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THE TECHNIC

TERMS

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HE who knows not, and knows not that he knows not, is a fool; avoid him. He who knows not, and knows that he knows not, is ignorant; teach him. He who knows and knows not that he knows, is asleep; wake him. He who knows, and knows that he knows, is wise; follow him.—Tartan, Carnegie Inst. Tech.

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ON account of the two weeks' vacation, several departments of the Technic are somewhat short of material this month. As it happens these departments, Differentials, Rose Leaves and Athletics, are the very ones that usually interest students most. Hence, if they appear a little skimped in this issue, please withhold judgment, and we will promise to do better next time.

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OUR Alumni article this month is by Mr. F. H. Miller, '95, who is Superintendent of Motive Power of the Louisville Railway Co., of Louisville, Ky. The new power station and equipment described in the article were to a large extent designed by Mr. Miller personally, and should, for this reason, be doubly interesting to all Rose men. The photographs and drawings used were very kindly loaned us by the author, together with a number of other very excellent and interesting ones, which space limitations compelled us to omit.

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WE recently received a number of quotations, suitable for use in the Technic, taken from a book entitled "Addresses to Engineering Students," published by Waddell and Harrington, Consulting Engineers, of Kansas City, Mo. These have been sent to a number of technical college journals, to be used by them in any way they see fit. The material presented is excellent, and the publishers are to be congratulated on the manner and spirit in which it was put out. It is decidedly not their idea that these quotations are to serve as advertisements for the book itself. They merely wish to do all they can to raise the standard of the engineering profession, and they take this means of doing it. If the use of these paragraphs results in the sale of a few copies of the book, the publishers will probably be out of pocket, as the expense of publication is large and the demand somewhat limited. We expect to use these quotations from time to time as the basis for editorials, or reviews, and trust that they will receive the careful attention of the students in general, for, to our mind, they certainly deserve it.

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INACCURACY is, perhaps, the greatest sin next to dishonesty, of which the engineer is capable. Its results are waste of money, danger, accident, and frequently loss of life. Failing bridges, broken dams, collapsed buildings, are likely to follow the misplacing of a decimal point or the omission of some essential in computation. But accuracy in calculation or in execution is not sufficient to avoid trouble. Accuracy in expressing conclusions, clearness in recommendations, and precision in describing the work to be done in contract and specification, are of the utmost importance. Serious loss and an enormous amount of litigation result from looseness and lack of clearness in description of the work to be done and the relative obligations to be assumed by owner and contractor in the specifications commonly prepared by engineers and architects.—*Lewis.*

The above is one of the quotations referred to in a previous editorial. Students in general often fail to realize the importance of accuracy in all their work. When a decimal point is forgotten in some problem in an examination, and the professor only gives half credit for the work on that particular question, many of us are prone to kick. We think he is too strict, when if the truth be known, he is in reality, far too lenient.

If a man has spent upwards of twelve or sixteen years in school, and finds that he cannot yet multiply and divide correctly, then the sooner he gives up the study of engineering, the better it will be for him. This may sound too harsh to some of us, but it is necessary that it be so. The only way that a man can learn not to make such mistakes is to be punished for them. It is true that anyone may make a mistake, but it is also true that there is but one thing by which an employer may judge a man, and that is by *results.* The theory used in designing a bridge may be fautless, but if a mistake in calculation is made, the result is likely to be something similar to the Quebec Bridge disaster of several years ago.

The thing is that when an engineer makes a mistake, he ceases to be an engineer. The whole thing might be summed up in the words used by Dr. Mees several years ago, when he said something to this effect: A doctor may kill his mistakes; an undertaker may bury his mistakes; and a lawyer may hide his mistakes behind prison bars, but unlike these, an engineer is buried by his own mistakes, and with himself he may carry scores of others who are the innocent victims of his carelessness.

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OUR leading article this month is by Mr. E. J. Rork, Assistant Superintendent of the Prest-O-Lite Co., Indianapolis, Ind. Mr. Rork is a graduate of the Michigan Agricultural College, in the Mechanical Engineering course, class '98. Sine cgraduation he has been with the above company, and has taken particular interest in their Oxy-Acetylene Welding Department, and is hence very well qualified to discuss the subject. This work has, during the past few years, passed out of the experimental and into the practical stage, and the article is, therefore, not only interesting but timely.

OXY-ACETYLENE WELDING

By E. J. Rork.

DURING the past few years oxy-acetylene welding has been gaining a foot-hold in engineering work. It is used in manufacturing, repairing and construction work to a considerable extent and its future growth in these lines will be even more rapid, now that its use is understood and the process has demonstrated an economy in these uses.

The high temperature that could be obtained by burning acetylene in the presence of pure oxygen was brought out first in France in 1903. Not earlier than 1907 the first outfits for oxy-acetylene welding were introduced in the United States. At that time this process received a serious set-back on account of the unreliability of the equipment and the lack of knowledge on the part of the operators of these outfits in the application of this intense heat. These adverse conditions were subsequently overcome by the improvement of the apparatus and the advancement of knowledge of the working conditions.

Now manufacturing industries are using the process extensively for manufacturing metal parts. Machine shops and repair departments for industrial companies are making repairs and incidentially large savings in repair bills by means of welding. Construction companies have made use of the oxy-acetylene cutting to a considerable extent. Steel structures are cut down in a remarkably short time and at a great saving in labor cost.

The field is broad for welding by means of the oxy-acetylene flame. Work of this nature that at first was found impossible in practice and seemed improbable theoretically is now being done as regular shop practice. But a short time has elapsed since the introduction of this process and the firm foundation it has established makes future applications in the different lines assured.

An oxy-acetylene welding flame when properly adjusted burns with an inner cone of 1/4 inch to 1/2 inch in length and an enveloping flame of somewhat larger proportions. A temperature of 6300 degrees F. is obtained at the point of this inner cone. This part of the flame is the product of combustion of carbon with oxygen.

Acetylene, C2.H2, theoretically requires 2.5 volumes of oxygen for complete combustion. Through the blowpipe from 1.28 to 1.5 volumes produces a neutral flame, the remainder being supplied by the surrounding atmosphere.

The enveloping flame is the product of combustion of the hydrogen which will not burn at the high temperature of the inner cone. This temperature is probably less than 4000 degrees F. which is the temperature of the oxy-hydrogen flame. Apparently this part of the flame is useless, but practically by forming a cone over the weld, it prevents the oxidation of the molten metal while the weld is in process.

Many different types of blowpipe or torches have been brought out which answer practically all the requirements necessary for successful welding. These are made in two different types known as high pressure and low pressure torches. In the high pressure type the oxygen and acetylene are under practically equal pressures and each gas must be maintained at a constant pressure by means of suitable automatic reducing valves. In the low pressure type, the oxygen is maintained at a higher pressure than the acetylene. The inner tips of this torch are arranged on the injector principle and the oxygen pulls the acetylene into the torch. This type is used when the acetylene is supplied by a generator in which high pressures are dangerous.

Various styles of torches are manufactured. To meet the demand for various classes of work, the best torches are made with interchangeable welding heads. The inner and outer nozzles are contained in the welding head, which can be changed quickly.

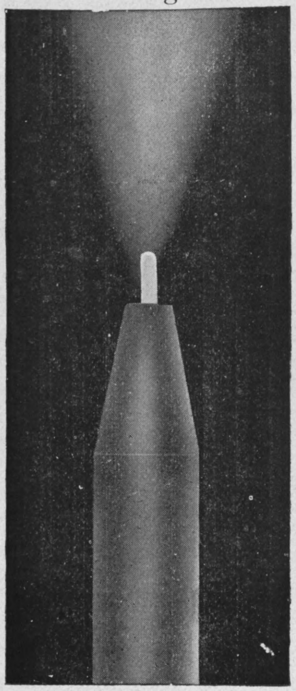
Oxygen for welding use may be manufactured as used in retorts from a mixture of potassium chlorate and manganese dioxide. Sufficient pressure is produced in the generator to answer the requirements for oxygen under pressure. This oxygen is not as pure as that made by the electrolysis of water, or by the liquefaction of air. Pure gases are one of the first essentials for gas welding. All items of expense considered, the oxygen can be purchased in seamless steel drums of 100 cu. ft. capacity, made by either of the above processes and compressed to 1800 lbs. per square inch, cheaper than to make as used from chemicals.

The acetylene supply for welding is furnished in two ways: acetylene generator and safety storage cylinders. The acetylene in these cylinders is dissolved in acetone. This liquid has the property of absorbing twenty-five times its volume of acetylene for each atmosphere of pressure. In order to exclude all possibility of decomposition of the dissolved gas, the interior of the tank is made up of a porous filling. Allowing for space taken up by filling material and expansion of acetone, a cylinder will hold at 15 atmospheres pressure practically 150 times its apparent volume.

Considering quality of work and expense incident to generating acetylene, it may be purchased economically in the safety storage tanks in which the gas is pumped after having been thoroughly purified and dried.

The objection to the generator is that it is never entirely safe and should not be used in connection with welding equipment, which must be portable. The acetylene must be purified and this is not possible without considerable extra equipment.

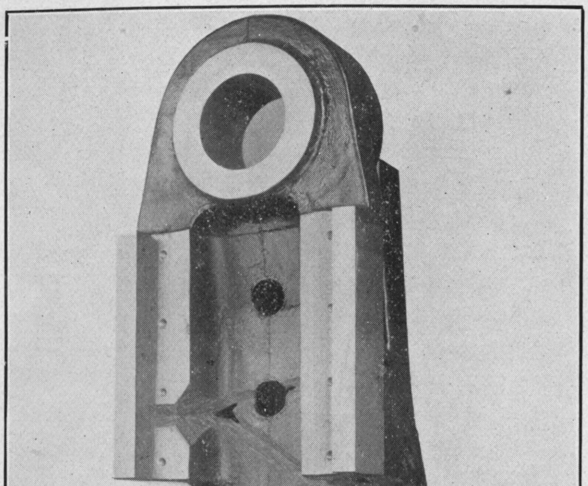
Welding by means of the oxy-acetylene flame is primarily a local recasting of the metal at the fracture. The flame is concentrated and the intense heat allows of recasting without undue loss of heat through conduction.



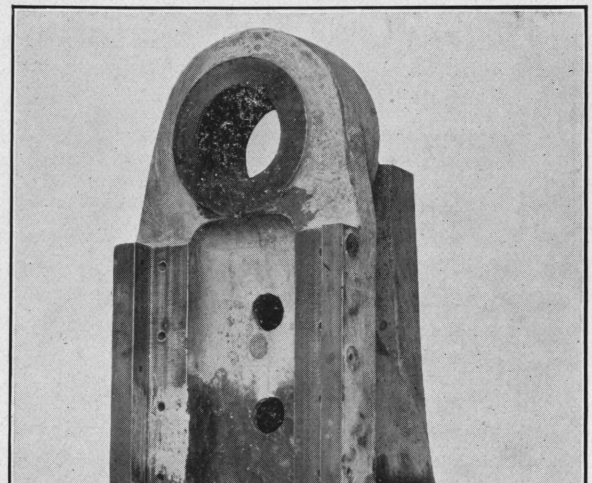
Neutral Flame

Cast iron, steel, brass, bronze and aluminum can be successfully welded by this process. The strength of these welds will depend considerably upon the skill of the operator. An efficiency of 85 per cent. would be a fair average for steel plates with welded section equal in area to original section.

