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IMPACT—THE EFFECT OF MOVING LOADS ON RAILWAY BRIDGES

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Most engineering structures must be designed to carry more or less moving, or "live" load in addition to a certain amount of immovable, or "dead" load. The calculation of stresses due to any set of immovable loads is a comparatively simple matter: as soon as the loads themselves have been determined, the principles of statics can be applied and the resulting stresses readily obtained. But the calculation of stresses caused by moving loads is not so simple. This is because the rapidity with which the live loads are usually applied produces stresses which are greater than the stresses which would be caused by equal dead loads. The additional stresses due to the effect of the velocity are known as impact stresses.

The usual method of calculating stresses due to live load is to divide them into two parts. One part is obtained by considering the moving loads as a set of fixed loads, and calculating the resulting static stresses. The other part, which represents the effect of the velocity of the moving loads, is determined by increasing the static stresses by a certain percentage, known as the impact percentage, or impact coefficient. Total live load stresses are given by the sum of the static and impact live load stresses.

In any class of structures where the stresses due to impact form any considerable part of the total stresses, it is necessary to know, within reasonable limits, the effect of rapidity of application of the loads, for the final results are uncertain to the extent that the impact stresses are uncertain. Railway bridges are a large and important class of structures which come under this head. This article will deal only with impact in this class of structures.

Unfortunately no exact method has been devised which will give a general expression for the coefficient to be used in calculating impact stresses. The attempts made to determine the impact coefficient can be classed under three general heads, as follows: first, mathematical methods; second, empirical methods; and third, experimental methods. As a general observation on the results obtained by these methods, it can be said that the first method is not very satisfactory, because the mathematics involved becomes so complex that only the simplest cases can be treated. The second method also is unsatisfactory, as empirical formulas generally are based on the personal opinion of the designer. Probably the most satisfactory method is the third. If tests could be made on all classes of structures under all probable loading conditions, a very close estimate could be made of the maximum impact stresses which would have to be provided for. At present the greatest real progress has been made along this last named line.

Direct observation on existing bridge structures has shown that the chief factors in causing impact are, (1) rapidity of application of live load, (2) unbalanced locomotive drivers, (3) eccentric wheels, (4) deflection of beams and stringers, which gives rise to variations in the action of the vertical forces, (5) flat or irregular wheels, and (6) rough and uneven track. Of these causes of impact the last two give impact which is in the nature of a sudden blow upon the structure. The other causes are more in the nature of a varying load, or a series of impulses, acting on the structure.

The efforts of mathematicians to develop an expression for the impact coefficient have been confined largely to the first of the causes of impact mentioned above. A small amount of mathematical work has also been done on causes two, three, and four. As the conditions are complex, no very definite results have been obtained. Causes five and six, when considered to be similar to a suddenly applied load, can be shown to produce a maximum impact stress equal to the static stress. This conclusion holds only for very short spans, or for localized conditions, such as joint details.

In making the mathematical analysis for the first cause of impact given above, it has been necessary to assume very simple initial conditions. The assumptions made are that the track is perfectly smooth, the abutments rigid, and that the moving load is a single load with the rotating parts in perfect balance. If the straight beam AB of figure 1 be supposed to carry a rolling load, which moves slowly across the beam, the deflection, greatly exaggerated, will be somewhat as shown by the curved line ACB. The path of the moving load is then along a path ACB. If the load be considered as moving with great velocity, its motion in a curved path will cause a centrifugal force to be set up, which tends still further to increase the deflection. This added de-

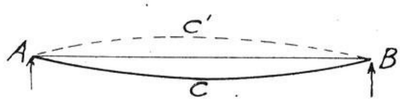

FIGURE 1.—*Deflection under Moving Load*

flection is a measure of the impact effect due to the rapidity of application of the moving load. The resulting equations are rather complicated and they will not be given here. For a discussion of this subject the reader is referred to the discussion in *Secondary Stresses in Bridge Trusses* by C. R. Grimm. A similar discussion is given on page 525 of *Modern Framed Structures*, Part II, where values for the impact coefficient have been worked out. The values given for a speed of 60 miles per hour are 8.7 per cent. for a 25 foot span, and 3.7 and 1.7 per cent. for spans of 50 and 100 feet respectively.

The percentages given above are relatively quite small. They are still further reduced by practical considerations, since in most cases bridge structures, when erected, are given a camber, that is, they are bowed upward, as shown by the dotted line AC′B of figure 1, to such an extent that under full live load the track is straight. The rolling load then moves along practically a straight line and little or no centrifugal force is set up, even at high speed.

When the impact is in the nature of a series of impulses, as in causes two to four given above, it is possible, in certain simple cases, to obtain some idea of the nature of the impact stresses. So many variables enter, however, even in a simple case, that the resulting expression is qualitative rather than quantitative in nature.

The case of unbalanced locomotive drivers is the most important of the impact-causing loads coming under this head, and the discussion will therefore refer to this cause of impact.

In order to transfer the power from the cylinders to the drive wheels of a locomotive, it is necessary to make use of a combination of rotating and reciprocating parts. It is possible to obtain a perfect balance for the rotating parts by means of properly placed counterweights. But in order to balance the reciprocating parts, it is necessary to add to the counterbalance certain weights over and above what is necessary to balance the rotating parts. This added weight is in the nature of an unbalanced force, so far as the track is concerned. In most cases this added weight is about 300 pounds per axle, but may reach 900 pounds in extreme cases. Figure 2 shows the path of such a counterweight during the forward motion of the drive wheel.

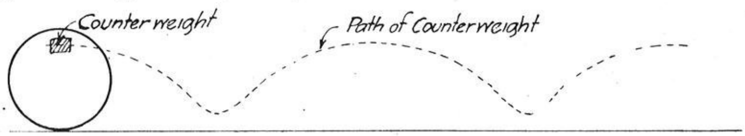

FIGURE 2.—*Path of the Counterweight*

The vertical forces produced by centrifugal force, act according to the laws of simple harmonic motion. As a drive wheel 7 feet in diameter, traveling at 60 miles per hour, makes about 250 revolutions per minute, it can be seen that the vertical forces due to centrifugal effect may easily be a large percentage of the load on the driver. Such a varying force acting on a structure, first as a downward load, tending to deflect the structure downward and then as an upward force, tending to deflect the structure upward, will if continued for any length of time, set the structure into vibration. A complete mathematical discussion of the subject will be found in Bulletin 125 of the American Railway Engineering Association, for July, 1910.

