Spring 4-1903

Volume 12- Issue 7- April, 1903

Rose Technic Staff
Rose-Hulman Institute of Technology, library@rose-hulman.edu

VOL. XII. TERRE HAUTE, IND., APRIL, 1903. No. 7

THE TECHNIC.

TERMS:

One Year, $1.00. Single Copy, 15 cents.

Issued Monthly at the Rose Polytechnic Institute.

Entered at the Post Office, Terre Haute, Indiana, as second-class mail matter.

THE bright weather of the past few weeks has caused the campus and athletic grounds to take on their customary spring vesture. The fresh, green grass of the campus, and the budding trees, show nature's endeavor to seize upon the first bright spring days for making its exit from winter quarters. The gray suits of the base ball team, the preparation of the tennis courts, and the activity among the candidates for the track team, leads one to believe that mankind is prone to follow nature's good example.

Indeed, it is a goodly sight. If there are any who fail to appreciate the beauty of the picture that all taken together presents, they are surely deficient in some of the more refined mental traits that God has bestowed upon man, and will do well to cultivate a taste for such pleasing sights.

THIS activity and enthusiasm among the track men, and the good results that are being obtained, convinces us that Rose will surely win a fair share of the honors at the field meet to be held at Richmond. Let those, however, who can not enter actively into the events remember that these men have a hard and persistent course of training to undergo, and that every word and deed of encouragement is a stimulus to the athlete and ultimately may prove to be of benefit to the entire school.

THE gray suits of the ball team do not give the least suggestion of a blue prospect for Rose on the diamond this year. But, upon the other hand, we have the greatest confidence in the success of our team, and the showing that it has already made but strengthens our confidence. Still our confidence is not all the team needs. It needs our united and hearty support, it needs our cheering on to victory and our upholding in case of defeat, it needs the attendance at the games and co-operation of every member of the Institute. So let us all make it a point to be on hand, and in the best of humor, at each and every game played upon the campus this year.

And fellows, remember that there are many base ball fans among the sex that is so skillful in manipulating fans of a different description, and that these would appreciate the opportunity of witnessing the games as much we would be pleased to have them grace our grand-stand.

ON to Pittsburgh, is the Seniors' war-cry.

THE twenty-first annual catalogue of the Institute was issued from the press of the Moore & Langen Printing Co. the first of this month. The catalogue has a neat cover and presents an excellent typographical appearance throughout. The first part of the catalogue appears very familiar to the more advanced students and Alumni, but after reading some way in one notes that some very material changes have crept in, while the tables of the courses of study in the back part are presented in an entirely new form. Many of these revisions are due to the change to the credit system of grading etc., as described in our last issue.

❧❧❧

A LIST of the thesis subjects, of the class of nineteen hundred and three, appears under the Rose Leaves department of this issue. Thesis work is always a subject of great interest—at least to the Seniors—and a great deal of stress is put upon it. We consider the policy of the Institute in laying considerable stress, and allowing a good portion of time for thesis work, a wise one. For we believe a student will derive more good, practical experience during the time devoted to his thesis work, than he will in all of the time devoted to practice and laboratory work of a general nature throughout the entire course. In fact, it is quite natural that a man should get more out of a subject in which he has some personal interest, some definite end in view, and one in which he realizes that at an early date he will be called upon to defend the results he has obtained, than he will out of a subject that does not present to him any immediate or important bearing.

Many people, when they hear the word thesis mentioned, jump at the conclusion that it is something that has gotten to be merely a matter of form at colleges, and that it has no substantiability back of it. Well, such may be the case at a certain class of colleges, but we believe if they will look over the list of thesis subjects of the Senior Class they will be forced to admit that every one has a practical bearing, and is strictly up to date. Such has been the nature of most of the theses presented at Rose. The Senior Mechanicals are now constructing a twenty-five horse-power, high speed twin steam engine designed as a thesis subject, by Chenoweth Housum last year. The Electricals are devoting their shop practice time to designing and building instruments and apparatus necessary for their respective investigations. The Architects and Civils are equally as busily engaged. Many of the Chemists began their investigations last term, and indeed, from the length of some of the chemical terms that appear in their list of subjects, we would judge that such a start would be necessary for them to learn to pronounce these terms without getting their tongues twisted.

Electrochemical Manufacture.

By WILLIAM A. NOYES.

THE last ten years have seen a very rapid development in the application of electrical processes to chemical manufacture. Probably the earliest application of electricity in a manufacturing process was in the electro-plating of articles with gold, silver and copper. In these processes, the value of the product justified the use of an expensive source for the electrical energy, and hence batteries could be used. It was not, however, until the modern development of the dynamo furnished the manufacturer with a source of electrical energy which is very much less expensive, that electricity could be applied to processes requiring large quantities of energy. The processes which have been developed in recent years may be classified under three general heads. 1. Electrolytic processes. 2. Processes in which the electric furnace is employed. 3. Processes employing electrical discharge of high tension.

ELECTROLYTIC PROCESSES.

Probably the electrolytic process which gives a product of the greatest commercial value is the electrical method for refining copper. The value of the product does not, however, depend chiefly on the quantity of electrical energy used, as the refining of the copper is only a relatively small item in the cost of production. The process, too, is simple and we need not dwell upon it here.

Possibly the first electrical process, in which the value of the electrical energy forms a chief item in cost to the manufacturer, was the Hall process for the manufacture of aluminium. The inventor of this process is an American and a graduate of Oberlin College. It was discovered by a series of experiments which Mr. Hall insti-institnted for the purpose of discovering, if possible, some solvent for dry aluminium oxide; his thought being that if he could discover such a solvent, the electrolysis of the oxide could be carried out in a manner similar to that of the electrolysis of aqueous solutions of metals which do not easily decompose water. He finally found the necessary solvent in *cryolite*, a double fluoride of sodium and aluminium, having the formula $Na_3 Al F_6$. This mineral can be obtained in quantity from Ivigtok, in Greenland. It melts at a low temperature and dissolves aluminium oxide very readily.

In carrying out the process, the cryolite is melted in an iron pot, aluminium oxide is dissolved in the liquid and the solution is electrolyzed with the use of carbon electrodes for the positive pole, the pot itself being connected with the negative pole of the dynamo. The electrolysis conducts itself as though the aluminium oxide were directly decomposed by the current. It is possible, however, that the fluoride is the substance that is really electrolyzed. In any case, however, as soon as the aluminium oxide is exhausted in the solution, the difference of potential required for electrolysis rises very greatly. This fact is made use of to guide the workmen in the addition of aluminium oxide to the solution. An Edison lamp is connected by a shunt with each cell, and so arranged that so long as the electrolysis proceeds normally the lamp remains dark; but as soon as the oxide is exhausted, the lamp lights up. The liquid cryolite is covered with some charcoal powder, and on top of this is always placed some of the aluminium oxide. Whenever the glowing of the lamp gives the workmen warning that more oxide is required, all that is necessary is to stir the materials together. The oxide desolves, while the charcoal quickly rises to the top of the liquid again. The electrolysis is carried out at such temperature that the aluminium produced remains liquid in the bottom of the pot, and can be ladled out from time to time.

The manufacture of aluminium by the Hall process requires, of course, large quantities of pure aluminium oxide. Until recently, this was purified by a wet process which was cumbersome and expensive. Recently there has been developed a method for the production of the oxide by a dry process in the electric furnace. The corundum which is to be purfied, is mixed with enough of a reducing metal to reduce the iron, which it contains, to a metallic state, and the mass is heated to incipient fusion in an electric furnace. In a second operation, the mass which has been thus prepared, is melted completely and the purified alumina and metallic alloy seperated by means of their difference in specific gravity. The object of the preliminary treatment is to get rid of the gases produced by the reduction so that they are not evolved in the final process where fusion takes place, and where their evolution would tend to project parts of the charge from the furnace.

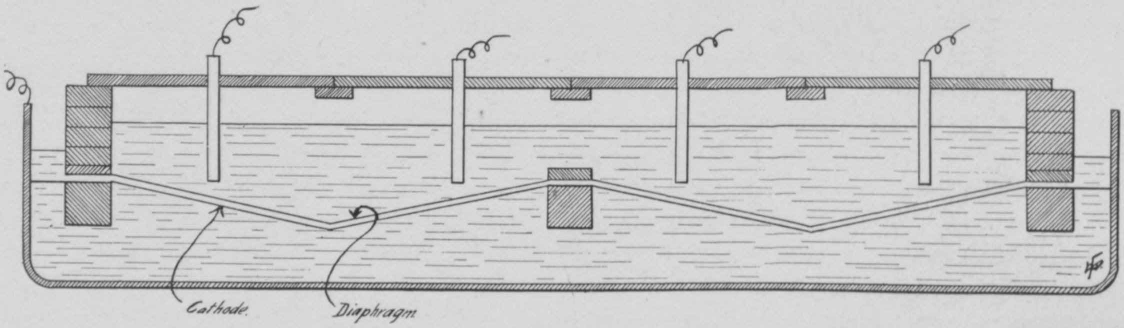


FIG. 1.