The heat value of acetylene gas is 1685 B. T. U. per cubic foot. An idea of the speed and cost of welding cold steel plates may be gained from figures given in following table:



Before Welding



After Welding

Approximate Cost of the Welding of Steel Plates.

Blow-pipe No.	Thickness of Plate Inches	Foot Run per Hour	Oxygen Consump-tion Cu. ft. per Hour	Acet. Con-sumption Cu. Ft. per Hour	Approx. Cost per Ft. Run Inc. Labor
3	3-64	30	4	2½	$0.012
4	3-32	21	6	3¾	.021
5	1-8	15	10	6	.037
6	3-16	6	16	10	.125
7	1-4	4	25	15	.256
8	3-8	3	36	22	.456
10	1-2	2	45	28	.827

The labor item is based on 30c per hour. A saving of from 30 to 50 per cent. can be made by pre-heating the plates in the area to be welded.

A recent application of the welding process in the laying of a high pressure gas main for the Pacific Gas and Electric Company of San Francisco, California, has met with success. The Progressive Age gives an account of the welding and states that 8 in. steel tubing 3-16 in. thick, was welded end to end and stood a test pressure of 150 lbs. per square inch without leaks. The welding was done above ground to allow the pipe to be turned as the welding progressed.

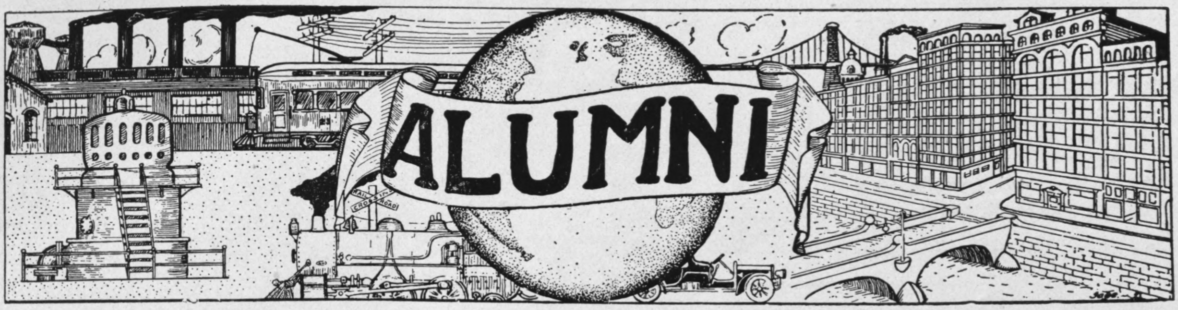
A test for strength was made by welding two 40 ft. lengths together. All supports were removed from under one 40 foot length and its entire weight was suspended on the joint. The weld was in no way affected by this treatment. After completion, the line was tested to 150 lbs. per square inch, which pressure stood for 3 days without loss.

This opns a new field for the application of oxy-acetylene welding and one that will be valuable for high pressure pipe lines for any of their various uses.

The cuts showing punch press before and after repairing illustrates another adaption that is now in every day use in all large repair shops. This punch press casting, weighing approximately 3500 lbs., was broken through the throat. A new casting could not be obtained and machined in less than three weeks. The repair was made and the press fitted up ready to run in three days. Practically, the press is as good as when new, being used for accurate work as before. The saving in time alone is an item to the credit of oxy-acetylene welding besides the saving of at least 75 per cent. of the replacement price.

The process is used to advantage in the manufacture of metal articles, both for new work and saving defective material. Many tanks that formerly were made up by riveting and brazing are now manufactured by welding. The joint is neater and better. Once perfectly made, it cannot become defective through use, as it is all solid metal of like material.

The future will see many more uses for the process than are now in daily use, but even so its present sucessful applications recommend it for use wherever it can be applied.



HIGH STREET POWER STATION OF THE LOUISVILLE AND INTERURBAN RAILROAD CO.

By F. H. Miller, '95.
Superintendent of Motive Power Louisville and Interurban Railroad Company.

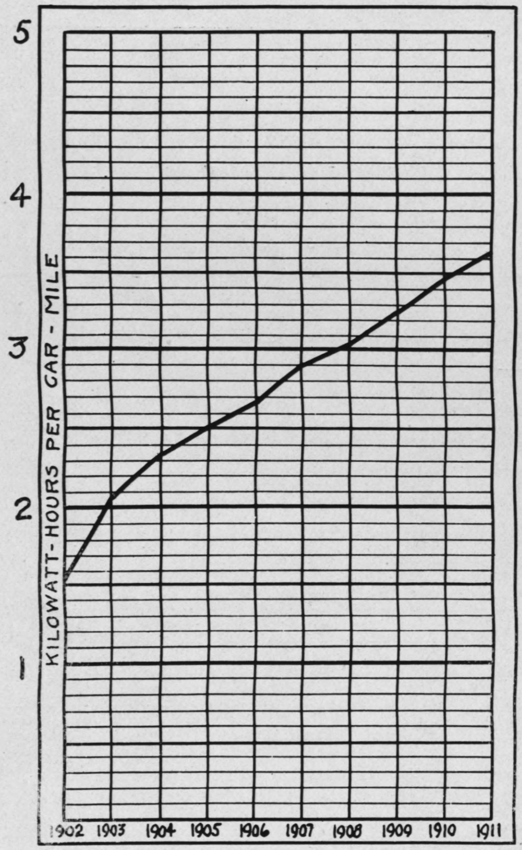
THE Louisville Traction Company of Louisville, Kentucky, owns the Louisville Railway Company and the Louisville and Interurban Railroad Company, the Louisville Railway Company operating about 160 miles of city track and the Louisville and Interurban Railroad Company about 95 miles of interurban track. Power for this entire system is now generated from the plant at Campbell & Finzer Streets, situated on Beargrass Creek in the southeastern part of Louisville.

This generating plant contains in alternating current apparatus one 3500 K. W. and one 3000 K. W. steam turbine; two 1650 K. W. reciprocating vertical engine type units, all generating current at 13,200 volts, 25 cycle, 3 phase. The direct current 550 volt equipment is as follows: two 1650 K. W.; three 500 K.W., a total of 14,600 K. W. A. C. and D. C., and in connection with this one 3,000 ampere-hour storage battery. The plant has a boiler capacity of 14,000 rated H. P. All available space in boiler and engine rooms is taken up with installed apparatus.

This Campbell Street plant is located on Beargrass Creek, from which formerly the condensing water was obtained. Beargrass Creek water consisted of 90 per cent. sewage, so that when, within the last five years, the city of Louisville built sewers paralleling the creek, the flow of water in the creek was reduced to an almost neglible amount, making it necessary for the Louisville Railway Company to get its condensing water for the greater part from artesian wells and a spray cooling system. These methods where the amount of water is limited, and pumping necessarily costly, reduce the efficiency of the plant to such a degree as to make it necessary that a location be found where plenty of cheap water is available.

The average daily output of the generating station of this Company in 1900 was 35,000

K. W. Hrs.; in 1905, 70,000 K. W. Hrs.; in 1910, 120,000 K. W. Hrs.; in 1912, 10 months to date, 149,691 K. W. Hrs., while the maximum hour load demand rose as follows: 1900, 3,000 K. W.; 1905, 7,400 K. W.; 1910, 12,600 K. W.; 1912, to date, 15,000 K. W. These increased outputs are caused by several reasons of which the following may be noted: increased mileage of the system; increased car-miles; in-



One Reason for Additional Power Station Effect of Increased Size of Cars and Car Equipment.

creased car sizes and car equipment. This latter is well shown by the fact that in 1902 the generating station output was 1.5 K. W. Hrs. per car-mile; in 1905 this had increased to 2.5 K. W. Hrs.; in 1910 to 3.46 and in 1912 (10 months to date) to 3.877 K. W. Hrs. per car-mile.

It was decided to erect a new power station in another locality where water was plentiful, where coal was easily obtained, where real estate was cheap for open coal storage to tide over high water, strikes, accidents to transportation, etc. Time was ripe for removal in view of the fact that all of the available space in the Campbell Street Plant under roof was occupied, the last steam turbine installed necessitating the removal of a smaller unit.

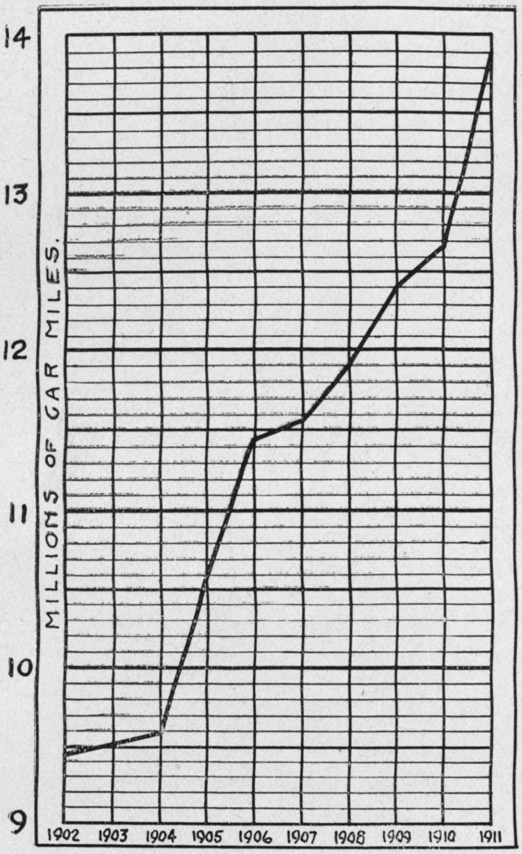
In looking for a site for the new plant we were forced to go to the Ohio River, the only available body of water within many miles of Louisville. Across the falls of the Ohio River the U. S. Government has built a removable dam to limit the low water stage in the Louisville harbor to a 9 ft. stage, or elevation 412 above sea level.

To allow boats to pass up and down the Ohio past the falls there is a flight of three Government locks, with a canal leading to serve same some 10,000 feet long. This canal, now 87 ft. wide, is being widened to 200 ft. Below the locks the water at minimum low water will not float a boat. It is proposed by the Government eventually to erect some 52 locks and dams between Pittsburg and Cairo, so that a nine foot boating stage can be maintained at all seasons of the year. The local conditions of the river determined that the site for the plant should be above the locks where a definite minimum stage of the river could be figured on.

The Ohio River, the normal stage of which with dam in place is 412 ft. above sea level, has been, before the dam was built, as low as 405 ft.; in 1884 it rose to 449.7 and in 1883 to 446.7 the two highest floor-stages on record at Louisville in the history of the local Weather Bureau covering 36 years.

The above high water record determined that a site should be chosen which should be above the previous high water stage by a safe margin. These limitations made the selection of a site quite difficult, it being always essential that good railroad facilities be at hand.

A site was selected in 1909 and purchased in 1911 which we believe is ideal for the purpose. Contracts for all waterways and concrete building and equipment were let to the Henry Bickel Company, of Louisville, Ky. Ground was broken for the station May 1, 1912. We hope to have it in service not later than August 1, 1913. The site is in the extreme north-



Another Reason for Additional Power Station.
Increase in Car-Miles.

