developments of electricity, good instances of a similar condition of things can be found. Electricity has been successfully applied to the production of light, and its most inefficient role in this direction, and one involving the largest amount of copper in the conductors, has proved most acceptable to the public. The incandescent lamp, on account of its attractive appearance, its ease of installation, its steadiness and its healthfulness, as it does not contaminate the air, has proved a most serious competitor with gas. Yet the inefficiency of the comparatively low potential incandescent lamp is almost startling when compared with the economy of the arc lamp. There is something repugnant to the scientific economist in the idea of delivering electric energy with an initial potential of little over two hundred volts. But the public likes the incandescent lamp, admires it when mounted on beautiful electroliers, is willing to make it softer to the eyes by screening it with ground or cut glass and sees no enormity in wasting eighty or ninety per cent of it by the last named processes. The incandescent lamp has been accepted by the public, and the expenditure of a horse power for the maintenance at low white heat of a yard or two of fine carbon filament is good practice, if it is poor theory. The engineer makes an error if too theoretical—he must remember that he is catering to the affairs of practical everyday life, and fuel economy or pure efficiency may be absolutely unpopular. The human element must be taken into account.

Electric heating is now coming to the front, and for certain cases has become a possibility, because of the low economy which seems necessarily inherent in domestic processes. It has to compete with heat most wastefully applied; otherwise it would be out of the question, except as a matter of luxury. But when to the low economy of the kitchen fire, which is its competitor, there is added it own extreme convenience and cleanliness, it will be seen that a very good case is made out for the employment of the electric current.

The general aspect of the case is thus put by its advocates. In the electric station energy is generated with an efficiency of about six per cent. When this energy is applied in cooking operations great economy results, and but little of the six per cent is lost. Thus, if water is to be boiled, a heating coil in direct contact with the water will utilize nearly all the energy except that represented by the difference between the average temperature of the water and that of the air. In broiling or baking by the use of scientifically designed heaters, a very high percentage of the electric energy can be utilized. The low economy of the generation of the electric energy is compensated for in the comparative sense by the low economy of cooking with coal. To boil a kettle of water or to properly broil a few chops any quantity of fuel may be heaped upon a fire, and after the work is done the fuel may burn on for hours doing nothing. But the electric current is turned on only as wanted. The instant the cooking is accomplished it is turned off, and all expenditure ceases. It is calculated that a cooking fire may only utilize one or two per cent of the heat produced while cooking is going on. When the cooking ceases, all goes to waste.

Electric heating has to contend with one great obstacle—the low efficiency of the steam plant; and its utilization is only possible because of the waste of fuel in household operations.

In the field of heating the adaptability and simplicity of application of electricity may give it great success. The catalogues of the suppliers of electric heating apparatus are full of most suggestive suggestions. From a radiator for heating a room to an electric curling tongs all are figured. There is something wonderfully attractive in starting a stove by turning a switch. The stove may stand on a table, to be set aside when its work is done.

There are no products of combustion to be disposed of. A kettle can be boiled in a parlor without any flame or danger from alcohol explosion.

As regards heating on the large scale, as of rooms or entire houses, success is very doubtful. Ordinary heating apparatus may be made to give much higher efficiency than can be given by the regulation cooking stove, where, practically speaking, a scuttle of coal may be expended in cooking a few chops. A properly arranged furnace or heating apparatus can be made to give results far ahead of anything that electricity, with its 94 per cent handicap, can be expected to produce.

Opening of the Metropolitan Elevated Railroad, Chicago.

The Metropolitan Elevated Railroad, the first electric elevated road in Chicago, was formally opened on April 17. The motor cars, which were built for the company by the Barney & Smith Car Company, of Dayton, Ohio, necessarily differ in many respects from those ordinarily used either on surface or elevated roads. The principal feature of the car is the steel sub-frame, which was added to enable the car to pull six loaded, forty-foot trailers, and also to get sufficient weight for traction; for the latter reason no attempt has been made to lighten the construction of the car body and trucks.