A second electrolytic manufacture of increasing importance is that of sodium hydroxide, and associated with it, the manufacture of chloride of lime, or bleaching powder. Three principal methods compete with each other, at present, in this manufacture. In the Le Seuer process, a strong brine is electrolysed in the apparatus, shown in the accompanying figure, which is taken from an article by Professor Charles L. Parsons which appeared in the *Journal of the American Chemical Society*, **20**, *868* (*1898*). The annodes are placed in the upper part of the cell, and are made of an alloy of iridium and platinum. This part of the cell is separated from the cathode by a diaphragm of asbestos. The cathodes are of iron, and are placed below this diaphragm. On passage of the electric current, chlorine is liberated at the annode, and is conducted away for the manufacture of bleaching powder, or, in some cases, of a solution of hypochlorite. The sodium liberated at the annode reacts with the water, forming sodium hydroxide, and liberating hydrogen. A little hydrochloric acid is added from time to time to the annode compartment to neutralize the sodium hydroxide, which diffuses through the diaphragm and which, if allowed to remain, would form hypochlorite and interfere with the process. The solution containing sodium hydroxide is drawn off from time to time, and replaced by fresh brine, the latter being introduced in the annode compartment. The alkaline solution still retains a large amount of salt, but, on concentrating, this separates first, leaving a very concentrated solution of sodium hydroxide which contains but little salt. The undecomposed salt is separated from this solution by centrifugals, and is then dissolved and used again, while the alkaline solution is heated to expel the water which it contains and yields sodium hydroxide of good quality. This process was formerly in operation at Rumford Falls, Maine, and was, I believe, the first successful electrolytic process for the manufacture of caustic soda in this country. The works, however, I understand, have been abandoned.

A second process, which is in commercial operation at Niagara Falls, and also at Sault Ste. Marie, is that of Castner. In this, a shallow slate box, as shown in Figure 2, is employed. The two partitions which separate the central

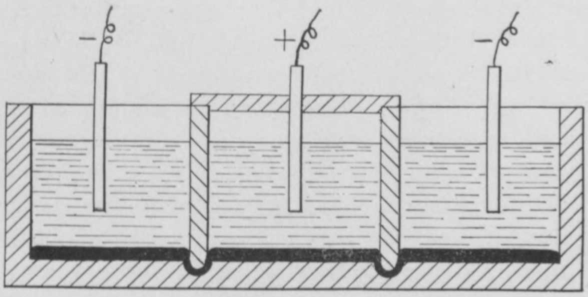


Fig. 2.

portion from the remainder of the box rest loosely in grooves in the bottom of the box, while they are cemented tightly at the two ends. The bottom of the box is covered with mercury which can run freely beneath these partitions. A strong brine is placed in the central compartment, while a dilute solution of sodium hydroxide is placed in the two side compartments. The annode dips in the brine while two cathodes dip into the solutions of caustic soda. In the center compartment, the mercury becomes negative with reference to the annode, and dissolves the sodium which is liberated, forming a sodium amalgam. The chlorine liberated at the annode is used, of course, for making bleaching powder. By giving the box a slow tilting motion, the sodium amalgam is transferred in part, alternately, to one side or the other of the partition. In the side compartments it becomes positive, with reference to the cathodes, and the hydroxyl liberated by the electrolysis of the sodium hydroxide, in these compartments, combines with its sodium to form sodium hydroxide. The sodium liberated at the cathode also reacts with water to form sodium hydroxide, and thus the concentration of the solution is increased, and from time to time a portion can be removed and replaced by pure water. This process gives, of course, a pure sodium hydroxide, free from salt.

In the Acker process, fused salt is electrolysed in contact with metallic lead, which, of course, is in a molten condition. The lead takes up the sodium, forming an alloy which is automatically transferred to a second compartment, in which it comes in contact with steam, thus forming sodium hydroxide and hydrogen. The second compartment is kept at such a temperature that the sodium hydroxide and lead both remain liquid, the latter being returned to the first cell, while the sodium dydroxide can be drawn off and on solidification, is ready for the market. The Acker process is also in commercial operation at Niagara Falls.

Which of these processes is destined to a permanent success, or whether some other process may soon displace them all, can be, at present, only a matter of conjecture.

An electrolytic process that has also been proposed, and indeed attempted on a commercial scale, is one for the preparation of metallic sodium and oxides of nitrogen from fused sodium nitrate. The oxygen and nitrogen are converted to nitric acid by means of air and water. This process seems to have failed of success largely through lack of a market for metallic sodium. Metallic sodium, it is true, is largely used for the preparation of mixed sodium and potassium cyanides from potassium ferrocyanide, in some of the amalgamation processes for gold and silver, and in the manufacture of sodium peroxide, but there is, at present, no large demand for the metal.

ELECTRIC FUNACES.

When the electric arc passes between carbon points, a temperature, estimated at approximately 3500 C., is obtained. This has placed at the service of the manufacturer a temperature which can be obtained by no ordinary form of furnace, and has made possible the production of many chemical reactions which were heretofore impossible. The first commercial application of this high temperature seems to have been the manufacture of aluminium bronze by the Cowles Bros., of Cleveland. About twenty years ago, they invented a process by which aluminium oxide, carbon and copper were heated in an electric furnace. At the temperature of the furnace the oxide is reduced by the carbon to aluminium, and the latter alloys with copper to form aluminium bronze. This was also the first commercial preparation of aluminium by a process which did not involve the use of metallic sodium. The process, however, is not able to compete with the Hall process, which has been described, and the Cowles brothers never succeeded in obtaining pure aluminium by this method.

When limestone and coke are heated in an electric furnace, calcium carbide is formed by the reaction:

$$CaCO_3+4C=CaC_2+3CO.$$

A revolving furnace has been devised, in which the process is carried on in practically a continuous manner. Large quantities of the carbide are made at Niagara Falls, and at several places in Europe. The carbide is u-ed for the preparation of acetylene for illuminating purposes. The gas has from ten to fifteen times the illuminating power of ordinary illuminating gas.

By heating together quartz, or sand, and coke, a beautiful crystalline silicide of carbon is formed:

$$SiO_2+3C=SiC+2CO.$$

This silicide is known, commercially, as carborundum. It is very much harder than emery and is used in making carborundum wheels, and otherwise, as an abrasive.

Recently it has been proposed to manufacture barium oxide by the following reactions:

$$BaSO_4+2C=BaS+2CO_2$$
$$BaS+3BaSO_4=4BaO+4SO_2.$$

The first reaction can be carried out in an ordinary furnace, but the second requires the temperature of an electric furnace.

By heating anthracite coal in a electric furnace, it can be converted into graphite, nearly or quite all of the impurities being volatilized by the high temperature. It has been shown that a small amount of iron plays a very important part in this transformation of carbon to graphite, though Moissam has stated that carbon can be converted to graphite by the action of heat alone.

PROCESSES MAKING USE OF ELECTRIC DISCHARGE AT HIGH TENSION.

It has long been known that the discharge of electric sparks through air will cause a combination of part of the oxygen and nitrogen to form nitrogen peroxide. Recently, processes have been patented for the manufacture of nitric acid on this principle. The following is an abstract, by Prof. S. P. Sadtler, of an account of this process which was recently published in *Electrochemical Industry*. This abstract is taken from a recent number of the *Journal of the American Chemical Society*.

