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The Wisconsin Engineer

VOL. XXII OCTOBER, 1917 NO. 1

ENGINEERING MAGAZINE MAKES FIRST APPEARANCE

List of Engineers in Gov't Service Feature of Initial Issue

"The Engineering Magazine" will make its first appearance of the present school year on the campus today. A leading feature of the magazine is a list of recent graduates and undergraduates of the College of Engineering who have gon into government service and includes a brief survey of what these men are doing and where they are.

Two articles of special interest to engineers are a part of this number, one on "Protection of Street Traffic at Highway Drawbridges," by Prof. L. F. Van Hagan, and another entitled "The Contractor's Superintendent," written by W. A. Rogers, '88, president of the Bates and Rogers Construction Company of Chicago.

[illegible] number of campus notes in the magazine include a list of faculty changes in the College of Engineering. Faculty changes have occurred in almost every department, a number of faculty members having gone into the service of the government.

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WISCONSIN ENGINEER

The Wisconsin Engineer

VOL. XXII OCTOBER, 1917 NO. 1.

The 1917 and 1918 Honor Roll

Editor's Note: It is desirable to leave a record, as complete and accurate as possible, of the response made to our Nation's call in this hour of need by the students and the faculty of the College of Engineering. We most earnestly hope that you will give your assistance and co-operation toward this end. Bits of news, extracts of letters, and material of similar nature will be welcome and should be given to some member of the Staff or dropped into the mailbox of the WISCONSIN ENGINEER at the entrance of the building.

BENNETT, J. GARDNER, c '18, U. S. Navy, Ensign; Ass't Paymaster.

BOND, AUBREY H., c '17, Coast Artillery Corps, Regular Army, Second Lieutenant, The Presidio, San Francisco.

BOSTWICK, G. L., e '17, Electrical Service, First Class Electrician, U. S. Navy.

BROWN, HERBERT H., c '17, Infantry, First Lieutenant.

BROWN, HUGH F. J., c '18, Motor Transport Service, American Field Service in France.

CASE, PERCIVAL F., m '17, Ordnance Dep't.

CASEY, THOMAS B., c '17, Field Artillery, Second Lieutenant, O. R. C., Camp Custer, Battle Creek.

DRAKE, RONALD I., ch '18, U. S. Navy, Electrical Dep't, Third Class Petty Officer, U. S. S. Agamemnon.

ELLISON, ELWOOD C., e '17, Heavy Artillery, Sergeant; C. A. Co. 11, F. M. T. C., Fort Sheridan, Ill.

EVANS, W., c '17, Artillery, Second Lieutenant, Camp Custer, Battle Creek, Mich.

FANTA, E. K., m '17, R. O. T. C., Fort Sheridan, Ill.

FARLEY, JOHN L., e '17, Infantry, Regulars, 44th Inf., Second Lieutenant, Vancouver Barracks, Wash.

FOWLER, DWIGHT S., c '17, Field Artillery, Private, Camp Grant, Rockford, Ill.

GEISSE, J. H., m '17, Aviation Corps, First Lieutenant.

GOCKEL, ARTHUR P., ch '17, Infantry, R. O. T. C., Ft. Benjamin Harrison, Indianapolis, Ind.

GOLDAMMER, CHARLES J., e '17, U. S. Naval Reserve, First Class Electrician, Quincy, Massachusetts.

GOULD, S. G., c '17, Field Artillery, R. O. T. C., Ft. Sheridan, Ill.

GOULD, S. W., ch '19, U. S. Military Academy, Cadet, West Point, New York.

GOWER, ARTHUR W., e '17, Coast Artillery, Second Lieutenant, Fort Banks, Winthrop Center, Mass. (Now in France.)

GRAMS, RAYMOND C., e '18, R. O. T. C., Fort Sheridan, Ill.

GREGSON, WILLIAM F., m '17, Field Artillery, Second Lieutenant, 329th F. A., Camp Custer, Battle Creek, Mich.

HAGEN, A. E., m '17, R. O. T. C., 3rd Btry., 2nd P. T. R., Fort Sheridan, Ill.

HALLOCK, N. C., c '17, Infantry, Second Lieutenant, 339th Infantry, Camp Custer, Battle Creek, Mich.

HANSEN, WALSO G., m '18, Infantry, First Lieutenant, U. S. R., Co. No. 13, Ft. Sheridan, Ill.

HANSON, MALCOLM P., m '18, Naval Radio Service, Electrician (radio), Class No. 1, U. S. N. R. F., Class No. 4.

HARTUNG, RAY C., e '17, First Class Electrician.

HELMLE, WILLIAM C., ch '17, Field Artillery, Private, Camp Grant, Rockford, Ill.

HENDERSON, BURNIE O., c '17, Coast Artillery, Second Lieutenant.

HOLLING, HAROLD H., m '18, Aviation Service.

HOPPE, ALFRED G., m '17, Infantry, Second Lieutenant, 337th Infantry, Camp Custer, Battle Creek, Mich.

JEHLE, C. W., ch '17, ~~R. O. T. C., Fort Sheridan,~~ Ill. Inspector of Ordnance Muskegon

JENKINS, JAMES W., e '17, Field Artillery, Second Lieutenant, 16th U. S. F. A., Camp Robinson, Wis.

JOHNSON, WILLIAM S., c '17, Heavy Coast Artillery, F. M. T. C., Fort Sheridan, Ill.

JOHNSON, RUSSELL S., ch '18, Officer's Training Infantry, Private.

JOHNSON, ROBERT C., c '17, Engineering Corps, Second Lieutenant.

JONES, VICTOR H., e '17, U. S. Naval Reserve, Seaman, Second Class.

KALVELAGE, CLEMENS, e '18, Engineer's Battalion, Sergeant, Company B.

KAUFFMAN, CLARK E., m '17, Illinois Naval Reserve, First Class Machinist's Mate.

KELTY, ASHER E., m '17, Aviation Section, First Lieutenant, S. E. R. C., Chanute Field, Rantould, Ill.

KNOTT, RICHARD F., Jr., m '17, Heavy Artillery, Second Lieutenant, Ft. Dade, Florida.

LANGE, HERBEL A., m '18, Engineering Corps, Waco, Texas.

LANE, R. K., m '17, Field Artillery, 3rd Btry., 2nd P. T. R., Fort Sheridan, Ill.

LORD, HERBERT O., c '18, Infantry, Second Lieutenant, U. S. R.

LUDDEN, HOMER J., e '17, Field Artillery, Second Lieutenant, 329th Field Artillery, Camp Custer, Battle Creek, Mich.

MARTIN, B. HAROLD, e '17, Artillery, Second Lieutenant, 328th Reg. F. A., Camp Custer, Battle Creek, Mich.

McHUGH, KEITH S., ch '17, Machine Gun Service, Ordnance Dep't, First Lieutenant, Ft. Collins, Colo.

McMULLEN, C. A., e '19, Ordnance Dep't, Private.

MEAD, HAROLD W., c '18, Light Artillery, Second Lieutenant, 329th Reg. F. A., Camp Custer, Battle Creek, Mich.

~~MENDELSOHN, ISADOR W., c '17, Quartermaster Corps, Ass't Storekeeper, Washington, D. C.~~

MEYERS, PAUL W., ch '18, Heavy Artillery, Second Lieutenant, C. A. C., American Expeditionary Forces in France.

MIELENZ, H. F., c '17, Coast Artillery, Co. No. 11, F. M. T. C., Fort Sheridan, Ill.

NASH, LUCIUS B., e '17, Electrical, First Class Electrician, U. S. S., Salem.

NEWTON, L. C., m '17, R. O. T. C., 3rd Battery, 2nd P. T. R., Fort Sheridan, Ill.

OAKEY, WARREN, c '17, Coast Artillery, R. O. T. C., Co. 11, F. M. T. C., Fort Sheridan, Ill.

OESTREICH, CARL R., c '17, Quartermaster's Dept., Corporal. Newport News - Va.

OWEN, HALSEY F., m '18, Infantry, Second Lieutenant, U. S. R., 338th Inf., Camp Custer, Battle Creek, Mich.

PAMPERIN, ARNOLD T., e '17, U. S. N. R. F., Chief Electrician, Quincy, Mass.

PORTER, RAYMOND E., m '17, Ordnance Dep't, Second Lieutenant, Bridgeport, Conn.

RAMSAY, RALPH E., ch '18, Infantry, Captain, Co. I, ~~No.~~ 39th Infantry, Camp Custer, Battle Creek, Mich.

RASMUSSEN, JOHN, c '18, Engineering Corps, First Lieutenant, U. S. R., No. 311 Engrs., 1st Lt. Co. A, Camp Grant, Rockford, Ill.

REINHARDT, J. A., ch '17, Bureau of Standards, Washington, D. C.

RICHARDSON, GLENN C., m '17, Aviation Service, First Class Private, U. S. Aviation School, Urbana, Ill.

SAECKER, CARLETON E., m '18, Coast Artillery, Second Lieutenant, C. A. C., Fort Levett, Maine.