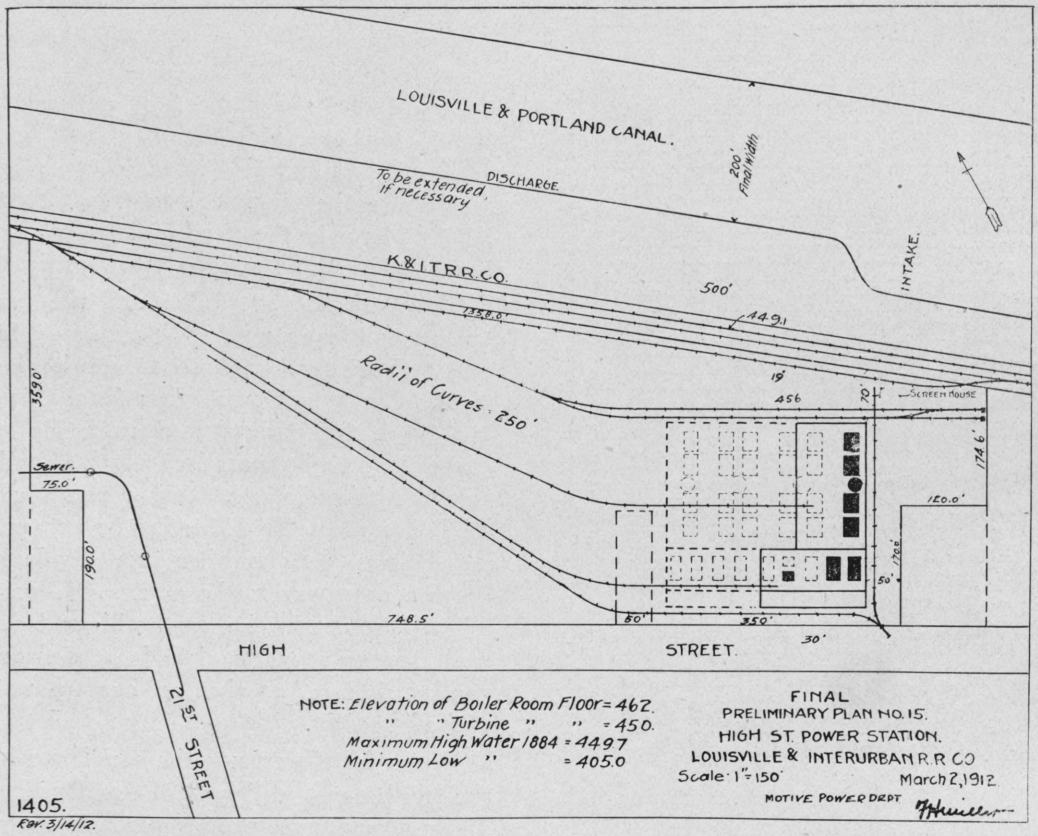
west section of the city, some four miles from the Campbell Street plant. A line drawn from the Campbell Street plant to the High Street plant would be approximately at right angles to the general direction from which wind storms blow at Louisville, that is from the southwest; so that a severe storm would have to cover an unusually wide path to affect both plants. The new plant site is located on the north side of High Street, having a frontage of 1148.5 feet on High Street; and being 344.6 feet deep on the eastern side, 549.0 feet deep on the western side, extending 1358 feet along a 40 foot right of way of the Kentucky & Indiana Terminal Railroad Company. This railroad is a double track belt line around one-half of the city and connects with and switches from all railroads leading into the city. Government property and the canal from which condensing water will be taken are immediately north of the railroad. The general level of the ground on which the plant will be located is about 456 feet above sea level, or some six feet above the maximum recorded high water. At this level in the yard storage we expect to keep two to three months coal supply.

Two switches are taken off the main line tracks, one leading into the property from the east and one from the west to a switching track on the Company's property; from this switching track two tracks lead over the concrete coal-unloading hoppers just north of and alongside the boiler house; another track leads into the boiler room for delivering boiler apparatus, new boilers, etc.; another track leads into the turbine room under the crane. Between these various tracks in the yard will be located the coal storage space, coal to be stored on a well graded surface, so that all surface water will run off readily.

Water is taken from the canal at a point in the south canal wall near the eastern boundary of the Company's property where the canal is double width to allow boats to pass.

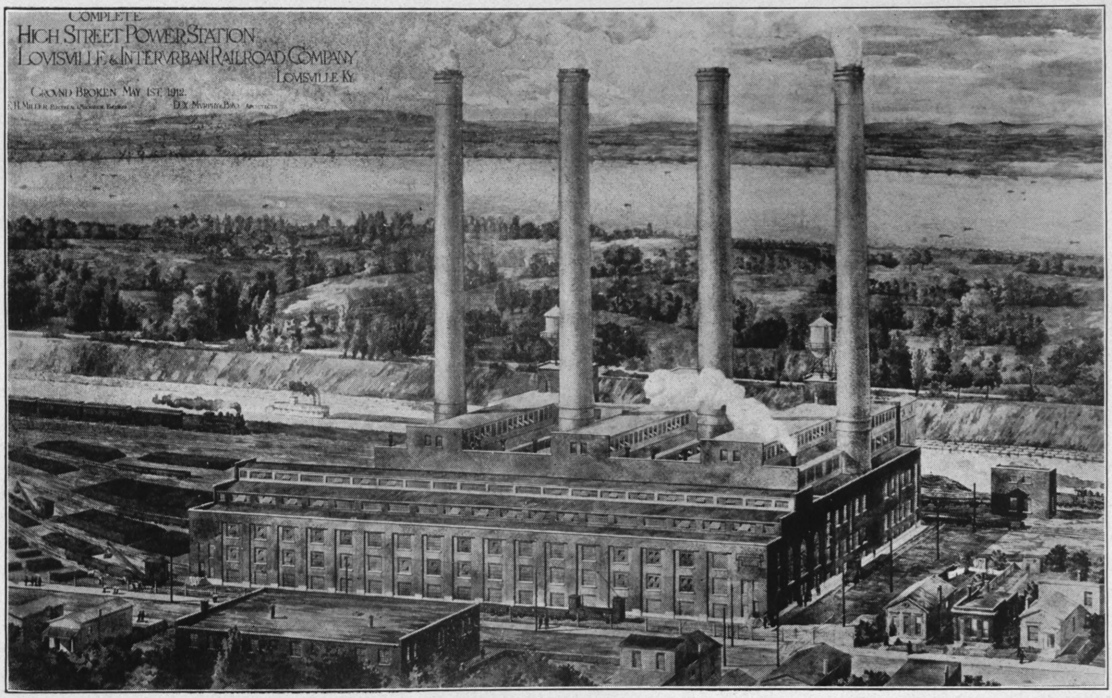
Water is taken from the canal through eight (8) 4 ft. 8 in. x 8 ft. 0in. openings, elevation of the bottom of openings being 400, elevation of the top of openings 408, or four feet below normal water level. We hope that on this account surface trash will float down stream past the intake. Just inside the intake openings in the canal wall there are four cast iron screens set at 20 degrees to the vertical, composed of

4 in. by 1-2 in. bars with 2 in. openings for the screening of logs and large trash. Openings are provided at the top of these screens for bringing trash collected up to elevation 417.5 or grade of canal bank. Leading into the property under the right of way of the Kentucky & Indiana Terminal Railroad Company there are two 10x10 ft. concrete ducts; these ducts lead into an 18 ft. 6 in. by 32 ft. 4 in. screen house, concrete up to elevation 455, brick construction above grade, in which there is a double row of movable vertical screens; there are four double screens in a row, in each of which the screen nearest the river is of 7-8 in. mesh No. 8 copper wire and the other of 1-2 in. mesh No. 10 copper wire, each screen set in a substantial angle iron frame 7 ft. 1-4 in. wide by 14 ft. 9 in. high; these frames have side projections which slide in cast iron vertical slots set in concrete. The screens are raised and lowered by means of an electric crane operating on runways, so that the screens can be raised, moved to one side of screen house over a trough, cleaned and replaced rapidly. From the screen house twin concrete tunnels 7 ft. wide and 8 ft. high lead up to and under the turbine room. These tunnels are protected by 7 ft. by 8 ft. Chapman Sluice Gates operated from the screen house floor at elevation 455. These intake tunnels from the canal slope towards the turbine room 00.22 per cent. and all the pumping equipment is designed so that water may be taken from either or both. Manholes with top at grade are built into the top of these intakes every 100 ft. for cleaning and inspection purposes. Provision has been made by extending walls and keying same beyond present building line for future extension



of the intake conduits.

These intakes were quarried out of rock their entire length, elevation of flow line at river 400 and at west end of turbine room being approximately 398, elevation of rock 410 to 415. Where the intakes leave the east end of the turbine room, being very near to property other than this Company's, the intakes were tunneled out of rock for a distance of 135 feet. All the rest of the intake ducts were open cut.



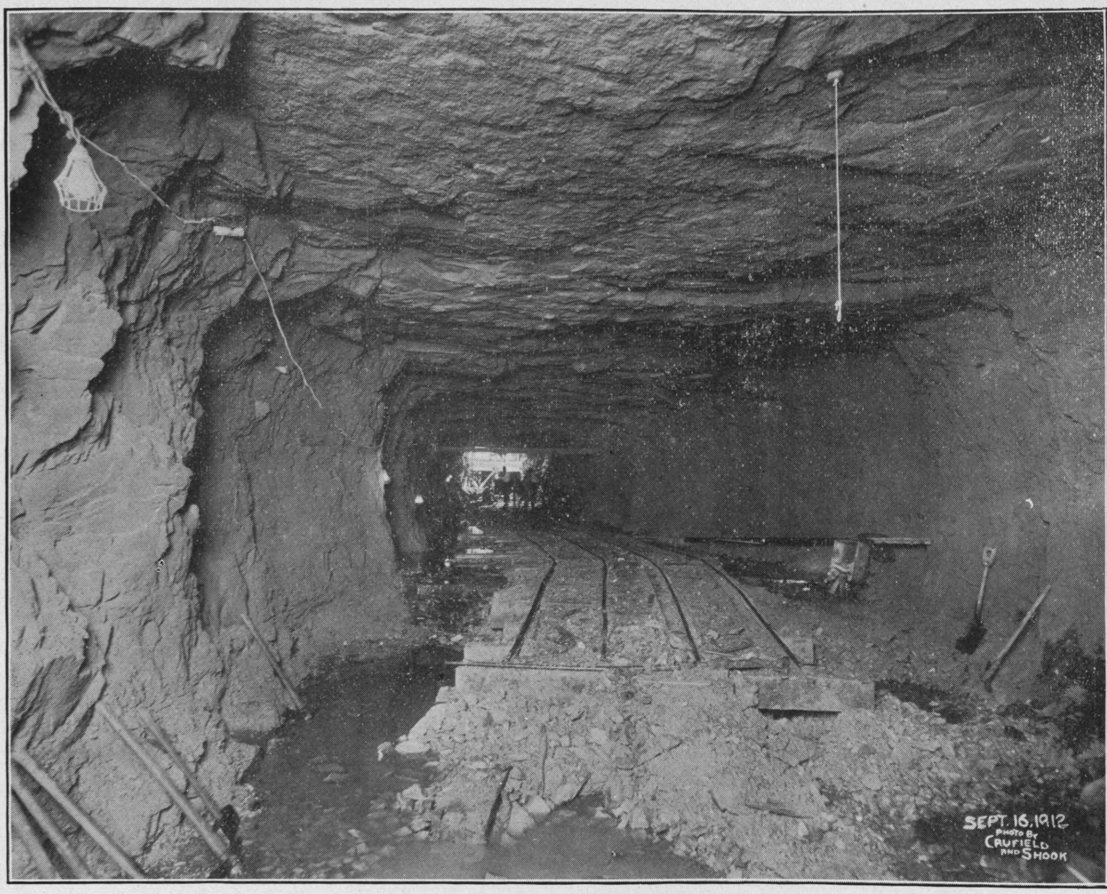
Architect's Perspective.