The car weighs nearly 40,000 pounds without electric apparatus of any kind. The body is 40 feet long, while the steel frame is 47 feet 3 inches. The entire height from rail to roof is 12 feet 10 inches, the width at the sill is 8 feet 7 inches, and that at the eaves is 8 feet 11 inches.

The end sills are of oak, and the six longitudinal sills and stringers are of long leaf yellow pine. The end frames have iron plates at the sill and uprights to prevent telescoping in case of collision.

There is a motorman's cab at each end, diagonally opposite each other, extending out on the platform as far as the end of the hood. The entrance doors are, therefore, next to the corner posts, and slide back into the cabs. As the front door is always to be kept fastened, this will not inconvenience the motorman.

The cars are handsomely finished within in quartered oak, and are lighted by incandescent lamps placed directly above the seats. Electric heaters will be used in the winter. They are also equipped with quick-acting air brakes, the air being carried in storage tanks under each car.

The first train to carry other persons than officials made its trip succesfully over the Metropolitan "L" road on the 17th ult. The northwest branch of the road is complete to Wicker Park, and to this point the special Pullman train was run. The run from Canal Street to Paulina Street was made in five minutes. There the main line of the road, which carries four tracks, ends, and the Garfield Park, Douglas Park and Logan Square lines begin. The Garfield Park line extends to Forty-eighth Street. The Douglas Park line extends from the terminal of the main line south to Twenty-first Street, and thence past Douglas Park to Central Avenue. This branch is not yet completed. The Logan Square line extends from the terminal of the main line north to Milwaukee Avenue and Division Street, and thence northwest, parallel with Milwaukee Avenue, to Logan Square. The Humboldt Park line branches off the Logan Square line at Robey Street and North Avenue, and will extend west to Crawford Avenue when completed. The Logan Square line penetrates one of the most densely populated districts of the west side and will draw its patronage largely from the Polish quarter.

These various lines contain miles of track as follows: Main line, 1·8 miles; Garfield Park line, 4·2 miles; Douglas Park line, 3·7 miles; Logan Square line, 4·49 miles; Humboldt Park line, 2·13 miles. The various lines contain forty-three stations.

The Metropolitan line will run 155 cars—100 passengers and 55 motors.

There are two impressive pieces of engineering—one the bridge on the Logan Square line, which carries the elevated tracks over the Northwestern Railway tracks and has a span of 250 feet. The method by which the Metropolitan tracks are carried over the Lake Street "L" tracks also presents an interesting feature of engineering.

Meal of Sunflower Cake.

Sunflower cake has been found, especially in Russia, one of the best auxiliary cattle foods. As early as the year 1866 about 100,000 centners of sunflower oil (oil of the seeds of Helianthus annuus) were manufactured in Russia, and its amount has increased year by year, it being esteemed as a very palatable alimentary oil. The oil was formerly obtained by hydraulic means; the residual cake is harder than any other variety of oil cake, and for this reason apparently it has not found a wider application. Denmark and the northern countries import large quantities annually, as do also the eastern provinces of Germany, and the problem of its disintegration has been successfully solved by several manufacturers there. It is still unknown in Southern and Western Germany; now, however, that it is put on the market in the form of meal it will doubtless soon find general application, suited, as it is, both on account of its composition and pleasant taste, for fattening cattle. The percentage of proteid varies between about 30 to 44 per cent, the fat between about 9 to 18 per cent. It is possible to prepare two qualities, one rich in proteid and poor in fat, and the other rich in fat and poor in proteid. When, for example, the somewhat finely ground meal is sifted, employing a mesh of 1 mm., that which passes through is much richer in proteid and poorer in fat than the original, while the reverse is true of that which remains in the sieve.

[FROM THE WESTERN UNIVERSITY COURANT.]

Spectroscopic Observations of Saturn at the Allegheny Observatory.