SCHAPER, HAROLD H., m '19, Field Artillery, Second Lieutenant, stationed in Northern Alaska.

~~SCHLOSSER, WILLIAM C., e '18, Infantry, Private.~~

SCHMIDT, EDWIN X., m '18, Coast Artillery, R. O. T. C., Ft. Sheridan, Ill.

SCHRADER, HERBERT E., m '18, Infantry, Private.

SCOTT, ALLISON F. H., m '17, Experimental Division, U. S. Signal CORPS, First Lieutenant, Langley Field, Va.

SEARIGHT, H. F., min '17, Field Artillery, R. O. T. C., Leon Springs, Texas.

SHNABLE, EARL POTTER, m '18, U. S. Navy (Submarine Service), First Class Machinist's Mate.

SHUFFLEBARGER, F. G., c '17, Infantry, R. O. T. C., Fort Sheridan, Ill.

SINNEN, FREDERICK E., e '17, Infantry, Private.

TYRRELL, DONALD W., ch '17, Coast Artillery, Second Lieutenant, C. A. C., Ft. Stark, Newcastle, New Hampshire.

WADSWORTH, RANDOLPH L., m '17, Field Artillery, First Lieutenant, Somewhere in France.

WYATT, RALPH M., e '17, Coast Artillery, R. O. T. C., Fort Sheridan, Ill.

~~ZAHORIK, PETER A., e '18, Infantry, Private.~~

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THE CONTRACTOR'S SUPERINTENDENT*

W. A. Rogers, c '88, C. E. '97

President, Bates & Rogers Construction Co., Chicago, Ill.

Some of the vital questions to be answered by the civil engineering student about to graduate are: "What am I going to do when I leave college, what form of work will I take up, will I go into railroad work, power development work, bridge work, or will I perhaps go into the employ of a contractor?" Only a few senior engineering students have positions secured before finishing their course. I imagine that many of you are wondering, just as I did before graduating from this university in '88, what you will find to do and whether the position secured will be that for which you are best qualified. Your ideas are perhaps more or less indefinite as to the different kinds of work which an engineer may be called upon to do. Many young men who apply to me for positions with our company, in response to the question as to what kind of a job they want, reply that they "want to do anything." Their knowledge of what their work would be, if employed by a construction company such as ours, is often very vague.

With this in mind when I was asked to speak to you, it seemed to me that it might be of value to you if I would describe the work of the contractor's superintendent, and what his characteristics should be. It is with peculiar pleasure that I speak to you today. I have watched the Engineering Department of the University of Wisconsin grow from 1888, when there was only one man besides myself graduating in the course, till now when you have reached the size and importance of to-

* An address delivered before the College of Engineering, University of Wisconsin, May 29, 1917.

day. My talk today might be called a sequel to the address made to the university engineers about twenty years ago by my employer and afterwards business associate, Mr. Onward Bates, ex-president of the American Society of Civil Engineers, whose subject was *The Railway Superintendent of Bridges and Buildings.*

What is a contractor's superintendent, what does he do, and what qualifications must he have to be successful?

The answer to the question: What is a contractor's superintendent? depends upon the contractor, upon the class of work done by him, and upon the employee. Contractors may be divided into two general classes: the specialists and the general contractors.

The specialists, confine themselves to one or more special kinds of construction, such as grading, masonry or concrete, paving and sewer work, buildings, steel erection, foundations and substructures, and so on. Their work is often done largely with their own organization without subletting to others. The other class, the general contractors, take work which may include construction of many different kinds, and they frequently sublet the different classes to the specialist contractors just mentioned. For instance, a general contractor agrees to build a railroad line, involving the construction of grading, masonry, tunnels, bridging, terminals, track-laying, ballasting, etc. He then sublets the work to other contractors in short sections, in which case the sub-contractor will do all work of any kind on the section, or according to the class of the work, in which case each specialist sub-contractor will do all work of a particular kind on the whole undertaking.

When a contractor secures more work than he can handle personally, it becomes necessary for him to employ some one to manage at least part of it. This employee is ordinarily called a superintendent. His duty is to represent the contractor in the management of the work and in his dealings with the principal or client. The authority he may have in any case depends upon the people he is working for and upon himself. He may, in reality, represent the contractor, both in the management of the contract and in his dealings with the client and others. For all practical purposes he is the contractor, managing the work in all its details, and being responsible for results only. In this case the general policy would be laid down by the contractor, and the plant to be used and its lay-out would be settled in conference with the contractor. The superintendent would deal directly with the client and would settle minor matters without reference to the employer. Even in this case the superintendent is necessarily guided by the general policy of the company, especially where it affects other contracts which the company may have. In other cases the superintendent may be required to refer every little detail to his employer, either because he is not big enough to have greater responsibility placed upon him or because the employer himself desires to handle all details. The ideal case is the one in which the superintendent is big enough and competent enough to manage and is responsible only for results.

Under our plan of organization we place a superintendent on each contract. If the work is all in one location and of sufficient size, the superintendent usually has a general foreman on whom the details of the management fall and to whom the various foremen report. If the work is scattered, there may be one or more assistant superintendents, or in the case of grading work, what is known as a walking-boss. All clerical work is handled by the superintendent's clerk who has such assistants as he requires. To him the timekeepers, material men, and commissary clerks report. When the contract is of sufficient magnitude, an engineer is assigned to the superintendent. His duties are to measure and keep track of the work done and make any plans or calculations which may be required. He might, for instance, be called upon to make a plan of a pile driver, or design sectional concrete forms, or sketch the lay-out of the plant. He is expected to check with the client's inspectors and engineers to make sure that our work is correctly measured and classified. A position of this kind offers excellent training for that of superintendent. You will notice that this organization is practically the same as if the superintendent were a contractor with only one job.

To give you an idea of the superintendent's duties we will follow through the operation of an imaginary contract. The first thing to be done is to prepare the bid for the work on which we have been asked to make a proposal. In order to learn the local conditions we first have one or more of our superintendents investigate the proposed work on the ground. They examine the foundation sites, the material to be excavated, and the location of sand and gravel pits; determine the available local supply of all other materials, and look up the roads from the nearest railroad over which material may be hauled, the local supply of labor, and the prices to be paid for both labor and material. A study is made at the site, of the method of handling the work and the plant required. After finishing the local study they investigate other points from which materials may be obtained and determine what the material from such points will cost.

After these investigations have been made, the next step is to make an estimate of the unit cost of each item in the contract. This estimate is based on the cost of labor and material for each item, plus a proportion of the general expense. The term "general expense" includes items of expense not covered by labor and material, such as superintendence, liability insurance, bond, depreciation of plant, small tools, supplies, fuel, traveling expenses, buildings, loss on camps, and innumerable other items. Costs should be based upon records of similar work, adjusted by judgment to fit the work in hand. After the men have prepared their estimates of costs, a consultation is held and their figures are subjected to a critical analysis each item being considered in detail. There are often wide variations in ideas regarding costs, which must be thrashed out and reconciled. When the revised estimate of cost is finally agreed upon, it ordinarily represents the combined judgment of three or more men. The margin of profit desired is now added and the bid made up and presented to the prospective client.

If the proposal is attractive and the work is awarded to us, a superintendent is assigned to the contract and his job of organizing begins. A general foreman, experienced in that particular line of work, and a clerk, are detailed from our organization. Then foremen, timekeepers, and the rest of the organization are selected. In the meantime, in consultation with our office, the method of handling the work is fixed, the plant required is determined upon, and the assembling of the same is started. The successful outcome of the contract depends to a large extent upon the proper selection of the plant and the proper lay-out of the work. For instance, if grading is under consideration, is it steam shovel, drag-line, or team work? If shovel work, how large a shovel and what size of cars are to be used? Does the work require standard gauge equipment with heavy locomotives and 12-, 16-, or even 24-yard cars; or, are smaller cars with narrow gauge "dinkies" best? And so each detail must be decided upon. If concrete work is under consideration, the type of distributing system must be decided; whether the chuting system will be employed or whether the concrete will be distributed by cars or by buckets handled by derricks. Then the mixing plant with charging-hoppers and other details must all be worked out. Any new plant required is bought and that which we have in stock is loaded and shipped to the work. It may come from other contracts where it is not needed or from a storehouse. In the meantime arrangements for materials have been made. On securing a contract, we ordinarily protect ourselves as far as possible by closing for all of the material required during the life of the contract.

The superintendent, with a nucleus of his force, gets on the job, picks his camp site, builds camps, puts his roads in shape, gets the material, plant, and organization coming, and starts work. The selection of a camp site is an important matter, depending upon the lay of the land, water supply, accessibility, and many other considerations. With the help of the general foreman the organization is licked into shape. It is now up to the superintendent to keep his eye on the job and keep it lined up. He must so organize and handle the work that every one pulls together, so that it goes along with a swing. Of course this is impossible unless he plans each operation in advance and every foreman or straw-boss knows before he is up against it just what he is going to do next. It is possible on going onto a job, to feel that everything is going along swimmingly or that the work is disorganized. Just as one riding in an automobile, can tell whether every cylinder is working or whether one or more of the cylinders are missing, so you can tell whether or not the force is hitting it up well.