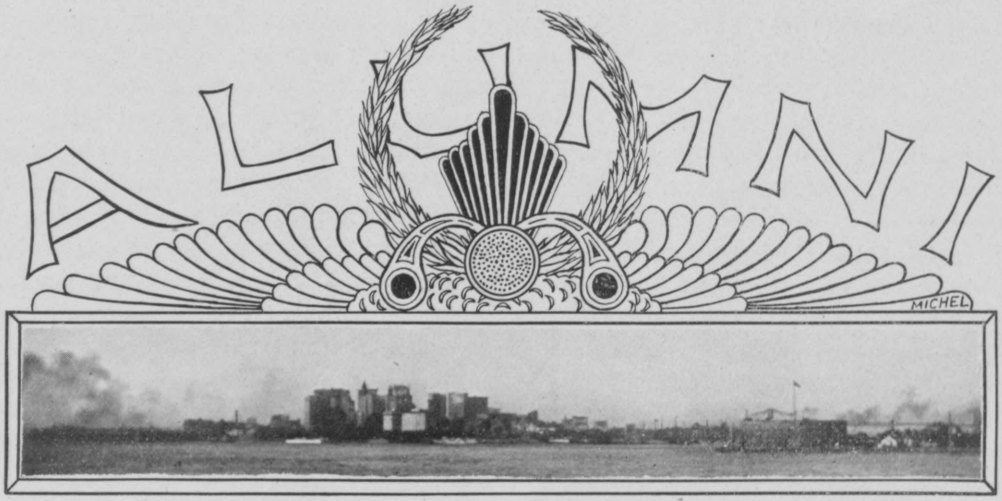
"The patents of Bradley and Lovejoy are now being developed by this company on a practical scale at Niagara Falls. The patent is for a manner of producing nitrogen compounds from atmospheric nitrogen, and points out that whereas the silent electric discharge and the spark or disruptive discharge can cause nitrogen and oxygen gases to combine, they have very little capacity in this respect, which is also the case with the electric arc as ordinarily used. To obtain efficiency, it is necessary to use an arc, divided up into such small, thin, flat subdivisions as to present a large surface for a small amount of energy; the thinner the arc the greater is its efficiency, up to the point where it breaks. It is necessary, therefore, to greatly subdivide the current, to arrange the arc circuits in parallel, and to provide against short-circuiting. The company uses a 45 Kilowatt generator, ordinarily delivering 0.75 ampere direct current at a potential of 8,000 volts, but capable of delivering several amperes at as much as 15,000 volts. The current supplies 138 arc contacts, each of which is made and broken 50 times per second, giving to each arc some 0.005 ampere. The arcs are all sprung successively 6,900 per second in the apparatus, each arc lasting about $\frac{1}{200000}$ of a second, and thus giving practically a steady load to the machine. As each arc tends, the moment it is formed, to increase suddenly in volume, the short-circuiting, which this would produce, is retarded by placing induction coils or resistances in series with the arcs. These are so calculated that during about $\frac{1}{400000}$ of a second they impede the flow of the current, therefore preventing too high an amperage flowing, and during the succeeding $\frac{1}{400000}$ second, while the arc is being drawn out and is about to break, it sends an impulse which increases the flow and so prolongs the arc. Using 8,000 volts, with an average current of $\frac{1}{200}$ of an ampere to an arc, the arcs are drawn out 4 to 6 inches. By keeping a constant flow of air into the apparatus, the per cent. of the combined products in the issuing air is only 2 to 3 per cent. and much loss by dissociation is thus avoided by keeping down the concentration of nitric oxides.

The patent claims are for 'exposure of a mixture of nitrogen and oxygen to the action of an electric arc and renewing the mixture so as to prevent dissociation.' The output is represented by one pound of theoretical HNO_3 per 7 horsepower per hour of electric current used. This costs 1 cent at Niagara Falls.

The air used is first carefully dried to avoid formation of acid in the apparatus and consequent corrosion of the metallic parts. The inside of the appartus is protected by a coating of asphalt varnish and glass peep holes provided, permitting inspection of the interior. A mixture of equal parts of oxygen and nitrogen works better than air, giving a higher return for the current used. The issuing gases pass into an iron reservoir two feet in diameter by ten feet high, where they have a chance to still further combine, and thence pass into a scrubbing tower to condense the gases produced. In commercial practice, water towers will be used to obtain nitric acid, while Lunge's scrubber, supplied with milk of lime, will be used to produce calcium nitrate for fertilizing purposes."

The most important other application of the high tension discharge is for the production of ozone. This is now employed on a large scale for the sterilization of public water supplies at one or two places in Germany. It is claimed that it is possible to destroy practically all of the living organisms in water, by the use of ozone, at a moderate expense.

In the development of electro-chemical industries, both at home and abroad, water power is being used very extensively. A large group of electro-chemical manufacturing plants is gathered at Niagara Falls, in our own country, and the value of the products of electro-chemical industries in the United States exceeds that of similar products in all the rest of the world.



Filter Plant and Purification Works for the Louisville Water Co.

By W. E. BURK, '96.

THE water supply for the city of Louisville is taken from the Ohio river at a point about four miles up-stream from the city, which source at its best needs considerable of corrective attention to render the supply fit for potable as well as tenchnical purposes.

For a number of years the water has been allowed to first settle in Crescent Hill subsiding reservoir before entering the city mains, but the immense importance of a pure water to a city of the first class is such as to decide, in the case of Louisville, the construction of filtering plant with connected purification works of such suitability and magnitude as to insure to the future of that city a sufficient supply of an almost pure water, utilizing the Ohio river as a source. The works are well under construction, but will perhaps not be completed for two years or more.

Upon visiting the plant one is at first impressed with the immensity of the buildings, filter-tanks, storage vaults, etc., but in this age the colossal is expected, and one wearies with dimensions. The purification process itself includes no novelties, and one realizes with a high degree of satisfaction that here the well-tried and true sand-filtration process has been adopted ; this, too, after an exhaustive examination of the whole situation, consisting of series of tests, mechanical, chemical, and bacteriological, extending over an active period of more than two years, and under the able direction of Mr. George W. Fuller.

The general specifications put the system adopted under the head of the American (Mechanical) System of Filters, by which is defined, "Filters composed of layers of sand in metal tanks through which sand the turbid and unfiltered water is passed, having first been coagulated by application of chemicals (usually sulphate of aluminum), and clarified and purified." System also includes the cleaning of sand layers in place without removing them from the tanks, by reverse water currents, air, or combination of the two.

In the Louisville plant previous subsidence in Crescent Hill reservoir is also included.

The amplified steps in process will have the following physical order :

1st. Plain subsidence in reservoir.

2nd. Application of coagulent to effluent from reservoir.

3rd. Rapid sand filtration by force of gravity.

4th. Cleansing of sand by reverse current of filtered water.

The effort has been made to utilize all important modern arrangements, mechanical and otherwise, but after all it is the plain sand-filtration process with the use of sulphate of aluminum for coagulant. In accordance with Mr. Fuller's final report the works now under construction are expected to remove 99% of the bacteria and all of the silt and sediment as well as color; this with the Ohio river, which for most months of the year carries a great deal of sediment, consisting of particles as fine as 0.00001" in diameter, and too fine for satisfactory subsidence.

The daily water consumption of Louisville varies from 16,000,000 gallons to 27,000,000 gallons, which supply has up to the present time been taken from a setling reservoir of something like 100,000,000 gallons capacity. The maximum consumption is occasioned by wasteful practice on the part of consumers, usually in times of coldest weather in allowing water to flow to prevent bursting of pipes. When the new purification works are in operation installation of meters will be encouraged, which, if generally adapted, it is estimated would save in consumption 25% to 30%. Under existing practice no estimate can be placed upon what would be the normal daily consumption of water, but some idea is given from the above extremes of 16,000,000 and 27,000,000 gallons with a probable economy of 25% under meter regulation, and such consumption based on a population of 210,000.

Up to the present time water has been pumped directly from the river to the reservoir, which reservoir head affords pressure for city distribution and utility. "Y" connection with gates provide for supply direct from river pumps to the city when occasion demands.

Under the proposed system, the present river pumping station and reservoir will be utilized as heretofore, the water from the reservoir passing to and through the new filtration plant and into receiving vaults.

A new pumping plant to be erected at this point will take water from the storage vaults and will deliver same to the city through 48 and 30 inch mains under a pressure of 80 to 90 pounds, a pressure increase of about one hundred per cent. over that heretofore in operation. The main plants of the new works consist in the coagulator, the filtering tanks, the receiving vaults and power plant.

The buildings are to be monolithic in structure, two of which are about completed. The largest of these, 390′ by 460′ with 26 feet eaves and 21 inch walls, will contain the filter tanks and covers a part of the receiving vaults. The entire structure consists of concrete in one continuous mass forming the walls. Concrete was prepared from crushed limestone, using everything under one inch mesh and mixing four parts of same with one part of Louisville natural cement and two parts of sand.

Retaining boards were arranged forming walls between which the concrete was placed. After seven days, retaining boards were shifted as construction progressed. A rather striking figure in volumes is afforded by an estimate made on actual weights covering a construction of over 17,000 cubic yards of concrete, in which for each cubic yard of concrete 25.16 cu. ft. rock, 12.58 cu. ft. sand, and 6.29 cu. ft. cement, or a total of 44.03 cu. ft. were required.

In the construction no joints or seams were arranged. Six contraction craks were formed later on at regular intervals along the wall length and these were filled by pumping cement into same, with the result of a perfect monolithic structure.

Sufficient limetone for concrete construction was obtained from the excavation for storage vaults. The underground storage chambers occupy four acres in area, being sectioned into four compartments of one acre each by walls extending all the way across, the compartments being connected by open arch gates so that the four sections are all in communication. These storage vault are 25 feet in depth and have a combined capacity of 25,000,000 gallons. In the construction of the same, i. e., the surrounding and cross walls, as well as for the roof, concrete similar to that above mentioned was used. The roof consists of groined arches supported by pillars set at corners of squares 22 feet to the side. These pillars are 3.33 feet in diameter and are constructed of concrete in which Portland cement was used. The groined arch roof over each set of pillars has a rise of 3.8 feet from top of pillar to apex of arch, the concrete thickness grading from 4.3 feet over pillars to 0.5 foot at apex. Accompanying cut from photograph shows general arrangement of pillars, walls, and roof forming the receiving vaults.

