### Self-operating Wire Rope Tramway.

A description has recently been given in the German technical press of a wire tramway in connection with the coal mining industry established near the Hersteigg, the products of which it brings to the main line belonging to the Southern Railroad of Austria. In its alternating rise and fall during its distance of 3,000 yards, there is a useful excess of incline of about 142 yards, which, it is said, suffices to keep the line in self-acting working, after it has been started by means of the twelve horse power engine provided for that purpose. When there is no return load to be sent to the mine, the speed of the line can be regulated by a brake. Under these circumstances, the cost of working the line is estimated at about 4½ cents per ton of coal.

In its general arrangement, the tramway forms a straight line, and consists of two drawing ropes and the train rope. The line which is used for conveying the coal to the station is 1·10 inches thick, and is composed of nineteen steel wires, each 0·18 of an inch in diameter. The line on which the coal buckets are returned to the mine is only 0·66 of an inch thick, the nineteen steel wires of which it is composed being only 0·13 of an inch thick. Both ropes consist of wires about 765 yards long, coupled to each other, and for the ropes a breaking strength of 73 tons per square inch section is guaranteed. At the ends of the ropes, weights of 5 and 3 tons are applied in the usual way for obtaining the proper tension. The distance between the seventeen supports varies from 60 to 400 yards. The train rope is 0·6 of an inch thick, and consists of twelve soft steel wires, of 0·07 of an inch diameter, and runs at a speed of about 1⅝ yards per second. The buckets which convey the coal follow each other at a distance of about 83 yards; thus thirty-six are always on the way to and the same number coming from the station. Each bucket contains about 10 bushels, or about a quarter of a ton of lignite, the total quantity carried per hour being about 17½ tons. The cost of the line was about $14,000.

### Pile Driving by Dynamite.

In the course of executing some municipal works at Buda-Pesth, the piles already driven were required to stand a greater load than had been originally contemplated. It was, therefore, necessary to test them, and drive still deeper those that yielded. On account of the expense of bringing a pile driving machine successively over each pile for so little work, it was determined to try the effect of dynamite; and the city engineers applied to Colonel Prodanovic, of the Second Regiment of Austrian Engineers, to carry out the experiments.

According to the *Wochenschrift des Oesterreichischen Ingenieur und Architekten Vereins*, the piles were cut square, and a wrought iron plate, 15 inches in diameter and 4⅜ inches thick, was placed on the top of each. On its center, and immediately over that of the pile, was placed a charge of No. 2 dynamite, in the form of a cake, 6 inches in diameter and three-fourths inch thick, and weighing 17½ ounces avoirdupois. This was wrapped in parchment paper, covered with clay, and fired. The effect produced was found on an average to be equal to five blows from a 14¾ cwt. monkey falling from a height of 9 feet 10 inches. The iron plates stood from twenty to twenty-four explosions. The system is not considered applicable to a pile standing considerably out of the ground, but saves a great expense when piles already driven have to be sunk deeper. In this country gunpowder has been used for many years, particularly in Philadelphia, for pile driving, though employed generally to drive the monkey upward.

DR. THOMAS TAYLOR, of Washington, has made some investigations, which convince him that the common house-fly, aside from being an annoying pest, is possessed of the capacity of transmitting disease by carrying the germs from place to place.

### IMPROVED RAILROAD CRANE.

In the powerful crane shown in our engraving the post is a dry sand casting in one piece. The bottom of the post and the deck plate upon which it stands are carefully faced up, making a fitted joint, and they are held together by the foundation bolts, which extend through the stone foundation to the anchor plates at the bottom.

A hub is fitted into the top of the post with a large pin, on which the jib turns, the jib being secured by rods to the yoke, which turns freely on the pin. The yoke also takes two vertical bolts, which go through the shoe casting at the bottom. In the shoe are two turned cast iron wheels, which track around a turned belt on the post, so that the jib turns very easily, having the friction only on the upper pin and the wheels.