The water discharge is 9x9 ft. concrete section of horse shoe shape, discharging into the canal some 500 feet below the intake. The discharge is built for the most part on top of the rock formation. The intakes were built for the present length of building while the discharge was built for the complete turbine building, one-half of which is being erected at the present time. The discharge tunnel flow line is 413 or one foot above the normal river stage at east end of building with 00.22 per cent. slope towards the river, or elevation 411 at canal. The discharge tunnel has discharge pits built in same below the flow line, for sealing condenser discharge water. Entrance for water discharge into discharge conduit is by means of flanged castings built into same. Manholes inside the building and at each discharge pit and outside the building every 100 feet will allow ready inspection. Castings were placed in the discharge conduit outside the present building line for four future units. All of this discharge conduit outside the building was tunneled, working 50 feet each way from a manhole, this proving cheaper than open cutting.

All curves in the discharge were lined on the wearing side with vitrified paving brick.

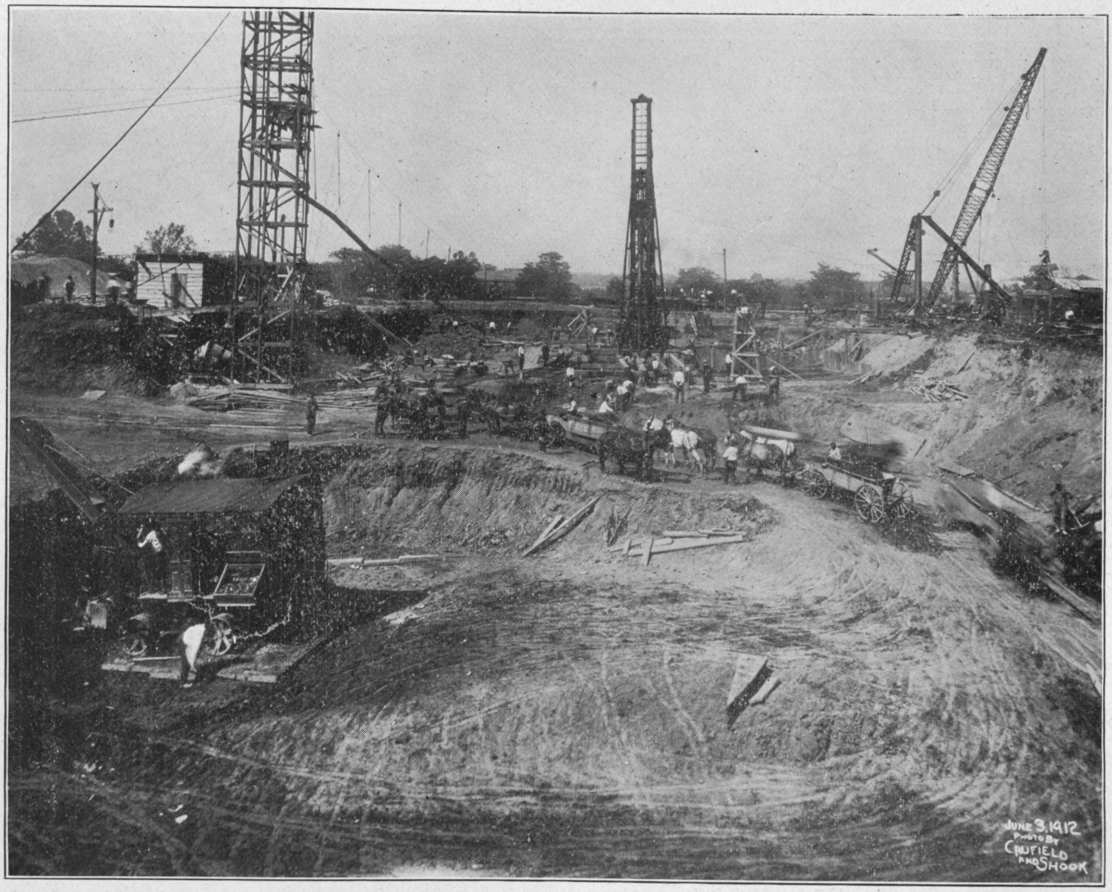
The discharge tunnel crosses the Kentucky & Indiana Terminal Railroad Company's tracks at right angles, then turns parallel to tracks and canal with eight openings from discharge duct through the canal wall, the first 4x7 ft., the last 7x7 ft. These discharge openings are distributed along the canal wall for a distance of 112 ft. 6 in. Top of the discharge openings are into canal 5 ft. below the normal water stage. The eight discharge ducts dip sharply from elevation 411, that of the bottom of the main discharge duct parallel to canal, to elevation 400. The end of the nine foot section discharge conduit is arranged for future extension parallel to the canal, so that more openings into the canal could be provided, or if found necessary water could be discharged further down stream from the intake.

The openings both for intake and discharge are figured for a flow of 160,000 gallons per minute or eight units at 20,000 gallons per minute each, and at this flow, openings are large enough to produce a discharge speed of only 1.19 feet per second at the discharge. It was necessary that this speed be made as low as possible so as not to interfere with boats moving in the canal.



Rock Tunnel for Intakes.

Great difficulty was experienced both in excavating and rock blasting, due to the following causes: first, ground water that lay above the water level in the canal, and second, water from the canal. Earth excavation for the turbine room through a total depth of 41 feet from grade at 455 to rock level 414 was carried on day and night by means of three steam shovels through an assorted dump of ashes, tin cans, etc.; for sixteen feet and below, yellow clay, blue clay, sand and gravel; the gravel being water bearing, required constant pumping until pits were finally sealed with concrete. The rock excavation consisted of two feet of slate on top and the rest hard limestone and softer concrete rock about equally divided.



Thirty-three Days After Breaking Ground.

Excavation at the canal was made behind sheeted cofferdams, earth filled. Considerable trouble was experienced in making the cofferdams water tight, there being from 10 to 15 feet of water in the canal during the work. Part of the trouble was due to the fact that the discharge cofferdam had to be made very thin to allow space for the passing of one Government snag boat that require 75 feet for passage.

The top of canal masonry wall is at elevation 417.5, and there being a level space of 20 feet back from the canal, level with the wall, from this elevation there is a gradual slope up to the railroad right of way at elevation 449.

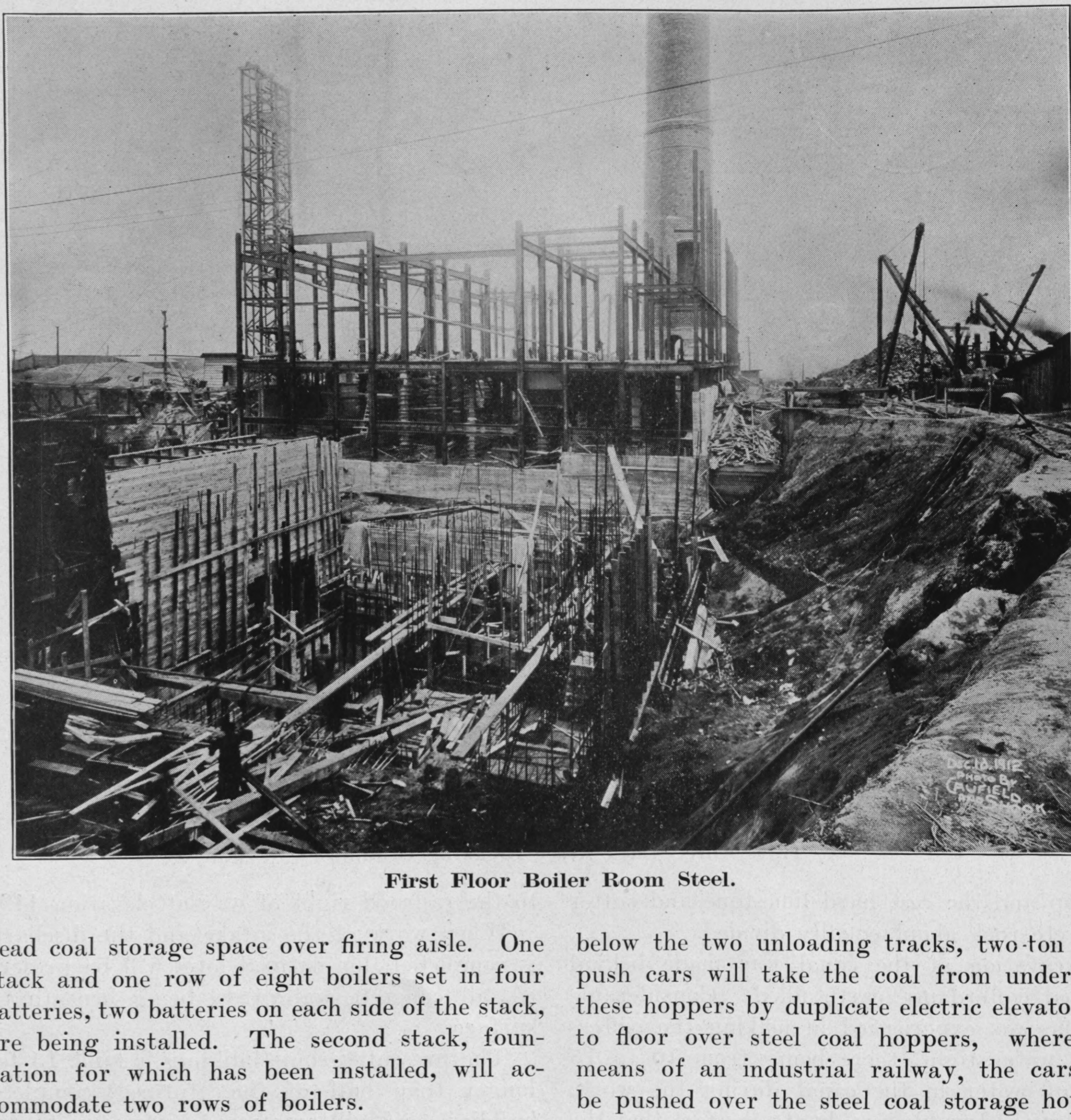
When work at the intake and the discharge is completed this natural level will be preserved, all concrete waterways being beneath the surface.