The main filter house above mentioned stands exactly over one of these acre receiving compartments, the filtered water from filter tanks passing directly to the receiving vaults below. Effluent pipes from these storage vaults will lead to the pumping plant to be constructed near by, from whence water will be delivered through 48 and 30 inch pipes to the city. The roof of the receiving vaults is coincident with the earth's surface, the same being sodded and offering no suggestion of the cavern below. The roof of the main filter house, covering one acre in area is without interior support, and is of steel construction with slate cover. Three-tenths of the acre floor space is to be utilized at present for filter tanks, three in number, each unit covering one-tenth acre. The remaining area is in reserve for future enlargement of filter capacity. Each filter unit will consist of a rectangular iron tank 146.9 x 30.25 feet and eight feet in depth, containing a bed of three feet of pure white quartz sand of effective size 0.35 millimeters. Sand filter of such design should have filtering capacity of 125,000,000 gallons per acre per 24 hours, or 12,500,00 gallons per unit filter of one-tenth acre.

Original specifications provided that each tank be divided into an upper and lower compartment by means of a horizontal diaphragm constructed of "I" beams and brass wire cloth of suitable number of folds, gauge of wire and size of mesh to support sand above and permit of filtration downward. Some change in this arrangement is probable, however the general plan is that the water from the coagulator tank is to pass through the sand by gravity flow, effluent passing to receiving storage vaults below. When sand filter bed becomes clogged, a reverse current of filtered water is to pass through the sand beds by means of a system of pipes and gates and the sediment washed to waste. At time of washing the sand, the same is to be agitated by a mechanical agitator consisting of a horizontal grille 30.25 x 149.5 feet, constructed of "I" beams and supporting seventy-two individual agitators. The single agitators are to be operated by a worm wheel, and will consist of a vertical shaft with ten spines extending radially four feet in length.

Agitators are to be driven by two electric motors, worms on the several line shafts being alternately right-handed and left-handed in pitch to neutralize cumulative tension and compression.

The complete agitator, consisting of grille, seventy-two agitators, shafting, etc., is to be suspended from a trolley, consisting of ten trucks running transversely across the house on the top of a traveling crane bridge, and can be lowered into filter tank and lifted therefrom. Grille complete will weigh sixty-five tons, which weight is to be transferred to the trucks of the trolley by ten screw suspension rods, through the trucks to the bridge of the traveling crane, and thence to the walls of the house. The water is to flow by gravity from the old reservoir through the entire works to the storage vaults. It first passes to the coagulating stand-pipe. This stand-pipe is an upright steel cylinder 50 feet in diameter and 61 feet in height, lined with Portland cement. As the water enters the coagulator it encounters a stream of sulphate of aluminum, which solution is interjected through a pipe leading down from an upper annular compartment where the salt is dissolved and from whence it is pumped by acid-proof aluminum or brass cylinder feed pumps, two in number. These pumps are to be double-acting 18½, the stroke varying from one to thirty-two inches. An aluminum or brass turbine meter will rest on a flange from the 48-inch pipe leading into the tank from the reservoir and a vertical from this meter will operate the pumps feeding the sulphate of aluminum solution at a rate varying with the rate of water inflow from the reservoir. The suction of this pump will be submerged by the sulphate of aluminum solution and the displacement of pump per stroke will be such as to deliver a 1% solution of sulphate of aluminum at such a rate as to supply ¼ grain of the salt per gallon of water at one inch stroke, and by extending stroke to thirty-two inches to supply 8 grains of the salt per gallon of water, the variation in stroke enabling the coagulent to be applied to the water entering the stand-pipe from the reservoir at any rate desired from ¼ to 8 grains per gallon of water. By means of a 48″ floating tube and weir to be erected in the stand-pipe, the coagulated water will be discharged into a main leading to branches and these to filter tanks above described, same always taking the water from, at, or near the surface of the water in the tank.

Louisville will justly be proud of this well-adapted filtering plant, designed to fill the city mains with a water of almost perfect purity, and the effect of which will aid not a little in maintaining the present record of the lowest death rate of any American city of her size or larger.

The city of Louisville owns the water works, and the construction of this plant can be looked upon as a crowning success to the long and able service of Mr. Charles R. Long, the company's President, and to Mr. Charles Hermany, chief engineer of the company.

Construction of work has been largely under the personal supervision of the assistant engineer, Mr. Webster Gazlay, to whom this paper is indebted for much of the information contained.

ALUMNI NOTES.

Frank T. Green, '96, is Superintendent of the Fox River Valley Telephone Company, at Appleton, Wisconsin.

William Hadley, '01, was in the city visiting relatives recently. He is now with the Wilmington Malleable Iron Works, Wilmington, Del.

Abe Balsley, '91, has added another to the rapidly growing list of future candidates for Rose. The boy arrived on March 9th. Balsley is now with the Lachine Rapids Hydraulic and Land Company, at Montreal, Canada.

John T. Dickerson, '01, has resigned his position as Assistant Engineer of Bridges for the Chicago, Burlington and Quincy Railroad, to accept a similar one with the Chicago, Rock Island and Pacific Railway.

Harry E. Richardson, 1900, has recently resigned his position in the Ordnance Department of the U. S. Army, at Washington, and accepted a position in the Engineering Department of the "Long Arm" System Company, of Cleveland, mechanical and electrical ship outfitters. His address is 1404 Lexington Ave., Cleveland, Ohio.

Stephen S. Raymond, '90, from whom nothing has been heard for several years, writes that he is a Mining and Metallurgical Engineer, 24 First St., San Francisco, Cal.

As was predicted in the last number of The Technic, Mr. George E. Wells, '96, was married on March 14th. Mr. Wells' bride was Miss Eloise Compton Long, of St. Louis. Mr. and Mrs. Wells will be at home, after April 30th, 817 Clarendon Avenue, St. Louis.

T. D. Witherspoon, '00, has accepted a position as Electrician of the Toledo Furnace Co., Toledo, Ohio.

Prof. John Mack, '87, of the University of Wisconsin, was in the city recently.

M. L. Oglesby, '92, recently lost, by fire, all his office furniture and engineering equipment. His diploma, signed by Col. Thompson, was also consumed.

Taro Tsuji, '90, is at present Engineer of Imperial Government Railways and Ministry of Communication, with headquarters at Tokio, Japan.

FROM AN ALUMNUS.

The following was inclosed to us in a letter by an Alumnus, who is doubtless in a position to appreciate the effort, for at the bottom he had written, "There is more truth than poetry in the above."

[Spring Effusion No. 1.]

THE CHEMIST'S SATURDAY NIGHT.

Dedicated to the P. R. R. Chemical Laboratory, by G. W. C.

The sun is dying in the west,
The chemist dons his coat and vest,
And hies him to his needed rest.
By Fortune he is not caressed,
You can tell it by the way he's dressed.
It's value has ne'er been assessed.
He gets the ozone in his chest,
And skips along with added zest,
For this is the hour he loves the best.

Methods of Making Illustrative Cuts.

By ALFRED N. AUSTIN, '03.

THE huge amount of reading matter of the present day is possible only through duplication by the printing press. Through this same medium the most careful and brilliant work of the best artists accompanies this reading matter, and does not add seriously to the ultimate cost. This is largely due to the modern methods of manufacturing illustrative cuts. Formerly, every plate from which a print was made, was tediously engraved or carved out by a copyist, who, not always in sympathy with the original artist, often infused too much of his own personality. To-day, a mechanic, with the aid of photography, completes a cut rapidly, and retains in the print most of the beauty of the original drawing.

The plates used in reproducing illustrative photographs and drawings may be divided into two general classes—those in which the image is engraved or scratched into the surface, and those on which the image is raised from the surface. The first is the "Intaglio" and the second the "Relievo."

Owing to the modern method of printing and to the care necessary to get good results, the intaglio is never set up and printed with type; a separate printing is necessary. Although the use of this form of cut is expensive, the results are beyond criticism and the prints from them are still seen. Under this head falls the photogravures or heliogravures, the Woodburytype, the copper-plate engraving, and dry-point etching.

The relievo is the kind commonly used. Like the old-time wood-cut, it is set up with type and printed with it. Under this head would fall the line-process plates and half-tones.

If this line process is to be used, the picture must be composed only of lines. These lines must be of equal depth of shade, but to obtain the proper pictoral effect they must be of different width and proximity. The pen and ink drawing is an example of this class.

The half-tone plate is used in cases where the picture to be reproduced is composed of unbroken graduations of shades or lines of various intensities—for example, the photograph, wash-drawing or pencil-drawing.

There are three line-processes now in common use—swelled-gelatine, albumen, and bitumen. The first requisite of all three of these is a negative of the drawing. In the swelled-gelatine process, a plate is evenly coated with a solution of hard gelatine in water. When dry, this is exposed under the negative. Those parts which were struck by light—namely, the lines of the drawing—become non-absorbant of water and when placed in cold water, the unexposed parts absorb and swell while the exposed parts do not. This leaves the lines as indentation in the surface, or, the whole becomes an intaglio. A mould of plaster of paris is made from this and a wax intaglio is, in turn, made from the mold. From this wax cast the final plate is electrotyped and mounted on a wooden block.