As soon as possible after getting started, it is our plan to have the superintendent make out a schedule showing the dates upon which he plans to start and finish each operation. For instance, if he is building the substructure of a bridge, he estimates the date of starting and finishing the excavation for each pier or abutment; when he will build each cofferdam; start and finish pumping; start and finish driving piles; and start and finish the concrete. This schedule is made up with the idea of completing the work well ahead of the completion date named in the contract. The dates are revised from time to time as the work progresses. There are many advantages in having this schedule. In the first place, it means that the man in charge, in order to make it up, must necessarily plan the job through in all its details. He has before him at all times, a schedule of what is to be done next and it keeps him prepared for the next move. Then, too, his organization will have a pride in keeping up with or beating, the schedule. It acts as a pace-maker for the men on the job. It serves as a guide by which the main office can check the progress of the work from time to time.

As the job progresses the superintendent is constantly in touch with the client. In addition to handling his actual work he must see that the engineers furnish him plans and instructions, and make their decisions far enough in advance that he can properly arrange for each operation. He must keep everlastingly after the engineers to have them prepare for the work, or he runs the risk of being tied up. Engineers often do not realize the importance of giving instructions as far in advance as possible so that the contractor may look ahead in his preparations. The superintendent, or his assistants, must constantly keep after the delivery of material required. There is rarely a good excuse for getting out of material.

A good superintendent has constantly in mind two things. First, in order that the contractor shall stay in business, he must turn out good honest work, and make friends of the clients by doing a first-class job and completing it on time. In other words, quality of output should be his first consideration. He may occasionally have to restrain over-zealous foremen who have the idea that it is to the advantage of his employer to skin the work. Secondly, the good superintendent must also remember that, in addition to turning out a first-class job, he must do so at a profit, or his work is not a success. To do this he must be everlastingly after the loose ends, watching for improvements of methods and for economy of materials and supplies. He must look out for close buying, cut out unnecessary work, and in every way lessen the cost of construction. With this in mind, he should know at all times what his work is costing. He should keep, from day to day, the costs of the different units in order that he may know at all times how these costs are running. He must be able to put his finger on any trouble before it is too late. Each man naturally will work out just how he can best handle this personal cost check. These data would be more in detail than that required by the general office.

During the progress of the work a diary, or log of progress, and running history of the work should be kept. This should cover a record of any orders or instructions that have been given. This record is important as history to settle any disagreements which may arise. Each day's notes should be initialled by the superintendent or by the person involved in any occurrence of importance. When the contract is completed the final estimate is checked, and any adjustments of matters which may have been held open until the end are taken up and settled.

How are men trained for this responsible position? We believe the best way is to train the men inside the organization—from the bottom up. Starting at the bottom, the man becomes familiar with the duties of the men in the various steps of progress upward; he becomes saturated with the ideals of the company and becomes familiar with its particular methods of handling the work and system of cost records; he gets to know the men. He may start as a timekeeper, or commissary clerk, as material man, or even as a laborer, rising through the position of engineer on the work, or through foremanship, or through a clerkship in the office. It is largely a question of the qualifications and capabilities of the man as to just the line he takes. The things which go to make a successful superintendent are largely the same as those which make a successful contractor. These qualifications are both business and moral. He must be a good executive, able to judge men, able to place his forces so that each man is in the position for which he is best adapted. After organizing his force, he must be able so to inspire the loyalty of his men as to get the best out of them that they are capable of giving. His men will not be loyal unless he treats them fairly. I do not mean by this that he must be easy; an easy boss is never respected. He should know what a day's work is and be able to get it out of his men. The good superintendent will take good care of his men and will furnish a good camp and substantial food. He cannot expect good work unless his men are well cared for. A good business head is a prime necessity. He will deal with all kinds of men, and he must have the business instinct so developed that he can see quickly whether any particular act will pay as a business proposition. He must have ever before him the thought that he is there to make a profit for his employer. Practical engineering sense well developed is a valuable trait; and while theoretical engineering knowledge is a good thing, what is really wanted is what I would call common sense or practical engineering knowledge. What I mean is that in addition to knowing why a thing is done or how to figure it out theoretically, he must know how to do it right at the least cost, that is how to construct economically what another man has designed. A detailed knowledge of the various pieces of machinery employed on the work is a fine thing, and the ability to operate any part of the plant if it becomes necessary, is very valuable. The man who can run a hoisting engine has an important acquisition. The good superintendent must be able to make decisions promptly and be quick to act in an emergency. Many emergencies arise when the superintendent must know what to do "right off the bat." I often think that the superintendent's training should fit him to be a diplomat, for he surely must use diplomacy in his dealings with his men as well as in his dealings with the engineer and client. The faculty of being able to get along with people is one that has definite value in money. It costs money to be constantly at variance with those for whom one is doing work. The habit of looking at things from the other fellow's standpoint as well as your own is a good habit to form. The other fellow, in the majority of cases, intends to treat you right. What should be done is to get him to see things from your point of view. If you make him angry, it is almost impossible to accomplish this. It may be very exasperating to have a young engineer, just out of school, full of theoretical knowledge but without experience, lay down the law and try to tell the experienced superintendent, who is conscientiously working for the employer, what to do. But it is the business of the superintendent patiently to train the young engineer in practical work, to make him understand that both are working for the same end and that the best results are obtained by working together rather than at cross-purposes.

A truly successful superintendent must be a man of good habits, of good moral character, and have high ideals. He must realize that honesty is not only the best policy, but is right, and that it pays to have the reputation of doing honest work. The old idea that a contractor, in order to be successful, must be what is known as a good fellow, inclined to drink, and do other things that he should not, in order to entertain the engineers and others, is obsolete. Any amount of drinking with a man or entertaining him will not help in attaining success; but, on the other hand, may have just the opposite effect.

A good address is a valuable asset. While appearances are only on the surface, sometimes the first impression made by the outward appearance is of vital important. If practicable the ability to express one's ideas clearly and forcibly in good language is invaluable. It is a sad fact that many of our college graduates cannot spell correctly. The longer I live the more I am impressed with the importance of being able to talk convincingly on your feet an accomplishment which I never acquired. The ability to go on a job and take it all in is also important. The habit of observation should be cultivated. Loyalty to the employer is, of course, essential. The man who does not have this quality is in the same class as he who receives money under false pretense, and has the making of a Benedict Arnold. If you are not in sympathy with the people you work for, you should get out. I believe that the superintendent should be constantly striving to widen his acquaintance with engineers, contractors and others with whom his company may later have business relations. He must always keep his eyes open to see how the other fellow does his work, ever ready to select better methods than those he is using. In doing this, he broadens his viewpoint and becomes a better engineer.

I have left to the last, two of the most important qualifications without which I believe it is impossible to become successful. The first is the willingness to assume responsibility. It is far better to do something and do it wrong than to do nothing. The man who is always waiting for some one to tell him what to do and how to do it, does not get anywhere. Take responsibility and put all that there is in you to do right what you have assumed to do. The other qualification is what I call "stick-to-itiveness." The quitter should never enter the contracting game for there is no place for him in it. What is wanted is the man who does the thing he starts out to do, in spite of good reasons why it can not be done; who does not know when he is beaten; who does not know how to quit. If there is a "yellow streak" or quitting streak in a man, he should never start in a career leading to that of a contractor's superintendent. We have in our organization men who when they set out to do a task, do it. We simply forget that it is to be done and assume that it is as good as done when it is turned over to them. That is the kind of man wanted as superintendent and that kind of a man is bound to succeed.

In closing I want to say that unless you are willing to go anywhere, do anything, and be on the jump every minute, you had better stay out of the contracting business. On the other hand, there is immense satisfaction in doing things, and in having a part in coping with the forces of nature and overcoming them. It is a fine thing to bridge a river, drive a tunnel, build a railroad, make a power development, and to realize that you have put part of your life into this work, and that the part that you have had in the work will live after you.

THE PROTECTION OF STREET TRAFFIC AT DRAWBRIDGES

L. F. Van Hagan, c '04
Associate Professor of Railway Engineering

The problem of equipping highway drawbridges with safety devices capable of giving adequate protection to street traffic has been increasing in difficulty with the increase in the weight and speed of vehicles. Many bridges are protected only by devices that are survivals of the day of the high-wheeled buggy and the team of spanking bays. Even now these simple devices might be sufficient if the people using the streets were careful; but the average plain person who makes up our great commonwealth is a careless fellow who takes all sorts of chances with a fine disregard for consequences, a fact which probably accounts for the great vogue of the safety-first movement. The idea of considering safety-first was novel and therefore appealing. If the average plain person were a person of prudence and foresight there would have been no novelty in the idea and consequently no appeal. As a matter of fact safety does not come first, nor even second, in the mind of the average person. Take, for instance, the matter of crossing a railway track. Most people will grant that a train, at forty miles an hour, is a poor thing with which to take chances, and yet a series of observations is said to have been made in St. Louis which showed that about ninety percent of the average plain person neither stops nor looks to right or left when crossing a track, just plunges blindly across on the chance that no train will catch him. Put into the hands of such naturally reckless people a powerful machine like the automobile, and cross their paths with drawbridges, and conditions are created that are bound to produce accidents.

