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Rose Technic Staff

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THE ROSE TECHNIC.

VOLUME VIII.

1898-9.

ROSE POLYTECHNIC INSTITUTE,

TERRE HAUTE, INDIANA.

TERRE HAUTE, IND.:
THE GLOBE PRINTING HOUSE.
1899.

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THE ROSE TECHNIC.

VOL. VIII.

TERRE HAUTE, IND., NOVEMBER, 1898.

No. 2.

THE TECHNIC.

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NOTICE TO SUBSCRIBERS.

Hereafter we shall follow the general rule regarding subscriptions, and shall continue sending THE TECHNIC to subscribers until notified to discontinue.

THE TECHNIC Board has added one name to the staff and only the vacancy left in the local department remains to be filled, by a member of the Freshman class, in order to have the full number of editors. At the last meeting of the Board, Mr. Edgar L. Flory, of Dayton, Ohio, a member of the Freshman class, was elected to fill the position of Assistant Business Manager. This addition to the Board has become necessary through the increased duties placed upon the Manager and the scarcity of time in which to do the routine work of his department.



THE sad news of the death of Mrs. Mary Packard Noyes, the mother of Professor W. A. Noyes, was received by friends and stu-

dents with a deep feeling of sorrow and grief for Dr. Noyes in his loss. THE TECHNIC joins with the faculty and students in individually expressing their deepest sympathy.



THE attention of the Alumni is called to the "The Alumni Association Notes," which Mr. J. B. Aikman, '87, Secretary and Treasurer of the Alumni Association, has given THE TECHNIC for publication. Several important announcements are made and the attention of all is directed to the necessity of carefully considering the question of the election of the two members of the Board from among the Alumni. The election does not take place until next March, but should be born in mind so that an early reply can be given to the ballots which will be sent out. Another question of vital importance to the interests of the school is the active co-operation of the Alumni in promoting the welfare and increasing the field of influence of the school. The class secretaries should respond at once and enter heartily into any plan which may be suggested to increase the attendance and thereby extend the influence of their Alma Mater, to whom they owe so much, for the prestige they hold in the field of engineering. Attention is also directed to the letter which was sent out in the October number of THE TECHNIC, in which Mr. Aikman urges the Alumni to give their support to THE TECHNIC, which is the official organ of the Association, and through its medium the Alumni can be kept more closely in touch with each other and the school. Without your support and interest THE TECHNIC must lose much that has given it prominence as a college journal of engineering. Contributions and notes are earnestly solicited upon any phase of engineering, especially the results of your own investigations upon the line of work in which you are engaged.

RECOGNIZING the necessity for a decided and immediate change in the rules and regulations governing absences, the Faculty have entirely revised the former plan of excusing absences. Under the new rules the student is thrown entirely upon his own judgment, being given the privilege of attending the exercises or staying away and taking the consequences—his own loss. The per cent. of time so lost, or for any reason whatsoever, will be deducted from his recitation average, unless he can by satisfactory means convince the professor that he has made up the work. The professor is given the privilege of requiring either an oral or written examination at any time and upon the results of these examinations the professor can recommend that the student be conditioned which the faculty can grant as deemed best. In the shop, laboratory and drawing room lost time can be made up in general if satisfactory arrangements can be made as to expense, for providing such opportunity for work. Tardiness will, in every case, be counted as a half absence and cannot be excused. This has met with general favor by the student body and a sense of the justice and fairness seem to be appreciated by all. In placing the restriction upon absences on this basis, the man appreciates the fact that every hour lost means such a per cent. deducted from his recitation average, unless satisfactorily accounted for. Before these rules were put into effect there was a tendency to let any slight excuse keep the student away from school and no thought was given to the necessity of making up the lost time other than was necessary to go on with the class work. But as it stands at present an option is given either to make the work up in an acceptable manner or loose so much from the recitation average. In regard to making up time in the shop, drawing room or laboratory, it has been left to the professor to decide on the time and also whether he will be caused to spend extra time or make unnecessary demands upon the equipment of the department under his care. The cost of all extra time and use of apparatus must be born by the student. Wherever it is possible for the head of the de-

partment to let the work be carried on during the hours he is in his department, the privilege has been granted, in most cases, and respected by the students who are only too anxious to be as fair in this regard as possible. Not a little dissatisfaction has been caused by the action of one of the professors in charging a certain sum for making up lost time. Were it not possible that the time could be made up during the hours when he is engaged at the Institute, such action would be entirely satisfactory; but when the subject is of such a nature that it can be made up during the time of meeting of another class with out in any way interfering with their work—then it must be looked on as an infringement upon the privileges which the school has offered. Of course this extra time is in a measure the granting of a concession, but where the man has been forced to be absent through a justifiable cause, he should be allowed all the privileges possible. No one would ask the professor to spend one moment of extra time at the Institute in order to give instruction without due compensation, but so long as he is present in the building attending to regular duties, and the privilege asked be made in the desire to receive all the benefit possible from the course and in no way distracts his time or attention from the other duties, it should be allowed.



AFTER a thorough investigation, which was authorized by President Mees, the Faculty Committee on Athletics presented the letter, given in another department, which entirely clears the Rose Tech team of any charges of unfairness or ungentlemanly playing in the DePauw-Rose Tech game. While the committee lay the responsibility and charge for the foul playing upon the DePauw man, they do not excuse the Rose Tech man in forgetting himself so far as to strike a man on another team, although, under the circumstances, he would seem thoroughly justified. The attitude of both the Faculty and the student body in desiring the matter thoroughly investigated is most pleasing. Upon the request of

abused, and if he complains as any self-respecting machine would, he may be discharged and a new man hired in his place, apparently without the loss of a cent.

This view is a superficial one, however. An employe becomes an investment on the installment plan, and when he is discharged or leaves, the investment is a partial loss. It may and often does become necessary to incur this loss on account of incapacity, discharge or as a matter

bring the best possible results for which we are working. A man should place himself behind results he aims to achieve.

I believe it pays to take into your confidence to a certain extent those who are carrying into effect your ideas and orders. It acts as an incentive to intelligent cooperation, as most men are glad to show by their actions that they appreciate the confidence you have in them.

It puts work on a plane above mere drudgery to give it a definite aim. Manual operations become by long practice so mechanical that they can be accomplished with very little brain effort on the part of the operator whose mind is left free to occupy itself with other things. Naturally near by subjects secure attention first, matters which affect the every-day life of the men; their pay, how hard they have to work, what an easy job some one else has, how the business is managed and how it ought to be &c., &c. Ideas are exchanged and before long there is a pretty general sentiment that things are not just as they should be. It may or may not go farther than this, but it is an undesirable condition, and if it can be prevented by suggesting a more desirable line of thought it ought to be done. News travels quickly and it is very easy to make it generally known that you are working out a definite problem, which is to accomplish certain results within a definite time, and it is also easy to make it evident that you will need the help of everybody all along the line. This need not be a confession of weakness on your part, and you will of course have your eyes open to discover the black sheep who may need your attention.

When men take an interest in their work, no matter what it is, and try to do their best they will accomplish much more than when they are simply putting in their time to draw their pay. It is more healthful for men to be thinking of their work than of their ailments. Have it understood, and show by example, that during working hours a strict attention to business is expected.

There is quite a variety of opinions in regard

to the number of rules and regulations necessary to properly govern a body of men.

Some think it necessary to have a very complete set of printed rules and regulations all numbered and with the penalties for breaking them attached. Others think that the fewer rules there are the better, and that if a man works full time and behaves himself he does not need any rules. The essential point is that if a man is attending strictly to business it is needless to trouble him about rules, and if you can not make him do that, either you or the man had better "get through."

I believe it generally pays to cultivate a pleasant feeling between employer and employes, recognizing that their interests are largely mutual.

The question of pay is of course a vital one and perhaps causes more friction between the two interests than any other one thing. It is too broad and scientific a question for me to more than touch upon. Here is the problem: the employer wishes to produce the greatest possible results at the least possible cost; the employe wishes to do as little work as possible and get as much money as he can for it. Required, a solution satisfactory to both.

All possible solutions divide themselves into two general classes; first, pay by the day; second, pay by the piece. The first is satisfactory in great many cases, but fails utterly to produce the results required in the face of sharp competition.

Once the day rate is settled to the satisfaction of both parties there is no incentive to the employe to exert himself to the utmost and no penalty if he is short of it, unless he is an evident shirk. It is the simpler and easier solution for the employer and is satisfactory to the trade unions for it supposes all men of one class of trade to be equal and should be paid the same.

The incentive necessary to produce the greatest results, is a reward for extra exertion and a penalty for laziness, or a piece rate.

There is a proper use for each method, and the wise employer or manager is the one who

knows where to use each, and can adapt modifications of each to suit his own particular needs. A study of the methods used in some of the largest industrial establishments of the country would prove very valuable and interesting.

I would suggest a continuance of the subject by others giving methods now in use, and if possible their effects on production and production costs. These are the things which make or lose success for us as much as our technical ability.

the seam to the bottom, being careful to avoid the top and bottom slates and partings. Follow this method in several places where the coal is being mined, mixing the several portions to form the entire sample, about 125 pounds in weight. By this means a good sample, representing the quality of coal shipped, is obtained.

To sample coal from the car, proceed as follows: Have the coal shovelled from the middle of the car until the floor is reached. This will leave the coal sloping up to the full height of the load at the ends. Now starting at one corner of the car take the coal from a shallow gutter or trench along the top of the load and down the faces of the slopes to the floor, until you reach the diagonally opposite corner; repeat this from the opposite corner to its diagonal corner. Be sure that the ratio of slack to lump is the same in the sample as in the car. These two portions mixed together form the sample, and it should all weigh about 150 to 160 pounds.

Below will be found the result of sampling coal in the mines and of the same coal on its receipt in cars, the sampling being done as above described:

Mine Sample	Car Sample
1.24 Moisture	1.20
20.90 . . . Volatile Matter . . .	20.72
72.15 . . . Fixed Carbon . . .	72.29
5.71 Ash	5.79
100.00	100.00

COKE SAMPLING.

In well burned coke about $\frac{1}{18}$ by volume consists of black butt and over burned or spongy top and in taking a sample this fact must be kept in sight and the proportion of soft to hard coke should be kept about one to eighteen. At the coke works the sample should be taken at the oven, while at the blast furnace or steel mill the sample must be taken as the car is unloaded.