In the next two line processes, instead of electrotyping a mold, the metal of which the cut is made is etched directly by acids. In both cases a plate of zinc and tin alloy is used and the lines of the drawing are protected from the etching acids during manufacture.

In the albumen process, the zinc plate is covered with a solution of albumen and water sensitized with bichromate of potassium. After exposure under the negative the coating is covered with transfer ink (an unctuous compound of beeswax, soap, lithographic ink and shellac.) The light struck parts become insoluble and do not wash away as do the other parts, when immersed in warm water. After development in water there remains the lines of the picture in transfer ink on the bare zinc. The whole surface is sprinkled with finely powdered resin, which sticks to the ink and makes a better protecting surface. After waxing the bottom and edges of the plate, it is immersed in a weak solution of hydrochloric acid. This eats into the zinc a very short distance. The plate is next put in a solution of copper sulphate. This leaves a fine deposit of metallic copper on the bare zinc. When next placed in a stronger solution of acid a voltaic action is set up and the zinc is rapidly eaten away. When this action ceases the above operation is repeated. The repetition is continued until the necessary depth is obtained. "Under biting" is prevented by sprinkling powdered resin over the plate, warming and letting the melted resin flow down over the sides of the lines. This is done each time before immersion in acid.

In the bitumen process, the zinc plate is coated with a very thin solution of bitumen in benzole (the bitumen being first treated in ether to remove those constituents not sensitive to light). After exposure under the negative the bitumen is softened with olive oil and developed with turpentine, the plate is then immersed in nitric acid. This soon etches it deeply enough for an application of transfer ink, after which it is treated identically with the albumen process. Of the above three methods the swelled-gelatine gives the best results, but is the most expensive. The bitumen comes next, the albumen being best suited for rough work.

As before mentioned, when an illustration is composed of gradual gradations of shade, the half-tone is used. The only difference between the half-tone and bitumen processes is in the preparation of the negative used in the exosure. Before reaching the plate in the camera the light passes through a screen. This screen is a glass plate on which is ruled a fine net-work of lines (eighty to a hundred and fifty to the inch). These etched lines are filled with ink and make a net-work of white lines on the negative. The varying intensities of light passing through the lines at different points make dots of varying size at those points, and this constant variation gives the whole an effect of gradation.

The methods outlined above are the principal ones now in use. There are, however, a great many others, some differing only in minor details. The typogravure breaks up the half-tone shade by means of a grain in the surface of the metal. The collotype obtains gradations by unequal pressures of a gelatine surface. Lithography utilizes the aversion of greese to water. The image of the picture is applied to stone in greasy lithographic ink; the stone is flooded with water, and printer's ink applied. The ink sticks only to those parts untouched by water, and when paper is applied to the stone, under pressure, the image is transferred to the paper. Photographic processes are now used to apply the lithographic ink.

An interesting application of the half-tone is the tri-color process. In this, the fact is used that all tints are a combination of the primary colors. A negative is made through the half-tone screen of each color of which the subject is composed. The inks of these primary colors are superimposed on the same paper by the cuts obtained from the above negatives, and the resulting print is a replica of the original in all its delicate gradations of tint.

In decorations composed of several flat colors, a separate drawing is made for each color. It is necessary that these drawings fit into each other in such a manner that they do not overlap or leave any vacant spaces. This can be accomplished by tracing the drawing for each color from a drawing of the design as a whole.

A great deal of our newspaper cartooning is done on chalk plates. A steel plate is here covered with a chalky preparation about one-fourth or one-eight of an inch thick. The drawing is scratched through this on the steel plate. Over this is pured molten type-metal and a relievo cut thus obtained. The simplicity and inexpensiveness of this process appeals to newspaper managers a great deal more than the mussiness and stubbornness of the material appeals to the artist.

THESIS SUBJECTS.

F. V. Aguilera—Test and Study of Wagner Elec. Co.'s Single Phase Motor.

R. B. Arnold—The Hydrolysis of Mixtures of Maltose and Dextrine.

A. N. Austin—A Library Building for the City of Terre Haute.

M. W. Blair—Design of Steam Jet Pump for Mines—Based upon experiment.

W. D. Bowie, J. E. Fitzpatrick, J. W. Ijams—Test of Compressed Air Plant at Vandalia R. R. Shops.

H. S. Braman, J. S. Brosius, H. S. Kellogg—Test of Electric Lighting Company's Plant, Brazil, Ind.—Boiler, Engine, Dynamo and Transformer.

E. Burt—Study of Friction of Journal Bearings.

C. L. Chamberlain, H. W. Palmer—Tests of Dielectric Strength of Insulating Material.

I. J. Cox—Preparation and Study of Cyancarboxethylcyclopentanone.

N. H. Cox, C. D. Fisher, Jr.—Velocity of Steam Through Ports in Slide Valve Engine.

J. A. Cushman—Design of a Compound Duplex Condensing Pumping Engine, Suitable for Water Works Station.

G. Davies, H. B. Pettit—Reconstruction and Test of Polyphase Motor, Constructed in the R. P. I. Shops.

H. C. Gilbert, F. N. Rumbley, J. P. A. Williams—Test of Pittsburgh Freight Locomotives on Van Line.

J. B. Hunley, Jr., C. L. Post—Concrete Steel Bridge Over Wabash River.

W. D. Ingle—A Study of Electrical Coal Mining Machinery.

B. C. Jacob, C. J. Kiefer—Determination of Hysteretic Constant for Transformer Plates.

E. C. Kirby, E. C. Metzger—Power Required to Drive Machine Tools.

A. A. Krieger, B. H. Pine—Guaging the Wabash River at Main Street.

G. B. Lindenberger—Design, Construction and Test of a Gasoline Engine.

A. E. Michel—Test of a Root 4,000,000 Gal. Rotary Power Pump at Terre Haute Water Works Plant.

W. A. Peddle - The Behavior of Cooling Cast Iron from the Molten State in a Magnetic Field.

R. J. Schefferly—Design of a Touring Car, Gasoline Engine.

C. E. Smith—Crossing Van. R. R., Thirteenth St., Terre Haute, Ind.

H. E. Wiedemann—Synthesis of Camphor From Aminodihydrocampholytic Acid.

AWARD OF PENNANT.

A. W. Lee, '06, has been awarded a silk R. P. I. pennant for the songs which he handed in to THE TECHNIC. One or two yells and songs were handed in, but these were either without the names of the authors, not long enough, or not up to the required standard. The songs composed by Lee were printed by the "Rooters' Club" and distributed at school. For the benefit of those who have lost their leaflets, or failed to get one, we reprint the songs below:

No. 1.

TUNE: *A Hot Time.*

There's going to be some doings
In this good old, good old town,
For Rose Poly has got started,
And she will not be put down;
For in base ball and foot ball
And in basket ball we'll win,
And our track team will go out for us
And bring that pennant in.

CHORUS:

So play—play—play,
Oh play for all you're worth.
We'll show that Rose
Is the only school on earth.

Oh Poly—win for us boys,
Put up a good old fight,
There'll be a hot time
For old Rose to-night.

No. 2.

TUNE: *Marching Through Georgia.*

When you yell for Poly, boys,
Yell out long and strong,
For we are all for good old Rose,
Be she right or wrong.
So soak it to 'em, fellows, hard,
And do 'em all up brown.
Show 'em how we do it at Rose, boys.

CHORUS:

R. P.—R. P., fling Rose banners high.
R. P.—R. P., 'tis Poly's warpath cry.
Then help them on to victory,
For win we will or die.
So give three cheers for the R. P. I.

LARSON IN A NEW ROLE.

THE TECHNIC is in receipt of the following hand-bill, which doubtless will be of great interest to many of our readers. Mr. Larson, who is giving the lectures, graduated with the Class of 1900, and has since made a most remarkable success in his profession.

FOR MILWAUKEE MECHANICS

PLAIN, PRACTICAL TALKS

ON

STEAM ENGINEERING

By a Graduate of

ROSE POLYTECHNIC INSTITUTE

MR. C. J. LARSON

Erecting Engineer Allis-Chalmers Co.

MARCH 19, 1903

STEAM—Its Character and Properties.

MARCH, 26, 1903

Steam Boilers and Boiler Settings.

APRIL 9, 1903.

THE STEAM ENGINE—Slide Valve, Automatic and Corliss Engines—Simple and Compound.

APRIL 16, 1903

Injectors, Pumps and Condensers.

APRIL 23, 1903

Engine Economy and the Steam Engine Indicator.

All Talks will be illustrated by numerous Tables and Charts

Talks begin at 8 P. M.

INDIANA COLLEGE ATHLETIC LEAGUE.

A MEETING of the Indiana College Athletic League was called on March 6th, at the Denison House, at Indianapolis, with all delegates and managers of foot ball teams of the respective colleges in the league present.