In giving below, at the request of the editor of the Courant, an account of some recent observations of Saturn at the Allegheny Observatory, I have thought that a brief glance at the previous history of the subject would be of interest as an introduction; such a review is, indeed, necessary, in order that the reader may correctly understand the significance of the results which have been obtained at this place.

The hypothesis that the ring of Saturn is nothing more or less than a multitude of small bodies, revolving around the planet in circular orbits, is a very old one. It was suggested by Roberval in the seventeenth century, and was revived by Jacques Cassini in 1715, but in those days of course it had no better basis than mere speculation. These suggestions were forgotten, and when the great mathematician Laplace took up the question he regarded the rings as solid bodies. He arrived at the result that such rings could not exist in their actual form unless they were unsymmetrically weighted, and left the problem in this unsatisfactory state. At a later date Professor Peirce, of Harvard, showed that the rings could not be solid, and regarded them as composed of some fluid denser than water. Finally, the English physicist Clerk Maxwell discussed the whole matter thoroughly in a prize essay submitted to the University of Cambridge in 1857, and showed mathematically that the rings could be neither solid nor liquid, and that stable equilibrium would be impossible unless they were made up of separate bodies of no great size—"a shower of brickbats," he was in the habit of calling them.

It was indeed proved before Maxwell's time, by Edouard Roche, of Montpellier, that a body of considerable size cannot revolve within a certain limiting distance of a planet, as it would be torn to pieces by the strain due to unequal attraction, but Roche's investigations were long overlooked. In the case of Saturn this "Roche's limit," as it is now called, is just outside the ring, and hence it follows that the ring must be made up of separate small bodies.

Thus it will be seen that the accepted hypothesis rested on a mathematical demonstration that no other constitution of the ring is possible according to the laws of mechanics, and although the mathematical proofs are conclusive to those capable of appreciating them, a proof by direct observation was regarded as having so much importance that the results obtained at the Allegheny Observatory attracted the widest notice.

If there were any spots on the ring, the matter would have been settled long ago; but there are none, and the motion of the ring was measured at Allegheny for the first time by means of a spectroscope. According to a well-known optical principle, a line in the spectrum of a heavenly body is displaced toward the violet if the body is approaching the earth and toward the red if the body is receding. Now, as Saturn's ring rotates, one side is continually moving toward the earth and the other side away from it. Hence the lines in the spectra of opposite sides of the ring are displaced in opposite directions, and by photographing the spectrum, and measuring the displacement on the photograph, we can determine the velocity in miles per second. The moon has no motion in the line of sight, and by photographing its spectrum on the same plate, without disturbing the apparatus, we have a starting point from which the displacements can be reckoned.

But this is not all; the velocity of different parts of the ring will differ according to the way the ring is made up. A satellite must move in obedience to Kepler's third law, and a consequence of this law is, that the velocity of the satellite varies inversely as the square root of its distance from the center of the planet; the nearer a satellite is to the planet, the faster it moves. It is easy to calculate that, if the ring is made up of satellites, its inner edge must move at the rate of 13·06 miles per second and its outer edge at the rate of 10·65 miles. If, on the contrary, the ring is solid, its outer edge must move faster than its inner edge, just as the tire of a wagon wheel moves faster than a point nearer the hub. The outer edge would in fact move more rapidly by about five miles per second.

Now let us see what the photographs say. Here are the main results obtained from the measurement of two different plates:

Velocity of the middle part of ring, 11·2 miles per second.

Velocity of inner edge greater than outer edge, 2 to 3 miles per second.

Comparing these figures with those given further above, we recognize that the photographs contain a proof that the ring is made up of independent bodies, revolving as satellites.

Perhaps I need hardly say that such results are not obtained as easily as they are described. Some idea of the delicacy of the observations can be formed when I state that a velocity of one mile per second causes a displacement on these plates of only one twenty-five thousandth part of an inch, and that the image of Saturn, which the telescope casts on the slit of the spectroscope, must not move much more than one three thousandth of an inch during the long exposure of two hours. The plates are measured under a microscope, and while it is impossible to be certain of the fraction of an inch, an accuracy sufficient to decide in favor of the meteoric hypothesis of the constitution of Saturn's rings is quite readily attained.