AT THE OVENS.

After the coke is quenched and about three barrows of coke have been drawn out, have the coke drawer lay aside a lump of coke the entire depth of the charge—then after about five more

barrows are drawn lay aside another lump, continuing this until the oven is completely drawn. You will then have about seven or eight large lumps from different parts of the oven from which to take your sample. Break these pieces up and select the sample taking one part of butt and top to about eighteen parts of hard coke. You should have a sample weighing from 30 to 35 pounds.

CAR SAMPLING.

In sampling from the car, take portions of coke as it is unloaded, keeping the proportion of soft to hard coke at one to eighteen, continue this until about 125 to 150 pounds are in the sample and the car is unloaded. Below are the results of sampling the same coke, at the ovens and on unloading the cars, taken as described above

Oven Sample	Car Sample
.43 Moisture . . . .	.39
2.09 . . . Volatile Matter . . .	2.13
85.60 . . . Fixed Carbon . . .	85.56
11.88 Ash	11.92
100.00	100.00
.95 Sulphur . . . .	.98

PREPARATION OF SAMPLE.

Crush sample, and put through an inch mesh screen, put in a heap and divide into quarters, retain diagonally opposite quarters, mix and crush this putting through $\frac{3}{4}$ inch screen, quarter, retain diagonally opposite quarters, continue this, passing through successively smaller screens and quartering until about two or three pounds remain. Mix thoroughly, quarter, and put through a 100 mesh screen. Sample taken by the foregoing method and prepared as directed will be found to be accurate and of value as representing the coal or coke under examination.

Illinois Steel Co., Union Works Laboratory.

The work done by Eastwood, Lansden, Pirtle and Wiley, under the direction of Professor Wagner, last June, on the L. & N. R. R., at Birmingham, Ala., and presented as their theses, has been published in the *Railroad Gazette*.

ALUMNI ASSOCIATION NOTES.

The Committee on Elections provided for in the action recently taken by the Board of Managers, relating to the election of two additional members of that body from the Alumni Association, has been appointed by the President, Mr. John B. Peddle. It consists of

George M. Davis, '88, Chairman.

Chas. E. Scott, '86.

Victor K. Hendricks, '89.

The Committee has held one meeting, thus far, to consider and familiarize themselves with the plan and details of conducting the election.

The Association has been working for several years to secure representation from the Alumni on the Board of Managers. Now that it has been granted, it is important that the individual members of the Alumni manifest their appreciation of this generous action of the Board, by responding promptly to the communications that will be sent out by the Election Committee next March.

The first communication will request each Alumnus to make two nominations, each representing a different Engineering course and a different class. Only Alumni of three years standing or more are eligible to election; hence the nominations must be selected only from the class of '95 and those which preceded it.

All Alumni are entitled to vote and make nominations.

After the nominations are all in, the Election Committee will canvass the same and select the four names having the highest number of votes as the nominees. This list will then be sent out by mail to the Alumni membership with a request that votes be promptly returned with two of the names. The votes will be counted at the Annual Meeting of the Alumni next June and the two names receiving the greatest number of votes will be declared elected to membership on the Board of Managers. The one who receives the most votes, will serve two years, the other one year. After this year, but one alumnus will

have to be elected each year and he will serve two years. This is a very important duty for the Alumni to perform and should be done with great care.

Each Alumnus should examine the list of graduates who are eligible and carefully consider who would, in his judgement, make a useful and desirable representative on the Board, before making his nominations. It would be well to do this before next March so that prompt returns may be made to the Election Committee, in answer to their requests for nominations.

The time is drawing near for the selection of an Alumni Orator for the Commencement of 1899. This must be done in December and the duty devolves upon the Officers and Executive Committee of the Association. The Secretary will be glad to receive suggestions from any of the Alumni, concerning the matter.

At the Annual Meeting of the Association last June it was felt that some organized effort should be exerted by the Alumni toward acquainting people, in their respective localities, more fully with the exceptional merits of the Rose Polytechnic Institute as a College of Engineering.

The high standing of our graduates in the Engineering world has already given to Rose an extensive and excellent reputation for turning out good men, but the graduates themselves have not always realized the obligation resting upon them, of being continually on the alert to speak a good word for their Alma Mater where it would do the most good. They have not been as thoughtful as they might be, to look out for young men contemplating a course of study in Engineering.

In order to stimulate this individual interest and active effort among the Alumni a resolution was adopted directing the Secretary to appoint a Corresponding Secretary in each class that has graduated, whose duty should be to carry on as continuously as possible a correspondence with the members of his class with the object of awakening their interest and active cooperation

in this important matter. The appointments have been made as follows:

Class of '85 Ben McKeen, Terre Haute.
 Class of '86, H. W. Foltz, Indianapolis.
 Class of '87, J. B. Aikman, Terre Haute.
 Class of '88, E. G. Waters, New York.
 Class of '89, A. J. Hammond, Terre Haute.
 Class of '90, T. L. Condron, Chicago.
 Class of '91, S. S. Wales, Youngstown, O.
 Class of '92, W. A. Layman, St. Louis.
 Class of '93, Arthur M. Hood, Indianapolis.
 Class of '94, Howard M. Stanton, Indianapolis.
 Class of '95, W. O. Mundy, Louisville, Ky.
 Class of '96, W. E. Burk, Louisville, Ky.
 Class of '97, R. M. Newbold, Birmingham, Ala.
 Class of '98, Frank A. Whitten, Holyoke, Mass.

Some of these men have not yet responded to the secretary's notice of their appointment, while a few have asked to be excused from the work, pleading lack of time. It is earnestly hoped the latter will reconsider their action and undertake the work they are asked to perform, remembering that however valuable and limited their time may be, it can be no more so than that of those Alumni who have heretofore done the work of the Association.

This excellent plan depends very largely for its success upon the enthusiasm and industry with which these class secretaries undertake the work.

J. B. AIKMAN, '87.

November 2d, 1898.

Secretary and Treasurer.

ALUMNI NOTES.

ALUMNI ASSOCIATION.

President John B. Peddle, '88, Terre Haute
 Vice President J. David Ingle, '97, Oakland City, Ind
 Secretary and Treasurer John B. Aikman, '87, Terre Haute
 Executive Committee—H. W. Foltz, '86, Indianapolis, Chairman;
 Robt. L. McCormick, '91, Terre Haute; Victor K. Hendricks, '89,
 Terre Haute.

Walter Decker, '96, is with the Elevator Supply and Repair Co., of New York City.

J. D. Ingle, '97, is at Columbia University taking a post graduate course in Mining Engineering.

H. S. Hart, '93, is the eastern representative of the Fostoria Incandescent Lamp Co., stationed in New York City.

W. G. Arn, '97, is with the L. & N. Terminal

at Nashville. He is at present working on a job which will take two years to complete.

S. S. Roberts, '98, is on Location Survey in Illinois for the St. Louis, Peoria & Northern R. R.

F. C. Brachmann, '98, is with Dietz, Schumacher & Boye at Cincinnati. He is at present installing an electrical plant for the firm.

Clairborn Pirtle, '98, is draughtsman with the McWilliams Co., of Louisville, Ky., contractors for steam and electrical installation.

J. T. Montgomery, '98, is with the Faukman Construction Co., Chicago, Ill. He is also doing some work for the John Roebling Sons' Co.

Roger M. Newbold, '97, is President of the Pratt-Ensley Light & Power Company, of Birmingham, Ala. J. M. Lansden, Jr., '98, is general manager.

E. B. Harris, '96, who has been first assistant in the Armour Laboratories Chicago, Ill., has accepted a position with the Eastman Kodak Co., as chemist.

S. D. Collett, '90, who has been confined in the Roosevelt Hospital at New York for over three weeks, is gradually improving. His confinement was caused by a surgical operation.

The marriage of Bigelow, '95, is announced: Miss Elizabeth L. Stanley and Mr. Henry W. Bigelow, married Thursday, November the seventeenth, eighteen hundred and ninety-eight, at Mt. Auburn, Cincinnati.

W. J. Fogarty, '92, who was reported in our last issue as being with the Barney and Smith Car Co., of Dayton, O., is with the Stillwell-Bierce-Smith-Vailè Co., of the same place. He was never associated with the Car Co.

C. E. Theobald, '98, who was reported as being with the McKay Metallic Fastener Co., has accepted the position of assistant engineer in the construction department of the New York Telephone Co. He is under the direction of Arthur Rice, '93.

K. E. Voorhes, '98, is with the McKay Metallic Fastening Association, Winchester, Mass.

The company makes 80 per cent. of all the machines used in shoe manufacture. Voorhes writes that the work is most interesting and that he is associated with the inventor of the machines in design work.

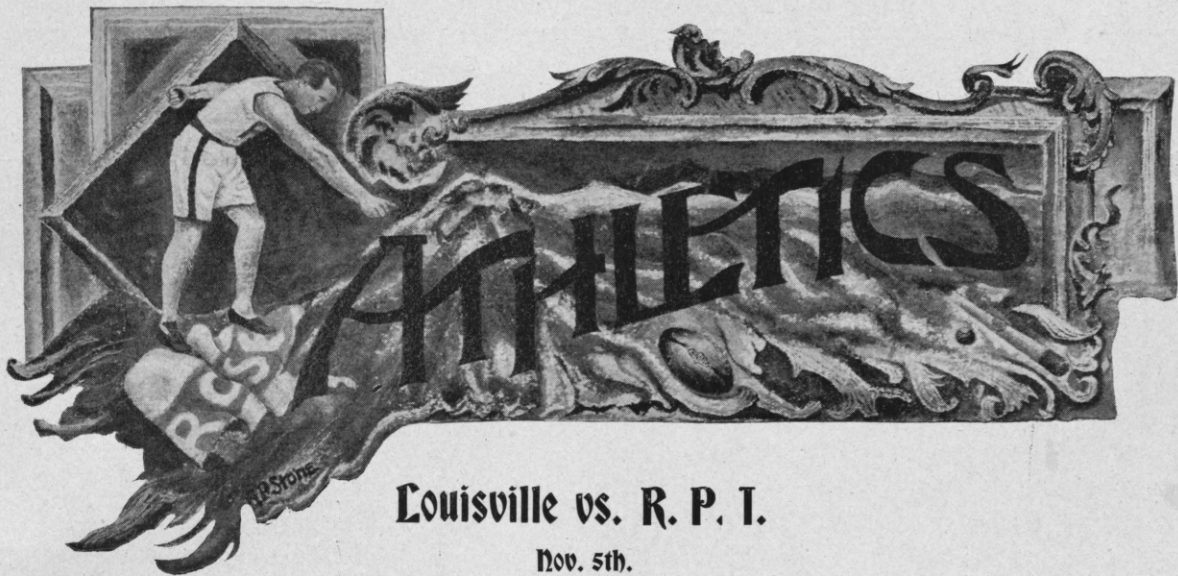
A. C. Eastwood, '98, is at present with the Carnegie Co., of Homestead, Penn., studying the construction and operation of a steel plant being built by the Carnegie Steel Works for the Ensley Steel Co. He will be given a responsible position as superintendent of the electrical equipment with the company when the plant is erected in Birmingham, Alabama.