Figure 3 shows, in a way, the sequence of events as a single unbalanced load passes over a structure at high speed. Sketch (a) shows the beam carrying the single unbalanced load. As mentioned earlier in this article, the static and impact live load effects can be considered separately and the two added to give total effect. On this assumption sketch (b) shows the static deflection of the center point C as the load moves slowly over the span. This is called an influence line for deflection, and differs from the ordinary deflection diagram in that the deflection d, of sketch (b), shows the deflection of point C, sketch (a),

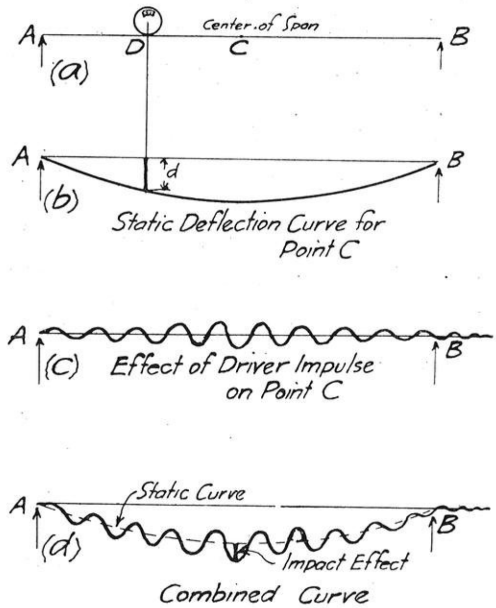

FIGURE 3.—*Effect of Centrifugal Force on Deflection*

for the load at point D. In the same way sketch (c) shows the effect of the centrifugal forces due to the rotating counterweight on the position of point C. As the load moves onto the span, the effect of the varying load is to set the beam into vibration. This vibration becomes a maximum as the load approaches the beam center, after which it gradually dampens out. The curve is continued beyond the end of the span in order to show that the beam remains in vibration for a short time after the load has passed off the span. Finally, sketch (d) shows the combined curve.

The curves of figure 3 show ideal conditions, which occur when the period of rotation of the counterweights coincide with the period of vibration of the structure. Under such conditions the vibration is cumulative, and the maximum combined effect is obtained. At the center of sketch (d) where the maximum effect is shown, the distance from the static curve, shown by dotted lines, to the combined curve, shows the effect of impact due to unbalanced drivers.

When the two periods of vibration do not coincide, the two effects may wholly or partially neutralize each other, in a manner similar to conditions studied in physics in the theory of sound waves. Where a locomotive is followed by a train load, the total weight of the train and structure is variable, as some loads pass off the span and others come onto it. This causes the period of vibration of the structure to be variable. It is then probable that the two periods coincide only for a short time. In any event, that speed of live load which produces maximum cumulative vibration, and therefore maximum impact effect, is known as the *critical speed.*

In the theoretical discussion given in the bulletin above referred to, it has been shown that the coefficient for maximum impact which occurs at the critical speed can be expressed by the equation

$$I = k \frac{M}{p\,c\,l}$$

In this equation, I = impact coefficient; M = moment of rotation of the counterweights; p = live load per foot; c = circumference of drivers; l = span in feet; and k = a constant depending upon the design of the structure. The value of this constant must be determined by experiment. Stated in words, the equation says that the maximum impact coefficient, at critical speed, varies directly as the moment of the counterweights, and inversely as the live load, the circumference of the driver, and the span length.

The effect of eccentric wheels is somewhat similar to that of unbalanced drivers. If the speed is such that the period of rotation of the eccentric wheel coincides with the period of vibration of the structure and its load, cumulative vibrations are set up, which, in observed cases, have been equal to those produced by the locomotive.

The most important and extensive experimental attempt to determine the impact stresses in existing railway structures is that conducted by a sub-committee of the committee on Iron and Steel Structures of the American Railway Engineering Association. A complete record of the tests made will be found in the proceedings of the association (see Bulletin 125 A. R. E. A. July, 1910). The tests referred to were made under the personal direction of Dean F. E. Turneaure of the College of Engineering of the University of Wisconsin, and the late Prof. C. L. Crandall, of Cornell University. These tests extended over a period of ten years, during which time tests were made on about 60 bridge spans which varied in length from 25 to 550 feet. In all, about 2,500 test runs were made, with test trains, and about 20,000 records were taken.

Based on a careful study of these tests, the sub-committee has proposed the following formula as representing in its judgment the probable maximum values of the impact coefficient.

$$I = \frac{1}{1 + \frac{l^2}{30000}}$$

In this formula, l = span length in feet, and I = percentage of impact, or impact coefficient. The above equation is shown graphically in figure 4.

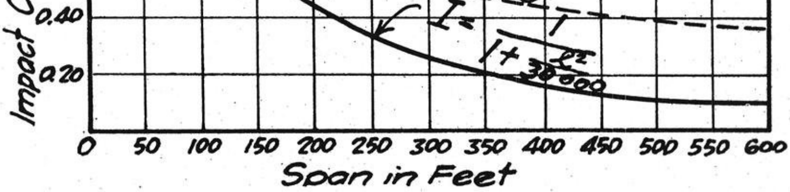

FIGURE 4.—*Impact Formula*

The determination of impact stresses by empirical formulas is usually based upon the personal experience of the author of the formula. A number of such formulas have been proposed. The formula which has met with the widest use is that given in the Specifications of the American Bridge Company. This formula is

$$I = \frac{300}{300 + 1}$$

The terms in this formula have the same meaning as those in the A. R. E. A. formula. It is shown in figure 4 plotted as a curve.

Comparing the two curves, it will be seen that the A. R. E. A. proposed formula gives much smaller values for spans over 100 feet in length. As the A. R. E. A. formula is derived from experiments, it probably more nearly represents actual conditions. Figure 5 shows the instruments used by Dean Turneaure in the tests. On the left is a recording extensometer devised by Dean

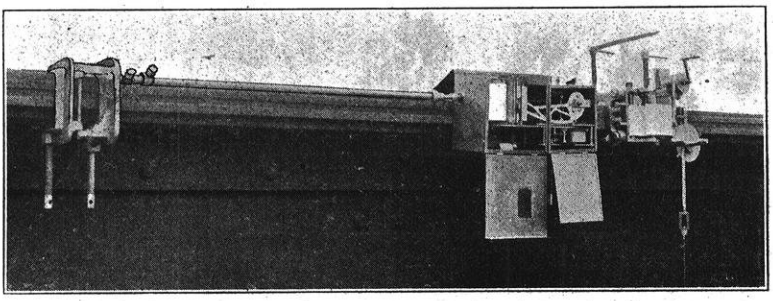

FIGURE 5.—*Extensometer and Deflectometer*

Turneaure and constructed in the mechanician's shop of the College of Engineering. These instruments measure the distortion over about four feet of the member. On the right is a deflectometer manufactured by a German instrument maker. This instrument measures the vertical deflection of the structure. On the A. R. E. A. tests twelve extensometers and one deflectometer were used.