For some years the writer has been gathering—without much system or effort it must be confessed—a list of drawbridge accidents occurring in his immediate part of the country. The list is now of considerable length, and a study of it seemed to justify the conclusion that it is time to bring this subject forward to see whether conditions cannot be improved.

The frequency with which automobiles are involved in drawbridge accidents is noticeable. The electric car and the motor-cycle are also frequent victims of their speed. It is these fast-moving vehicles which have rendered insufficient the ancient warning devices, the bells, the lights, and the chains, and have made the problem of protection a formidable one. Bells and lights are good so far as they can be depended upon; but they are easily put out of operation and then they are guilty of the most heinous crime a signal device can commit,—they give a false indication of safety. The driver, depending upon the lights and bells to warn him if the draw is open, fails to receive the signal and is in the water almost before he realizes his danger. A number of bad accidents have happened from this cause. It is beginning to be recognized that warning bells and lights alone are insufficient protection, that some sort of a barrier is necessary. There is difficulty, however, in devising a barrier that is effective and at the same time harmless, a barrier that will stop a heavy, fast-moving vehicle without damaging it or its occupants or being itself damaged. Simple chains are sometimes used as barriers; but they are neither sufficiently conspicious nor sufficiently sturdy. An automobile or a street-car can break them.

There are three types of drawbridges in common use today, first, the old-fashioned swing bridge; second, the bascule bridge; and third, the vertical-lift bridge, each of the three presents a different problem to the designer of barriers.

The vertical-lift bridge and the open end of a one-leaf bascule bridge present similar conditions and may be equipped in a similar manner. Figure 1 shows the type of gate used with success on the Oneida street bridge at Milwaukee. The barrier consists of a heavy girder which is held down below the floor by the weight of the leaf when the bridge is closed and is raised to position by counterweights when the leaf is raised, the action being entirely automatic. The girder is supported by cables which are located in posts, one of which is visible in the photograph. A policeman, or other city employee, takes position at the gate when the signal is given and keeps watch on street traffic. This type of gate is effective as a barrier since it can be made very substantial. It is not entirely safe, however, as an incautious person might be caught between the leaf and

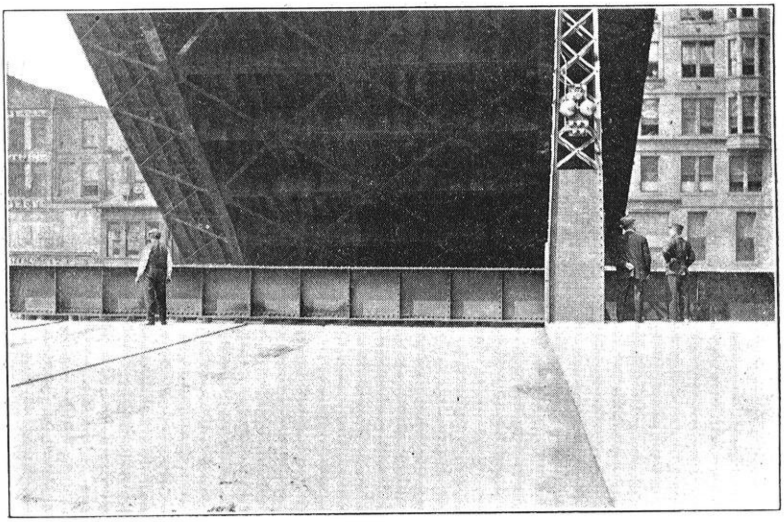

FIGURE 1

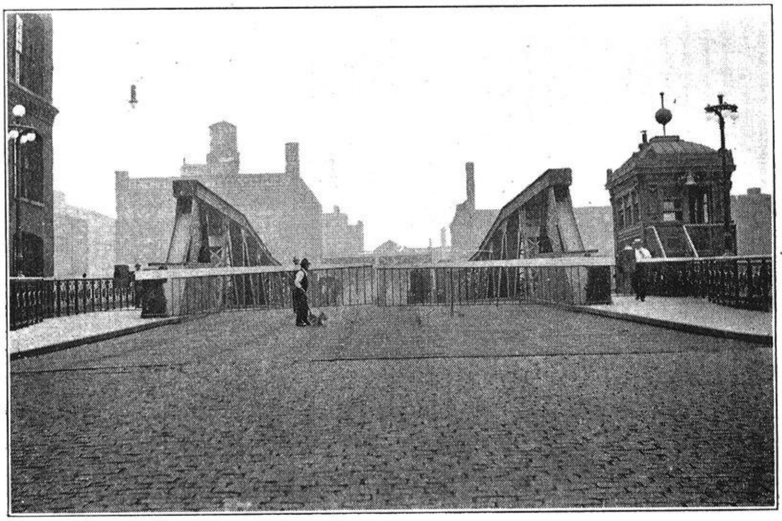

FIGURE 2

the gate. Pedestrians have a tendency to lean on the gate and, with their attention fixed on the passing vessel, may fail to note the descending span. A gate of this type, installed on Pennsylvania Avenue bridge in Sheboygan, Wisconsin, was not successful owing to a tendency to stick if it did not come up perfectly horizontally. The vertical-lift bridge at Halsted Street in Chicago, has stiff vertical gates that are said to be working satisfactorily.

One of the incidental advantages claimed for the bascule type of drawbridge is that the raised leaf acts as a barrier to street traffic and makes accidents impossible. The record of accidents, however, shows that the bascule bridge is by no means immune. While it is true that the raised leaf is an effective barrier, it does not furnish adequate protection while it is in the act of rising. It is apparent that some further protective devices are needed and this need is now being recognized and gates provided for this type of bridge. The railway crossing gate type has gained considerable popularity as a bridge gate, particularly for bascule bridges. Figure 2 shows the gates on the Washington Street bridge at Chicago. They are provided with flashing lights for night use. These particular gates are not automatic nor are they interlocked with the machinery that operates the lift span. It ought to be a simple matter so to interlock the gate control with the control for the drawspan that the closing of the gates before the opening of the draw would be ensured. So far as known this has not been done in any case. Attempts have been made, however, to make this type of gate act automatically. The City of Oshkosh, which has done a good deal of successful experimenting along this line, is said to have tried this type as an automatic gate on the Main Street bridge. Owing to mechanical defects it never gave satisfactory service and, after two or three years, the gates were removed. A set of automatic gates of this type was designed for the State of Connecticut for use on the Saybrook bridge. They gave no trouble from the mechanical side, but were unsatisfactory because they failed to keep traffic off the moving span. The arrangement was such that the gates began to rise before the leaves of the bascule were completely closed. The traffic was largely automobiles and, as soon as the gates lifted sufficiently, the drivers started forward and onto the moving span. These gates were replaced by independently-operated, motor-driven gates of standard railway type.

Although gates of this type are not very substantial barriers and are neither automatic nor interlocked, the type has several commendable features. It is a well developed, standard device, readily obtainable and easily installed; it is said to be excellent

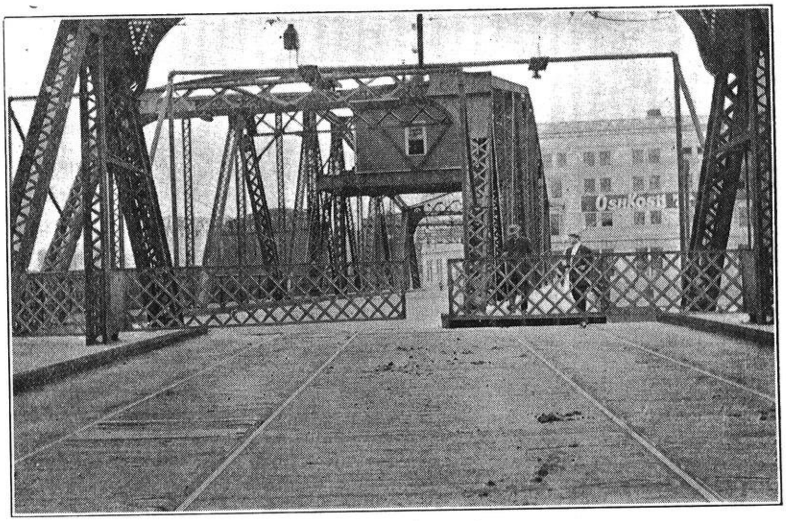

FIGURE 3

as a signal; its motion is vertical so that it may be closed readily even when the roadway is crowded; and finally, it does not, in itself, constitute a danger to street traffic.

The two-leaf bascule bridge at West Algoma Street in Oshkosh is equipped with power-operated gates which, when not in use, fold back in line with the curb. In closing they swing against the traffic. They are substantially constructed and form a fairly effective barrier although they would undoubtedly be damaged by a heavy automobile or electric car. They were installed in 1913 and up to the present time have given satisfactory service. There have been no repairs in over four years.

The Lake Street bridge at Chicago is said to be equipped with a cushion barrier that has stopped an electric car, moving at ten miles an hour, in a distance of ten feet without damage.