The following announcement has been received of the wedding of Henry Waite Bigelow, '95, Assistant to Engineer of Tests, Pope Mfg. Co.,

Hartford Conn.: "Mrs. R. L. Stanley invites you to be present at the marriage of her daughter Elizabeth to Mr. Henry Waite Bigelow, Thursday, November the seventeenth, noon, Church of Our Saviour, Mt. Auburn, Cincinnati."

The following invitation has been received of the wedding of Walter M. Blinks, '94, Superintendent Michigan City Gas Light Company, Michigan City: "Mr. and Mrs. Nathaniel Peabody Rogers request the honor of your presence at the marriage of their daughter, Elmira Little, to Mr. Walter Moulton Blinks, on Tuesday evening, October twenty-fifth, eighteen hundred and ninety-eight, at eight o'clock, 701 Washington street, Michigan City, Indiana. At home after December first, 313 East Seventh street."





Louisville vs. R. P. I.

Nov. 5th.

DESPITE the fact that they played against what seemed to be fearful odds, on November fifth, the Rose team won a distinguished victory over the Louisville team. Not only were the Louisville men much heavier, but they had the advantage of playing at home, and had daily practice under a coach's supervision. The general feeling on the part of the Rose men was "Well, we will do the best we can." But it was destined to turn out differently.

The game was started in a drizzling rain, with pools of water over the whole field. Rose won the toss and took the western goal. McDonald kicked off 35 yards for Louisville to Meriwether, who in an excellent run, returned it to the middle of the field. Huthsteiner gained 20 yards, Likert 20, Meriwether hit the line for a few more, Stone gained 10 and Meriwether was pushed over for a touch-down, Stone kicked a pretty goal. Time, 1:40.

McDonald kicked off 45 yards to Meriwether who returned the ball 15 yards. Louisville got the ball on a fumble on the next line up. A few minutes later Rose recovered the ball on downs, but it was lost again on a fumble, the wet ball being difficult to hold. Louisville was given ten yards for off side play. By steadily bucking the line Ellis, Struss and others got the ball within

five yards of Rose's goal. Here Rose secured the ball on downs. After Rose had in three downs advanced the ball fifteen yards, a fumble lost it to Louisville. Rose held Louisville for three downs, and McDonald tried for a goal from the field, but failed, Stone kicked off from Rose's twenty-five yard line, and the ball bounced along 60 yards before being secured. Louisville failed to advance it. Rose held them for three downs and McDonald punted 20 yards. Louisville got the ball, Meriwether fumbling it. Then by constantly bucking the line, the Kentuckians carried the ball straight to Rose's goal, making, on an average, five yards in three downs. Only once did they fail to gain. Ellis was shoved over for a touch-down. McDonald failed to kick goal.

Score: R. P. I. 6, Louisville 5.

Stone kicked off 45 yards to G. McIlhenny, who returned it 10 yards. By bucking the line the Louisville team steadily approached Rose's goal. Struss, McIlhenny, Ellis and Brown all made serviceable gains. The ball was between Rose's 10 and 15 yard lines, and steadily moving closer, when time was called for the first half.

Starting the second half, Stone kicked off 45 yards to Rittenauer, who regained 10 yards. By

successive plunges, the Louisville giants forced the ball down the field. They fumbled twice but regained the ball. One gain of five yards was the greatest they made. When the ball was within 20 yards of Rose's goal, the Indianians gained it on a fumble. For the rest of the game Louisville never had the ball except for the kick-off.

Likert and Stone tried the end, but each lost several yards in the slippery mud. Meriwether punted 35 yards out of danger. Likert by a good run gained the middle of the field and McLellan fell on the ball. Largely by bucking the line, Rose gradually approached Louisville's goal, gains by Huthsteiner, Meriwether, Stone and Glenn being of great value. Huthsteiner hit tackle and made the few yards necessary for a touch-down. Stone missed goal, score, R. P. I. 11, Louisville 5.

McDonald kicked off thirty-five yards to Likert, who regained nearly 25 yards before being tackled. Glenn gained five yards in two downs, and Likert and Stone advanced the ball ten, to the middle of the gridiron. Then Stone took the ball for an end run. Aided by what the Louisville papers called magnificent interference, he escaped all but the full back of the Louisville team. The latter stood directly in his way ready to tackle him. But just as the full-back closed his arms on the runner, Stone gave a half turn, and gliding from the man's arms, he completed the run of fifty-five yards, and downed the ball between the goal posts. He missed goal. R. P. I. 16, Louisville 5.

McDonald kicked off 35 yards to Meriwether, who returned the ball 20 yards before being downed by Brown. After several plays by which little was gained, Likert took the ball and made a splendid run of thirty yards around the end. In two downs almost no gain was made. Then Stone took the ball and made a fine run of thirty yards. The ball was now within two yards of Louisville's line. The ball was given to Meriwether who bucked Louisville's heavy line with such force, that he came out on his feet

clear of the opponents, and ran around to down the ball behind the middle of the goal posts. Stone kicked goal. R. P. I. 22, Louisville 5.

McDonald kicked off 40 yards for Louisville, to Huthsteiner, who by an excellent run succeeded in returning it thirty yards. Steady gains of nearly five yards each by Likert, Meriwether and Stone had brought the ball a little past the middle of the field, when time was called.

The line up and score follow:

Louisville—5.	POSITIONS.	Rose Tech—22.
Choate	Left end	Likert
J. McIlhenny	Left tackle	McLellan
Struss	Left guard	Thompson
Hoskins	Center	Appleton
Shouse	Right guard, Kittredge-Peker	
Brown	Right tackle	Capt. Davis
Rittenauer	Right end	Stone
Haerberle	Quarter-back	Jumper
Ellis	Left half-back	Glenn
G. McIlhenny	Right half-back	Huthsteiner
McDonald	Full-back	Meriwether

Substitutes—Louisville; Robbins, Rodman, Henry, Rose Polytechnic; Peker, Tallmadge, Lyons.

Referee—E. P. Edwards.

Umpire—R. Montz.

Linemen—John Morton and Frank Miller.

Timers—Stuart Leathers and Marshall Morris.

Touchdowns—Meriwether 2, Stone 2, Ellis, Huthsteiner.

Goals from Touchdown—Stone 2.

Halves—Twenty-five and twenty minutes.

The Louisville papers were loud in admiration of the team work displayed by Rose. Special mention was made of the playing of Stone, Meriwether, Likert and Huthsteiner. The men on the line, though having no chance to distinguish themselves personally, succeeded in holding their strong opponents with remarkable determination. Jumper as quarter put up the excellent game we have learned to expect from him.

A Louisville paper describes the game thus: "It was a hard, bruising contest, with much slugging and rough playing. No tender boy could have remained in that game a minute. There were giants on both sides, and they came together with a resounding crash after every line up."

DePAUW VS. R. P. I.

OCTOBER 22.

We do not attempt to say that we were not defeated fairly and badly, but our defeat was due more to our inferior playing than to our rival's superior work. The game was played on a field plastered with three inches of the worst of Indiana clay. The team went to pieces early in the game and added to the disadvantage at which Rose was placed in changing from one of the best gridirons in the state to one so inferior, this caused the loss of the game. Had Rose been able to put up the game she played at Bloomington we might have a different story to tell. When DePauw comes to Terre Haute on Thanksgiving we shall offer her one of the best sodded gridirons in the state, where the playing of both teams will show to advantage.

Both sides lined up in a drizzling rain, with Rose in possession of the ball. Stone kicked to DePauw's 35 yard line, where the ball was caught and brought back 11 yards. After a succession of nine downs, during which DePauw did some quick, active work, the ball was on Rose's 10 yard line and still in possession of her rival. Here Rose took a brace and held DePauw for downs gaining the ball, the first time since the kick off. In an attempted end run Huthsteiner made no gain. Meriwether bucked the line three times and advanced the ball 11 yards. DePauw soon gained possession of the ball and was rapidly pushing it towards Rose's goal when she lost it on a fumble. Meriwether hit the line for 6 yards and Glenn carried the ball around the end for 8 yards more. Meriwether hit the line repeatedly for small but sure gains. Things began to look brighter for Rose, but the ball was lost on a fumble and DePauw made 8 yards around the end. A foul was declared and DePauw lost 5 yards, but soon regained it and more too. Rose got the ball on another fumble but immediately lost it and then regained it on downs. By short gains Meriwether, Glenn, Huthsteiner and Davis advanced the ball 15 yards when it was lost on downs. Our team seemed to grow weaker and less energetic and

allowed De Pauw to carry the ball over the line for a touch down. DePauw kicked goal, score 6-0.

Stone kicked to DePauw's 35 yard line where the ball was caught and advanced 10 yards. DePauw punted and Rose obtained the ball. Meriwether and Glenn advanced the ball 15 yards and time was called with the ball in DePauw's territory.

In the second half Rose started out as though determined to score but soon fell to pieces again. The ball was kicked to Huthsteiner on the 25 yard line and advanced 5 yards. By a succession of short gains, the backs aided by Kittredge, advanced the ball to DePauw's 12 yard line where it was lost on a fumble. DePauw seemed to meet with no resistance and carried the ball down the field for another touch down. DePauw failed to kick goal, score, 11-0.

Stone kicked to DePauw's 30 yard line and the ball was rapidly advanced into Rose territory until on her 40 yard line Rose got the ball on downs but was unable to advance it. Meriwether attempted to punt but owing to the condition of the field the attempt was a failure and DePauw again obtained the ball and carried it down the field as before scoring another touch down. No goal, score 16-0.