JAMES E. KEELER.

A Wax Found in Cotton and Linen Fiber.

BY CLAYTON BEADLE.

It is occasionally observed that the iron walls of a beater in which cotton and linen pulp is disintegrated become coated with a film, which protects the iron against the action of the bleach, etc. It appears that this film is not formed under ordinary conditions of treatment, as its occurrence is not generally known to paper makers. This wax-like film, when of sufficient thickness, can be readily scraped from the sides of the beater. A case of this formation was brought before my notice about two years ago. The formation of this film was so rapid as to cause inconvenience, and to necessitate constant scraping of the sides of the beaters, lest portions should detach themselves and form yellow spots in the pulp.

I examined samples of this substance taken at different times, and found that it consisted of alumina, iron and lime salts, mixed with a substance soluble in ether. The latter substance has a sweetish smell and generally resembles beeswax. It has a saponification equivalent (p.c.) of 19·46 (KOH), and a very definite melting point of 47·5 degrees C.

The wax on saponification gave 91·04 per cent insoluble fat acids. Samples were taken and examined at different times, and were found of constant composition. The raw material that gave rise to the formation of this substance had been previously treated under pressure in a 3½ per cent solution of NaOH, and afterward thoroughly bleached in calcium hypochlorite solution at 32 degrees C. The wax does not make its appearance until the bleached material is disintegrated. At the back of the beater roll a thin film may sometimes be seen on the surface of the water. This in time builds itself up on the sides of the beater. The characteristic sweetish odor of the isolated wax can be traced back often to the bleached material, which sometimes smells strongly.

I think there is evidence that this substance does not exist in the raw fiber, but is formed in the cell wall during treatment. It is hardly probable that this substance, which is readily dissolved by soda, should survive the treatment with alkali under pressure. The odor which is characteristic of this substance is not noticed in the raw material until after the warm bleaching, and appears to be more developed after the bleached material is allowed to lie heaped up in a dense condition for some time. By altering the mode of bleaching of the raw materials, the occurrence of this waxy substance can be prevented. I found in one batch of cotton fiber, that smelt strongly of the waxy substance, that the alcoholic extract amounted to 2·87 per cent, and, when treated with ether afterward, the ethereal extract amounted to 0·73 per cent.

The separation of the wax in the beater is merely a mechanical one, and is probably due to the fact that it intimately penetrates in the fiber. The knives of the beater roll, which tear the ultimate fiber asunder, release the wax, which floats on the surface as a fine film, and quickly builds itself up on the metallic surface with which it comes in contact. I succeeded in at one time collecting about 50 lb. of the deposit, which was found, on extraction with ether, to contain 77·54 per cent of wax.—Chem. News.

Anthion—A New Agent for Quickly Washing the Hypo from Prints.*

BY DR. H. W. VOGEL.

We have in the preceding number, under the heading of "Novelties," already made mention of a stuff which we have several times tested as a destroyer of hypo, and which enabled us to shorten the washing process of prints and plates from one hour to forty minutes.

As our tests date back several months, we are convinced that pictures and plates thus treated are as permanent as those washed in the usual way.

It is self-understood that the saving of time is of importance to professional and amateur, both when quick work is required and where facilities and time are scarce. Especially amateurs who are deficient in patience will welcome this preparation. Of course, mistakes in its use will be made, but the test which is prescribed, and which always should be applied, points out such mistakes. Anthion is a white powder which but sparsely dissolves in water. One part requires 100 parts of water for solution. Warm water is recommended. We prefer to use solutions of 1:200; these will keep about four weeks. The sample placed at our disposal was a persulphate, KSO_4, and acted as an oxidizer. It changes hypo quickly to the harmless tetrathionate of soda (tetrathionic acid and soda base), liberates iodine from iodide of potassium solutions, especially in the presence of acid, while in alkali solutions (hypo-soda) the free alkalies materially accelerate the oxidizing effect. The hard salt proved stable. We performed the washing as follows:

A. Gelatine Plates.—1. The fixed plate, 13 by 18 cm., was placed for five minutes in about 500 c. cm. of water (more does no harm), shaking or rocking the dish repeatedly.