The present turbine building is built 15 feet longer than half of the future completed building, and will accommodate four units, two of which will be installed now, the temporary west wall of the present turbine building serving as foundation for the fifth unit when the building is extended. The boiler house is 177 ft. 6 in. by 94 ft., as now constructed, with firing aisle at right angles to turbine room.

Buildings and foundations are being built for two rows of eight boilers each, with overhead coal storage space over firing aisle. One stack and one row of eight boilers set in four batteries, two batteries on each side of the stack, are being installed. The second stack, foundation for which has been installed, will accommodate two rows of boilers.

For the eight 507 H. P. Babcock & Wilcox boilers now being erected a 13x255 ft. dark red radial brick stack has been erected by the H. R. Heinicke Company. Boilers will generate steam at 200 lb. pressure and 125 degrees superheat. Kentucky pea and slack coal will be burned on B. & W. chain grate stokers 12 ft. 3 in. long by 9 ft. 6 in. wide.

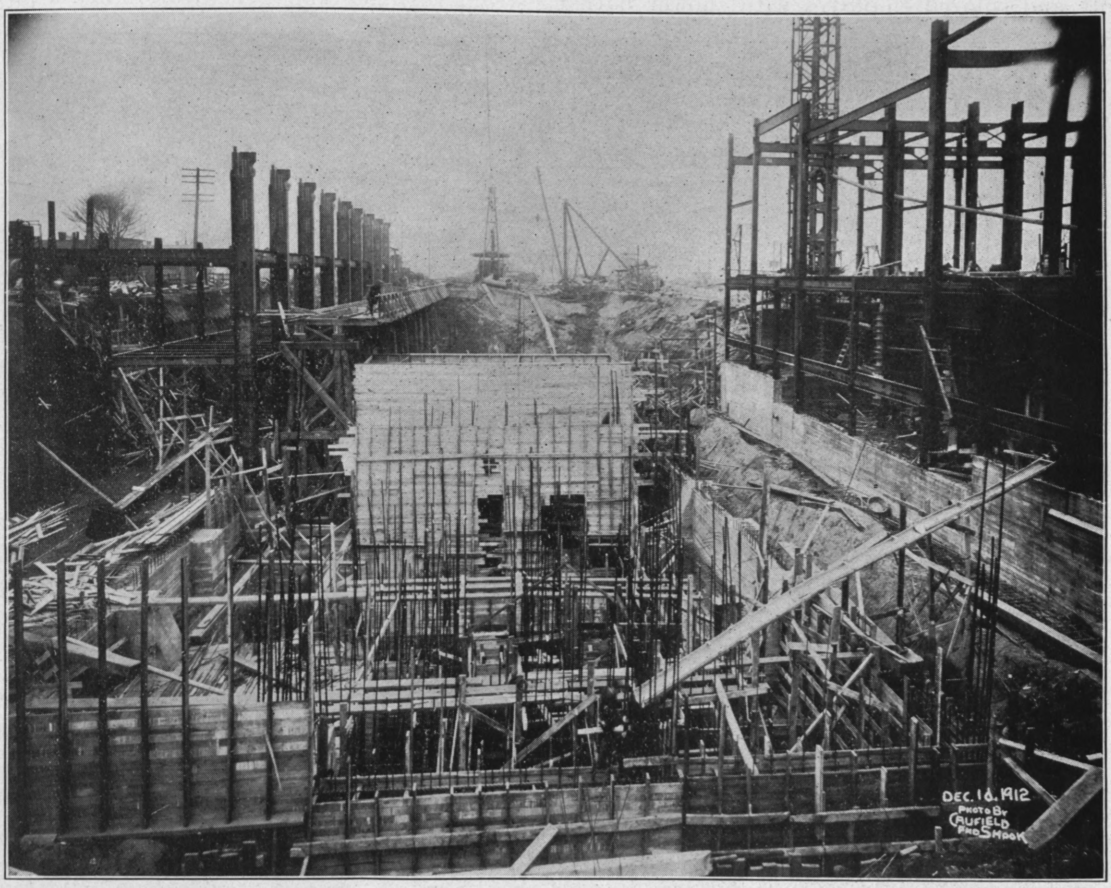
Coal will be dumped into concrete hoppers below the two unloading tracks, two-ton hand push cars will take the coal from underneath these hoppers by duplicate electric elevators up to floor over steel coal hoppers, where by means of an industrial railway, the cars will be pushed over the steel coal storage hoppers and dumped. These steel coal bins have a



First Floor Boiler Room Steel.

capacity of two days coal supply. Ashes will be removed from steel, fire brick lined ash bins under the boilers into push cars and elevated to floor over steel fire brick lined ash hoppers located over the coal unloading track, so that coal cars when unloaded, can be loaded with ashes by gravity.

The turbine room 174 feet long consists of a turbine space proper 61 ft. 6 1-2 in. wide, served by a 50 ton crane, 30 feet from floor to top of crane runway. On the street or south side away from the boiler room there are two galleries above the turbine floor proper, another at the main floor level and another beneath, each gallery 21 ft. 10 1-2 in. wide.

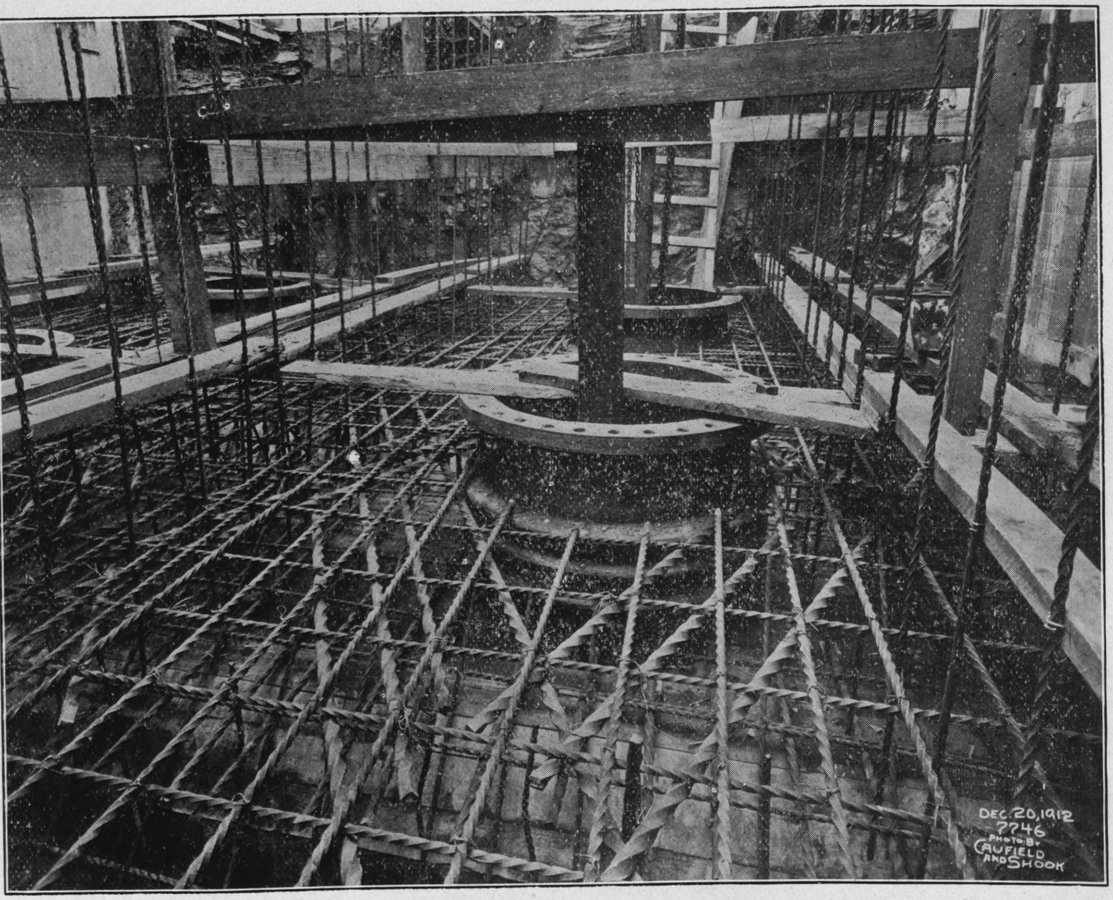


Turbine Foundation Forms, and South Crane Columns.

On the lower gallery the conduits come in from the street with necessary cable bells, transformer compartments and low tension busses. On the main floor gallery will be located the machine shop, and tool and store room, and the oil switches controlling all high tension circuits. On the first gallery above, will be the offices, draughting room, laboratory, space for future storage battery, switchboards and main desk control board. The panels for control and exciters, out-going A. C. and D. C. feeders, as well as turbine desk control board, are placed at the west end of the building now being constructed or at the center of the complete building when extended. A balcony extends into the turbine room beyond the gallery line in front of the control boards so that an operator by stepping out on it can have a clear view of operating floor below. From this gallery there leads a three foot gallery across the east or permanent end of the building to the boiler room, so that employees may go from dressing rooms upstairs to the boiler room, without crossing the turbine room floor. The upper gallery contains dressing rooms for white and colored employes with shower baths, lockers, wash basins, and closets, the two rooms being duplicates of each other. Space is also provided on this gallery for future outgoing overhead transmission feeders, with their lightning arresters and control apparatus.

The west end of both turbine room and boiler room will be constructed temporarily of corrugated iron, for ease of future extension. The buildings above the concrete foundations are of steel and brick throughout, with concrete floors, every attention being paid to making them entirely fire proof. Large window space has been provided, using Fenestra sash, in both turbine and boiler room, for natural light.

There will be installed at the present time two 6,000 K. W. normal rated Westinghouse steam turbines and generators, each equipped with a 20,000 sq. ft. Worthington surface condenser, a dry vacuum pump 12x31x18 in. manufactured by the Laidlaw-Dunn-Gordon Co., a 4 in. two stage Worthington hot well pump driven by a Terry steam turbine of 27 H. P.