Kittredge retired from the game and Appleton took his place. The ball was kicked to DePauw's 30 yard line. DePauw made 25 yards and lost the ball to Appleton on a fumble. DePauw soon got the ball on downs and advanced it to within 4 yards of the goal line when time was called. Score 16-0. The line-up was as follows:

DePauw.	Rose.
Walker . . . R. End I. . .	Likert.
Blakley . . R. Tackle L. . .	McLellan.
Pierson . . R. Guard L. . .	Kittredge—Appleton
Tucker . . . Center . . .	Thompson.
Brown . . . L. Guard R. . .	Peker.
Ellis . . . L. Tackle R. . .	Davis, Capt.
Fisher . . . L. End R. . .	Stone.
Haines . . . Quarter . . .	Jumper.
Kuykendall . . R. H. B. . .	Huthsteiner.
Davis L. H. B. . .	Glenn.
Pulse—Nelley . Full B. . .	Meriwether.

SECOND ELEVEN vs. INDIANA STATE NORMAL.

Saturday, October 29th, our second eleven prepared to do battle with our yearly adversary the Indiana State Normal. Formerly the teams have been so unevenly matched that the game was a walk over for Rose from start to finish, but this year the teams were more evenly matched and consequently the game was more interesting and exciting. The Normal team under careful coaching and continual practice combined with their exceptional weight are able to put up a game which is not to be ridiculed for lack of science. Only one or two of their last year's players are on the team and for men unaccustomed to the game as the Normals are they certainly put up an excellent game. The second eleven had not had as much practice as was to be desired, but nevertheless was in fair condition and showed itself capable of competing with a team of much heavier weight. Although it was by no means a case of weight against skill, still the Normals had much the heavier team.

In the first half Pfleging kicked to I. S. N., who made several short gains through the line and one around the end. Here they were held and tried to punt but failed and lost the ball. Wilbanks carried the ball forward 15 yards. Several good gains were made through the line and then Nicholson made 12 yards around the end, Dickerson made good gains through the line and Wilbanks carried the ball over the line for the first touch down. Edwards kicked goal and the score stood 6-0.

I. S. N. kicked to Wilbanks who advanced the ball 10 yards. After several short gains the ball was lost to I. S. N. on a fumble. The Normals carried the ball rapidly down the field by numerous rushes through the line. Peck made several good tackles, but our line was unable to withstand the vicious onslaughts of the Normal backs who broke through repeatedly making short but telling gains. Their plays around the end were less effective, and were not very frequent. The ball was soon pushed over the line and an attempt to kick goal resulted in a failure. Score, 6-5.

Peck kicked to I. S. N. and after a few rushes time was called with Rose in possession of the ball near the center of the field.

In the second half I. S. N. kicked to Tallmadge, who failed to advance the ball. A short gain through center by Dickerson and a similar gain by Wilbanks around the end and Rose was held and the ball delivered to I. S. N. on downs. Again the Normal backs bucked the line and with telling effect, but in an attempted end play Rose secured the ball and by repeated gains through the line by Dickerson and short end runs by Nicholson and Wilbanks the ground previously lost was speedily regained. Several fumbles were made and by one of these I. S. N. secured the ball, but Edwards obtained the ball on a fumble and Rose was carrying it down the field 6 and 7 yards at a time when time was called with the ball 20 yards from goal. Score, 6-5.

INDIANA STATE NORMAL.**ROSE POLY INST.**

Douglass	R. End. L.	Edwards
Morris	R. Tackle L.	Pfleging
Houch	R. Guard L.	Hadley.
Smith	Center	Appleton
Clements	L. Guard R.	Kelton
McCracken	L. Tackle R.	Tallmadge
Masey	L. End R.	Lyons
Kimmel	Quarter	Peck
Pierce	R. H. B.	Nicholson, Capt
McGrew	L. H. B.	Wilbanks
Wilson	Full B.	Dickerson

Referee: Jumper.

Umpire: Davis.

SECOND ELEVEN VS. TERRE HAUTE HIGH SCHOOL (?).

Saturday, Nov. 5th our second eleven lined up against an aggregation of foot ball players who pleased to call themselves the representatives of the Terre Haute High School. They may all have been enrolled as students at the High School at some previous time, but it is evident that most of them have at present no claim to that distinction, and if so they surely do no credit to that institution.

In order to secure a game with T. H. H. S. the management of our second eleven was rather lenient and allowed them to play a man who had

no connection whatever with that institution. Exemplifying their disposition they took advantage of this concession on our part and attempted to run in more players of the same sort. This started a discussion which lasted for some time and during which the High School team proved to possess as much stubbornness and bull-headedness as they lacked principle. The numerous spectators began to get impatient and some of the High School rooters indignantly demanded their quarter back or a game. Under these conditions the game was started.

The wind was blowing strongly across the campus and rendered accurate kicking impossible. The whistle sounded and Hadley, R. P. I. kicked the ball high into the air, the wind carrying it over the line. Hadley kicked again to Beauchamp on the 15 yard line. Jumper attempted to tackle but missed him and then Peck attempted a difficult tackle, but again Beauchamp eluded him and was not stopped until he reached the 20 yard line, where Wilbanks made a fine tackle and downed his man. In falling Beauchamp injured his right ankle and had to retire from the game. After a gain of 4 yards more T. H. H. S. was held for downs and the ball was given to R. P. I. After a short gain the ball was fumbled and was again in possession of T. H. H. S. Again they were held and the ball given to R. P. I. No gain, another fumble and the ball was lost to T. H. H. S. who by three brilliant line plays pushed Fortune over the line for a touch-down. Richards attempted to kick goal but failed. Score 5-0.

After the second kick-off the ball was held for some time near the center of the field but Rose gradually worked it to within 30 yards of goal where by good runs Wilbanks and L. Kittredge carried the ball forward 15 yards. Another High School player was retired from the game and the teams again lined up with but 15 seconds to play. The ball was snapped back and R. P. I. made a gain of 9 yards. Here it was demonstrated that the High Schools, must win if not by fair means by foul, for Referee Dubridge called the players back claiming that

the ball was not in play. The ball was again put in play and Wilbanks by a brilliant end run carried it behind the goal-posts. Nicholson failed to kick goal. Score 5-5.

In the second half the High Schools' worked in a portion of Uncle Sam's army in the form of Private Whitlock of Company B. T. H. H. S. kicked to Pfleging who was downed in his tracks. R. P. I. had to forfeit the ball to the High Schools' on account of downs. By repeated gains through the line and several good end runs Whitlock was finally pushed across the line for the second touch-down. Richards kicked a very difficult goal making the score 11-5.

Hadley kicked the ball out of bounds and in another attempt kicked the ball between the goal posts. It was brought out 25 yards and given to the High Schools. By repeated gains through the center the ball was carried down the field for another touch-down by Fortune. Stevens and Peck made several good tackles, but our line was not strong enough to withstand the repeated attacks by the High School (?) heavy weights. Richards failed to kick goal and the score remained 16-5. The line up was as follows:

T. H. HIGH SCHOOL.		ROSE POLY. INST.	
Cox	R. End L.	. . . . .	Stevens
Bailey	R. Tackle L.	. . . . .	Hadley
Cook	R. Guard R.	. . . . .	Kelton
McClosky	Center	. . . . .	Fishback
Boyce	L. Guard R.	. . . . .	McKibbon
Glenn	R. Tackle R.	. . . . .	Pfleging
Woods-Goldburgh L.	End R.	. . . . .	C. Jumper
Thornton	Quarter	. . . . .	Nicholson, Capt
Richards	R. H. B.	. . . . .	Wilbanks
Fortune	L. H. B.	. . . . .	L. Kittredge.
Beauchamp-Woods	Full B.	. . . . .	Peck

Referee, Dubridge; Umpire, Kimmel.

REPORT OF COMMITTEE ON ATHLETICS.

The following letter which is copied from the *Terre Haute Gazette* of November 8th explains the result of the investigation which President Mees instigated, in order that the faculty might be thoroughly advised before any action was taken:

To the President of the Rose Polytechnic Institute:

SIR:—The faculty committee on athletics report that the charges made in the *Indianapolis Journal* and repro-

duced in the Greencastle *Banner-Times* and the Terre Haute *Gazette* with reference to the conduct of Mr. Stone in the DePauw-Rose foot ball game appear to do Mr. Stone an injustice. So far as the committee can learn from interviews from our players and one member of our Faculty, who was present, the charge of "dirty playing" should be transferred to Mr. Fisher, a member of the DePauw team who played opposite to Stone. The evidence is that Mr. Fisher struck our men repeatedly. Mr. Davis says that he was hit deliberately in the face by him. Mr. McLellan says that he was struck by Fisher below the belt in an effort to lay him out. Mr. Thompson says that Fisher deliberately kicked him in the face, and that afterwards when he told him he was a dirty player, Mr. Fisher replied that he knew it and was proud of it. Mr. Glenn states that while he was down with the ball, with his face on the ground, Mr. Fisher jumped upon his back with an oath and struck him three times on the back of his head, and that he had a swelling as large as his fist from it afterwards. Mr. Stone states that he pulled Mr. Fisher off of Mr. Glenn and struck him twice, and that this is the foundation of the charge against him.

The general testimony is that Mr. Fisher played foul throughout the game, and admitted it to the umpire who did nothing in the matter, and that he is desirous of a reputation as a rough player.

The students say that the reporter who wrote the article in question for the Indianapolis *Journal* came upon the grounds in defiance of the rules, rendered himself obnoxious by insulting remarks to our players, and urged the opposite side to injure our best players so as to put them out of the game, and that a player of the opposite side was heard to say to him. "Now watch me, I am going to do some slugging." He is believed to be a student of DePauw University and was finally put off the grounds by one of our men, Captain Davis.

The committee regret that Mr. Stone should have so far forgotten himself as to strike an opposing player,

however great the provocation. While the circumstances do not warrant the charge made against him, the committee recommend that in future DePauw-Rose games Mr. Stone and Mr. Fisher be informed that if in any case or under any provocation foul play be made they will be immediately excluded from the game.


A. S. HATHAWAY, Chairman.

NOTES.

Systematic work in the gymnasium will be taken up as soon as the football season closes and the weather prohibits the continuation of out-door exercises.