The object of the A. R. E. A. tests was the determination of the maximum impact coefficient. From the equation given for this coefficient, it can be seen that the desired coefficient depends upon the characteristics of the structure and the locomotive. The impact coefficient for a given structure may be different for two locomotives of different types, as for example, passenger engines, with large drivers, and freight engines with small drivers.

In order to determine the maximum impact coefficient by experiment, a given test train is run across the structure at varying speeds. The test is usually started with a slow run of about ten miles per hour. Due to the slow speed the rotating counterweights have practically no centrifugal effect, and the records are equivalent to static diagrams. Other runs are then made, gradually increasing the speed by small increments of about 5 miles per hour, until the record shows that the critical speed, and also the maximum impact, has been reached. By comparing the high speed records with the static or slow speed records, the amount of impact can be readily determined.

To illustrate the general process, and the character of the records obtained during a test for maximum impact a few diagrams of actual test records are given in figure 6. Most of the

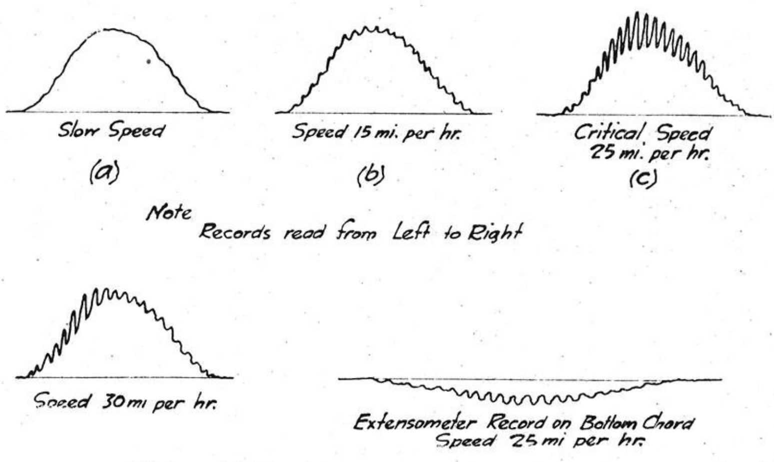

FIGURE 6.—*Records taken with a Deflectometer*

records shown are from the deflectometer, as this shows best the action of the structure as a whole.

The records shown were taken on a 300 foot span. Sketch (a) was taken for a slow speed. The curve is fairly smooth and represents static effect. In (b) the curve becomes wavy, showing that the centrifugal effect of the counterweights is becoming evident. The maximum counterweight effect occurs in (c) for a speed of 25 miles per hour. Here the agreement between period of rotation of the drivers and the period of vibration of the structure is probably exact. It will be noted that if the static curve of (a) were sketched on the maximum combined curve of (c) it would cut an average line through the center of the "saw teeth" of the latter curve. At a somewhat higher speed, shown in (d), the curve starts with well defined saw teeth, but as the train advances onto the span, its period of vibration is decreased and the vibration becomes broken up, as shown by the irregular saw teeth. Sketch (e) is an extensometer record taken on the lower chord of the truss at the same time (c) was taken. Note the well defined saw teeth on this record.

It is of interest to note that slow order sign boards at the ends of the bridge from which the records of Figure 6 were taken called for a speed limit of 25 miles per hour. Sketch (c) shows that, for certain locomotives at least, this was the worst possible speed for the structure. In this case a speed of 40 miles per hour might have been better for the bridge than the slower speed.

MISTAKES IN ENGINEERING JUDGMENT.

There is a curious popular misconception that engineering is an exact science and therefore an engineer should make no mistakes. Nothing could be further from the truth. As well say that because the rules for computing interest are exact the business man should make no mistakes or failures. In fact the very engineering formulas used for computing the size of a beam, the flow of a river, or the bearing value of a pile are based on assumptions that are only approximately true, and in some cases may be as much as 50% in error. The results obtained by their use depend entirely on the skill, experience and judgment of the engineer who applies them. He must select the constants to be used just as a business man must, from his general knowledge, decide whether a certain enterprise will pay 2 or 20% on the investment.—(Quarterly Bulletin, Philippine Bureau of Public Works January, 1914.)

MILITARY ENGINEERING*

General Wm. M. Black
Chief of Engineers, U. S. Army

I have not prepared any set speech for this afternoon. I was told some time ago that I was to be given the honor of speaking to you and was told of one or two things on which they desired me to give the army opinion, and perhaps I might start on them first.

One of the questions that come up to all educators now is, which is the more necessary, continuing the school course, or going to the front? I want to tell you how we in the army think of that and what we think of it. It may possibly help you.

As you know, the first class at West Point was graduated in April of this year, two months early. That really did not lose them any of the course, because the time lost from the Academy would have been devoted mainly to review work, so they were able to go into the service and get their diplomas with practically the same training as if we had held them there to graduate in June instead of April.

Due to a dearth of officers in our service, it was concluded advisable to take the second classmen and put them through an intensive course so as to graduate them in August. That does not mean the loss of the entire year, for the reason that ordinarily at the military academy from the middle of June until the first of September the time is taken up entirely in practical outside exercises. They are now given some of them plus a lot of theoretical work. Then the question came up whether it would be advisable to limit the course at West Point to two or three years in order to provide the supply of officers necessary year by year. That was given extremely careful consideration in the War Department, considered first by the academic board at West Point and then afterwards referred to the various officials in the War Department, and practically all the graduates who were on duty there were consulted about the matter. After very careful consideration we came to the conclusion that inas-

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much as the supply of officers that could be given by West Point is very small anyway, but a small drop in the bucket compared to the number we have to have, and further inasmuch as the advantage of West Point came from a finished product, formed by four years of severe labor and that that finished product had been, as it were, an example to the rest of the service, so that the man coming into the service from other sources had a sort of criterion to which to work in the way of military discipline, that it would be extremely inadvisable to lower that standard; that the good that would come to our country for the long future required that the four years' course should be kept up, and that men should not be graduated half educated, and although we are in the war of unprecedented magnitude when disciplined and trained men are urgently needed, we concluded to keep up the four years' course at West Point during this war, just as it was kept up during the Civil War, so as to provide the trained, finished product of the Academy for the army as the time went on.