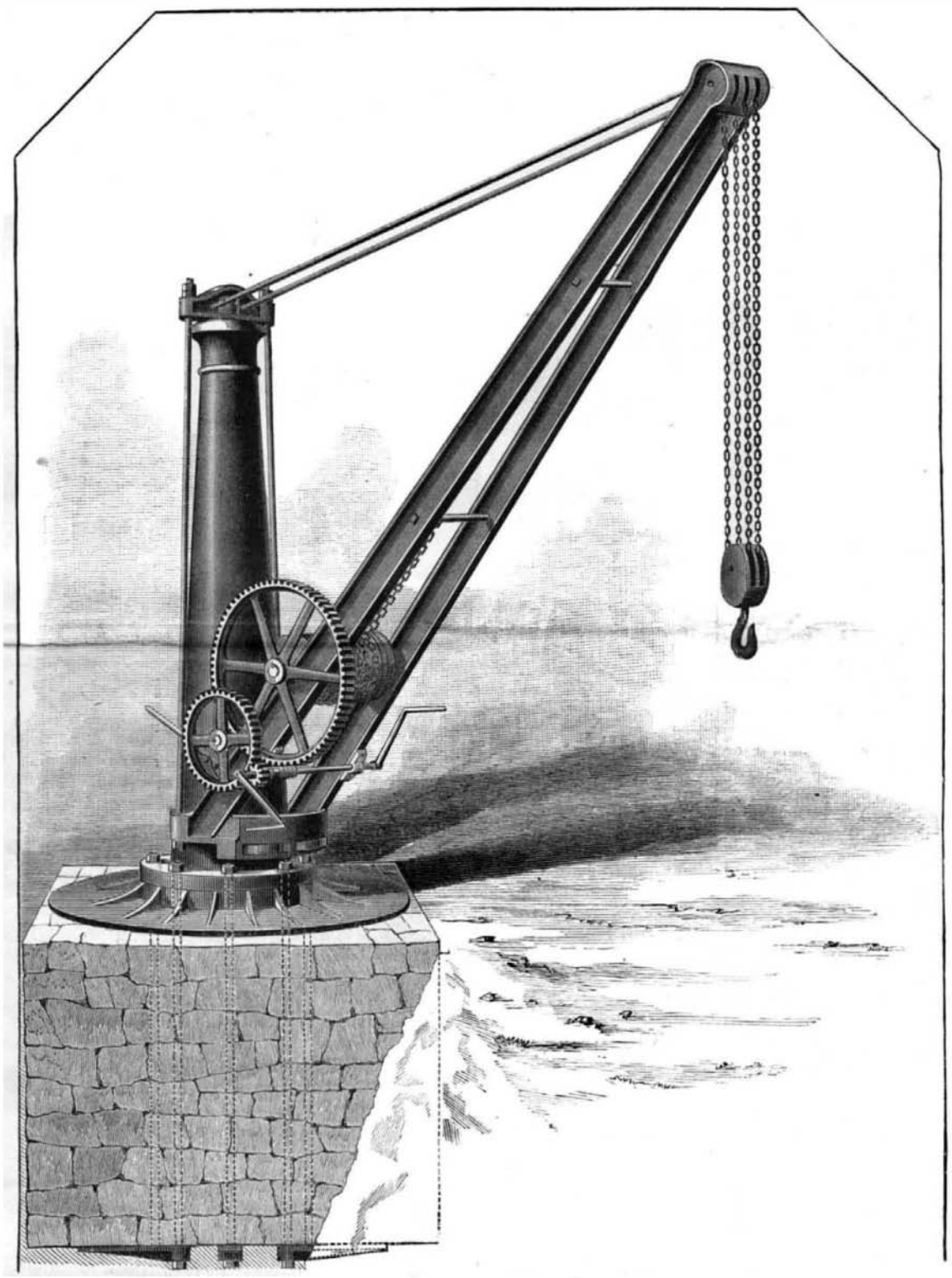
The jib consists of two wrought iron beams, which are bolted at the top and bottom to the bonnet and the shoe, and is provided with stay bolts between.

The gearing is double, with the pinion on the crank shaft, which works into either gear for fast or slow motion, or at half way between both blocks, or the pinion can be slipped out of both, so that the load can be lowered by the brake without causing the crank to turn.

The chain barrel is a hollow casting with spiral grooves around the outside, in which the chain follows. All of the moving parts are so simple that they cannot get out of order

BBB crane chain is used on all these cranes, and the sheaves in the bonnet have roller bushings, and require no oil. The crane is very simple, and may be used by any one; and wherever it is in use it gives perfect satisfaction. They are made in the following sizes, viz., 4, 6, 10, 15, and 20 tons capacity.