Under the new system of management the constitution and by-laws of the Athletic Association are being revised and remodeled to suit the existing circumstances.

The football team have but one more game scheduled and that is with DePauw on the Rose Tech campus, Thanksgiving, Nov. 24th. The management is financially embarrassed at present on account of the loss incurred by previous games and it therefore becomes the duty of the students to attend and assist so far as possible in the DePauw game. The team has steadily improved and are now on an equal with DePauw and if cheered on by their fellow students, feel confident of success. The game however will be hotly contested for as the visitors are prepared to put up their best game of the season. It is earnestly hoped that the students will do all in their power to make the game a success.



for better or for worse as the case may be. So, high above the arch of the main entrance where the eyes of the engineer, with head up, are ever soaring, they left their memorial.

THE SCIENTIFIC SOCIETY.

The association opened its programme for the year with perhaps a little more than the usual ceremony, Saturday, Oct. 15th; a new lease of life seemed very much in evidence from the fact that the meeting was given a place during regular school hours and all four of the classes were in attendance.

Dr. Gray responded to the invitation of the society's president, Butler '99, and kindly opened the meeting with a short appropriate address. He spoke on behalf of the faculty in regard to their willingness to grant time for meetings so long as they could be made profitable and general interest is taken by the student body. Speaking further he touched upon the merits of the work and of the results to be obtained by interested co-operative work. Certainly our education is incomplete without some study and practice along this line.

Helmer, '01, read a paper at this meeting on the "Generation of Acetylene." The paper was both historical and descriptive of the present day methods of acetylene manufacture from calcium carbide. The merits of the gas and a comparison with ordinary coal gas were discussed quite extensively. His paper was illustrated by experiments giving the commercial and laboratory methods of preparation.

The second meeting was called at four-thirty, Thursday, October 27th, Kidder, '00, reading first. His paper "The Ship Canal Locks at Sault St. Marie" contained a condensed chapter of their history and a more extended discussion of the new locks. Twelve lantern slides prepared from photographs taken by the reader while witnessing the operation of the locks, and others taken during their construction, made the paper very instructive. Brewer, '00, followed with a paper on "Modern Naval and Coast Defense Guns." The paper was perhaps a little

more extensive than most of those delivered before the society and showed a very close study of the subject; screen projections were used in illustrating. The manufacture and efficiency of the shrunk jacketed guns and wire wrapped guns were discussed at length; the breech mechanism of various types were given in detail.

RESOLUTIONS OF CONDOLENCE.

Learning of the bereavement of our classmate, Cubitt B. Symth, in the loss of his mother, we tender to him as our classmate and friend, our most sincere sympathy.

October 25th, 1898.

THE CLASS OF '99.

Wishing to assure Mr. T. D. Witherspoon, Jr., of our sincere sympathy in his bereavement, in the loss of his father, we tender to him this simple message.

THE ASSOCIATE EDITORS OF THE TECHNIC.

RESOLUTIONS OF CONDOLENCE—CLASS OF 1900, R. P. I.

Whereas, Mr. Thomas D. Witherspoon, Jr., our classmate and friend, has suffered the loss of his father, the Rev. Dr. T. D. Witherspoon, be it

Resolved, That we extend to him our most sincere expressions of condolence.

CLASS OF 1900.

NOTES.

The September number of *Modern Machinery* contains an illustrated article upon the Rose Tech.

A considerable amount of testing of metals for physical properties is being carried on in the mechanical laboratory for outside parties.

Several electrical measuring instruments have been sent by the Wagner Electric Co., of St. Louis, Mo., to be standardized in the electrical laboratory.

Two especially constructed scales for weighing the reactions in the bridge models recently constructed in the shops, are being made by the Fairbanks Scales Company.

It is a good policeman who can prove that a Freshman daubed and bedribbed with paint of a peculiar shade, has even *heard* of any of the freshly-painted inscriptions about town.



Chas. Gray, ex '96, is with the Dayton Ohio Gas Light & Coke Co.

A number of Freshmen are taking special work in the Chemical Laboratory.

R. W. Scott, ex '98, is in the office of the C. & C. Electric Co., at New York City.

J. H. Loofbourrow, '00, has returned to Rose Tech, much to the joy of his many friends.

Harry Holt, ex '93, later of Purdue University is with the Brownell Boiler Co., of Dayton, O.

Appleton, '00, has been tried in the position of center on the foot ball team with good results.

We are indebted to 'Arry for the following rigorous definition, "A cylinder is anything with a hole in it."

A Senior trip? Who dares to mention it? April is to be devoted exclusively to practice, what a chance!

A Freshman wants to know if when a circus goes abroad it is customary to collect duty on the elephant's trunk.

Prof. Wickersham: "Mr. Schwable, will you please read the next." Smyth, '99, just waking from a nap: "I can't read this" ——— and the "break" cost him a zero.

A considerable amount of outside work is being done in the shops in the way of designs for special machines. A large number of patterns for the Kester Electric Co. have just been made in the wood shops.

The Freshman-Sophomore "scraps" have been honored by publication, not only in the Terre Haute papers, but in several Indianapolis

dailies as well. By the time the story had gotten as far as the latter, it had developed from a modest affair between a few of each class to a bloodthirsty struggle in which one class was nearly annihilated.

We suppose no one can guess on what sort of occasion Burge, '02, used the following words to a few of his attentive schoolmates, "I'll play on my mandolin for you, if you won't take the rest of 'em off."

Half of the Fall Term is passed—Thanksgiving is almost here, and only five weeks until the examinations. Some hard plugging will have to be done, and absences made up, or there will be a day of reckoning.

Members of the class of '98, interested in Gerwig, ex '98, can get the information of his whereabouts from Brachmann, '98; the two passed through the city en route to St. Louis early in November.

An article summarizing the experiment upon "Electrical Strength and the Value of Insulating Materials" made under the direction of and by Dr. Gray, will appear in the next number of the *Physical Review*.

Dr. Gray favored the Seniors with a short lecture on the stability of floatation of ships, his remarks upon the physiological as well as the mechanical effects of extremely short rotary motions were very interesting.

Little as one would think that a street fair was an important feature in the course of the Rose Polytechnic Institute, its importance was nevertheless proved by the diligence and application

with which every student devoted himself to the mastery of every detail in it.

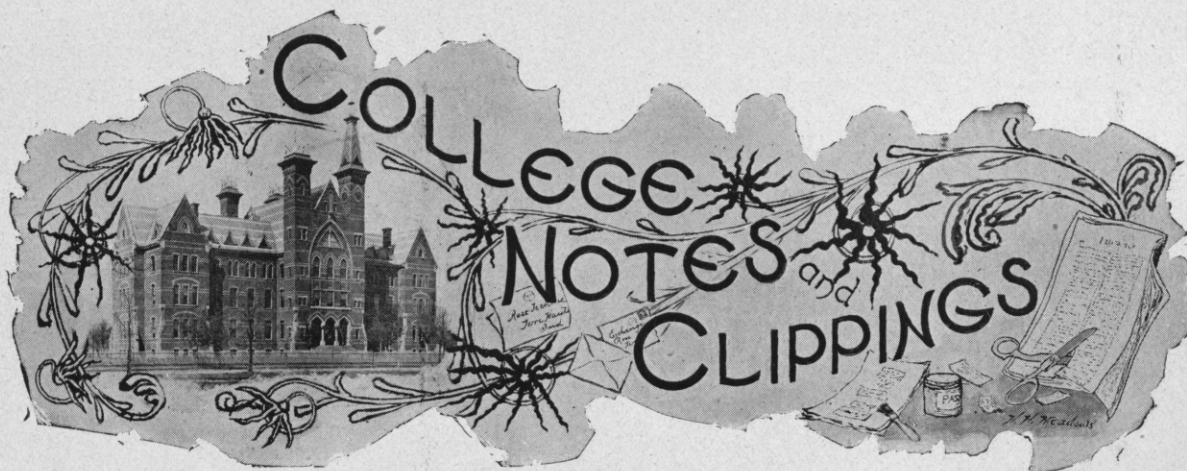
A collection is being made of the samples of various building and constructional materials which show peculiarities of breaking and fractures. These will be placed in the museum with full data as to strength, weight, etc.

The game between the team of the class of '99 and a picked team from the three under classes resulted in a tie, 0 to 0. This was undoubtedly the hardest fought and most interesting game for both spectators and participants of the year.

The morning after a Freshman raid on the Sophs, Wilbanks, '02, who takes Sophomore Chemistry, told Dr. Noyes that he had been to several Sophomore's rooms the night before, but for some reason or other had been unable to get the notes on the last lecture. The Doctor looked much surprised at the laughter that greeted this.

The shop has been crowded with work for the past two weeks, and has been running at night to fill orders for outside parties. The duplex pump which the Junior class has been constructing is ready to be assembled. The three-phase alternating current dynamo, designed by one of the Senior class last year, is under construction, all of the castings being ready, and work has been started on finishing the various parts.

Nature repeats herself. Does the natural order of events recur at the Rose Tech? Reviewing the catalogues and bound volumes of the *TECHNIC* we are inclined to say that in a large measure it does. This is necessarily so, but looking further we are proud to find an ever prevailing tendency towards improvement. How quickly an alumnus visiting the Institute notices these changes! Do the present students appreciate all of their privileges?



Knox College has a weekly this year called "*The Knox Student*."

The students at Ann Arbor have subscribed funds for a "players bed" or hospital for wounded foot ball men.

The *Aerolith* comes printed half in German and half English hence only five eighths of it has been reviewed. That paper must be sent in two months ahead of time if justice is expected.

The October number of *Vassar Miscellany* is a

Fiction number and is a production for which great credit is due the editors. We are always glad to receive the *Miscellany*, probably because the tone is so decidedly remote from engineering, but the October number is better than usual.

During the past two or three years more time and energy have been spent in perfecting the electrical furnace than ever before. This is to a great extent due to the increasing demand for calcium carbide. There are several problems

set before the engineer in designing these furnaces to work inexpensively. While an intense heat is thus produced it is very costly and devices must be arranged which will turn nearly all of the current into useful heat. *Electrical World*, Oct. 22, has a very complete history of this style of furnace, up to date, and with illustrations of the different types.