I think that that need exists through all our educational institutions, that the trained technical man should be provided for the future. We all know that men who are eminent in their professions who never had the advantage of that early training, will themselves be the first to tell you that they have felt the disadvantage. Our country is going to live long after this war. We hope and believe that our form of government is the permanent one of the world. Today it is the oldest government in the world that is settled and fixed—I was going to say with the exception of Japan, but after all the Shogun has gone from Japan, and our government, our form of government, has remained where others have gone. I do not recall a single government which in its present shape is as old as ours, and yet ours is called an experiment. But we believe, and believe truly that this experiment is a successful one. If that be so, it must be carried on with the same quality of men, the same quality of brains, as we have had in the past. This catacylsm of war must not be allowed to disorganize our structure for all time, and one of the things we will need after the war, just as we needed it before the war, just as we are needing it today, will be trained young men to take the place of the older who go out.

So that I would think it a great mistake for the educational institutions of our country to shorten their courses or in any way to cease to provide this trained product, just as I think it a great mistake for our young men to leave these courses before they are trained, excepting those who may be strictly needed. We have enough men for our army without taking all the trained specialists, and particularly men in training and before they are trained specialists.

The engineers of our country responded most nobly to her call. The action taken by the engineering societies about a year ago has been productive of very great good, due to the fact that they were able to get incorporated in the law—I think it was May of last year—a provision for the engineer officers reserve corps. The engineer department was ahead of any other department in this preparation, in being ready to meet the call, excepting the Medical Department, which had also had the advantage of the same kind of reserve corps that we had. When we made our request of the engineers to come into active service they came forward in numbers greater than we can actually handle. It is a mistake for a trained man to go into the ranks with a musket. It is a waste of good material. How many of us will be needed we do not know, but do not let us waste this wonderful material that we have by putting a man, who is fitted to be a leader of men, fitted to do high service, to the performing of a service which does not require education or training, with the probability of his complete loss to the country.

So I think we can assure all our young men that the country for the present has a supply of young graduates, men who have completed their school training at least sufficient for our needs. The training camps are over-full. In our own corps we have received a great many more applications than we can possibly take care of. There are more men now commissioned in the reserve corps than we can place in the regiments we are forming, and that despite the fact that in the regiments that we will form for the National Army, as it is called—I do not know how large it is, but taking the first call of five hundred thousand men—we will not be able to give more than two regular officers to each regiment. That will be just enough to guide the others.

So I think it would be very advisable indeed for the educational institutions of our country, the schools of technical training, to keep right on with their work. If any young man feels it is his duty to go out, let him go. It may become the duty, the increasing duty, for more of us to go. But in the meantime we can all of us serve by doing to our level best the duty that lies immediately before us, and be prepared for further calls when they shall come. So much for that subject.

I do not know that there is very much more that you want to hear from me. I want to tell you, however, one difficulty that we have had in filling our engineering corps itself. The number of graduates from the Military Academy has never been great enough to fill the ranks of officers of the regular service. I think the highest proportion of graduates we have ever had in the service at large was not over about forty-four per cent. Since the army has been increased, we are quite unable—to get enough men from West Point to fill the ranks of our corps, so that about four or five years ago the provision was made in the law that each year we could obtain from the graduates of technical colleges in civil life a certain number of officers, enough to fill out. As a matter of fact, we never have been able to obtain them. The fault has not been at all with the difficulty of the examination. The fault has been partly with the schools, but mainly with the young men themselves. In civil life a young man gets a diploma as a civil engineer, and goes right into the employ of some large company, and quickly finds his level. I do not suppose over ten per cent., or fifteen per cent. at the very outside, of all the graduate engineers of the country ever rise beyond subordinate positions; so that a college, a technical school, can freely give a diploma to a man who has answered a certain number of questions and studied a certain number of books, although, as one of the faculty of one of our foremost engineering colleges told me, they know they graduate a number of men who never will be engineers. No particular harm is done the country. The training is good for them, but those men will not be advanced. In the corps of engineers we are differently placed because, due to things we need not discuss here now, it is absolutely essential in the army that promotion shall go more or less by seniority, partly because of our own form of government. We in the army are very much afraid indeed of having promotion made by selection. That sounds very curious. It sounds as though we were opposed to having a good man go forward. The trouble is, who will select them? In the past, selection has not been altogether happy. We found it better to take the men as they come along, especially if we can eliminate the men who are notoriously unfit, and in peace times we can get rid of them. The service is better off by letting men go up by age merely. There is less harm to the service.

In time of war it is different. In times of war a man has a chance to show his mettle, and he may show such commanding preëminence that he must be advanced; but in times of peace that can not be done. That being the case in the corps of engineers, you can see that each officer of the corps must be advanced through lower to higher duties until, when men come to the top of the corps, they have position and responsibilities which are held by but few men among the civil engineers of civil life. They have enormous responsibilities, and therefore we must be careful, in getting men into our corps, to get only, if possible, the kind of men who are capable of advancing to that position and who are capable of going to these higher responsibilities, because we can not hold them still as you do in civil life. So, out of a class at West Point, all taking practically the same course, we do not want and would not want at all, more than, at the very outside, perhaps one fifth. We can not get as many as that. This last class that graduated had one hundred and forty members. Of that number we asked for twenty three for the engineers, and we were a little bit uncertain whether some of them were the best.

From the technical schools we want only the best. Unfortunately, except for the man who knows the army and who loves the service, there are no inducements for a good, bright able young engineer to go into the army at all. It is nothing but genteel poverty from beginning to end. It is the scraping of each penny, squeezing it hard, in order to get through; and so these young men from the colleges find they can do better for themselves in civil life, and it is only the young man who knows the service and knows the peculiar pleasure we have in being in it, the peculiar satisfaction that comes from living as we do, entirely for our work without anxiety for personal gain, who is willing to come to us, and the result is that I presume the great majority of the men who apply for examination are men whom you yourselves, if you were going to select associates, would probably reject. The result is they are rejected, and we get a very small proportion who pass.

I think that is one reason why we have been able to get so few men from civil life into our corps through these annual examinations. We want them, we need them. Today, as soon as all promotions for which there are vacancies are made, there will not be a single lieutenant in the corps of engineers; any man who gets a commission in the corps of engineers becomes a captain right at once. Of course, that is not as we would like to have it, but it only shows how difficult the situation is. We have just had an examination in June for which we have not yet heard the results. There were many applicants and we hope we can get a number of good men from them; but in looking over the questions and in looking over the answers, as I wish all of you gentlemen could do, I realized, as I think you would all realize, there is something wrong with the teaching. When a man can graduate at a technical school and work five years on a railroad location and then can not make a little topographical map without any difficult features on it, he does not know topographical surveying very well.

Again, we have always in the Military Academy carefully paid a good deal of attention to descriptive geometry, and I find that is being dropped more and more from the ordinary courses. I think that is a great mistake, gentlemen. He is a very poor engineer and never will rise to a high position or do great things who can not visualize a problem before him, who can not see, before he has laid a stone or dug a single shovelful of earth, the completed work standing out. Is there any single study in the curricula of the schools which will aid that visualization as will descriptive geometry? So I would commend to you a little bit of thought about that, whether it is not wise to give a little more.