The details of this barrier are unknown to the writer; but apparently it is similar to the chain barriers used on the Panama Canal to prevent ships from striking the gates of the locks. This device seems to offer considerable promise as a safe and effective barrier against heavy, fast-moving vehicles.

Swing bridges are more difficult to protect than the other types since the power and the operator are on the moving part detached from the approach spans upon which the gates must be located. Figure 3 shows a set of Faust automatic gates installed on the Main Street bridge at Oshkosh. They are shown partly folded back as the bridge closes. Two pedestrians will be noted in the national pastime of taking a chance. The gates were installed in 1911 and have operated satisfactorily ever since. Before the installation of the gates two automobiles, five bicyclists, and a number of pedestrians went into the river at various times while the bridge was open. Two of the accidents resulted fatally and one of them cost the city several thousand dollars. Since the installation a number of cases have occurred in which the gates, in all probability, prevented similar accidents. In one instance an automobile was driven between the gates while they were being closed and was caught. The damage to the car and to the gates was slight.

The Light Street bridge in Oshkosh is equipped with the Rideout automatic gates. These gates, when completely closed, meet at an angle, so that in case pressure is applied, they act as an arch instead of as cantilevers. The mechanism is extremely simple and has been satisfactory except that it prevents the drawspan from turning a complete circle. It is desirable that swing bridges should turn end for end in order that the wear on the rollers and track may be uniform. Since their installation the gates have proved their value in several instances. In one case a run-a-way team attached to a heavy truck crashed into the gates. The horses, although one of them was thrown down, were unhurt. One of the gates was slightly damaged but could be operated.

Conversation with the bridge tenders on both the Main and Light Street bridges made it clear to the writer that these men were convinced of the value of the protection the gates afford. They state that since the gates were installed, they experience much less anxiety over the possibility of accident while the draw is open. There is a third swing bridge at Oshkosh equipped with automatic gates and the expense for maintenance on all three is said to average about $25 per bridge per year.

The matter of furnishing adequate protection to street traffic at drawbridges has already begun to attract the attention of the law-makers, and some attempt has been made to meet the situation by legislation. In 1913, the Legislature of Wisconsin passed an act (Chapter 518, Laws of 1913) giving the Railroad Commission of the State power to require those parties responsible for a drawbridge "to erect and maintain at such points such safety gates or other safety devices of such kind as it may describe." In 1916, the mayor of Boston appointed a special committee "to consider methods of safeguarding highway drawbridges," which committee, after a brief consideration of the subject, made certain general recommendations. Since this problem undoubtedly will come sooner or later, to the attention of the law-makers, the engineers should be prepared to assist them at the proper time by having well crystallized ideas of what constitutes adequate protection under modern traffic conditions; otherwise unfortunate restrictions may be placed upon the development of such protection. In Wisconsin, for example, the original draft of the bill above mentioned, specified that the bridges should be equipped with "automatic safety gates, or other suitable devices, which gates or other devices shall operate automatically." In spite of the fact that the framer of the bill had in mind automatic gates that were in actual operation on two of the bridges in his State, the engineers who were consulted in the matter, felt that the automatic gate was not sufficiently developed to justify requiring that type exclusively and, upon their advice, the bill was modified so as to eliminate that requirement.

In conclusion, the writer would offer the following as a list of the requirements to be fulfilled by a safety gate designed to afford protection at a highway drawbridge:

1. It should be reliable in its action, forming a barrier across the roadway whenever the bridge is open. This would require that the gate be either automatic, or, if power-controlled, that the control be interlocked with the control of the draw span in

such a way that the gate must be closed previous to the opening of the draw.

2. The gate should be closed completely before the drawspan commences to move. None of the existing types of automatic gates is able to accomplish this, the complete closure occurring after the draw has started to move. The best that can be hoped for with the automatic gate is to cut the time interval between the beginning of the operation and the complete closure to a minimum making it so small that there will be no possibility of a vehicle passing the gates during that interval.

3. The gates should act as a barrier against pedestrian as well as against vehicle traffic.

4. The gates should be strong enough to stop automobiles or street cars going at moderate speed. It is doubtful whether it is practicable to construct a gate that will stop such vehicles going at high speed.

5. The gates must not be dangerous to traffic. There should be no possibility of pedestrians or animals being injured by them. They should stop street cars, automobiles, and runaway horses without injury to either the traffic or the gate.

6. The gate should be as simple in construction as possible. This will reduce the liability of it being put out of operation either by ordinary use or by accident, and will reduce the time necessary for repairs in case of accident. It will reduce the maintenance charge.

7. The gate should be plainly visible by day and by night. Warning bells and lights should be used in connection with the gates.

DEVISING A TEST FOR INSULATING FIBER

J. B. Emerson, B. S. '99
Consulting Engineer, Robert W. Hunt & Co.

The St. Louis laboratories of the Robert W. Hunt & Company have recently completed extensive research work for the purpose of determining the normal characteristics of a good track insulating fiber. At the same time an effort was made to determine common defects which might result in poor service so that these might be eliminated in due time. Tests were to be devised which would develop both the good and bad qualities of a material and which could be applied to material on routine orders before it would be accepted from the manufacturer.

The Reinforced Rail Joint Company authorized these tests on account of the difficulty which it had experienced in fixing a proper specification under which to purchase fiber. The record of these tests will, perhaps, be of interest.

The lack of available information regarding this material, is indicated by a remark made by a chemist of one of the large manufacturing companies who is quoted as saying, "Despite the fact that the annual production of vulcanized fiber in this country exceeds 15,000,000 pounds, comparatively little is known either of the method of manufacture or of the properties of this widely used material. Books on industrial chemistry or cellulose products as a rule dismiss the subjects with a few words often inaccurate or misleading, and give in many cases the impression that vulcanized fiber is still largely in a visionary state interesting chiefly from the theoretical standpoint."

Practically all of the tests were made on end posts, as it was desirable to have the specimens of standard section in order to get convenient dimensions and a common denominator without mutilation. With one exception all of the brands tested have given fairly satisfactory service in the track. It was not the purpose of the tests to determine which manufacturer's product was superior, and the samples were therefore identified simply by stamped letters, A, B, C, D and X and this was the only information furnished to the testing engineers. Efforts were made to secure all data which might form the basis for a rational specification to govern the characteristics expected in this material, and which might possibly furnish information that would lead to improvements in its manufacture.

Fiber used for insulation in rail joints, switch rods, etc., is largely a synthetic horn produced by the hydrolization of cellulose through the fluxing action, so to speak, of a solution of some appropriate electrolyic salt. Zinc chloride is the principal agent used to effect this hydrolization. The subsequent processes of calendering and pressure, renders the material homogeneous with partial elimination of the salt solution. Subsequent digestions for prolonged periods in successively diluted salt solutions are necessary in order to remove the salt, which if allowed to remain in notable quantity, undoubtedly, exerts a harmful effect on the fiber by causing ultimate brittleness. These successive digestions with solutions of constantly decreasing concentration are necessary in order to avoid blistering and disintegration through osmotic pressure.

In considering possible tests on these samples, the subject was analyzed as follows: It is thought that weather is the agency most destructive to track fiber; hence a test involving saturation, freezing and heating of the fiber should be valuable, and a knowledge of the amount of the loss of integrity of the fiber through such treatment, if any loss occurs, is essential. It is thought further that a repeated boiling and baking of the fiber with a mechanical test intervening might be a greater punishment than the saturation, freezing and heating test, and more adaptable to laboratory work, as definite knowledge of the loss of integrity in the fiber would be obtained in a shorter period of time.

A mechanical test is needed that will show the loss of strength caused by the punishment. A mechanical test before punishment is otherwise of little value, for the punishment may develop a wide variation in the strength. A di-electric test is interesting, but not of much value, as almost any fiber will safely resist a much higher voltage than is ever used in the track. A chemical test for chloride of zinc and glycerine would no doubt be helpful to the manufacturer, but it is not important to the user.

It was decided to run three sets of tests, starting on the original fiber; the first test to include saturation, freezing and heating; the second, boiling and baking; and the third a chemical analysis. The general results of the first two tests are shown in the accompanying table, the percentages being in each case based on the original properties of the material. The analysis for chloride of zinc showed a content varying from 0.08 to 0.42 per cent.

It is to be regretted that time and facilities did not permit the introduction of the scleroscopic test to measure the elastic limit of the material in compression, tension, and shear, as well as the factor of malleability and surface hardness. An examination with a petrographical microscope, either in section or superficially, would probably develop interesting data concerning the hydrolization of the individual cellulose fibers, and would show laminations arising from imperfect maceration and calendering. It might have been better had all the specimens been submitted to a drying at 212 deg. F. before making official observations, but it seems probable that the common denominators in this respect were nearly constant enough for all practical purposes. A larger number of mechanical tests on the fiber at various stages of saturation would doubtless have given some information, as the insulation is in service under conditions of ever varying saturation. With one exception the Brinell numbers were not taken between the boiling and baking tests. This should have been done, as fiber in the track is in service in a saturated condition, and the mechanical values in this condition are necessary to a more thorough understanding of fiber service. No investigation of the ductility of fiber was made in these observations. This deserves thorough study, however, as brittle fiber should never be installed.