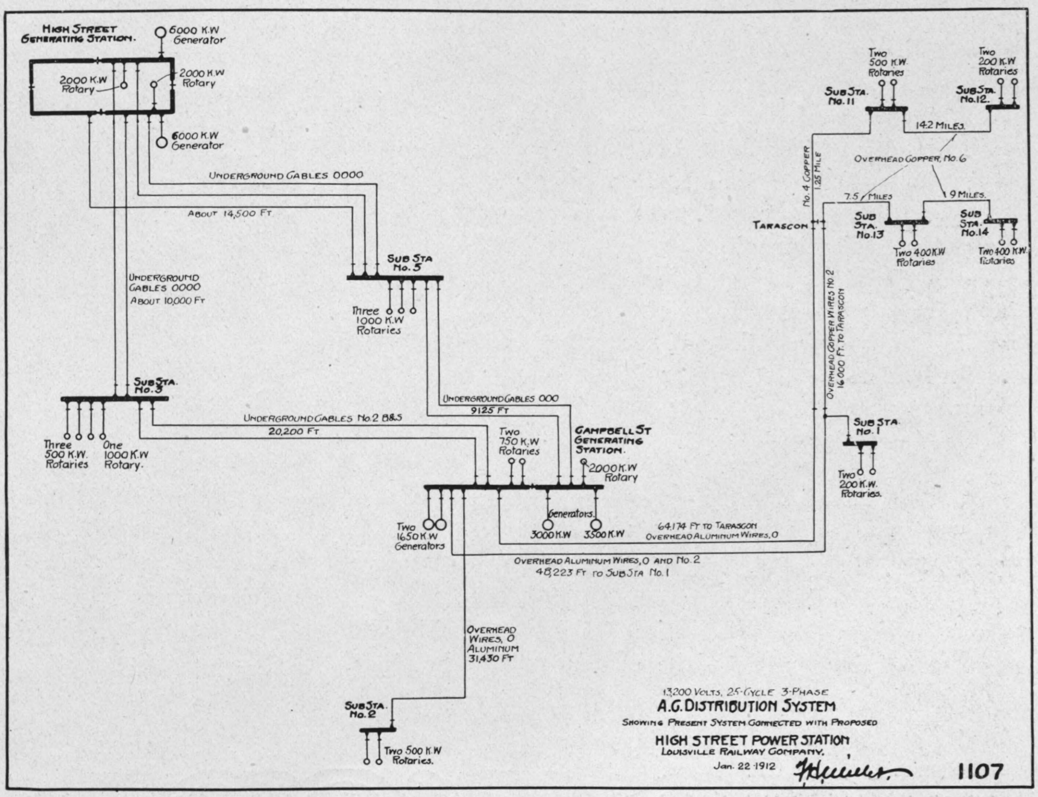
Reinforcing Steel for 24 in. Floor Over Two 7 ft. by 8 ft. Intakes, Supporting Suction Castings.

The generators will generate current at 13,200 volts, 3 phase, 25 cycle, and all switching and transmission will be without transformation.

Boiler feed pumps will be centrifugal Worthington make driven by General Electric steam turbines; there will also be installed reciprocating Worthington pumps for fire service, in addition to a connection with the city water mains.

Under normal conditions, boiler feed water will be taken from the hot well condenser units, and they can be cross-connected more readily and economically. Thus units No. 1 and No. 2 will be so arranged, so that either dry vacuum pump or main circulating pump can be used with the other unit.

The dry vacuum, centrifugal boiler feed pumps, air compressor for boiler cleaning, and other small auxillaries will be placed on the main turbine floor under a gallery, extending under the boiler room, the boiler room firing



pumps, with enough make-up water from the house service pumps, pumping from the main intakes.

The generating units will be set in pairs, with condensing auxilliaries set in a pit between two foundations, thus units No. 1 and No. 2 will be spaced 45 ft. centers, units No. 2 and No. 3 on 30 ft. centers. In this way one operator can take care of the auxiliaries of two aisle level, being 12 feet above the turbine room floor level.

Exciting current at 125 volts for the main generators, will be supplied by one 30 K. W., motor driven generator, one 100 K. W., and one 150 K. W. Westinghouse steam turbine driven generators. The exciting current will be regulated by a Tirrill regulator.

This generating station will be tied in

electrically with the two city sub-stations Nos. 5 and 3 and the Campbell Street generating plant from which the country sub-stations are fed. All of the high tension transmission lines from the High Street plant will be three phase paper insulated lead-covered under-ground cable. A conduit system having been built to connect the High Street station, with the existing conduit system in service some years.

There will be installed in the High Street station at once a 2,000 K. W. rotary for feeding the trolley sections in the vicinity of the plant. This station will also be connected with the nearest sub-station by means of 600 volts direct current trunk lines.

The house lighting will be from 110 volt direct current obtained from the small exciter generator, with emergency 600 volt series lighting from the trolley circuits.

D. X. Murphy & Bro., of Louisville, are the Architects on the work; while the electrical and mechanical design and installation are being taken care of by the Motive Power Dept. of the Company.

ooo

ALUMNI NOTES.

Earl Schmidt, '08, spent Xmas with his parents, Mr. and Mrs. Henry Schmidt, of this city. Mr. Schmidt, who has been chemist for the Mark Hanna Mining Co., of Diorite, Mich., has been promoted and goes to the company laboratory in Toledo, Ohio.

O. F. Reynolds, '05, chief chemist of the Missouri Pacific with headquarters in St. Louis, was married in St. Louis to Miss Mary Huston.

Benjamin McKeen, '85, has been appointed general manager of Pennsylvania lines west of Pittsburg.

Wm. H. Webster, '10, was married to Mary E. Warren, in this city.

Ferdinand E. Meyer, '12, spent Christmas with his parents in this city.

Owen Dodson, '12, who is located in Portsmouth, Ohio, had his mother as his guest on Christmas day.

Wallace Andrick, '07, of of Jamaica, N. Y., was called to this city on account of the illness of his grandmother.

Ren M. Davis, '07, of Newport, Ind., has been promoted to erecting foreman on the Keokuk, Iowa, dam on the Mississippi river. Mr. Davis has been erecting engineer.

Wilbur Shook, '11, was in the city to spend the holidays.

THE Louisville Rose Tech Club held a meeting at the Henry Matterson Hotel on the evening of Dec. 30th. It had as its guests Mr. Frank H. Bennett, who formerly taught languages and had charge of the library at Rose, the members of the student body who were in town, and several prospective engineering students from the high schools at Louisville. The Alumni present were Denehie '94; F. H. Miller '95; Tinsley '92; H. W. Wischmeyer '06; C. Wischmeyer '06; R. N. Miller '01; Butler '10; Heidenger '08; Reagan '12; Lee '06; and Beck '12.

Mr. R. N. Miller talked about Rose Tech and engineering in general and Prof. Tinsley, principal of the Male High School, recalled some happenings of twenty years or so ago at Rose. He was followed by Mr. Bennett, who also dug into the past and told of his boyhood days in Terre Haute, and of how he used to congregate with a "gang" on Third Ave., to molest the "Poly's." Prof. Tinsley discovered that the "dirty little Mick" who bounced a rock off his head on Hallowe'en night, 1890, was none other than this same Bennett, who has changed considerably since then.

Prof. Wischmeyer showed 32 stereopticon slides, giving happenings around the campus. The talks and pictures were preceeded by a very good supper.

The third regular meeting of the Student Council was called to order by President Buck Saturday, December 14, 1912.

Beauchamp, Barrett and Nehf absent.

No reports of officers.

No reports of committees.

As Freshmen are supposed to use the cloak rooms on the second floor, it was suggested that President Buck ask Doctor Mees to post a notice to that effect.

A short discussion on the subject of cribbing in examinations was held.

Adjourned.

F. E. SULLIVAN, Secy.

The fourth regular meeting of the Student Council was called to order by Pres. Buck, Jan. 11, 1913.

Barrett absent.

Report of credits of different associations read by Financial Secretary Beauchamp.

No committee reports.

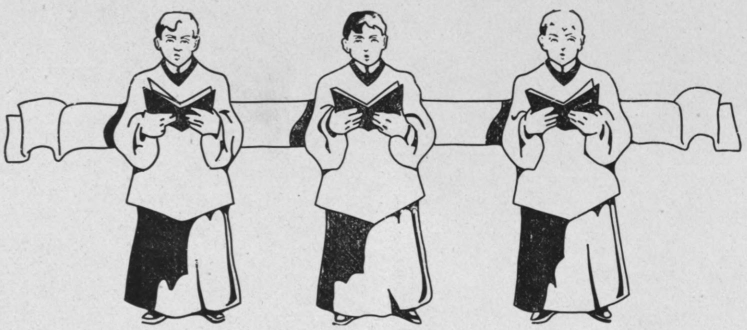
Three men nominated by Dr. Mees for the office of Financial Secretary of the student council were Kauffman, '14, Price '15 and Harrison '15. Harrison was elected.

Harrison 5
Kauffman 2
Price 1

Committee of Denny, Deck and Sullivan appointed to audit the books of retiring financial secretary Beauchamp.

Faculty's answer to student council petition for re-instatement of O'Laughlin's, read.

Adjourned.



BY the time The Technic is out the basketball season will be in full swing. Shortly before the holidays the Athletic Association decided to engage a coach for the season. Their choice was Paul Stump, an old Wabash man, and he took charge of the squad a few days before the first game. Stump had four years' experience playing on the Wabash team which is proof that he was a player in his day. He finished college two years ago. He played under Ralph Jones, the present Illinois coach, which is another point in his favor.

As for the outlook for basketball this year, with the past football season in mind, we will not get too optimistic. From present indications the squad will be composed of Gray, Crowe, Hegarty, Deming, Bringman, Barrett, Kingery, Trimble and one or two more, with the chance of a couple or so more good men getting into the game after the smoke of the finals has cleared away.

The class games were done away with this year. We hope that this feature of basketball will not be dropped at Rose permanently, as the interclass series always resulted in some exciting games, and helped to keep up interest in the student body, besides often serving to dig up and help develope new material from which to pick the squad.

———ooo———

Manager Madison, of the basketball team, gave us the following schedule:

Jan. 6—Illinois there.
Jan. 10—Purdue there.
Jan. 15—Butler here.
Jan. 18—Wabash here.
Jan. 22—Franklin here.
Feb. 1—Franklin there.
Feb. 5 or 6—Notre Dame here.
Feb. 8—Butler there.
Feb. 13—Wabash there.
Feb. 18—DePauw there.
March 4—DePauw here.

There is a chance for a game here with Vanderbilt on Feb. 22nd, and possibly an exchange of games with Eastern Illinois Normal. The home games will be played on the new K. of C. floor.

R. J. TEMPLETON has succeeded Cox as manager of track and has already laid his plans for starting the season's work. Indoor work at the Y. M. C. A. gym is contemplated and will probably be started soon after the first term. Our track team this year ought to be better than last year's. Coach Stephenson's cross country work last fall is expected to improve Rose's showing in the distance events. Under a ruling adopted last spring, only one point in a state meet is required for an R in track.

———ooo———

WE think the time is ripe to say a few words about rooting at the basketball games. This is an old, old question and bobs up every year, but every year it has been the same old stunt. Any fair-minded fellow knows that the idea of hooting and yelling one's head off when an opposing player trys for a foul goal and then getting things quiet as a mouse when a Rose man tries the same thing, is not showing a very good spirit toward the visitors. And it's also a mighty poor sport who hisses when the referee, who has only one pair of eyes, fails to see something that maybe ten pairs of eyes among the rooters see. If the referee uses his own judgment on a play and calls a foul on Rose, somebody is liable to bawl out "How much have you got up on this game?" or words to that effect.

We hope some of this bush-league spirit will disappear this year and that the practice mentioned above will be cut out. A visiting team should be treated with hospitality, and this applies to baseball as well as basketball. But being in a hall like the K. of C. these things are a lot more noticeable and are easier heard than out in the open. It isn't the whole student body that is behind this lop-sided support of the team, but somebody starts the ball rolling and then more join in.

Its all right to get excited and root and howl, but don't be a hog. Give the visitors a yell when they come on the floor; don't rejoice when one of them gets laid out; your own team will appreciate good treatment when it is on the road.