University of Illinois has been adding to her library this summer and the *Illini* publishes a list of about 300 volumes of current fiction. Unless abused this is a valuable addition. There are times when after long study a man turns with real pleasure to something like "Landlord at Lion's Head" because he can be entertained without any expenditure of energy.

Boston Tech is to have a trophy room. The walls will be decorated with pennants and cups won at various meets and photographs of track teams taken each year. Institute magazines and societies are to have desk room or book cases if desired in which papers or reports may be filed from time to time. This is an excellent scheme and should be adopted generally.

Since the introduction of Mechanical Engineering into the curriculum of Colorado Agricultural College fifteen years ago, the scope of the work has been extended to such a degree that there was not sufficient room to carry on the investigations desired. During the coming year a new mechanical laboratory is to be built and fitted with the most improved machinery and instruments for testing.

Some experiments in the line of Chapel exercises are being carried on at Indiana University. The present plan is to have meetings of the student body bi-weekly at which college notices may be given out and at which some noted lecturer or public man of prominence may address the students. Meetings of the entire student body is absolutely essential to the promotion of college spirit, but the length of interval between such meetings is a question that admits of discussion. Compulsory daily chapel has been generally proven undesirable and there is reason to believe that the plan adopted by I. U. will make the students look forward to chapel as a bright spot rather than a bore.

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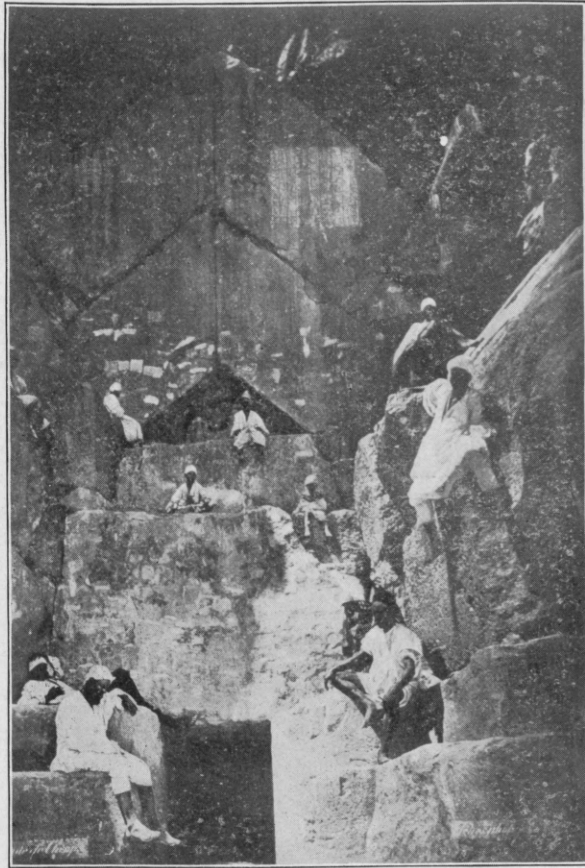


Fig. 1. Entrance to Great Pyramid. (4000-3000 B.C.)

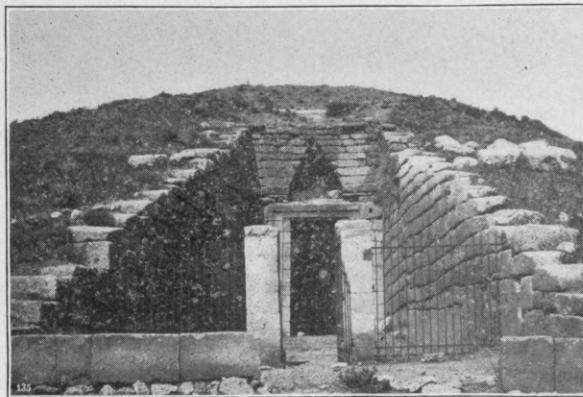


Fig. 2. Entrance to Treasury of Atreus Mycenae (about 1000 B.C.)



Fig. 3. Cloaca Maxima, Rome. (615 B.C.)

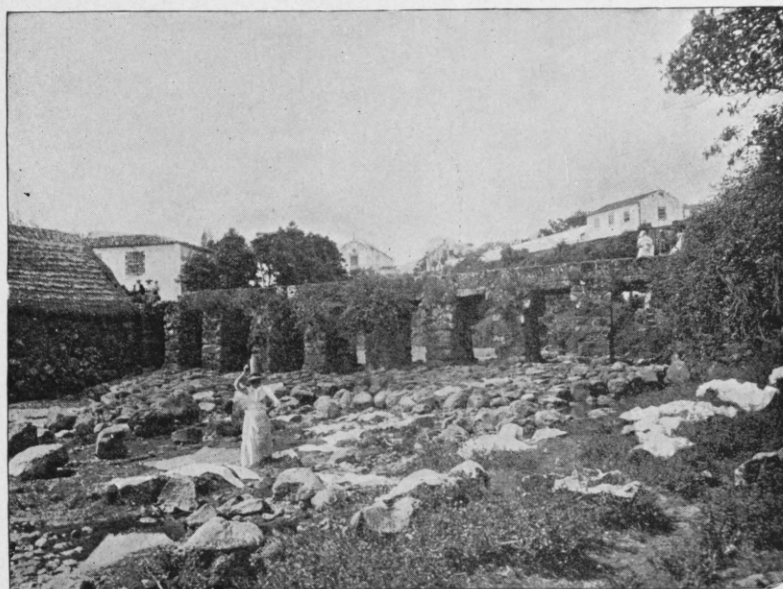


Fig. 4. Valley of Flemengos, Fayal, Azores.

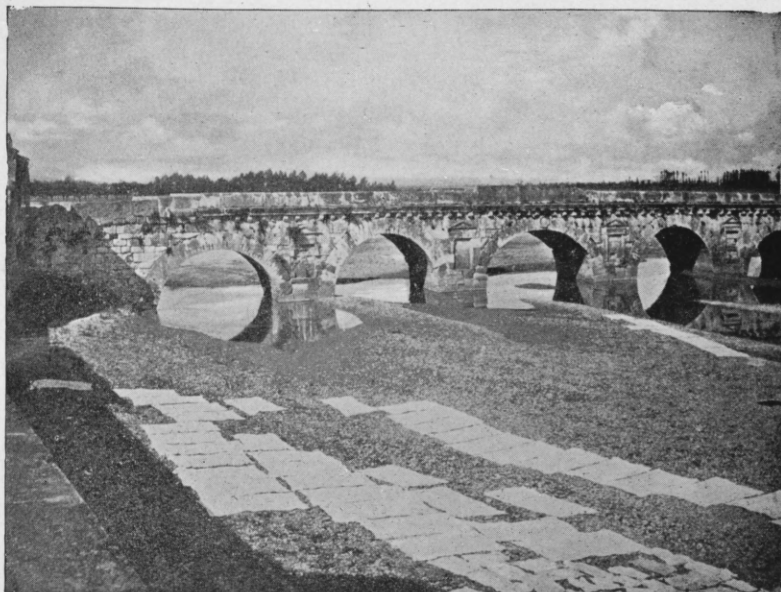


Fig. 5. Bridge of Augustus, Rimini, Italy. (27 B.C.-14 A.D.)

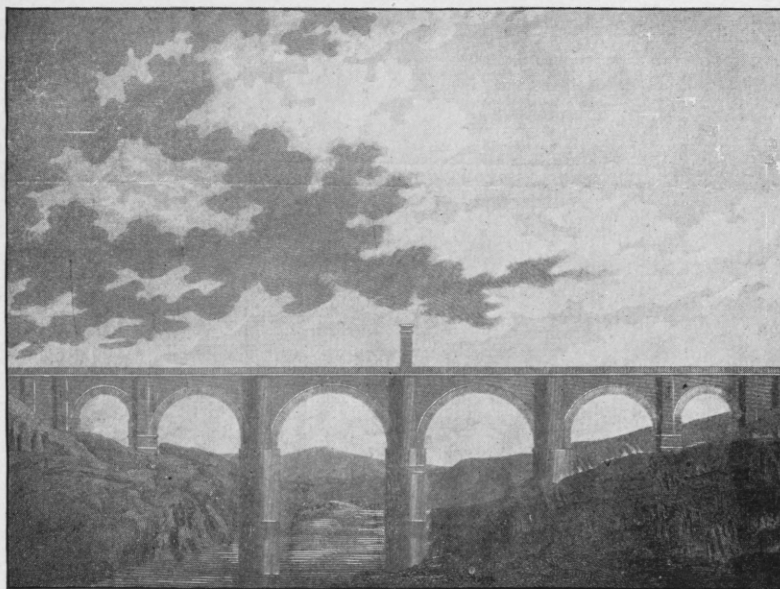


Fig. 6. Old Bridge at Alcantara, Spain. (104 A.D.)

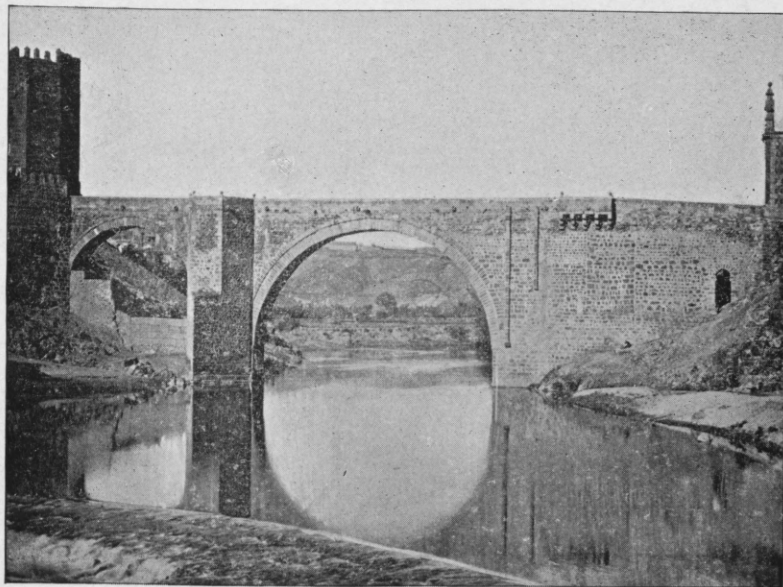


Fig. 7. Bridge of Alcántara, Toledo, Spain. (997 A.D.)