The saturation, freezing and baking test shows that specific gravity is not the determining factor in arriving at the value of the fiber. The boiling test suggests a relation between the loss in strength and the increase in volume at the respective periods while there is no relation between the loss of strength and the apparent specific gravity.

It is suggested that a proper laboratory test to ascertain the properties which fiber should possess might be developed as follows: From each classification of fiber select a quantity, one-half of which is to remain in the laboratory, and the other half to be installed in the track. Apply Brinell and scleroscopic tests to every piece of fiber, then have that which is to be installed in the track placed in joints of the same make in order to have the same mechanical treatment of all fiber. From these joints remove the insulation at stated intervals, bake it and apply the mechanical tests. The mechanical tests of the sample that lasts the longest should be accepted as a guide. The punishment of the fiber that is left in the laboratory should consist of alternate boiling and baking with mechanical tests taken after each boiling and each baking. The comparison of the results will show an analogy between the defects of the laboratory test and the track service, and suggest the proper laboratory procedure for ascertaining the properties of fiber.

SATURATION AND FREEZING TEST

Original Properties

Sample	Weight	Volume	Spec. Grav.	Brinell Test
A	45.5446 gr.	31.54 c. c.	1.44	23.5
B	50.2308	35.03	1.43	22.7
C	41.9935	33.79	1.24	17.6
D	54.1777	37.98	1.43	25.2

Alternate Saturation, Freezing and Baking

This treatment consisted of the following, in which S indicates saturation, F, freezing, and B, baking. All figures are in hours: 16½ S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 66 S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 16½ S, 3½ F, 4 B; 66 S, 3½ F, 8 B.

Properties After Punishment

A	.99%	Dec.	3.96% Inc.	4.16% Dec.	13.6% Dec.
B	1.13	Inc.	6.49	4.89	38.7
C	.05	Dec.	2.01	1.61	36.9
D	2.16	Inc.	6.21	4.19	11.9

BOILING AND BAKING TEST

Original Properties

Sample	Weight	Volume	Spec. Grav.	Brinell Test
A	16.14 gr.	12.11 c. c.	1.322	23.5
B	17.54	12.30	1.426	22.7
C	17.50	13.53	1.29	17.6
D	21.21	14.69	1.443	25.2
X	20.23	14.82	1.37	22.7

Eighteen Hr. Boiling; Thirty-four Hr. Soaking; Ten. Min. Charring; and Forty-four Hr. Soaking

Properties After Punishment

Sample	Weight	Volume	Spec. Grav.	Brinell Test
A	40.64% Inc.	46.1% Inc.	3.18% Dec.	71.4% Dec.
B	36.5	52.94	9.55	77.8
C	36.49	42.86	2.32	68.1
D	37.94	49.23	7.55	77.6
X	43.99	52.46	5.84	77.6

Ten Hour Baking

Properties After Punishment

A	4.89% Dec.	4.27% Inc.	6.96% Dec.	28.9% Dec.
B	1.02 Dec.	4.29	3.23 Dec.	22.4
C	.12 Dec.	1.48	.78 Dec.	5.11
D	.31 Inc.	3.04	1.59 Inc.	23.0
X	1.31 Dec.	8.98	8.78 Dec.	26.4

AFTER FIVE THOUSAND YEARS*

JOHN MEAGHER

The commercially possible burned clay concrete building brick, not the sand and stone aggregate, the semi-wet molded nor the wet cast, but the pressed, machine-made concrete brick is here and with its advent comes the first radical change made in the process of manufacturing since brick first came into use, some six thousand years ago.

Brick as a building unit dates back to very early times. The first bricks of which there is authentic record were found on the sites of the ancient cities of Babylonia. It is known that well burned clay brick were made by the Babylonians as early as 3400 B. C., and that the brickmaking craft reached a very high state of proficiency among those ancient people, as well as among the Assyrians of the same era. The early history of the Chinese, Egyptians, Greeks, and Romans cites innumerable instances which very convincingly indicate the important part that brick had in the civilization and development of those people. Many parts of the great wall of China are built of brick. There still remain many examples of the brickmakers' craft in Egypt. Brick had its part in the architectural triumphs of the Greeks. Rome's brick aquaducts and other civic improvements are famous. Throughout Europe today may be found many wonderful structures which stand as convincing evidence of the proficiency of the craft, as well as the general use of brick in the Middle Ages. In America, Virginia hands down to us, along with some of our most cherished history and tradition, a record of the first brick manufactured on this continent, in 1611.

Throughout this long span of time—unquestionably exceeding five thousand years—clay in its natural state alone has been the material used in the fabrication of the building units we know as brick. While the product has been refined and process improved, the basic material has remained absolutely unchanged. Seemingly, a new era in brick-making is here.

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*Reprinted from "Portland Cement," September 1917.

Within the next few days a long established shale brick plant** in Kansas City, Mo., will, in addition to its regular production of shale brick, begin the manufacture of bricks composed of Portland cement and clay and shale burned under a new process,*** which, after long years of study and experimental work and under most rigid testing, have been demonstrated to be fully the equal of the present-day commercial clay or shale brick and its superior in many of the more important features. A description of the plant at Kansas City and of the process of manufacturing the burned clay and shale concrete bricks, unquestionably, will be of interest to the building and construction industries.

The first step in the process of manufacture is the burning of the clay and shale. A sixteen-foot portable rotary kiln, with a capacity for burning approximately one hundred cubic yards of material each twenty-four hours, is used for the purpose. The portable feature was incorporated to permit locating the kiln close to the pit or dump from which the clay and shale is taken and so eliminating unnecessary handling of the material. From 1,700 to 2,200 degrees, Fahrenheit, are required to sufficiently burn the clay and shale, the variance being governed by the class of clay and shale being handled. The burned material is allowed to remain where discharged from the kiln to cool in the air and is then well sprinkled with water to slack any lime particles that may be present.

The second step of the process is the reduction of the burned material to pass a half inch mesh screen which produces four sizes: i. e. impalpable dust to that passing a 60-mesh screen; that passing a 10-mesh screen; that passing a 4-mesh screen and that passing a 2-mesh screen.

The material is then ready to be mixed according to formula worked out to best meet, in combination with Portland cement, the requirements for the brick to be made. This method utilizes the material in what might be graded as the "run of the

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**Builders' Brick and Manufacturing Company.

***Patents owned by the National Burned Clay Concrete Company. Manufacturing and licensing rights controlled by the Haydite Products Company.

pile" and, generally speaking, is very satisfactory. On the other hand, if the aggregate be graded along ideal lines it will more fully assure a dense and homogeneous mass with the maximum of strength. The grading of the material is a very important part of the process, particularly if strong, light-weight brick are essential, as it governs the weight of the brick, as well as the texture of the surfaces. Generally speaking, by using a perfectly graduated material from one-half inch to dust, the lighter will be the weight of the brick. While the use of the dust and that passing a 10-mesh screen exclusively, will increase the weight slightly, it produces a surface texture very closely approximating face brick.

Proportioning the aggregate to the cement is the next step. This follows closely the practice for sand and stone concrete. The only notable feature of the mixing is the amount of water used, which approximates twenty per cent by volume and which is ample to start the chemical action in the cement. This amount of water is rather unusual when it is remembered that the mix is automatically fed and worked through a power press. The mixer is located directly above the press, the mixed concrete being conveyed from the mixer to the press through metal chutes.

The press at the Kansas City plant is an Anderson of the regulation shale brick type, molding four bricks at a time and having a daily capacity of twenty thousand brick. The press is always readily available for the manufacture of either shale or concrete bricks, the only changes necessary are the molds. For concrete brick, the molds are set exactly to the desired size of the finished product with no allowance for shrinkage as with the clay and shale bricks. The brick are discharged from the press on pellets which are stacked and allowed to remain undisturbed for from twelve to twenty-four hours, when the bricks have attained sufficient strength to be "hacked" into piles to cure. With the exception of an occasional sprinkling to prevent too rapid drying out, the brick need no further attention. After from eight to fourteen days the brick are ready for delivery to the building, sewer or other work in which they are to be used. When completely cured, the bricks are several shades lighter in color than the usual "concrete" gray.

The testing and investigation of these products was conducted by Dr. Roy Cross of the Kansas City Testing Laboratory and the following data has been taken from the laboratory's certifications of the results of their work:

CRUSHING STRENGTH

The following figures are the averages obtained from two specimens of six different lots of brick. Of the two lots of 1 to 7, one was of a graded aggregate and the other was the "run of the pile." Of the two lots of 1 to 8, a differently graded aggregate was used in each instance:

	Pounds	Per Square	Inch
Mix	14 Days	28 Days	60 Days
1 to 5	1,394	1,909	2,220
1 to 6	1,610	2,008	2,175
1 to 7	1,559	1,929	2,106
*1 to 7	1,362	1,928	2,130
1 to 8	1,241	1,786	2,120
1 to 8	1,202	1,747	1,810

*Run of pile.