———ooo———

AT its last meeting the Athletic Association passed the following:

To be entitled to a letter in any one of the three branches of athletics named below, a man must have fulfilled the following requirements in that respective branch:

Football—Any man must play in at least five games, and by a game shall be meant that he shall have played one full quarter, or the equivalent time.

Baseball—Seven games are required, at least least 15 minutes per game.

Baseabll—Seven games are required, at least 4 innings per game. Pitchers are required to take part in but five games.

These requirements replaced the ones given in the present Rose Y. M. C. A. handbooks.

It was evidently thought that R's were too easy to get under the old rules. These new requirements seem a little too stiff and rather impractical in some respects. In baseball especially, where the schedule contains only a dozen or so games, (as was the case last year) if the team is carrying a pinch hitter or extra infielder who can deliver when called upon, chances are against him getting into seven games, much less four innings in seven games. Of course, the argument is brought forward that if a man is good, he will probably win his letter in four years, and therefore more severe requirements will keep a fellow trying longer and harder, and work out better in the long run. However, more than one man who works hard enough to get an R may come as far as his senior year and not be good enough to be a regular on a baseball or basketball team, though at the same time he is an excellent substitute. If he is not in the regular line-up, seven games is a big bunch for him to get into, and he has to stay in the game quite a while at that.

It is going to be hard to keep records straight, unless the manager of the football or basketball team holds a watch on the side-lines, and the manager of the baseball team will have to learn how to navigate with a score-book.

Besides making the above rulings, the Athletic Association elected Walker Henry manager of the 1913 football team and Schoonover assistant manager for baseball this year.

Ferd Loehninger also turned in a very good financial report for the past football season.

———ooo———

ILLINOIS 52—ROSE 14.

(Jan. 6th at Champaign)

Rose opened her season against Illinois. A lack of practice together naturally meant a lack of team-work and as the season gets farther along and the team gets into its stride, better things are looked for.

Reports from the game were that the superior team work and weight of the Illinois team were too much for Tech. Rose played a hard game throughout, being kept on the defensive most of the time.

Dahringer, of Illinois, was the individual star, with Captain Gray doing well for Rose. The summary:

Illinois 52.		Rose 14.
Kircher, Dobin	F	Barrett, Kingery
Williford, Erwin	F	Hegarty
Dahringer, Comstock	C	Gray
White, Cohn	G	Deming
Crosman	G	Crowe

Field Goals—Dobin 3, Kircher 3, Erwin 2, Williford 6, Dahringer 11, White, Barrett, Hegarty 3, Gray 3. Foul goals—Hegarty 2. Referee—Schommer, of Chicago.

———ooo———

PURDUE 51—ROSE 8.

(Jan. 10th at Lafayette.)

Tech was outclassed by the Boilermakers. The score of this game is all the dope we have on it right now. Summary:—

Purdue 51.		Rose 8.
Johnson, Little	F	Barrett
Oliphant, Liehr	F	Hegarty
Tuple, Ball	C	Gray
Berny, Dillon	G	Deming
Exten-Porter	G	Crowe, Kingery

Field goals: Johnson 6, Little 2, Oliphant 2, Tuple 10, Ball 1, Exten-Porter 3, Barrett 3. Foul goals: Johnson 3, Hegarty 2. Timer, Harvey. Referee, Diddle. Umpire, Gipe.

———ooo———

I. C. A. L. MEETING.

At a meeting of the Indiana College Athletic League held Dec. 14, 1912, some of the rules of the constitution and by-laws of that organization were changed.

The most important change was that of Rule 7, and the change adopted was that proposed by Wabash College. The rule as it now stands is to the effect that it is not necessary for a student to get permission of the Chairman of the Faculty committee on athletics to play on outside teams. The rule regarding professsionalism, or semi-professionalism, however, is now exactly as it was before. The rule as it now stands seems to be a step in opposite direction to what the members of the League have been trying to achieve with this rule, consequently a committee consisting of Dr. White, of Rose Polytechnic, and Westphal, of the State Normal, was appointed to formulate amendments to this rule and propose them at the next meeting.

The other changes are as follows:

Article XII of the constitution be amended to read: "The annual track and field meet and tennis tournament shall be held each year on the fourth Saturday in May on grounds controlled by a member of this league."

Article XIII, Section 1, be amended to read: "The annual track and field meet and tennis tournament shall be held on the grounds of the different institutions in the following order:

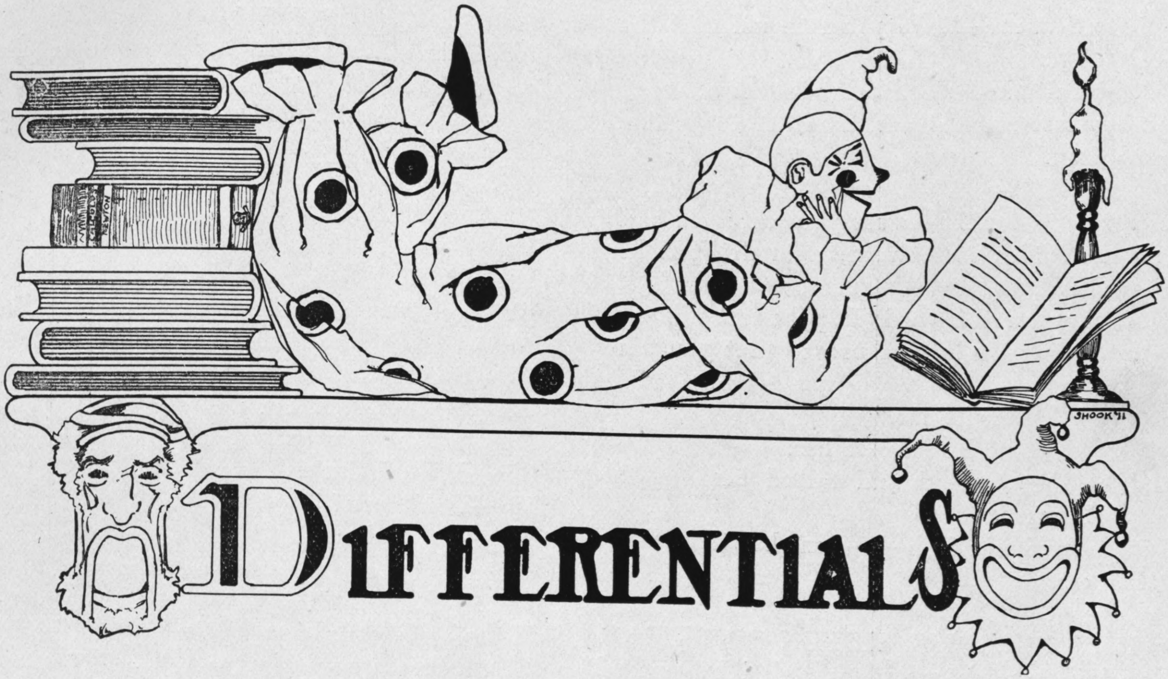
Depauw	1912
Earlham	1913
Franklin	1914

Hanover 1915
State Normal and Rose
Polytechnic 1916
Wabash 1917

There were three other amendments, one to the effect that the championship trophy be a cup instead of a penant, another to the effect that "two contestants in any event from the same institution shall not be required to run in the same trial heat," and the other was to the effect that there should be no rule which would not permit a foot-ball game being played on Thanksgiving Day.

The officers for the coming year were elected as follows:

President—Dr. White, of Rose Polytechnic.
Vice-President—Hotckiss, of Hanover.
Treasurer—J. M. Thurber, of Franklin.
Secretary—Prof. Baines, of DePauw.
Finance Com.—Westphal, of State Normal;
Thistlethwaite, of Earlham.



DIFFERENTIALS

The melancholy days have come,
The saddest of the year,
Not cold enough for whiskey straight,
But too d—— cold for beer.

* * * *

Dick Headley (discussing football)—Do you know Joe Carter? He is going to be our best man before long."

She—Oh, Dick, what a nice way to propose.

* * * *

NOT THE TURTLE'S FAULT.

Mr. Marrynew (a little crossly)—This soup, Agnes, doesn't seem to taste much like turtle.

Mrs. Marrynew—I don't see why John. I let the turtle swim around in the kettle until the water was nearly hot enough to scald the poor little thing!

* * * *

TRUE SYMPATHY.

The thin man darted across the platform. "Will you hold the train a moment for my wife, conductor?" he gasped. "She is just crossing the street."

"Can't do it," snorted the conductor; as he raised his hand to signal the engineer.

"B-but, conductor, she's going away to stay six months!" cried the thin man. "If she doesn't go now, she may change her mind."

"I'll hold it," replied the conductor.

* * * *

MISAPPREHENDED.

She—Those roses you sent me were lovely and fresh. I do believe there is a little dew on them still.

Derr—Well, there is, since you mention it, but I shall pay it off shortly!

* * * *

Teachers' faults are many,
But pupils have only two—
Everything they say,
Everything they do.

First Student—Have you seen much of that girl?

Second Student—Sure; met her on the beach one day last summer and took her to the ball that same night.

* * * *

"I thank you for the flowers you sent," she said,
And she smiled and blushed and drooped her head,
"I'm sorry for the words I spoke last night,
Your sending the flowers proved that you were right—
Forgive me."
And he forgave her.
And as they walked and talked beneath the bowers,
He wondered who in h—— sent her those flowers.

* * * *

HEY, FELLOWS, LISTEN TO THIS!

A freshman chemical was asked by one of the Profs. what the most dangerous poison was. The poor Freshy thought for a while and then a sudden gleaming of his eyes, "Aviator poison," he whispered, "because one drop kills."

* * * *

Waggie—What is the matter with your problem, Mr. O'Connell?

Jo—I don't know how to do it.

* * * *

Mac—You know that arch out at the cemetery? I designed it and Donn Roberts put it up and he actually put in more steel and a better foundation than the contract called for.

* * * *

Waggie—What if the mixture was 25 per cent. alcohol?

Smithie—Alcohol and what?

Waggie—Water.

* * * *

What verse in the Bibble best describes a college student?

"They toil not, they spin not, and yet I say unto you, that Solomon in all his glory was not arrayed like one of these."

* * * *

Joe Gillum has started a new style in the wearing of full dress suits, and all accessories, such as ties, etc., which bids fair to become quite popular. For particulars, see him.

* * * *

A SOCIETY CONVERSATION.

He—You seem pensive.
She—Do I?
He—Yes, you do.
She—I don't think that I am.
He—Don't you?
She—No, really, I don't.
He—I think you are.
She—Well, I don't.
He—Don't you?
She—No, I don't.

—Cornell Widow.

* * * *

Said the bald-headed man to the waitress bold,
"Look here, woman, my cocoa's cold."
Said the waitress to him, "I can't help that,
If the blamed thing's chilly, put on your hat."

* * * *

TOMMY (ATKINS.)

You who like to read and study,
Listen to this kind advice,
Come and join us in Hydraulics
Tommy makes it quite concise.
Lest you get the wrong impression,
We'll endeavor to explain,
And submit a sample lesson,
You can judge if it is sane.

In, with sprightly step, walks Tommy
With his thick discriptive pad,
In between his text and class book.
Seniors, noticing, feel sad.
Up speaks one a little bolder,
Than the rest of us—he'll say,
"Will you please explain this problem,
It's the tenth one for today."