West Point is not a great engineering school. If you compare its curriculum with that of the Boston Institute of Technology or with those of a dozen other schools, you will find at once West Point should not turn out engineers; and yet it does.

I think we can point to Goethals and think of a great many other men who are pretty fair engineers, as they go. Is there not something a little more than the mere acquisition of knowledge that should be had at the schools? West Point does not teach it concretely. The engineering course is quite short, but the mental training at West Point is very, very long, and very, very hard. West Point does teach those boys to concentrate themselves on whatever they have before them. It does teach them that the lesson of the day is the task of the day and the thing to be learned. It discourages very decidedly a man making side excursions into knowledge, no matter how important they may appear. The first thing it asks is, "here is a certain task you are put upon to perform. That is your duty. Have you done your duty?" That is drilled into cadets from the time they enter until the time they leave. That is one thing.

Then another thing: If you will examine that curriculum of West Point carefully, you will find that it gives to anyone who has apprehended it, who has learned it thoroughly, the tools that will open the gates of any profession, and has given him a mind after that training that enables him to use those tools, and then the mere acquisition of knowledge afterwards is a very simple thing. Are the educational institutions of our country taking that view? Are not some of them trying to cram a whole lot of facts, so-called practical work, into men without giving them what is much more essential, training; that training of the mind which will make it a machine capable of coping with anything, and with that devotion to duty, that idea of duty that makes the man feel that the thing that is put before him for the day is his task and no matter how alluring other things may be, no matter how unpleasant that task may be, how distasteful, yet that is the thing to be done and that must be done before anything else? I think those are the things West Point gives, and you know whether the other institutions follow.

In the engineer corps it became necessary last year to change our policy. At first when we started to obtain men from civil life we were groping around to see what we could do and we restricted the application for entrance into the corps to graduates of a few of the better known institutions of learning. We did not get material from them, as I have told you. Out of twenty-five or thirty candidates, only two or three passed. I know that out of a class of five that entered a year and a half ago, we had to send two out. There are only three left. You see we give a man, when he comes in, what we term a provisional appointment, which is a most wise provision of law. After a candidate gets a second lieutenancy, he can go right on up, but yet with that provisional appointment during his first two years, and if during that time he is found incapable of handling men, incapable of getting the full grasp of the situation—it is not only a question of the mental examination, but a question of the man himself—then he is allowed to depart—in peace. Last year the policy was changed and candidates from practically all the schools of civil engineering of the country are admitted to the examinations. We want quality of man rather than quality of education, if the choice must be made.

Someone said something about military engineering. Military engineering is one of the most simple things in the wide world, and it practically amounts to giving a man a lot of experience, so that if he is told to do a thing, he will take anything that there is around there—it does not make any difference whether it is the conventional thing or not—and do it. That is all there is to military engineering. Of course, there is a science of fortification, and it is most interesting. There is a science of war. Take that question of the science of fortifications, and trace it back through the early times, and you will see that it consists right along of certain fixed principles which were learned years and years—yes, centuries ago. As the weapons of war changed, and the missile weapons increased in power, the practice of fortification simply changed to meet the new conditions. The material was changed from wood to stone, and then to earth. You know they tried to go back to stone, but they had to give it up. Earth is the best.

So you can see a gradual growth all through, and it is a most interesting proposition. In the science of war, the principles have remained the same. The great soldiers of a thousand years ago should be the great leaders of to-day. It is simply the application of the principles that has changed slightly, not very much even in that. This war is being fought on three dimensions, where we had one before, and I am not sure they will not find the fourth before we get through with it. At any rate there is nothing specially new. The missiles are the same, the means or instruments are the same—simply improved and, being improved, their application changed. So it is not so very difficult to learn to be a soldier, because after all, gentlemen, the profession of being a soldier or the fact of being a soldier is much more a mental and moral attribute than anything else—the willingness to subordinate one's will absolutely to the will of the person placed in authority over him, and then the willingness to accept responsibilities within the sphere assigned to one for action. That is the main thing in being a soldier, but it takes a great long time to get it, I can assure you.

THE BEST DEFENSE AGAINST SUBMARINES.

Sir Eric Geddes, First Lord of the Admiralty, in his speech in Parliament on November 1, 1917, said: "There is one thing which is almost the most potent protection against submarines that exists. It is not an appliance; it is a gift of God given to men on the ships. It is their eyesight. It is the good look-out that is kept. A good look-out, kept by an experienced man covering a great many attacks by submarines, has given us the following facts: That if a submarine is sighted by the look-out on a vessel, whether the vessel is armed or not, it is 7 to 3 on the ship in favor of getting away; out of every ten attacks when the submarine is sighted by the ship seven of them fail; but of every ten attacks when the submarine is not sighted, eight ships go down. It is 7 to 3 on the ship if the submarine is sighted, and 4 to 1 against it if it is not."

CONTEMPLATED CHANGES IN THE SHOP BUILDINGS

A. L. Goddard, m '96

Superintendent of Shops and Assistant Professor of Mechanical Practice

The first Shop Department of the College of Engineering was located in the basement of the north wing of "Old Science Hall." After this building was burned in 1885, two new buildings were built to provide quarters for the departments of Chemistry and Shop Work. The building now known as the Chemical Engineering Building was our first Chemistry Building. This was opened for use during the year '87–'88. The Machine Shops, as the shop building was called, was opened the preceding year.

The Machine Shops as first built, had a two story front wing, and a one story wing extending north, toward the lake, for the machine shop, while a narrow wing, extending east from the north end of the machine shop, was occupied by both forge shop and foundry. The whole upper floor of the front wing was used for instruction in pattern making and carpentry. The lower floor of the east extension of the front wing was occupied by the university carpenter shop until 1910, when this was removed to its present quarters in the Service Building. The machine shop occupied the balance of the lower floor of the front wing and ran back into the north wing above mentioned.

This arrangement continued until 1894 when the quarters provided for the Department of Mechanical Practice, as it was then called, were increased by raising the roof of the north wing and building a second story on this wing, at the same time extending this wing toward the lake, about forty feet. The foundry and forge shop wing was doubled in width also, and the forge shop was quartered in the new part while the foundry extended its space into the old forge shop. The new second story on the north wing, was used for wood-working mill-room, for locker-room, and for the carpentry courses of the Short Course in Agriculture.

At the time of this extension of the shop work quarters, the front wing of the building was extended westward, to provide space for the electrical engineering laboratory and for the mechanics laboratory.