Further information may be obtained by addressing the Farrel Foundry and Machine Company, Ansonia, Conn.



RAILROAD CRANE MADE BY THE FARREL FOUNDRY AND MACHINE COMPANY.

AN excellent soap-bubble preparation is composed of oleate of soda and glycerine, and from it bubbles two feet in diameter and of exceeding brilliancy can be blown. Some of these have been kept forty-eight hours under glass.

### Phosphoric Acid.

The author proposes a method for the direct determination of phosphoric acid from the weight of the phosphomolybdic precipitate. The following conditions must be observed in precipitation: The solution must contain a sufficiency of free nitric acid. The molybdic solution added must be four-fold the volume of the phosphoric solution to be precipitated, and at least one-third of the molybdic acid added must be in excess of the quantity required for combination with the phosphoric acid. In every 100 c. c. of the volume of liquid after the addition of the molybdic solution must be dissolved 25 grammes ammonium nitrate. The precipitate of ammonium molybdic is filtered after standing for twelve hours, and is washed with a 20 per cent solution of ammonium nitrate, to which at the beginning of the washing one-thirtieth of its bulk of nitric acid is added. After removal of the greater part of the ammonium nitrate by means of water the contents of the filter are rinsed into a porcelain crucible, the matter adhering to the paper is dissolved in hot dilute ammonia, the solution is concentrated by evaporation, an excess of nitric acid is added, the solution is poured into the porcelain crucible, the liquid is evaporated away, and the ammonium nitrate expelled by gently heating over a flame placed below a wire gauze. The volatilization of the ammonium nitrate is found to be complete when a cold watch-glass placed over the crucible is not clouded. The ammonium phosphomolybdate is not decomposed if a needlessly high temperature is avoided. The residue is hygroscopic, and must be cooled in the desiccator over sulphuric acid, and quickly weighed in a covered crucible. The residue is said to contain 3·794 per cent phosphoric acid. O. Hehner, in the *Analyst* (iv., p. 23), criticises this process, and proposes a modification. A. Atterberg has determined the conditions in which the most rapid and complete separation of the ammonium phosphomolybdate can be effected. He finds that by boiling the solution with molybdic acid solution the phosphoric acid is precipitated in a satisfactory manner. The boiling is effected in a beaker of moderate size, stirring continually to prevent bumping. The heat is obtained from a naked lamp flame beneath a wire gauze. The precipitate settles very quickly, and can be at once submitted to further treatment.—*R. Finkener.*

### Perils of Ballooning.

Information has been received in this city of the frightful death of two over-daring aeronauts in Madrid under peculiarly horrible circumstances. It appears that Captain Mayet and an assistant ascended in a balloon in Madrid, before an immense concourse of people, on January 28. When the balloon had reached a height of about 1,000 feet, Captain Mayet got out upon a trapeze suspended from the basket and began his performauces. The trapeze was seen to break, and the performer lost his hold. While in the air he turned over and over many times He struck the stone pavement an unrecognizable mass. A moment later the balloon containing the other occupant was seen to descend with meteoric rapidity, and it crashed with terrible force against the projecting eave of a house, tilting the basket and hurling the occupant out head first. Striking a veranda, the man was precipitated to the ground, torn, cut, and mangled to such a degree that he died in a few moments. Both the men were under engagement to Barnum, Bailey & Hutchinson, and were to perform in this city on March 26.

THE Canada-Atlantic Railway Company recently opened its line between Montreal and Ottawa for freight and passengers. An extension from Ottawa to Toronto is now in progress, and in less than a year will afford a competing line to the West. The company proposes to build a bridge across the St. Lawrence at Coteau Landing, so as to connect its line with railways to Boston and New York.

### Killing Cattle by Electricity.

In a recent issue of the *Zoophilist* Mr. Lane-Fox describes an easily constructed apparatus for putting an end to worn-out horses, asses, or even cattle used for food, by the electric discharge. An ordinary stall has an iron plate fastened upon its floor large enough for a horse or bullock to stand upon. With this plate is connected the negative pole of an electrical condenser, formed of alternate layers of tinfoil and tissue paper soaked in paraffine. This condenser is charged from an ordinary coil to its full capacity of a hundred "micro-farads," and is to be discharged at an electromotive force of 15,000 "volts," which produces a one inch spark. The animal to be dispatched has the top of its head and also its feet and legs wet with salt water. It is then led into the stall with its hoofs resting on the iron plate. The brass knob which makes the positive pole, and has an insulating handle, is then applied to the forehead of the animal, which falls down stone dead the moment the contact is effected.