TRANSVERSE STRENGTH

As with the crushing tests, the figures below are the average for two specimens from six different lots of brick:

	Pounds,	Actual Strength
Mix	28 Days	60 Days
1 to 5	1,550	1,730
1 to 6	1,760	2,055
1 to 7	1,790	1,980
*1 to 7	1,490	1,680
1 to 8	1,800	1,990
1 to 8	1,305	1,455

*Run of pile.

WEIGHT AND SPECIFIC GRAVITY

The same six lots of brick were drawn upon for the tests made for weight per cubic foot and for specific gravity. The figures below are the averages of all of specimens tested grouped by proportion:

Mix	Pounds Per Cubic Foot	Specific Gravity
1 to 5	98.6	1.58
1 to 6	95.8	1.53
1 to 7	96.7	1.55
1 to 8	95.6	1.53

In these particulars, the averages for the twelve specimens tested are of interest. In weight per cubic foot, the average is 96.5 pounds. In specific gravity, the average for the twelve specimens is 1.5475, which is very close to the ideal.

COMPARATIVE FIRE TESTS

The methods followed in these tests were rather severe and represent extremes rather than average fire conditions. The tests consisted of heating the specimens to given temperature and then completely immersing in cold water with the least loss of time after being taken from the furnace. After the specimens had completely cooled they were tested for crushing strength. Specimens of sand and stone concrete, made under laboratory conditions, were tested along with the burned clay and shale concrete and one specimen of clay building brick was also tested, but at only one temperature. The following results were noted:

	Pounds Per Square Inch After Being Heated and Cooled		
	Clay and Burned Shale Concrete 1 to 7 Mix	Sand and Stone Concrete 1-2-4 Mix	Clay Brick
Room Temperature	2,024	2,260	———
750 Degrees, F.	1,720	2,100	———
1,150 Degrees, F.	1,709	1,900	———
1,300 Degrees, F.	1,701	1,850	———
1,700 Degrees, F.	1,690	Failed	Failed
1,900 Degrees, F.	540	Failed	———
2,200 Degrees, F.	Fused to Fluid	———	———

While private tests for absorption and porosity indicate the clay and burned shale concrete bricks to be considerably the superior of the clay or shale building bricks, the tests in this respect have not been completed by the Kansas City Testing Laboratory, therefore they have no certification in this particular.

Sufficiently exact data are not yet available to permit of dependable estimates as to the cost of producing burned clay and shale concrete bricks. However, from the facts at hand, it is safe to say that the cost will not exceed that for clay or shale brick. In all probabilities the cost will be considerably less than for clay or shale brick, especially when the mechanical process and method of handling has been standardized. A further and very important factor in keeping down the manufacturing cost is in the very low percentage of waste product. Practically every brick is perfect in formation, true in shape with even surfaces and sharp edges.

Unquestionably, these burned clay and shale concrete bricks will strongly appeal to the building and construction industries. The fact that they weigh but approximately four and one-half pounds as against the standard six-pound clay or shale brick—a saving of fifteen hundred pounds per thousand of brick—will solve much of the sometimes very vexing problem of reducing the dead weight in buildings. The light weight of these bricks will also recommend them in many other particulars to the architect and engineer. They readily recommend themselves to the builder and contractor because of the rapidity with which they can be laid and the true and even walls which it is possible to construct with them. They appeal to the insurance interests because of their superior fire-resisting qualities as compared with sand and stone and clay and shale brick.

For the brick manufacturer, burned clay and shale concrete bricks should prove most attractive, combining, as they do, all of the desirable features of concrete, some desirable features not possessed by concrete and yet with all of the flexibility of brick and a better brick than can be manufactured with clay or shale in their natural state. At a very small expense for additional equipment and without interfering in any way with the production of regulation clay or shale brick, the brick manufacturer can very profitably add these new concrete bricks to his line and distinctly to the benefit of the building and construction industries of his locality. There can hardly be a question as to there being a demand for these concrete bricks for no better reason than that they possess advantages that cannot be claimed for any other brick-making material.

We believe we can repeat with increased enthusiasm, "Seemingly, a new era in brick-making is here."

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EDITORIALS

The present college year is opening under very unusual conditions. We are in the midst of a great war. Everywhere the regular work of the nation is being interrupted, and the energies of the people are being gradually concentrated upon the great task of winning the war. It is the obvious duty of every loyal citizen to consider the demands of the nation upon his time and energies as paramount. We believe that this condition is recognized by our students, and that they are all ready and anxious to do their bit in the great cause.

The question therefore naturally arises whether or not the student is doing the right thing to continue his course in college, and whether by so doing he can render his best service. Fortunately this particular question has received a good deal of consideration on the part of the authorities at Washington during the past summer, and the expressed opinion of President Wilson, Secretary Baker, General Black, and others is to the effect that educational institutions should be maintained at the highest possible efficiency, and that young men not needed at once in active service should continue their education. General Black, Chief of Engineers, makes the following statement:

"I would think it a great mistake for the educational institutions of our country to shorten their course or in any way cease to provide a trained product, just as I think it a great mistake for young men to leave their courses before they are trained, excepting those who may be strictly needed. . . . In the meantime, we can all of us serve by doing our level best the duty that lies immediately before us, and be prepared for further calls when they shall come."

Whether the war ends soon or continues for a number of years, there will be great need for men of training such as is obtained in engineering schools, and when the time comes there is no question as to the readiness of the engineering graduate to take his part in the work.

So long as he is doing honest, satisfactory work, I believe the student may proceed with the feeling that he is doing the right thing; but having taken this position, it behooves him to make the very best use of his opportunities. This is no time or place for slackers,—there is too much work to be done. Let us begin the year with a drive that will carry us over the line at the finish.

F. E. TURNEAURE.

OUR FIGHTING ENGINEERS

The roll of honor published in this issue bears excellent testimony of the work Wisconsin engineers are now doing for their country. By these two classes alone, Wisconsin is represented in almost every branch of the Army and Navy. Many are with the American Expeditionary Forces in France. Others are in the forts and training camps scattered from Maine to Northern Alaska. *Of the 108 men graduating from the Engineering School in 1917, 51 are in service, and 21 of these have secured their commissions.* This is certainly a most estimable record. And yet these two classes by no means represent all of Wisconsin's fighting slide-rule pushers. Though the statistics are not yet available, our alumni, not to mention the men of '19 and '20 who have left in considerable numbers, are giving excellent service. And every one of these men has answered the nation's call with eagerness, with sincerest patriotism, and with the same old time pep which is daily characteristic of this Engineering School.

The lists of men in active war service published thus far are subject to corrections and amendments which we are very anxious to secure. Alumni as well as undergraduates are urged to provide the Engineer with additional names and information concerning Wisconsin men, whether they are in service or not. These names are of great interest to the majority of our readers, so that your cooperation with us in making supplemental lists will indeed be appreciated.

CO-OPERATION

As a medium for exchange of valuable ideas in engineering practice and as a medium by which the student may get into closer touch with our alumni, the Wisconsin Engineer is opening its twenty-second year of successful publication. But this year we are operating under rather trying conditions. A good portion of our staff is in war service; this is a period when the alumni have very little time to devote to writing; when time is scarce for everyone; and when economy is the word everywhere. More than ever the Wisconsin Engineer must have the cooperation of the alumni, the faculty, and the students if we are to maintain and to enhance the good reputation the Engineer has already established. We wish to place this publication in the top rank with similar student publications. But to do this we must have cooperation, and here is your chance. A couple of desirable positions on the staff are open to industrious and ambitious underclassmen upon whom we can depend for their cooperation and assistance in putting the Engineer through this year. Come into our office and talk the matter over.

ALUMNI NOTES

E. D. Stillwell, e '10, has recently been appointed superintendent of the Gatun Locks of the Panama Canal. After graduating he served nearly two years with the General Electric Company at Schenectady New York. He has been in Panama since 1912, as draughtsman, as testing engineer, and as assistant superintendent of the Gatun Locks.

Kan Su, c '16, C. E. '17 is in the Maintenance of Way department of the Chicago, Burlington & Quincy Railroad. His address is 3940 Calumet Avenue, Chicago, Illinois.

J. M. Ray, c '13, C. E. '16, is with the Sloan-Huddle Company at Chicago. His address is 1745 Conway Building.

H. E. Woolhiser, E. E. '12, is City Manager of Winnetka, Illinois.

W. H. Sackett, c '06, has left his consulting practice and has enrolled in the second officers' training camp at Fort Sheridan, Illinois.

Donald Hay, m '17, is working with Professor Mason at the submarine base station at New London, Connecticut.

E. L. Grant is working with the United States Geological Survey in the classification of the Gout lands which have been applied for under the stock raising homestead act. He will be in Idaho, Oregon, and Arizona for the next few months.