"I am sorry," is the answer,
"But our time today is short.

See me after class is over,
  Else to others please resort.
We'll endeavor now to figure
  Coefficients of discharge.
Denny, take your watch and time us,
  'C' this time should be quite large."

"My, but half the hour is over,
  Pass this paper, then we'll see
How you've grasped the situation.
  It's the best way known to me."
So there's placed before us problems,
  Three in all—in black and white,
And you needs must do some antics,
  Else you'll never get them right.

"But," cries one, "these are just like the
  Ones we were to have today,
And you wouldn't answer questions
  On them. That's not fair, I say."
"Do your best," the teacher answers,
  "Then I'll get a line on you.
Why, they're easy; here I've worked them
  In five minutes. You ought, too."

Slowly do the students, weary,
  From the struggle they've been thru,
Lay their papers on the table,
  Wondering what they next must do.
"Take, tomorrow, twenty pages,
  That's not much," the teacher mused,
"And prepare to work examples,
  One to twelve. Now class excused."

* * * *

Father (to his old friend's pretty daughter)—Good-bye, my dear. I won't kiss you; I have such a cold.

His Son (with alacrity)—Can I do anything for you, father?

* * * *

Deming's Girl—Cully came over last night and told me all about the game.

Gray's Girl—Was he a good talker?

Deming's Girl—Yes, indeed. He held his audience all the time.

Adam's pleasure often marred
  With trouble may have been,
But he never had to hold his pants
  Up with a safety pin.

* * * *

A EULOGY.

A newspaper, in speaking of a deceased citizen, said: "We knew him as old Ten Per cent—the more he had the less he spent—the more he got the less he lent—he's dead—we don't know where he went, but if his soul to heaven is sent—he'll own the harp and charge 'em rent."—St. Louis Mirror.

* * * *

FAME.

First Microbe—What's that new germ looking so stuck up about?

Second Microbe—Why, he had his portrait published in one of the leading scientific monthlies eight thousand times life size.—Philadelphia Evening Bulletin.

* * * *

Sommers—Say, Professor, do you work out all the experiments that are marked with a cascaret?

* * * *

Why are you running, little boy?
To keep two fellows from fightin'.
Who are the two fellows?
Me and Billy Perkins.

* * * *

Maid—Please, mum, the neighbor wants to borrow the lawn mower.

Mistress—What! Do they intend to use our new lawn mower on the Sabbath day? Tell him that we haven't any.

* * * *

LET IT SNOW!

The merry sleigh-bells jingle,
Ears and noses tingle.
Arms and waists mingle.
Oh! I'm so glad I'm single!

NEWS FROM OTHER COLLEGES.

The "movies" were used at Chicago University this year to show the freshmen how to register. Much confusion was thus dispensed with.

At the present time German Universities have a foreign enrollment of 4,672, of which 398 are Americans.

At present there seems to be excellent prospect of an international track meet in the Harvard Stadium with the athletes of Oxford and Cambridge pitted against those of Yale and Harvard!

The new gymnasium presented to Rensselaer Polytechnic Institute by the Class of '87, was opened December 2, 1912.

Governor Hiram W. Johnson, as President of the Board of Regents, dedicated the new Agricultural Hall at the University of California.

Statistics at Yale show the effect of "Proms" to be as follows: Percentage of girls they later marry they take to Prom: Sophomore, 8 per cent., Juniors 15 per cent., Seniors 27 per cent.

With a view to raising the standard of scholarship of fraternity men to the high standard of non-fraternity men at Vanderbilt University, a scholarship cup has been donated.

The University of Michigan, according to the latest registration reports, now leads American colleges in attendance of foreigners. According to the figures of the Cordes Fratres Cosmopolitan Club nearly 200 have registered.

The regents of the University of Michigan have authorized a medical dispensary to be located on the campus. Each student will be charged $2.00 per year for medical attendance. A university physician is to be employed to devote his entire time to the medical care and health of the student body and a woman physician is to be engaged to care for the women students.

It appears that last year there were 4,580 students from foreign countries pursuing courses in American colleges, this being the largest number in any year yet. Of these 900 came from Canada, about 300 from Mexico, 700 from the West Indies, 540 from China, 415 from Japan, 125 from the Philippines, 21 from Korea, etc. Even Germany, with all her great universities, sent 145 of her sons to this country to study.—Ex.

FALLING EXPANSION LINE WITH SUPERHEATED STEAM.

THE author of a recent paper upon superheated steam is troubled by the fact that when superheated steam is used the expansion line of the indicator diagram falls away more rapidly than it would with saturated steam, and that, therefore, in order that the engine shall develope the same amount of power, the pressure must be raised or the cutoff be made later. This does not mean, however, that the engine is using more steam or more heat per unit of power developed; quite the contrary.

The holding up of the expansion line with saturated steam is due to the fact that when the steam is admitted to the cylinder, it gives up some of its heat to the containing surfaces, which have just been exposed to the temperature of the exhaust and are therefore cooler than the entering steam. Being only saturated, that is, having only enough heat to maintain it in the form of steam, it cannot give up any without a corresponding amount of condensation. At the point of cutoff there is therefore present in the cylinder, not dry steam, but a mixture of steam and water.

If this mixture were expanded without taking up any heat from the cylinder walls or giving out any heat to them, the line would fall away considerably faster than does the line of the ordinary indicator diagram. As the expansion proceeds, some of the water which is above the boiling temperature at the lower pressue evaporates into steam, raising the pressure above what it would otherwise be. The expansion line of the diagram from an ordinary cylinder with saturated steam, does not represent therefore the relative pressure and volume of a constant amount of steam, but of a varying amount.

While this holding up of the expansion line adds to the area of the diagram and the power developed, it does so at an enormous expense. To heat up a cylinder with steam of boiler pressure and then to use a little of that heat at a lower temperature, to boil water to keep up the expansion line, allowing the greater part of it to keep on boiling out water after the exhaust valve is open, and to make steam to put into the exhaust, is a most inefficient way of fattening the diagram. The perfect engine would avoid this heat leak between the boiler and the condenser. A cylinder which absorbed no heat from and gave no heat to the working medium, would be the greatest improvement to which the steam engine is susceptible. The use of the steam jacket and highly finished internal surfaces are steps in this direction.

The use of superheated steam goes further than either of these. While it cannot preclude the absorption and giving out of heat by iron exposed alternately to high and low temperatures, this transfer is much less active between dry superheated steam than between moisture and the cylinder surfaces and with the use of superheated steam, the giving up of heat to the steam by the cylinder during the expansion is much less energetic and the expansion line is not raised so much above the normal as in the case of the saturated steam. But the heat which would be available for this purpose has not been taken from the entering steam in the first place, and if the author will compute the number of heat units which go to the condenser in both cases, he will find that, notwithstanding the longer initial pressure, a smaller number of heat units are thus voided per horsepower-hour with superheated steam and its more rapidly falling expansion line than with saturated steam and the fuller diagram.—*Power.*

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LARGE INTERNAL COMBUSTION PUMP FOR EGYPTIAN DRAINAGE PROJECT.

A pump of the Humphrey internal combustion type in which the explosion of producer gas takes place in direct contract with the water, has been designed for extensive drainage operations proposed by the Department of Public Works of Egypt. The pump is similar to those now being installed at the Chingford reservoir in England, which were described in the Engineering Record of June 29, 1912, page 727. The pump for the Egyptian work, however, is larger than its predecessors, having a capacity of 100,000,000 imp. gal. daily against a lift of 19 ft. It is stated in "Engineering" that the pump works on a four-stroke cycle. Starting with the working stroke there is the ingnition of a combustible charge compressed into the top of the pump cylinder. This charge is expanded down to a little below atmospheric pressure, which results in a charge of water and a charge of scavenging air being drawn in through automatic valves. At the same time water is delivered through the discharge main. This working stroke is followed by a return stroke of the water column, which first expels the products of combustion through the exhaust valve. These valves are then closed by the impact of the moving water and the air entrapped is compressed into the head of the cylinder, where it forms an elastic cushion, which gradually brings the moving column of water to rest. The re-expansion of this cushion produces a second outstroke of the water. The pressure above the latter again falls below that of the atmosphere, with the result that a charge of combustible mixture is drawn through automatic inlet valves. When the forward momentum of the water is exhausted a second return stroke takes place which compresses the charge in the cylinder ready for another working stroke. The valves are all automatic, but are interlocked so that they can open only in due sequence.

The water velocities are all very moderate, and although the pump appears bulky it is claimed to have the great advantage of extreme simplicity, there being nothing to get out of order and practically no parts requiring lubrication. To start the pump a charge of gas and air is delivered from a compressor to the combustion chamber and forces down the water level in the chamber until the charge reaches the required volume. A hand switch is then pressed, causing sparks to pass at the ignition plugs and the first outsroke is made. From this moment the action of the pump is entirely automatic and it picks up its load and soon attains its rated output.—*Engineering Record.*

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EFFECTS OF ELECTROLYSIS ON REINFORCED CONCRETE.

THE effect of electrolysis on reinforced concrete has received considerable attention of late and numerous conflicting theories have been advanced as to the cause of the phenomena observed. Some have gone so far as to prophesy the ultimate destruction of reinforced concrete structures by electrolysis. As a result there has been more or less apprehension, which, fortunately, should now be allayed. The U. S. Bureau of Standards, as has been quite generally known, has been investigating the subject thoroughly and at the convention of the National Association of Cement Users in Pittsburgh last week a summary of its work and of the conclusions reached was presented. An abstract of the paper will be found on page 697.

In general, the Bureau concludes that the fear entertained as to the destruction of concrete structures by electrolysis is groundless. In line with the conclusions of earlier investigators the Bureau found corrosion of the anode due to formation of iron oxide, resulting in the cracking of the concrete, but, contrary to the experiences of the earlier investigators, also found an effect at the cathode. This was a distinct softening of the concrete beginning at the cathode surface and extending slowly outward, in some cases 1-4 in. or more. While on exposure to the air this softened layer hardened again, it remained friable and brittle, so that the bond between the metal and the concrete was completely destroyed. Corrosion of the anode, the investigation showed, does not take place until the potential is about 60 volts per foot of anode, so that under actual conditions corrosion from stray currents may be expected only under special or extreme conditions. Unlike the anode effect, which is serious only at comparatively high voltages, the cathode effect develops at all voltages. The Bureau considers, therefore, that it may frequently occur in practice and that it is a more serious matter from the practical standpoint than the anode effect.

Nevertheless, the Bureau states positively that there is no cause for widespread alarm, though under certain conditions precautions are necessary. Waterproofing concrete would help to increase its resistance and so lessen the danger, but waterproofing effective against electrolysis is much more difficult than waterproofing to maintain a moderate degree of dryness. The best preventive measures, therefore, are directed at the electric currents themselves, every precaution being taken to prevent grounds on the building itself. Pipe lines, lead-covered cables and other conductors entering a concrete building should be insurlated to prevent contact with the concrete. A final interesting point is that even a small quantity of salt in concrete, frequently used to prevent freezing while setting, considerably increases the corrosive action and should not be used in the concrete of buildings that may be subjected to electrolytic action.—*Engineering Record.*

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