The London *Telegraph*, alluding to the article in the *Zoophilist*, concludes that there can be no kind of death more free from pain as well as from the horrid circumstances now attending the slaughter of favorite animals when old age, accident, or disease has rendered it necessary to kill. Everybody knows how sadly often the pistol or the knife, now in use, produces lingering agonies, and how shocking it seems to commit an old servant to the brutal hands and clumsy methods of such as too generally undertake the duty. Here is a plan which will obviate all this unpleasant experience and give to many a faithful animal an easy euthanasia. It well deserves to be put into practice and to receive public encouragement. There may be objections perchance to such a mode of slaughtering animals intended for human food, because of the effects produced on the flesh by the electric current; but possibly before capital punishment is abolished death by judicial lightning after such a fashion may be adopted in place of the hideous violence of the long drop. Certainly as a project for killing worn-out quadrupeds it appears as effective as it is kindly.

### How to Apply the Soda Remedy in Burns and Scalds.

It is now many years ago that the author, while engaged in some investigations as to the qualities and effects of the alkalies in inflammations of the skin, etc., was fortunate enough to discover that a saline lotion, or saturated solution of the bicarbonated soda in either plain water or camphorated water, if applied speedily, or as soon as possible, to a burned or scalded part, was most effectual in immediately relieving the acute burning pain; and when the burn was only superficial, or not severe, removing all pain in the course of a very short time; having also the very great advantage of cleanliness, and, if applied at once, of preventing the usual consequences—a painful blistering of the skin, separation of the epidermis, and, perhaps, more or less of suppuration.

For this purpose all that is necessary is to cut a piece of lint, or old soft rag, or even thick blotting paper, of a size sufficient to cover the burned or scalded parts, and to keep it constantly well wet with the sodaic lotion so as to prevent its drying. By this means it usually happens that all pain ceases in from a quarter to half an hour, or even in much less time. When the main part of a limb, such as the hand and forearm or the foot and leg, has been burned, it is best, when practicable, to plunge the part at once into a jug or pail, or other convenient vessel filled with the soda lotion, and keep it there until the pain subsides; or the limb may be swathed or encircled with a surgeon's cotton bandage previously soaked in the saturated solution, and kept constantly wet with it, the relief being usually immediate, provided the solution be saturated and cold. What is now usually sold as bicarbonate of soda is what I have commonly used and recommended, although this is well known to vary much in quality according to where it is manufactured; but it will be found to answer the purpose, although probably Howard's is most to be depended on, the common carbonate being too caustic. It is believed that a large proportion of medical practitioners are still unaware of the remarkable qualities of this easily applied remedy, which recommends itself for obvious reasons.—*F. Peppercorne, in Popular Science Monthly for March.*

### Cleansing Wash Leather.

A German optical journal recommends washing soiled polishing leather in a weak solution of soda and warm water, then rubbing a good deal of soap in the leather and letting it soften for two hours. It is afterward thoroughly washed until perfectly clean, and rinsed in a weak solution of warm water, soda, and yellow soap. It must not be washed in clean water, or it will become so hard when dry that it cannot be used again. It is the small quantity of soap remaining in the leather which penetrates its smallest particles and makes the leather as soft as silk. After the rinsing it is wrung out in a coarse hand towel and dried quickly. It is then pulled in every direction and well brushed, after which it is softer and better than most wash leather when first bought.

If rough leather is used to finish highly polished surfaces, it will often be observed that the surface is scratched or injured. This is caused by particles of dust and even grains of hard rouge that were left in the leather. As soon as they are removed with a clean brush and rouge, a perfectly bright and beautiful finish can be obtained.