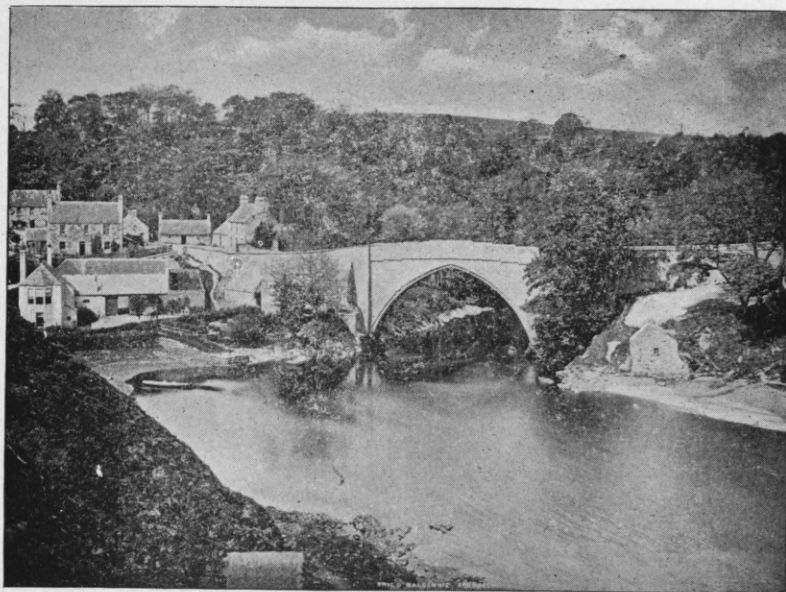


Fig. 8. Brig o' Balgownie, near Aberdeen, Scotland. (1281 A.D.)

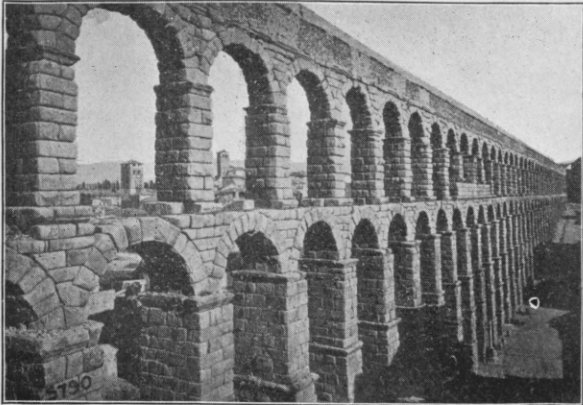


Fig. 9. Aqueduct Bridge, Segovia, Spain. (104 A.D.)



Fig. 10. St. Benezet's Bridge, Avignon, France. (1176-1188 A.D.)

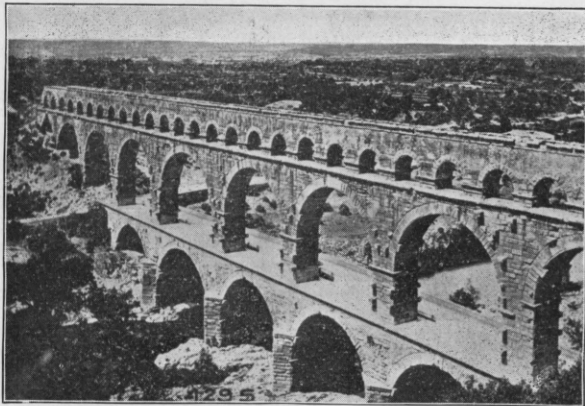


Fig. 11. Pont du Gard, Nîmes, France. (27 B.C.-14 A.D.)



Fig. 12. Comparative Modern Chinese Arch.



Fig. 13. Old Charles Bridge, Prague, Austria. (1357-1507 A.D.)

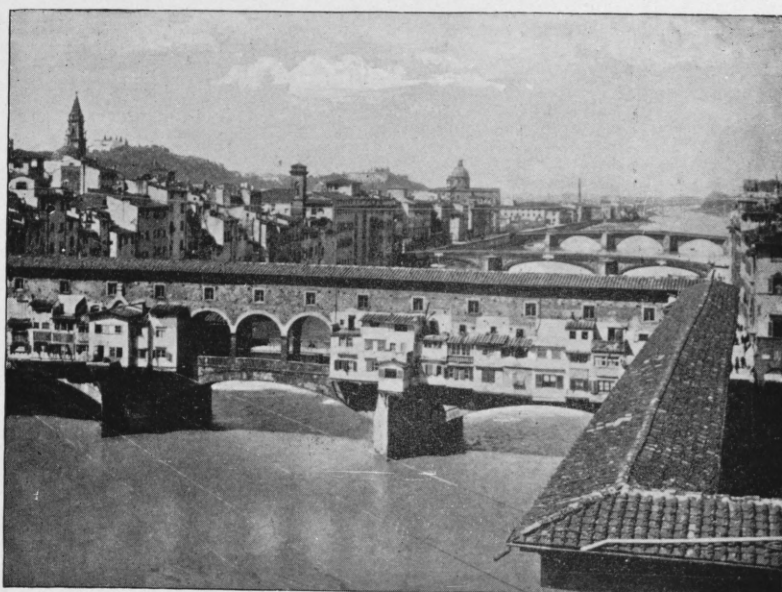


Fig. 14. Vecchio Bridge, Florence, Italy. (1345 A.D.)



Fig. 15. The Rialto, Venice, Italy. (1588-1591 A.D.)



Fig. 16. Dunkeld Bridge, Dunkeld, Scotland. (1809 A.D.)



Fig. 17. Pont San Martín, Toledo, Spain. (1203 A.D.)



Fig. 18. The Rialto, Venice, Italy. (1588-1591 A.D.)

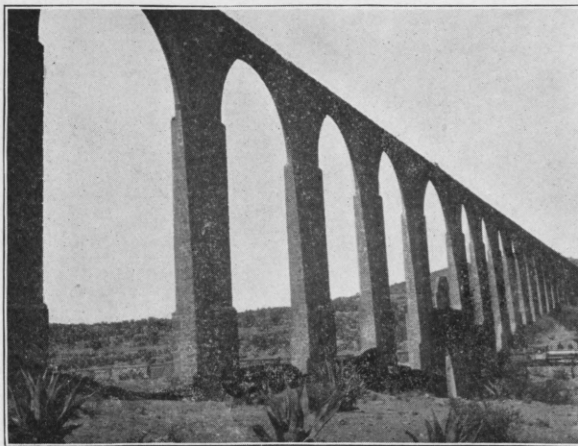


Fig. 19. Temploalá Aqueduct, Mexico. (1553-1570 A.D.)

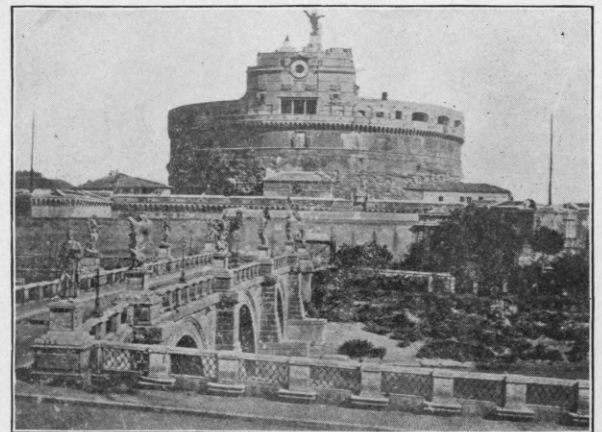


Fig. 20. St. Angelo, Rome, Italy. (135 A.D.)

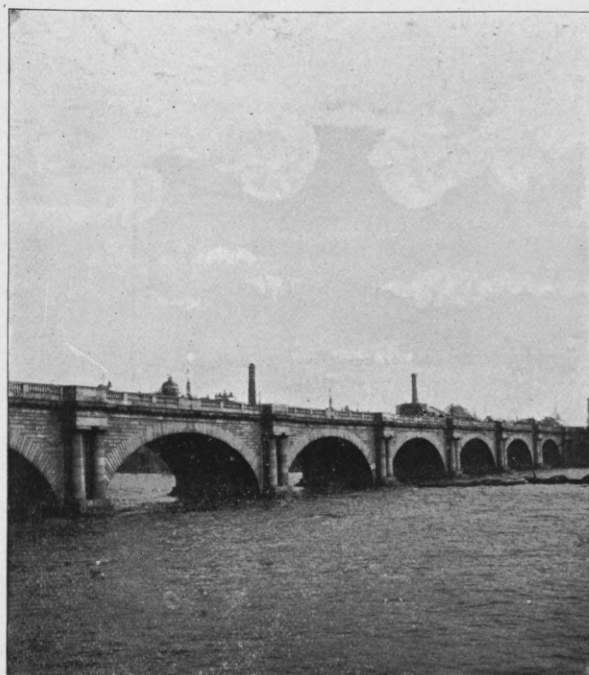


Fig. 21. New Waterloo Bridge, London, England. (1817 A.D.)

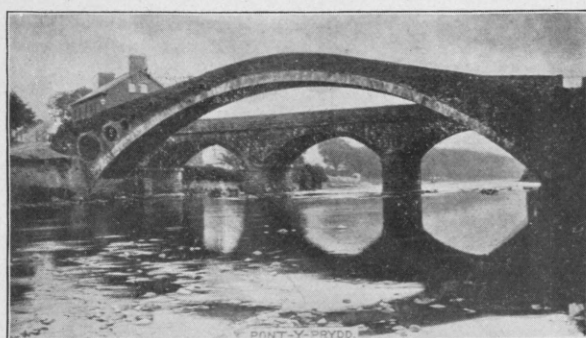


Fig. 22. Pont-y-Prydd, South Wales. (1755 A.D.)



Fig. 23. New London Bridge, London, England. (1824-31 A.D.)



Fig. 24. Bromielaw Bridge, Glasgow, Scotland. (1833-36 A.D.)