The order of business was, first, a discussion of the spring meet at Richmond, where Earlham College is situated. It was decided that gold and silver medals will be given to the winners and seconds in each event, there being eleven track and six field events. Also a banner will be given to the team scoring the most points in this meet. The meet is under the control of a committee composed of delegates from three colleges: Earlham, Rose Polytechnic and Franklin.

The advisability of bringing basket ball into the league was next discussed. The delegates all expressed themselves favorably on including this winter sport. However, it was not thought advisable to take a vote until the next meeting of delegates.

Application for membership from the State Normal was next considered, but it was thought best not to admit them this year.

CAPTAIN OF TRACK TEAM.

Paul E. Turk, '06, has been elected captain of the 1903 track team, and it seems to be the popular impression that the selection could not have fallen on a man better fitted for the position. Mr. Turk has proven himself an athlete of no mean ability, and under his leadership and control ought to give Rose what she has lacked for a long time—a winning track team.

TRACK ATHLETICS.

Prospects for a winning track team this year are brighter than they have been at any time since Rose was champion of the state in field and track events. More than twenty men are in active training, and as all seem enthusiastic and willing to work, we ought surely be able to pick a team from so large a field that will bring home the pennant from Earlham on May 16th.

The contestants for the different events are as follows:

100 and 220 yard dash—Crain, A. W. Lee, Turk, Willien, Ryan, Spalding.

440 yard dash—Weisel, Dorn, Johnson, Benson.

½ mile and mile run—E. Lee, Hahn, Johnson, Thurman, Lawton.

Shot put—Turk, Crevoisie, Bowie, Heick, Post, Williams.

High jump—Peddle, Ryan, Wischmeyer, Eastwood, Turk.

Pole vault—A. W. Lee, Weisel, Wood, Willien.

Broad jump—Turk, Eastwood, Ryan, Peddle, Crain, Wischmeyer.

The team is somewhat handicapped in not having a coach or trainer, especially as the men, with a few exceptions, have had little or no experience, but Capt. Turk, with the assistance of Messrs. Crain, McCormick and A. W. Lee, is doing all he can to get the team into condition, and so far the results are very encouraging.

The records made by the boys while practicing are excellent, and even though some of the fellows have but little hope of winning first place at the meet, still there are second and third places for which credit will be given.

We are in the field for the pennant this year, and any laudable efforts now will be a credit, not alone to the one who makes the effort, but also to the school which he represents.

INDOOR MEET.

An indoor athletic meet was held on March 28th, and as was expected, the Freshman Class came out victorious. The main purpose of the meet was to see what material we could depend on for the state field meet, to be held at Earlham on May 16th.

Although none of the marks made were of the record-breaking type, still the winners of the several events were not pressed enough to make them show their real ability.

Turk, '06, carried off the honors of the day, and came up to all expectations, as he won everything in which he was entered. The results were as follows:

HIGH JUMP.

Turk, '06	5 ft. 2 in.
Peddle, '05	4 ft. 11 in.
Wischmeyer, '06	4 ft. 10 in.

SHOT PUT.

Turk, '06	36 ft. 6 in.
Post, '03	29 ft. 8½ in.
Crevoisie, '06	28 ft. 6½ in.

STANDING BROAD JUMP.

Turk, '06	9 ft. 11½ in.
Randall, '04	9 ft. 7 in.
Crain, '04	9 ft. 5¾ in.

POLE VAULT.

A. W. Lee, '06	8 ft. 6 in.
Willien, 06	8 ft. 2 in.
Brosius, 03	7 ft. 19 in.

PULL UP.

Thurman, '06	23 times
Dorn, '04	22 "
McNabb, '04 / E. P. Lee, '06	21 "

McNabb won toss up.

¼ MILE POTATO RACE.

McNabb, '04	1 min. 47⅕ sec.
Johnson, '06	1 min. 48 sec.
Toner, '04	1 min. 48⅗ sec.

TOTAL POINTS.

1906	33
1904	14
1903	4
1905	3

BASE BALL.

The regular team has been picked by Capt. Daily and Coach Walters, and the following men will represent the R. P. I. during the coming season:

Catchers—Reed, Demmitt.
Pitchers—Daily, Braman.
First base—McBridé.
Second base—Freudenreich.
Third base—Stoddard, Barbazette.
Short-stop—Cox, Baylor.
Left field—Bowsher.
Center field—Bland.
Right field—Demmitt, Reed.
Substitute—Cushman.

PRACTICE GAME.

The first practice game of the season was played on March 21st with the local Stamping Mills, and resulted in a victory for the Poly by a score of 15 to 5. The day was very cold, and no doubt this was what allowed the Stamping Mills to score, as the air was too chilly for our fellows to play first-class ball.

T. H. H. S. 1, R. P. I. 16.

On March 28th Rose played a practice game with the City High School in the role of Innocent Victims.

Taken as a whole, the game was fairly satisfactory, our main weakness seeming to be inability to hit the ball on the nose. However, when the hot weather comes we hope to have a different tale to tell, for a team cannot win without a certain amount of good, hard, old-fashion slugging, and we must have a winning ball team this year, if only to dispel the idea concerning our old hoodo and enemy, our so-called Poly luck.

A good picture of the base ball team was taken on March 26th, by Mr. A. E. Michel, '03. These pictures can be obtained from him upon payment of 25c.

HIGH SCHOOL 0, ROSE 18.

A second game of base ball was played with the local High School, and resulted in a victory for Rose by the score of 18 to 0. At no stage of the game were the visitors in the hunt, as very few of them reached first base, and only one of them got as far as thira. Braman pitched the first seven innings and was then relieved by Greenleaf, who pitched the remainder of the game in fine style, not allowing his opponents a single hit. Only three hits were made off of Braman's delivery, while the Poly boys kept the High School fielders on the run by knocking the ball all over the lot.

TERRE HAUTE VS. ROSE.

About forty R. P. I. fans journeyed out to league park on April 4 to see the team taken into camp by the Terre Haute professionals to the score of 17 to 2. It was too cold for good base ball, but this seemed only to effect the Poly boys, as the score very plainly shows. Daily never let himself out, as he is really a hot weather pitcher, but as it was he struck eight of the professionals, who in turn made but 13 hits off of his delivery against 7 hits made by the R. P. I. team.

The T. H. pitchers were all new men trying for positions, and consequently did their best to hold down the hits and runs. Nevertheless the Poly managed to score twice and had men on base in nearly every inning and twice had the bases full, but the necessary hit was not forthcoming.

Let it be said in conclusion, to those who were disappointed over the showing made by the team, that there is no team on our schedule that can at all compare with our opponents in batting or pitching, and that if we can score on a professional team, there is no reason to fear the outcome of at least the majority of the games to be played this spring.

The team lined up as follows:

Bowsher, left field.
Demmitt, right field.
Freudenreich, second base.
Bland, center field.
McBride, first base.
Reed, catch.
Cox, short-stop.
Stoddard, third base.
Daily, pitch.

Turk has been doing 21 ft. 8 in. in the broad jump, while A. W. Lee is showing up exceedingly strong in the dashes.

Recently, at the University of Chicago, a meeting was held to discuss "The Control of Athletics," with Prof. C. A. Waldo, of Purdue, formerly a professor at Rose, in the role of chief speaker.

"Are our college athletic lawgivers succeeding in raising sport to a higher level?" asked Prof. Waldo after tracing the development of intercollegiate sport since 1890 and noting the alarming tendencies toward professionalism. "Are our students stimulated to greater achievement in honesty, loyalty and self-sacrifice? I fear that our students are coming more and more to the opinion that all is fair in athletics and war, that anything is justifiable which is not found out, and that there is no great disgrace attaching to things found out. Unless my observation is entirely at fault, there is danger, and it is increasing, that good men as well as bad among our students wink at the evasion of established rules and sit silent in the presence of even downright chicanery.

SUGGESTIONS FOR REFORMS.

Something must be done. Our conferences are working in the right direction. I would suggest a program of further reform.

1. Absolute business publicity.
2. A worthy and permanent record of athletic achievement.
3. One year's residence and reasonable success in studies before a student can become a candidate.

4. Repudiation of all recruiting agents or agencies.

5. Graduate and amateur coaching without pay.

6. A reasonable amount of disarmament.

7. A lower limit than now prevails for a maximum admission fee to witness inter-collegiate sports.

8. An athletic society among students who have attained distinction in athletics, which would insist on amateurism and high ideals of sport.

I would advocate the publication by groups of institutions of an athletic manual which would give the public inside facts and would tend to emphasize to athletes their correct and reasonable rewards for excellence.

GRADUATE COACHING IS ADVOCATED.

By a one year rule, strictly applied, most cases which cause scandal and suspicion would be eliminated. Such a rule would emphasize the primacy of scholarship and would almost completely stop the growing scandals attaching to the search for material.

A change to amateur and graduate coaching is a reform which would tend to a moderation of our present system—all too strenuous. An unscrupulous coach with a large salary is a menace to amateurism. What a temptation the system places before such a man to use part of his personal funds to secure mercenary material and build up a winning team, whose victories will enhance his own reputation and increase the ability of an association to pay him a still larger salary. I trust the days of the overpaid and imported coach are numbered.