The chemical engineers of the class of 1917 are located in the following positions:

C. E. Cooper, Acid Department, Mineral Point Zinc Company, De Pue, Illinois.

W. C. Helmle, Aluminum Company of America, E. St. Louis, Illinois.

G. S. Houghland, Walter E. Lummus Company, Boston, Mass. Manufacturers of Distillation Apparatus.

C. W. Jehle, Training Camp, Fort Sheridan, Illinois.

L. G. Kreuz, Consolidated Gas Company of New Jersey, Long Branch, New Jersey.

Walter C. Mackey, Michigan Electro Chemical Company, Menominee, Michigan.

CAMPUS NOTES

In spite of numerous difficulties the new Physics building was ready for occupancy at the opening of classes. A number of the physical laboratories are not yet ready for immediate use however. Two hundred forty-six thousand dollars were appropriated to be used in the erection of the building. Of this amount fifty-six thousand dollars was allowed for equipment and necessary fixtures. Great care was taken in the construction in order that the building should be fireproof in every detail. Even the sills and window frames are made of steel in order to insure absolute safety. In the physics department, which occupies the first two floors and basement, are located a shop for the mechanician and students, a large new library, research rooms, offices, telephone switch board, storage battery room, motor generator outfit, auditorium, museum, five large laboratories for sophomore physics, and a number of lecture rooms. The lecture room on the first floor is capable of seating three hundred fifty-six students and the adjoining supply room is capable of seating over one hundred. Upon the third floor are located two large statistical laboratories, a library, seminary rooms, seven recitation rooms, and offices for the political economy department. Commerce occupies the fourth floor with three accounting laboratories, five recitation and lecture rooms, library, museum, and offices for the department members.

* * *

A non-technical course in aeronautics is another new subject that is proving popular this year. Thus far seventeen engineers and seven men from other courses have enrolled and the indications are that a number of others will plan to attend the lectures even though they have not regularly elected the course. The class will meet twice a week under Professors Callan and Maurer. The engineers will be given slightly more technical work than the others. It is planned to teach much of the ground work that is taught at the aviation fields.

During the summer the huge steam engine that was situated just inside the entrance to the shops has been removed. The engine was removed because of its enormous steam consumption and because the motor driven generator which will soon be installed can be put to better use. Within a short time the other steam electric plant in the shops will likewise be taken out. The engine that has been removed was the largest single piece of machinery in the laboratories and was one of a Corliss type of three hundred horse power capacity. It drove a National two hundred kilowatt sixty-cycle generator, the current from which was used largely for experimental purposes by the various laboratories.

* * *

Last year a number of students worked upon the university radio set without credit in order to obtain the valuable experience that was to be had. Beginning with this semester a regular course in this subject has been offered and the indications are now that the course will be very popular as about forty men have enrolled already. Careful attention will be given to the mathematical theory of magnetism and electricity as related to wireless telegraphy as well as a detailed study of the instruments themselves. A review of general physics, a special study of transformers, oscillating currents, and their application to sending and receiving outfits, as well as a careful study of special forms of sending sets, will be included in the course. The course is planned so that the students will have a chance to become expert operators.

* * *

As soon as the Physics department moved out of Science Hall, work was started remodeling the building so that it can accommodate the College of Medicine and the Geology, both of which have outgrown their present quarters. The reconstruction will continue until the work is completed, despite the beginning of school. It is expected that this will take several weeks.

FACULTY CHANGES

Professor Leonard S. Smith, c '90, C. E. '95, has been advanced from Associate Professor to Professor of Topographical and Highway Engineering.

Professor Otto L. Kowalke, ch '06, Ch. E. '09, has been advanced from Associate Professor to Professor of Chemical Engineering.

Professor O. P. Watts has been advanced from Assistant Professor to Associate Professor of Applied Electro-chemistry.

Mr. Ray S. Owen, c '04, has been advanced from instructor to Assistant Professor of Topographical Engineering, and has been granted a leave of absence for military service. He has recently been appointed Captain of Engineers O. R. C., stationed at Fort Leavenworth.

Mr. L. F. Boon, c '10, C. E. '12, who, for two years, has been instructor in Railway Engineering, has resigned to take a position with the Sloan-Huddle Company, valuation engineers. His present address in Room 326, State House, Providence, R. I.

Mr. C. P. Conrad, c '15, who has been instructor in Hydraulic Engineering, is now a lieutenant in the Corps of Civil Engineers of the Navy. He is in charge of the rehabilitation of the power plant at the Navy Yard at Washington, D. C.

Mr. R. C. Pierce has been appointed instructor in Hydraulic Engineering. He is a graduate of the University of Illinois, class of 1908. He brings to his new position the experience gained in service with the United States Geological Survey and as a teacher of Civil Engineering at the Purdue University.

Mr. Paul C. Gillette, a graduate of the A. and M. College of Texas, has been appointed Fellow in Hydraulic Engineering.

Mr. F. N. Schustedt, c '17, who, last year, was student assistant in Topographical Engineering is a member of the new National Army at Camp Grant in Rockford, Ill. It is reported that he has been appointed sergeant.

Mr. Peter F. Hopkins has been appointed instructor in Topographical Engineering. He is a graduate of Iowa State College, class of '16. He has been with the Iowa Highway Commission for a number of years and taught for a year at Iowa State. His Madison address is 1127 Drake St.

Mr. C. M. Scudder, c '11, C. E. '12, instructor in Mechanics has been appointed Captain of Engineers in the Wisconsin National Guard and is now stationed at Waco, Texas.

Mr. J. Glaettli Jr., c '09, who has been instructor in Structural Engineering for a number of years, has been transferred to the position of an instructor in the Mechanics Department. His place in the Structures Department will not be filled.

Mr. C. W. Thomas, instructor in Drawing, has resigned to take a position as instructor in Drawing and Surveying at De Pauw University, Greencastle, Ind.

Mr. L. J. Markwardt, c '12, instructor in Drawing, resigned during the second semester, last year, to accept a position in the Forest Products Laboratory.

Mr. R. H. Morrison, m '03, instructor in Machine Design, will assist in the teaching of several courses in Drawing during the present year.

Mr. R. J. Roark, instructor in Mechanics, is at the second Officers Training Camp at Fort Sheridan.

Dr. H. C. Hecker, Assistant Professor of Chemical Engineering, has resigned to take charge of the Department of Chemical Engineering at the University of Florida.

Mr. E. C. Bain, instructor in Chemical Engineering, has resigned to take a position with the Goodrich Rubber Company at Akron, Ohio.

Mr. H. D. Valentine, instructor in Chemical Engineering, is a private in Co. A, 331 Machine Gun Batallion, at Camp Grant, Rockford, Ill.

Mr. Stanton Umbreit, ch '16, has been appointed instructor in Chemical Engineering. He has been employed with the Newport Chemical Company at Milwaukee.

Mr. O. A. Hougen has been appointed instructor in Chemical Engineering. He is a graduate of the University of Washington, class of '16. He held a fellowship at Wisconsin last year and had been re-appointed for the present year.

Professor William Black, of the Steam and Gas Department, has resigned to take charge of the Steam and Gas Engineering work at the University of Colorado. His address is 840 12th Street, Boulder, Colorado.

Mr. A. H. Aagaard, instructor in Steam and Gas Engineering, has gone to the Rice Institute at Houston, Texas, as instructor in Mechanical Engineering.

Mr. A. E. Berggren has been appointed Assistant Professor of Steam and Gas Engineering and will be in charge of the laboratory work.

Mr. Pat Clerkin has been appointed laboratory engineer in the Steam and Gas Laboratory in place of Mr. Tom Cain, who resigned to accept the position of assistant operating engineer at the Capitol.

Mr. A. Elmendorf, instructor in Mechanics, has resigned to accept a position of Research Assistant in the Forest Products Laboratory.

Mr. W. L. Dabney, instructor in Mechanical Practice, has been granted a leave of absence for one semester in order that he might work with the Experimental Staff at the Submarine Base in New London, Conn.

Mr. E. T. Breckey, formerly Mechanician, has been appointed temporarily as instructor in place of Mr. Dabney.

Mr. A. O. Schmidt, instructor in Mechanical Practice, has resigned to accept a place with the Madison-Kipp Lubricator Company.

Professor Robert C. Disque, of the Electrical Engineering Department, has been granted a leave of absence and is now a first lieutenant in the Quartermaster's Department, stationed at the aviation camp at Rantoul, Ill.

Mr. G. H. Gray, instructor in Electrical Engineering, has resigned to accept a position with the A. T. & T. Co. His headquarters will be at Des Moines, Iowa, though at present he is still in New York.

Mr. L. L. Greeley, tool-room attendant at the Machine Shops, received the commission of second lieutenant in the infantry. He is now stationed at Fort Green, N. C. Last winter he was at the Border with Troop A of the Wisconsin National Guard and attended the first camp at Ft. Sheridan last Spring.

Mr. R. H. Jones, E '15, has been appointed research assistant in the Electrical Laboratory.

Messrs. A. C. Brown, H. G. Hymer, and H. Linder have been appointed student assistants for the Engineering Library.

Professor A. H. Taylor, who, for a number of years, had charge of Engineering Physics, has been appointed Lieutenant in the Navy and is stationed at the Great Lakes Naval Station in charge of wireless operations in this district.

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