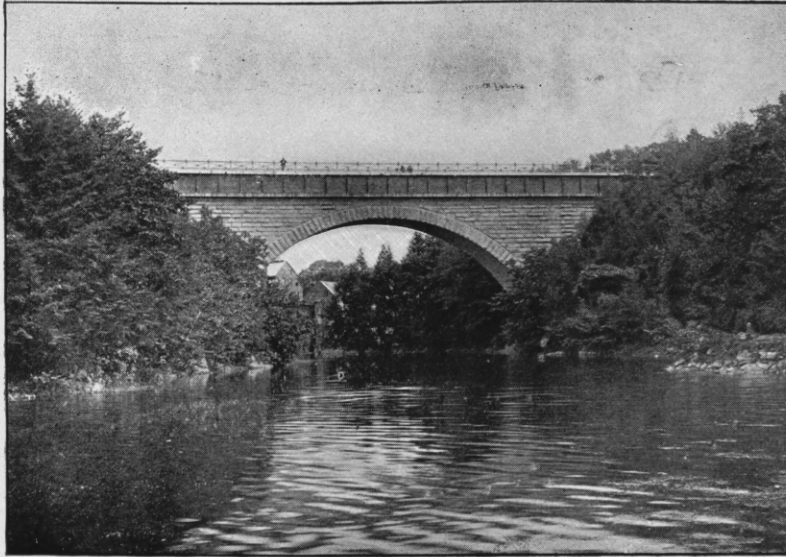


Fig. 25. Echo Bridge, Newton Upper Falls, Mass. (1876 A.D.)



Fig. 26. Waldföhren Ry. Bridge, near Bludenz, Austria. (1884 A.D.)



Fig. 27. Main St. Bridge, Wheeling, W. Va. (1892 A.D.)

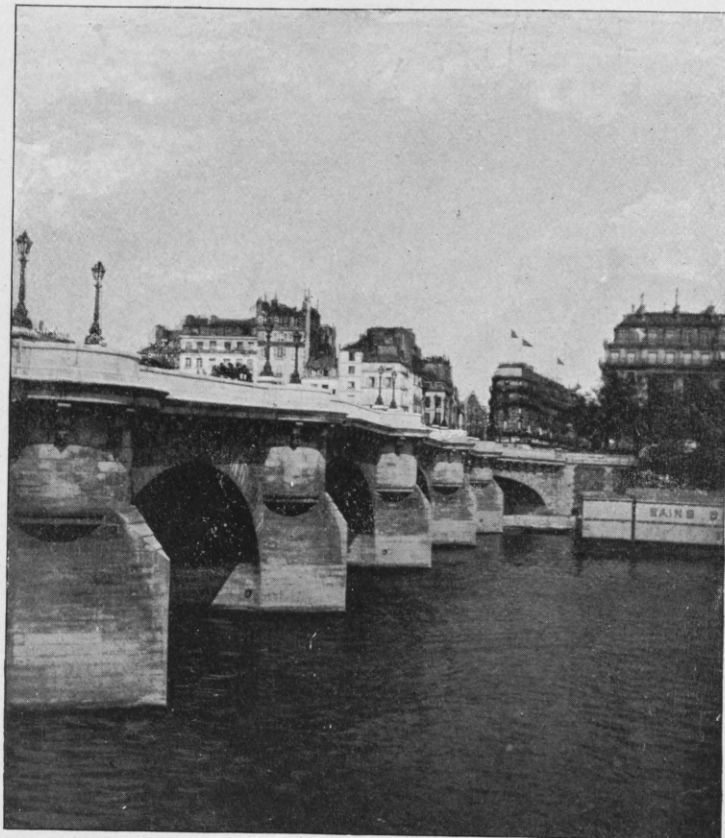


Fig. 28. Pont Neuf, Paris, France. (1578-1604 A.D.)

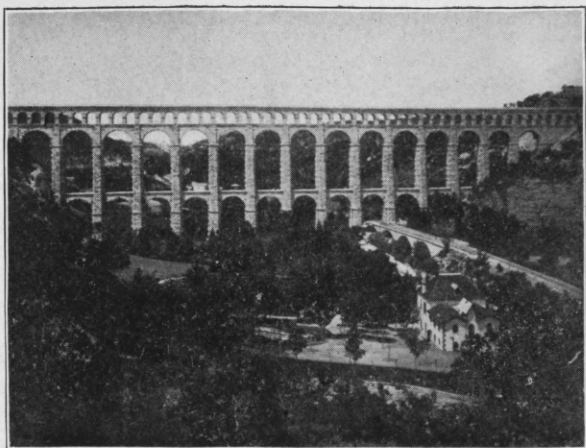


Fig. 29. Roquefavour Aq. Marseilles, France. (1841-47 A.D.)

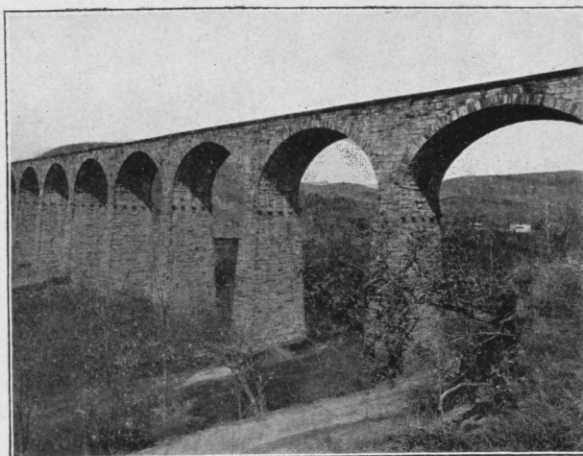


Fig. 30. Starrucca Viaduct, near Lanesborough, Pa. (1847 A.D.)

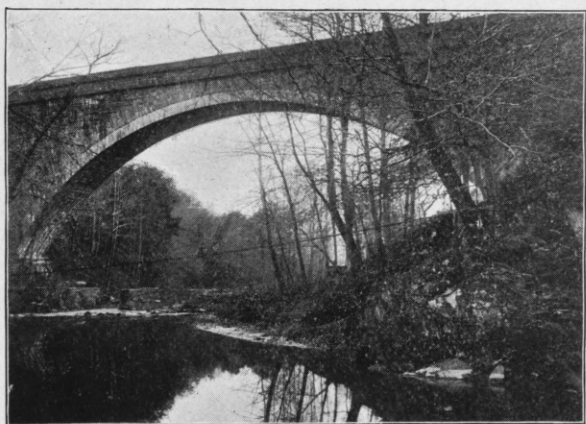


Fig. 31. Cabin John Bridge, Washington, D. C. (1852-59 A.D.)

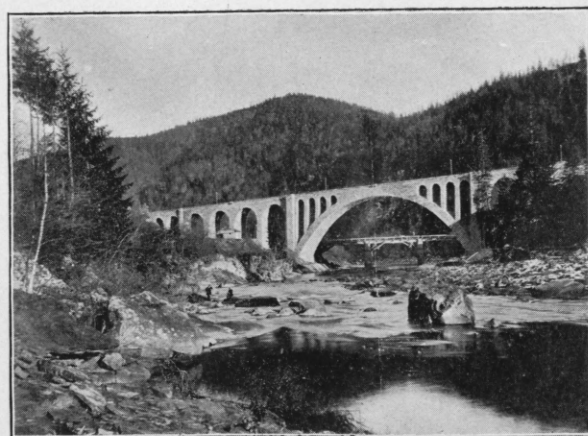


Fig. 32. Jaremcze Ry. Bridge, Eastern Austria. (1892 A.D.)

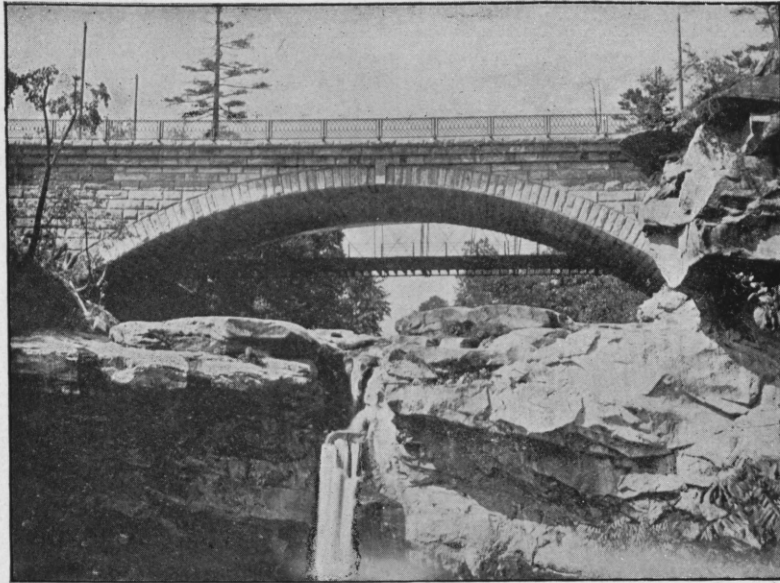


Fig. 33. Lodi St. Bridge, Elyria, Ohio. (1894 A.D.)

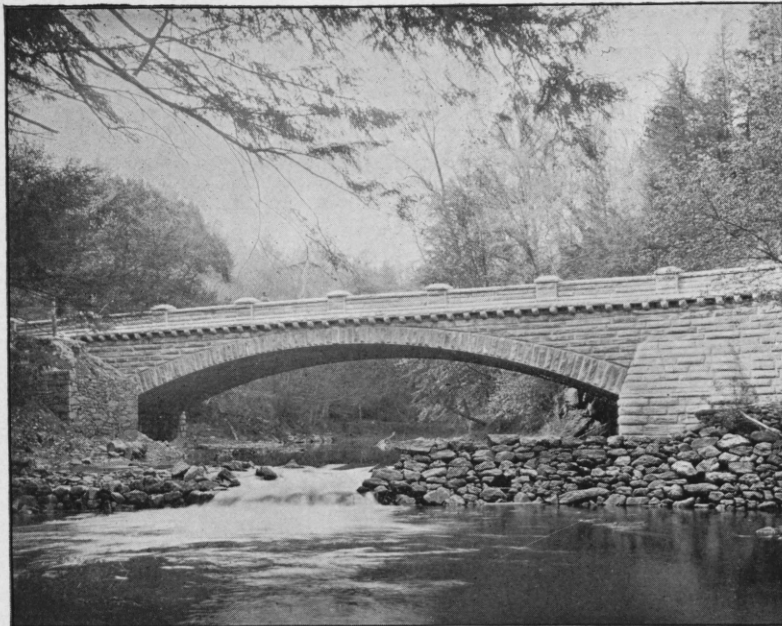


Fig. 34. Wissahickon Bridge, Philadelphia, Pa. (1897 A.D.)