Later, that part of the machine shop in the front wing was given up to the big Corliss engine which was removed last summer.

Thus, today the Department of Shops has less room than it had twenty-three years ago, but its equipment has been steadily augmented and, for several years, it has been at a disadvantage by reason of lack of space. In 1912 the Legislature made an appropriation for a new shop building. In 1914 this appropriation was withdrawn. In 1916, an appropriation of $25,000 was made for alterations and extensions of the present shop building.

The plans projected are:

First:—The addition of a second story to the foundry and forge-shop wing.

The foundry will occupy the second floor of this wing, which will be about forty-five feet square, or double the size of the present foundry. Seats arranged in tiers in one corner of the foundry will accommodate the class during the demonstration lecture. The molding machines, benches, core machines, etc. will be arranged so that they can readily be moved into position for use in the lecture.

The forge shop will be given half of the present foundry space and will use it for demonstration lectures and general forge work. The instructor's forge and the steam hammer will be moved in here, thus permitting the placing of several additional forges in the forge shop.

The other half of the present foundry space will be used for the heat treatment of steel. The gas, oil, and electric furnaces, and pyrometry equipment, at present placed in different parts of the shops, will be brought together there. The oxy-acetylene outfits happen to be there at the present time and will probably be kept there.

Second:—The excavation under the east extension of the front wing, for a locker and wash room. To give sufficient light and ventilation to this room, the first floor will be raised about two feet.

These additions will permit of several desirable shifts. The cabinet-making shop of the Department of Manual Arts, which is a department of the College of Letters and Science, has since 1910, occupied the former quarters of the university carpenter shop on the lower floor of the east extension of the front wing. As this work requires the use of the machines in the mill-room on the second floor, they have been much inconvenienced by their location. The removal of the lockers from the second floor above the machine shop will permit the removal of the pattern shop to that space, which will be adjacent to the new foundry. The manual arts shop can then move up stairs to the present pattern shop room and thus be adjacent to the mill-room. The agricultural carpentry shop will move to the present manual arts shop. This will be a more satisfactory location since it is more accessible, and agricultural carpentry does not require the use of the wood working machines.

About twenty-five feet of the north end of the second floor will be used for the bench and vise work of the machine shop. At present this work is done in the machine shop and when there is a chipping and filing class hammering away at the vises at the same time an instructor is demonstrating a machine operation, somebody's time is being inefficiently applied. The removal of the bench work from the machine shop will give much needed space for rearranging the machines and the tool room.

Third:—The construction of a demonstration lecture room opening from the west wall of the machine shop about midway of its length. This will provide a convenient place for giving instruction in a suitable manner.

Other changes which will make the operation of the department more satisfactory will be, the removal of the old Cummer engine now rounding out thirty years of service, and the substitution of several motors to drive the various groups of tools.

This work was to have been started this year and completed next year. War conditions have delayed this, however, and there may be further delays beyond those now forseen.

REGULATIONS CONCERNING THE DRAFTING OF ENGINEERING STUDENTS

F. E. Turneaure,

Dean of the College of Engineering

As the result of an appeal on the part of the National Engineering Societies and the Society for the Promotion of Engineering Education, the draft regulations under which men for the second draft are to be called, have been modified by the War Department so as to permit a certain proportion of engineering students to complete their work before entering into active service. Detailed regulations have now been received at this office, and are, briefly, as follows:

Any student over twenty-one years of age, whether registered or not, who is regularly enrolled in a standard engineering course, and who has the requisite standing in his class, will be permitted to enlist in the Engineer Enlisted Reserve Corps of the army. When thus enlisted, the student's name will be placed on the inactive list of this corps, and he will be allowed to remain on this list in order to enable him to complete his course of study.

The requisite standing is defined by the regulations as follows: His standing must be such that "in the judgment of the faculty, as indicated by the academic records, supplemented by his relations with his fellow students and by observation of his instructors, he may be regarded fairly as deserving a place, qualitatively, in the first third of the young men who have graduated from the institution in the past ten years."

Students meeting this qualification will receive a certificate to that effect, signed by the Dean, and will then immediately fill out an application blank for enlistment and forward the same, with the certificate, to Washington. Upon approval of this application, a card of authorization will be sent the student, authorizing him to enlist in the Engineer Reserve Corps, provided, of course, that he passes the necessary physical examination. Students not now twenty-one years of age will be permitted to enlist in the same manner as soon as they become twenty-one, the application in such case to be submitted within three months before or one month after reaching the age of twenty-one. It will be seen,. therefore, that these regulations apply to all those engineering students now twenty-one years of age, and to all others as rapidly as they become twenty-one years of age, who rank in the best third of the class, as measured by the average of the classes graduating in the last ten years.

The regulations further provide that immediately after the completion of the course of study, or upon its discontinuance for any reason, a student will be given the option of being called into active service in the Engineering Corps and being assigned to some one of the engineering branches of the army, or being immediately discharged and taking his place again among those subject to the draft.

It will be of interest to quote here certain paragraphs from the Resolutions of the American Society of Mechanical Engineers in support of its appeal to the War Department:

a. There are 4,300 graduates of engineering schools of the class of 1917. The greater part of these are already in the national service. One-third of the class of 1918 has already enlisted without waiting for graduation. The danger is not that students in engineering will refrain from enlisting, but that they will enlist before they are sufficiently trained to be most effective in active service.

b. Practically all engineering students of draft age are in Class 1 which is to be called first. At present 77% of the seniors and 40% of the juniors in engineering schools are of draft age, so that when Class 1 is called, there will be taken from the engineering schools approximately 2,400 juniors and 3,800 seniors, a total of 6,200 men. This number is less than one-third of one per cent of the total of Class 1, but it is more than seven per cent of all the engineers of the country.

c. The present demand for trained engineers is far in excess of the men available. Government departments and industries essential to the conduct of the war are continually asking the schools to recommend technical graduates, but none are available except those who already hold responsible positions.

d. The plea for attention which is herein urged is not made in the interest of schools or of students but solely for the utilization and preservation of a source of supply of technically trained men for the war.

It would have been a calamity to the country if the supply of technical men had been so completely cut off as would have been the case if the original plans for the draft had not been modified. A supply of engineers must be available one, two, and three years hence, and the responsibility of producing the needed men now rests with the schools and with the group of students who are privileged to enlist in this special service. This privilege should be looked upon as a high honor, and the faculty confidently expects this group of students to produce work of a higher order of merit than has ever been accomplished in the history of the College of Engineering.