### A Physical Paradox.

Dr. K. Stammer, of Koberwitz, calls attention to the fact that a given quantity of water may possess unlike weights, according to the volume it seems to occupy. If, for example, we pour three ounces of water into a four ounce beaker glass, balanced on a pair of scales, the water will be found to weigh just three ounces; if now we immerse any substance in the water that shall increase its volume so as to just fill the beaker, without touching the bottom or sides, the water will now weigh four ounces, or just as much as if the beaker had been filled up by pouring in one more ounce of water. The apparent anomaly consists in the fact that the increase of weight is the same whether the immersed substance weighs one-eighth of an ounce or eight ounces. An empty test tube pressed down in the liquid will produce the same increment of weight as would the same test tube full of water or of mercury. The difference consists in this, that the empty test tube must be pressed down with a considerable force; the tube full of mercury requires to be held up with considerable force to prevent its touching the bottom of the vessel.

Every one knows that a body immersed in water is buoyed up with a force equal to the weight of the water displaced, irrespective of the weight of the body. This loss of weight is, of course, communicated to the water, and its weight is increased by just so much, so that there is really less mystery about it than Dr. Stammer would have us think. It is like the ancient problem of why a pail of water weighs no more with a live fish in it than it does without the fish. The fact that a very light body can increase the weight of water more than it weighs itself, is due to the pressure that has to be applied to force it down into the water.

### Clothes Moths.

There has always been confusion and uncertainty in referring to the correct names of the clothes moths found in this country, and we are glad to note the fact that Professor C. H. Fernald, in the *Canadian Entomologist* for September, 1882, pp. 166–169, has given us a concise account of our species, based upon a large collection brought together from all parts of the country and sent to Lord Walsingham for comparison with European species. It appears that we have no native clothes moths, the three species observed in this country being identical with European species. They are as follows: 1, *Tinea pellionella*, Linn., the case making and most destructive species; 2, *Tinea tapetzella*, L., the gallery making species, rare in this country; 3, *Tinea biselliella*, Hummel, which is also not a case making species. The intricate synonymy of the first and third species, which have been redescribed by American authors under several names, is given in full by Professor Fernald, who also describes the imagos and gives some biological notes on the species.

### The Giant Sloth in Iowa.

Our readers will recall the suggestion of Professor Marsh that the man-like foot prints in the quarry of the Nevada State Prison might have been made by a giant sloth, though no other vestiges of the animal have been found in that region. Professor Marsh's suggestion gives special interest to a recent find of bones of this extinct animal, in a sand pit near Council Bluffs, Iowa.

The bluff formation along the Missouri River in western Iowa is composed of extremely fine silt cemented by lime. The bluffs, which are from 300 to 400 feet high, rest on the ordinary drift of the Iowa prairie, which overlies oolitic limestone. At intervals of two or three miles are pockets of pure sand from 200 to 400 feet deep. It was in opening one of these deposits that the bones were found in large quantities. It is said that no similar discovery has been made in that region. The skulls were in fairly good preservation, but the most of them were badly injured by the careless and ignorant workmen. The teeth, which are well preserved, are from three to four inches in length. The find has been taken in hand by a local scientific association, and careful explorations of the sand beds will be made.

### Theory of Magnetism.*

In the year 1879,† I communicated to the Royal Society a paper "On an Induction Currents Balance and Experimental Researches made therewith." I continued my researches into the molecular construction of metallic bodies, and communicated the results then obtained in three separate papers‡ bearing upon molecular magnetism.

To investigate the molecular construction of magnets required again special forms of apparatus, and I have since been engaged upon these, and the researches which they have enabled me to follow.

From numerous researches I have gradually formed a theory of magnetism entirely based upon experimental results, and these have led me to the following conclusions:

1. That each molecule of a piece of iron, steel, or other magnetic metal is a separate and independent magnet, having its two poles and distribution of magnetic polarity exactly the same as its total evident magnetism when noticed upon a steel bar magnet.

2. That each molecule, or its polarity, can be rotated in either direction upon its axis by torsion, stress, or by physical forces such as magnetism and electricity.

3. That the inherent polarity or magnetism of each molecule is a constant quantity like gravity; that it can neither be augmented nor destroyed.

4. That when we have external neutrality, or no apparent magnetism, the molecules, or their polarities, arrange themselves so as to satisfy their mutual attraction by the shortest path, and thus form a complete closed circuit of attraction.

5. That when magnetism becomes evident, the molecules or their polarities have all rotated symmetrically in a given direction, producing a north pole if rotated in this direction, as regards the piece of steel, or a south pole if rotated in the opposite direction. Also, that in evident magnetism, we have still a symmetrical arrangement, but one whose circles of attraction are not completed except through an external armature joining both poles.