2. The plate thus rinsed was now put into a dish containing from 200 to 250 c. cm. solution of anthion 1:200 for five minutes, rocking again.

3. From this solution it was passed back to the first dish, which had been rinsed and filled with fresh water, rocking several times.

4. The plate is now passed back into dish No. 2, which had been rinsed and filled with fresh anthion solution as in 2 and 3.

When taken from the last water the plate was found free from hypo, and was put away to dry.

Tests.—Put into a clean glass about 10 c. cm. of the last wash water, and add two to three drops of nitrate of silver solution 1:20. A slight formation of chloride of silver will usually be seen. Should this become yellow, then hypo is still present, and process under 2 and 3 must be repeated.

This silver test is absolutely safe.

It must be remembered, however, that chloride of silver changes color in the light, and the test should be made in a weak light.

B. Paper Prints.—These wash out more readily than plates. But they must be kept well separated to admit the liquids from all sides.

Place as in 1 about five just fixed and drained prints, one after the other, in 500 c. cm. water (vide 1), then each separately into the anthion solution (vide 2), and continue as in 3 and 4.

Don't neglect the test.

To make sure that the anthion water did not injure the prints, a picture was cut into halves, one-half soaked in anthion water 1:100, allowing it to dry in. Not the slightest difference could be noticed between the two halves.

For larger plates or prints, of course, correspondingly larger quanties of anthion are required. Five months have failed to show any signs of fading of pictures treated with anthion.

Price of 100 grammes anthion, 1 mk.—Wilson's Photographic Magazine.

* Communication from the Photo-chemical Laboratory of the Royal Technical High School in Berlin, Charlottenburg.

Daniel Webster on the Great West.

When we think of the teeming population which now fills many portions of our country west of the Rocky Mountains, and remember how famous, all over the world, is their singular beauty, and their incomparable value to the tourist, the health seeker, the agriculturist and the horticulturist, as well as the miner, it is interesting to read what so intelligent a statesman as Daniel Webster thought of them just fifty years ago, and to know that his views were shared by many other prominent public men of the time. In a speech delivered in the United States Senate in 1844, with regard to the proposal that a mail service should be established between Missouri and the Pacific coast, Webster said: "What do we want with this vast worthless area, this region of savages and wild beasts, of deserts, of shifting sands and whirlwinds of dust, of cactus and prairie dogs? To what use could we ever hope to put these great deserts, or these endless mountain ranges, impenetrable, and covered to their bases with eternal snow? What can we ever hope to do with the western coast, a coast of three thousand miles, rock-bound, cheerless and uninviting, with not a harbor on it? What use have we for such a country? Mr. President, I will never vote one cent from the public treasury to place the Pacific coast one inch nearer Boston than it is to-day."

Electrolytical Process of Bleaching.

In his recent review on progress in bleaching, in Lehne's Farberzeitung, Dr. Kielmeyer mentions an electrolytical process invented by Dr. Karl Kellner, which, whatever be its practical value, has at least the merit of being original. The necessary apparatus consists of a pair of rollers—the one iron, the other carbon—which, while rotating, are fed with an electric current by contact with wire brushes, and thus converted into the two poles of a battery. The cotton cloth, before passing these rollers, is saturated with brine, and runs in company with an endless felt blanket, also saturated with brine, which is next to the iron roller, and receives the caustic soda formed, to deliver it further on into a tank filled with salt water. The chlorine liberated at the carbon roller accumulates in the cotton fabric. On issuing from between the rollers (whereof there may be several pairs) the cloth remains rolled up for some time, before it is washed, to prolong the bleaching process. Whether the process has already found practical application does not appear in the paragraph referred to.