AMERICAN ROAD BUILDERS' ASSOCIATION

It has been decided to hold the fifteenth annual convention of the American Road Builders' Association at the Hotel Statler, St. Louis, Mo., during the week February 4 to 7, 1918. In view of the influences that have hampered highway construction during the past year or more and the vital need of a system of road transportation to relieve the already overburdened railways, the coming meeting promises to be the most important in the history of the organization. Owing to the difficulties of railroad transportation, it has been decided to abandon the great exhibition of road building machinery, materials and appliances which, for a number of years, has been an important feature of the Association's conventions. It is expected that this convention will be the only large gathering of road builders and users which will be held during the year 1918.

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AFTER THE INTERMEZZO

The holidays are over. Back we come from bright, warm homes and gay festivity to unpack our bags in the familiar but clammy room; to exhume the text-book needed for the morrow from among the mass of papers, notes, periodicals, tobacco, old letters, advertisements, and dust upon the table; and to crawl between the musty, inhospitable sheets, filled with a sense of unknown but imminent disaster. Like men of old we crave a wailing place. Cheer up. Twice ten thousand Wisconsin men and women have been there before you and have survived. Cheer up, think of those exams but a short month away and get busy.

* * *

TO THE FROSH

You freshmen have passed the "mid-semesters" with more or less éclat and are now approaching the real test, the test that will determine whether or not you will continue as a student at Wisconsin. You have before you a month, twenty-six days, two hundred and sixty working hours. Do not waste them. Perhaps you already feel the premonitory symptoms of that fearsome ravisher of the yearling class, the dread disease *soarise.* If so, forget it: forget its very existence. It is no time for panic even though you have been the male prototype of the foolish virgin. Miracles have been wrought by determined individuals in less time than a month; so go to it and luck be with you boy, for you are needed.

* * *

TO ALL OF YOU—AN OBLIGATION

A few days ago came word from Washington that a certain proportion of the engineering students would be permitted to remain in school, to continue their engineering training. With this privilege, comes an obligation, far reaching in its demands. A short time ago, when a man finished his preparation, and started out upon his life work, he set out to make a "mark for himself." Personal power, wealth, and fame were the forces that spurred him on, and he was counted a success by the world, if he obtained them. Today, however, millions of our brothers are leaving loved ones, position, ambitions, and wealth behind, and are giving their all in the service of their nation. Thousands of men who cannot give their lives in battle are giving their personal services and all that they possess to the cause. Never before in the history of the world has Humanity cried out so urgently for men to do her work, and to give their lives to her service. Never before has society turned away in such disgust from the man who refuses to make this sacrifice, whether he be the man who shrinks from fighting, the man who shrinks from parting with his fortune or business when humanity demands it, or the coward who, protected by "legitimate business methods," extorts tribute from the government or the people when they buy the necessaries of war or of life. The war may be over when those men graduate whom the government permits to stay in school. Their opportunity and their obligations, however, will not be over merely because they are not needed in the direct service of their government. During the great period of reconstruction that is to follow, humanity will stand in even greater need of true men who are willing to make any sacrifice for another's good. Today, men are not asking "in what branch of government work can I get the most pay?" but rather "where can I be of the most service?" There is no more excuse for a man entering the most remunerative occupation, rather than the most serviceable, in time of peace than there is in time of war. Let the men to whom privileges are granted be guided by the example of our own Professor Babcock when he rejected a personal fortune and gave the results of his life's work to the people; by that of Mr. Rittman when he spurned the millions offered him by the Oil Trusts and gave his process of refining oil to the world without compensation; and by that of Herbert C. Hoover when he threw away his personal fortune, his position, ambitions, and professional career, and rushed to the aid of a starving nation across the Atlantic. It is a time to put aside personal ambitions. —G. B. W.

* * *

APPRECIATION

It is a sad thing to be misunderstood, though not so sad as to be incapable of understanding others. Occasionally when engineering students venture beyond the confines of their own college for the purpose of making exploration in other fields of knowledge, they encounter a Philistine who, not understanding their enthusiasm or sympathizing with their point of view, chills their ardent spirits for a semester and manhandles them at the end of it. Humbled they return and hot, saddened as aforementioned. Because of certain uncontrollable factors the Philistine is encountered more often in the English courses than elsewhere. It is, therefore, both unguent to our wounded hearts and heads and rare incense to our nostrils when a professor of English utters such a whole-souled compliment as that with which Professor Homer A. Watt, of New York University, closed his paper upon *The Wisconsin Course in the Composition of Technical Papers* in a recent Bulletin of the Society for the Promotion of Engineering Education. He says:

"I do not believe that there is any better type of student in America than the junior and senior engineers. Disciplined by the drill of the early years of their college course and already beginning to have a vision of the responsibilities which lie even at the threshold of the great profession of which they will soon be members, they face present duties with an earnestness and cheerfulness which stimulates any instructor who is not case-hardened. And such students it is a pleasure and not a duty to instruct."

Professor Watt developed the course in technical composition here at Wisconsin and achieved a great success with the engineers. He understands thoroughly, not only engineering English, but also engineering *students*.

* * *

IMPACT

Professor Kinne's article on impact in this issue, although it may appear at first glance to be somewhat "heavy" and mathematical, will be found to be a simple and interesting explanation of an important factor in bridge design. Civil engineering students, whether freshmen or seniors, should read the article and file it for further reference. Moreover, the subject is so presented that students of other courses will find it well worth the reading.

* * *

MILITARY ENGINEERING

General Black's address on Military Engineering contains matter of more than passing interest. Among other things, his discussion of the value of descriptive geometry to the civil engineer and his explanation of the reasons underlying the futility of the attempts to fill the vacancies in the Corps of Engineers by recruiting among civil engineers, deserve thoughtful consideration.

WITH THE COLORS.

HONOR ROLL (Supplementary)

ADAMS, CAPT. WALTER K., c '03, has recently been transferred from the 21st. Engineers to the 311th. Engineers at Camp Grant.

AMEL, FLOYD A., a former student, has enlisted.

AYRES, ALBERT O., c '16, is 2nd Lieut. in the Engineers Corps and is stationed at Waco.

BERTELING, C. N., a former student in civil engineering, is a 2nd Lieutenant and is stationed at Camp Custer.

BRADY, L. J., ex-m '13, is a 2nd Lieutenant in the Engineers Corps.

BRENNAN, BERNARD C., c '05, is a Captain in the Engineers Corps. His permanent address is 381 Exchange St., Kenosha, Wisconsin.

BROWN, STACEY L., Ch. E. 4, is a 2nd Lieutenant in Battery D, 329 Field Artillery, Camp Custer.

CAHILL, RALPH H., c '13, is 2nd Lieutenant in the Coast Artillery Corps.

COLEMAN, ALFRED, m '09, is Captain in the Engineers Corps. His address is Rice Hotel, Houston, Texas.