The experimental evidences of the above theory are extremely numerous, and appear so conclusive that I have ventured upon formulating the results in the above theory.

I hope in a few weeks to bring before the Royal Society the experimental evidence which has led me to the conclusions I have named; conclusions which have not been arrived at hastily, but from a long series of research upon the molecular construction of magnetism, now extending over several years.

* "Preliminary Note on a Theory of Magnetism based upon New Experimental Researches." By Prof. D. E. Hughes F.R.S.

† "Proc. Roy. Soc.," vol. xxix., p. 56. 1879.

‡ "Proc. Roy. Soc.," vol. xxxi., p. 525; vol. xxxii. pp. 25, 213, 1881.

### Archæological Discoveries in Mexico.

Important archæological discoveries have recently been made at Mitla, a village in Mexico, which is situated between twenty and thirty miles from Oajaca, in the tableland of Mixtecapan. Extensive remains of ancient palaces and tombs have been revealed, and it is stated that they are exceptionally remarkable from the columns supporting the roof, a style of architecture peculiar to the district of Mexico in which they have been found. These ruins have been explored and photographed by Herr Emil Herbruger, although he was not permitted to excavate the sites. In a description of the ruins, Herr Herbruger states that the great hall contains six columns, and is 37 meters long by seven broad. Each column is 3½ meters in height and is of solid stone. The hall, which is entered by three doorways, was used as an antechamber for the royal guards. The tombs are all of equal size and T-shaped. The walls are embellished with stone mosaics. The vault floor is one meter below the surface, and at the entrance stands a monolith column. The tombs extend in order from the column, each being five meters long by one and a half broad; there are also several columns, each two meters high and one and a half in diameter. For some time Herr Herbruger and his Indian attendants used the tombs as sleeping apartments, but subsequently the Indians refused to sleep in the tombs, on the ground that they were haunted. The explorer intends to publish a work descriptive of these discoveries, with photographic illustrations.

### American Institute of Mining Engineers.

At the Boston meeting, February 23, the secretary submitted a report showing that the finances of the Institute were in a flourishing condition, and that its membership had been increased 1,213. The election of officers was announced as follows: President, Robert W. Hunt, Troy, N. Y.; Vice-Presidents, S. F. Emmons, Denver, Col.; W. C. Kerr, Washington, D. C.; S. F. Wellman, Cleveland, O.; Managers, John Birkinbine, Philadelphia, Pa.; Stuart M. Buck, Coalburg, West Va.; E. S. Moffatt, Scranton, Pa.; Treasurer, Theodore D. Rand, Philadelphia, Pa.; Secretary, Thomas M. Drown, Easton, Pa.

A party of about sixty members of the Institute went to Lowell, where they were received by Mr. J. B. Francis, by whose invitation the visit was made. Mr. Francis, the foremost of living American hydraulic engineers, planned the present elaborate system of utilizing the water power at Lowell, and is conspicuously identified with similar work in other sections of the country. The Lawrence, Lowell carpet, and Merrimac mills, together with the water power, dam, and canals, were in turn visited.

### Indelible Chalk Drawings.

The Swiss *Gewerbeblatt* recommends the following method of fixing chalk drawings:

Good black paper is coated with resin in the following manner: Common resin (colophonium) and shellac are dissolved in strong alcohol, and the solution applied to the black paper with a broad brush a number of times, each coating being allowed to dry perfectly before another is applied. The paper becomes matte and dull, but acquires a gloss when warmed.

Chalk drawings made on this paper can be made permanent by covering it with another sheet of well-sized paper over the face of the drawing and passing a hot smoothing iron over it. The extra sheet is carefully removed when cool, and the drawing can then be rolled up without any injury.

### Effervescing Lemonade Sugar.

The manufacture of effervescing lemonade sugar is said to be as follows: Five parts of powdered sugar are treated with an ethereal oil, and mixed with one part of bicarbonate of soda. This mixture is filled into candy moulds, and pressed by means of a stamp. Within the mould a cavity is produced in the mass by the pressure, and into this there is poured one part of citric acid, which is pressed down, and then a fresh layer of aromatic sugar is added and pressed, after which the candy is finished.