NOTES FROM OTHER COLLEGES.

Lemoyn, of Boston Preparatory, recently did 45 ft. 9 in. in the 16 lb. shot, breaking the Yale record by over a foot.

Earlham has declared that she will not have a base ball team this year, in order to develop a winning track team for the meet on May 16th, when the first meet under the auspices of the new Athletic Association of minor colleges will be held.

Admirers of western foot ball will have a chance to compare the western with the eastern teams when ihe University of Chicago travels east next fall, to meet the West Point team on the gridiron.

Purdue has elected L. E. Hearn, the distance runner, as captain for the 1903 track team.

The Indiana State Normal has obtained the grant of a large amount of money with which to buy and equip an athletic park.

The so-called "Big Five" have agreed to play by last year's base ball rules, disregarding any changes this year.

A dual track meet will be held between I. U. and Purdue on May 9th.

In the election of captain for the Yale foot ball team for 1903 Rafferty was chosen. Of the two other logical candidates Glass was proved ineligible, and Metcalf withdrew from the race.

Quite a number of the universities have contracted with players from the National and American leagues to coach their base ball teams this spring.

Yale won the inter-collegiate basket ball championship from Harvard. Yale has won the championship for the past three years.

Arthur Hillebrand has been chosen head coach in foot ball at Princeton next year. Hillebrand played on the Princeton team for three years, and made the All-American eleven for the years 1898 and 1899.

It is very doubtful whether there will be a foot ball game between Purdue and Indiana next year. Some hitch in the financial arrangements is assigned as the reason.

LOOKIN' ON.

When I hear the starter's "Ready,"
When I hear the pistol crack,
When I see those fellows comin'
Like greased lightning up the track –

Why, I can't sit still for nothin'
And I shout with all my might
Till the people all about me
Go to laughing at the sight.

And the man that gets my yellin'
When I'm watching such a race
Is the man who run's to win it,
Not the man who wants a place.

It's the man who digs his toes in,
It's the man who grits his teeth,
It's the man who keeps on running'
When the ground sways underneath.

He's the man who always gets there,
He's the man that always can,
For there's no one else a runnin'
That's a runnin' like a man.

—[*Exchange.*

Well, we're on the last lap.

"The smile that won't come off"—the ice-man's.

Prof:—A fool can ask questions which a wise man cannot answer.

Student:—Is that why so many failed in the last exams, Professor?—[*Ex.*

NOTICE! NOTICE!

Kadel, '05, claims he has a blister from working in the foundry.

Reynolds (in Chemistry Journal Review):—Boil this till it comes to a boil.

The orchestra expects to give a concert in about a month from now.

The teacher asked, "What is space?"
The trembling Freshman said:
"I cannot think at present;
But I have it in my head."

—[*Ex.*

THE IDEA!

Prof. W.:—Now, Mr. B., suppose you had a light load on——

Benson called on a young lady the other day, and while talking to her on the steps, sat down on a freshly painted orange-colored porch. The result was that he got a streak of yellow and ran home.

'Arry has been casting gold bricks in the foundry.

Senior:—"I never pay to get shaved."
Junior:—"How's that?"
Senior:—"I always get shaved on my face?"

—[*Ex.*

Dorn (reading French):—I have a small head-ache.

The Glee Club had intended to give an entertainment some time during the latter part of this term, but owing to the illness of Mrs. Adams the plan may have to be given up. We hope that we may have an opportunity to hear them before the end of the school year.

The Juniors awarded three prizes to the three men in the class who obtained the greatest number of points in the late inter-class indoor meet. McNabb received first prize, and Randall and Dorn were tied for second.

Mr. Logan received a surprise package on April 1st.

Wicky:—Just quietly keep still, please.

JUNIOR SCIENTIFIC SOCIETY.

President—John F. Regan, Jr.
Secretary—Prof. A. S. Hathaway.
Treasurer—John T. Staff, Jr.
Meetings, every Monday, Wednesday, Thursday and Friday.

The maid is afraid of the mouse,
And the mouse of the man is afraid;
The man when aroused will murder the mouse,
Yet the man is afraid of the maid.
—[*Ex.*

Hath:—Remember, you are your own teachers.

Junior:—Do we mark ourselves, Professor?

Its a mean trick for the weather to play April fool jokes on us.

Always read the advertisements in THE TECHNIC.

The fat girl in her bathing suit
Along the seashore fluttered.
The crowd obliging turned its head,
And multum in parvo muttered.

Klenk:—Don't hurry away, fellows. I'm going to bed as soon as you leave.

Senior:—That voltmeter is wrong; it is an ampere out at every reading.

Leedy (in chem.):—Glass must be heated before it can be used.

I'll show you something about calculus now.

Jenckes:—A little surprise party, Professor?

A SURE HARBINGER.

I know that spring is coming,
By the birds that sing at dawn;
By the faint, suspicious greening
Of the grass upon the lawn;
I know that spring is coming,
For my feelings tell me so—
I'm as lazy as a loafer,
And to work I hate to go.
But these indications are not
All that proves that spring is near,
Though the sap is slowly rising
(Like a thirst for good root-beer!)
There's a surer sign it's coming—
At our pocketbooks it aims—
For the paper's printing schedules
Of the
Baseball
Games!
—[*Cincinnati Commercial-Tribune.*

More than thirty Freshmen are taking electrical engineering.

H. Eastwood, who injured his eye several weeks ago, has returned to school.

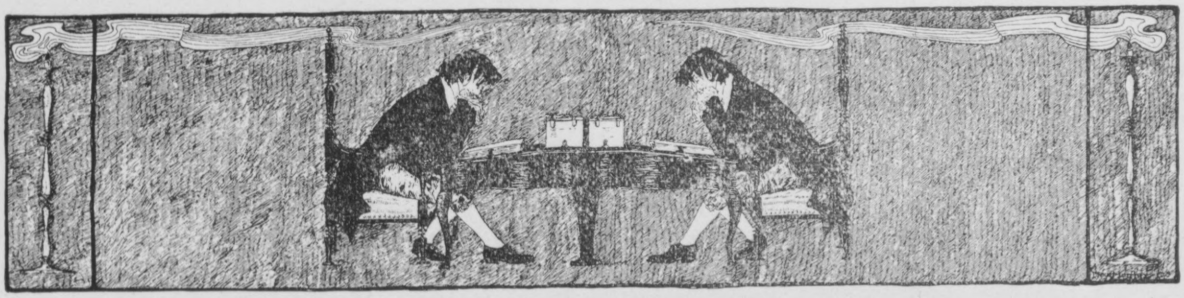
Thomas Hodge has left school on account of illness.

Man is like a kerosene lamp. He isn't especially bright; he's often turned down, usually smokes, and frequently goes out at night.—[*Ex.*

On almost any Sunday afternoon three Freshmen can be seen counting ties in the direction of St. Mary's college.

HOW TRUE!

The exchange editor may scratch with a pen
'Till the ends of his fingers are sore;
But some one is sure to remark, with a jest,
"Rats! How stale! I've heard that before."
—[*Ex.*



REVIEWS

IMPROVED METHODS FOR SUBAQUEOUS TUNNELING.

To overcome the difficulties which would be encountered in constructing the tunnels under East and North rivers, for the proposed new transit systems for Greater New York, engineers and contractors have been trying to devise some suitable means of constructing these tunnels. They must not only be placed at a considerable depth, but in soil whose character is variable and uncertain, but must be built under a four-mile current without obstructing navigation.

Several of the designs and schemes have been described in the *Engineering Record*, one of the newest being submitted by Mr. John F. O'Rourke, contracting engineer.

Mr. O'Rourke's system is a combination of principles which have been used in sinking bridge piers by pneumatic caissons. He proposes to sink rectangular pier caissons or temporary working shafts, to a depth somewhat below subgrade of the tunnel, about 500 feet apart. The two sides normal to the axis of the tunnel are to consist of removable bulkheads, while the two side working chambers are filled with concrete up to surface of ground.

The tunnel is to be built on shore and in sections about 500 ft. long and then floated into position between the piers. These sections will be made up of steel plates, reinforced by curved I-beams, and with concrete. Each section will be supported on a wooden caisson, decked over solid, with the sides extending a few feet below and forming a working chamber. A trench will be dredged along the line of the tunnel and the sections lowered into it, or they will be sunk like ordinary caisson by excavating from the air chamber. As the sections are lowered the bulkheads in the shafts are removed, and after alignment, the two adjacent sections are spliced and caulked in the shafts.

This method of construction, it is believed, will be a rapid one, as most of the work can be done on the shore, which also will allow for stronger and tighter tubes. The temporary shafts would only obstruct navigation slightly.

SOLID ELECTROLYTE CELLS.

It is only since 1885 that there has been a cell whose electrolyte is solid. In that year Bidwell produced a slight current with plates of silver and copper, and an electrolyte consisting of a mixture of copper sulphide and sulphur. Later he obtained a large current from a cell consisting of lead and metallic sodium plates and lead peroxide.

In 1900 Mr. A. L. Marsh repeated the experiments of Bidwell, and tried combinations of:

Copper, zinc, and a mixture of copper phosphide and red phosphorus.

Copper, sodium, and a mixture of copper phosphide and red phosphorus.

Copper, sodium, and metallic arsenic.

His methods and results are printed in the *Electrochemical Industry:*

> The copper phosphide was prepared by mixing pure sponge copper, obtained by electrolysis of a copper sulphate solution, with red phosphorus in the proper proportion to form the compound Cu_3P_2. The mixture was slowly heated in absence of air until combination took place, which is indicated by a slight explosion. By wash

ing this product with a dilute solution of potassium bichromate, to which a little sulphuric acid is added, and afterward with distilled water, a procedure recommended by Boettger, a quite pure product of copper phosphide (Cu_3P_2) is obtained.

For one set of experiments, a mixture of copper phosphide and red phosphorus was taken for the electrolyte, and compressed between a piece of metallic sodium and sheet of copper, and the whole kept under a light oil. The electro-motive force was found to be about 1.5 volts, and the resistance was less than 100 ohms per square inch of contact surface. The electromotive force did not materially increase when the percentage of phosphorus in the mixture was increased to 75 per cent.; but the resistance became much greater.

The substituting of zinc for the metallic sodium in the above combination, the electromotive force of the couple becomes about .8 volt. A cell prepared in a glass tube three-eighths of an inch in diameter gave a sufficiently strong current to move the mercury column of a not very delicate Lippman electrometer.

The zinc is used in the form of an amalgam, of such a consistency that it can be poured into the cell when hot and cools to a rather solid paste. The mixture of copper phosphide and phosphorus is pressed in over the zinc amalgam, and a disk of copper is pressed firmly over the mixture. The connection to the zinc amalgam was made by a platinum wire, which was sealed into the glass. The materials used were carefully dried before putting into the cell kept in a desiccator over sulphuric acid.

The following experiment was tried: A small lump of metallic arsenic was pressed against a slab of sodium, and the whole covered with a light oil. Each metal had a thin copper wire connected to it. An electromotive force of 1.2 volts was shown by a potentiometer. On another trial a copper-arsenic-sodium couple gave at the start an electromotive force of .05 volts. The cell was allowed to stand on closed circuit with 1,000 ohms external resistance. The electromotive force steadily increased, and at the end of ten days had reached .3 volt.

It is a difficult matter to get the materials absolutely free from water, but, granting that in the experiments described above there was a trace of water present, we should hardly expect the comparatively low resistance shown by solid electrolyte cells to be due to the pressure of water, since the materials are practically insoluble in water. However, the small number of experiments performed does not admit of any positive conclusions being drawn.

This class of cells has so far been but little studied, but it is to be hoped that the importance of these cells, from a scientific point of view, will induce others to take up their study. The work of the writer along this line was cut short and facilities for its continuance are not yet available.

Owing to their rather high resistance, solid electrolyte cells will find little practical use. It is possible that they may be used as standards of electromotive force, but so little has been done in the study of this type of cell that their adaptability to this work is uncertain.

ALCOHOL AS A SOURCE OF MOTIVE POWER.

THE *American Machinist* prints part of the consular reports of Consul-General Frank H. Mason of Berlin, in which he describes the cultivation of potatoes in Germany, especially for the production of alcohol for the purpose of light and motive power. Of the application, he says:

In the use of alcohol for lighting it is employed in a great variety of lamps, chandeliers, street and corridor lights, in which the alcohol vapor is burned like gas in a flame covered by a Welsbach mantle. The report says that "under such conditions alcohol vapor burns with an incandescent flame which rivals the arc light in brilliance and requires to be shaded to adapt it to the endurance of the human eye."

Mr. Mason says there has been recently a great improvement in the artistic models and finish of lamps and chandeliers for alcohol lighting and that this method of lighting is now competing with increasing success with gas and electricity. It is used also in heating stoves, and it is thought that it will largely replace the steam engines now used for various purposes, especially in agricultural work, there being with this engine no coal or water to be provided, no fireman needed, no offensive smells or danger of fire and finally greater economy than with the steam engine. For power purposes what is known as the Central Association undertakes to deliver free at any railroad station in Germany denaturized alcohol of 90 per cent. purity in quantities of 180 to 200 liters for 15, 16½ and 17 pfennigs per liter or approximately 15, 16 and 17 cents per gallon, according to the material used in the denaturizing. As the consumption of a modern alcohol motor for farming purposes is about 0.5 liter, costing about 2 cents per horse-power hour, it will be apparent that in Germany at least gasoline and kerosene have met a serious competitor as fuel for motor purposes.

Mr. Mason says the Hamburg-American Steamship Company has in service a harbor inspection launch which, with a 23 horse-power alcohol engine, makes a speed of 10 knots, and preparations are being made to greatly extend the use of such motors in launches and ship's boats of the German navy. It is also being used largely for motor vehicles with the greatest satisfaction and success.

Howard J. Mater

The 11 South Sixth Street

..Tailor..

for Elegantly Tailored Garments at Reasonable Prices. All garments of our own make pressed free.

SPRING AND SUMMER PATTERNS NOW ON DISPLAY

EVERETT

THE TAILOR

Suits $10 and up, Pants $3 and up

PERFECT FIT LARGEST SELECTION
BEST WORKMANSHIP LATEST STYLES

17 YEARS AT SAME STAND
SEVENTH STREE, NEAR BIG 4 DEPOT

Holloway

For Your Photographs

The Modern Studio

The Place You Can't Forget

HOLDEN'S

UP-TO-DATE

BARBER SHOP

CIGAR STORE AND BATH ROOMS,

12 NORTH SEVENTH STREET

NEAR POST OFFICE.

WE USE THE ANTISEPTIC COMPRESSED AIR.

BELL 7671 CITIZENS' 369

The Ermisch Dyeing & Cleaning Co.

652 MAIN ST., TERRE HAUTE, IND.

Fine Work in Cleaning and Dyeing of Ladies' and Gents' garments

---

Terre Haute Laundry Company

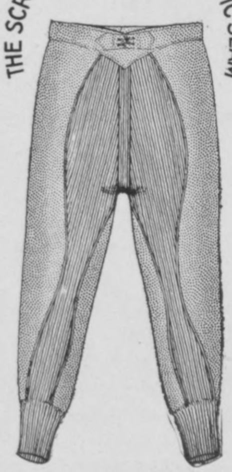
Both Telephones 184.
308-310 Cherry Street.

ED. E. LAWRENCE,
Manager.

TERRE HAUTE, IND.

FOULKES BROS.

THE SCRIVEN IMPROVED PATENTED ELASTIC SEAM



IF YOU WANT DRAWERS,

buy

"SCRIVEN'S ELASTIC SEAM."

THEY WEAR.

FOULKES BROS.

Hatters & Furnishers 631 Wabash Avenue.

Allegretti's
Lowney's **CHOCOLATES**

French Briar Pipes and Smokers' Requisites
Athletes' Supporters, Braces, &c.

BUNTIN DRUG CO. N. E. Cor. 6th & Wabash Ave.

Miller Tailoring Co.

ART IN DRESS — MAKERS of Good Clothes at Moderate Cost — DOWN TO DATE

674 Wabash Ave. Terre Haute, Ind.

Citizens Telephone 328 Bell Telephone 671

GEORGE HASKET

HACKS

BARN AND OFFICE
820
MULBERRY ST.

Terre Haute,
Ind.

PATRONIZE OUR ADVERTISERS, BOYS, IT WILL HELP US.

BLICKENSDERSFER TYPEWRITERS

MORE POPULAR THAN EVER. JUST THE THING FOR NEAT, CLEAR CUT WORK. A SPLENDID MANIFOLDER. STENCILS FOR MIMEOGRAPHING ONE OF IT'S STRONG POINTS. :: :: ::

A good, durable, efficient typewriter at a moderate cost. One that you can take right with you, and it is **Ready for Business at any time.** Don't forget, **The Business Letter that Tells, and the Manuscript that Sells,** are both typewritten. Used exclusively by some of the most noted authors in the U. S. Reuter's correspondent used a "Blick" all through his tours through Egypt. The Telegraph Companies have purchased nearly 3000 "Blicks" since their introduction. You will find upon the closest investigation, that the Blickensderfer Typewriters will bear inspection, and the more you know them the better you like them. Why not turn out typewritten work, in less than half the time it requires you to write it? Look into this matter, it will pay you. Get printed matter at the agency,

No. 630 WABASH AVENUE.

PRICES $35 & $50.
FULLY GUARANTEED.

P. L. MOUNCE, Local Agent.

J. E. POWELL,

DEALER IN

BICYCLES, SUNDRIES, ETC.

Special attention given to Bicycle Repairs.

EIGHTH & BIG FOUR RAILROAD

ALL WORK GUARANTEED.

Always mention THE TECHNIC when doing business with our advertisers. It may do us good