COLLINS, CLARK S., E. E. 4, is at the 3rd R. O. T. C. at Camp Grant.

COMPTON, DONALD E., C. E. 3, has enlisted in the Signal Corps and is now at the radio school at the Great Lakes Training Station. He expects to be there three or four weeks after which he will go to the Harvard school to complete his training.

CONRAD, CUTHBERT, c '15, C. E. '16, who is 1st Lieutenant in the Civil Engineering Corps of the Naval Reserve Force, has been sent to France.

CRUMP, ARTHUR W., c '15, is a Lieutenant of Artillery at Fort Oglethorpe, Ga.

DAVIS, LOUIS W., c '10, is a Captain in the Engineers Corps. His permanent address is Granton, Wisconsin.

EGBERT, PAUL S., c '16, is 2nd Lieutenant in the Engineers Corps. His address is Box 484, Mitchell, South Dakota.

EISELE, LEWIS G., ex-e '16, is a 2nd Lieutenant in the Engineers Corps.

ELLISON, ELWOOD C., e '17, has finished his training at Fortress Monroe and is believed to have been appointed 2nd Lieutenant.

ELLSWORTH, CHARLES W., c '14, is a private at Camp Grant.

FIEWEGER, THOMAS E., a former student in civil engineering, has been appointed 2nd Lieutenant in the Coast Artillery Corps.

FOWLER, DWIGHT S., c '17, who, after being rejected for the R. O. T. C. because of physical disability was drafted and sent to Camp Mills, recently responded to a call for volunteers for a railway regiment and is now in France.

GOLDSMITH, ELMER L., e '15, is a 2nd Lieutenant in the Engineer Corps.

GRANT, EUGENE L., c '17, is at the 3rd R. O. T. C. at Camp Grant.

GRIFFITH, WILLIAM H., c '12, is a Captain in the Engineer Officers Reserve Corps at Fort Leavenworth, Kansas.

HALL, MELVILLE C., c '15, is a 2nd Lieutenant of Ordnance.

HENDRICKS, JOHN H., '14, is a 2nd Lieutenant in the Engineer Corps.

HIRSHHEIMER, H. W., M. E. 4, who enlisted in the Naval Reserve last May, was recently called to the colors.

HOPKINS, WILLIAM T., c '13, an assistant paymaster in the Navy with the rank of Ensign, has recently been sent to France. He is stationed for the time being at Paris.

JOHNSON, RUSSELL S., Ch. E. 4, was recently ordered to report to Camp Custer.

KILE, ROY B., e '15, is a 2nd Lieutenant in the Engineers Corps. His address is 50 E. Cedar St., Chippewa Falls, Wis.

KITCHINGHAM, RAYMOND F., Ch. E. 2, has enlisted in the Aviation Corps.

KLEMME, GLENN H., C. E. 4, has completed his training at Fortress Monroe and is believed to have been appointed 2nd Lieutenant.

KUENTZ, OSCAR O., m '08, a Major in the Corps of Engineers, is at present acting as instructor at Fort Leavenworth.

LAMPERT, BEN H., c '13, is a Lieutenant in the Engineer Corps.

LANG, HIRAM A., a former student in civil engineering, is in the Engineers Corps and is stationed somewhere in Texas.

LARSEN, HERMAN, c '13, is a 1st Lieutenant in the Engineer Corps. He is believed to be in France.

LOWRY, L. L., c '14, is in the Engineer Corps at Camp Dodge, Iowa.

MANINGTON, JOSEPH A., ex-c '03, is a Captain in the Engineer Corps. His address is 1342 Detroit St., Los Angeles, Cal.

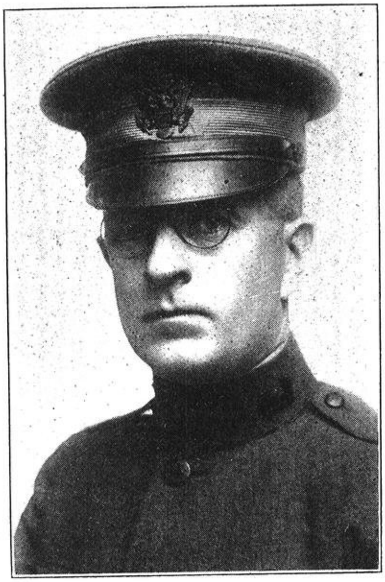
McINTOSH, F. C., c '13, is Sergeant-Major in the 109 Supply Train, at Camp Cody, Deming, N. M.

MIELENZ, HAROLD F., c '17, is a 2nd Lieutenant in the Coast Artillery Corps. He is stationed at Ft. Williams, near Portland, Maine.

NELSON, LOUIS F., c '16, is a 2nd Lieutenant of Infantry in the regular army.

NORTON, PAUL T., e '17, is a Sergeant in the Signal Corps. He is attending the radio school at College Park, Md.

OAKEY, WARREN, c '17, is a 2nd Lieutenant in the Coast Artillery Corps. He is stationed at Ft. Wright, N. Y.



Capt. Ray Owen

OWEN, CAPTAIN RAY S., c '04, after spending a short time with his family at Thanksgiving time left for France on December 6. The latest news from him was contained in a card he mailed at the wharf as he was boarding the ship.

REBER, LOUIS E., c '14, is at the 3rd R. O. T. C. at Camp Grant.

REID, JOHN W., c '06, is a Captain of Engineers.

ROARK, R. J., instructor in mechanics, has been appointed 1st Lieutenant and not 2nd Lieutenant as was erroneously stated in a previous issue. He has left for France.

ROGERS, LESTER C., c '15, is at the 3rd R. O. T. C. at Camp Grant.

SCHMIDT, EDWIN X., M. E. 4, has finished his training at Ft. Monroe and is believed to have been appointed 2nd Lieutenant C. A. C.

SCHMIDT, HERBERT E., min '11, is a 1st Lieutenant of Engineers. His address is 1415 E. 3rd St., Duluth, Minn.

SCHMITT, HERBERT C., c '14, is at the aviation school at Cornell University.

SCHUYLER, P. K., C. E. 4, is in the Engineer Corps.

SINNEN, FRED E., e '17, is at the radio school at College Park, Md.

SMITH, ROBERT M., c '13, is 1st Lieutenant, 10th Battalion, 155 Depot Brigade at Camp Lee, Petersburg, Va.

STOCKUM, S. F., Ch. E. 2, has recently been called to report to his draft board at Wausau.

SWIETLIK, WALTER, c '16, has finished his training at Ft. Monroe and has been appointed 2nd Lieutenant in the Coast Artillery Corps.

TANGHE, JOHN, c '16, is in the Oversea Sec. 1, Gas Defense Service. He may be addressed American Expeditionary Force, via New York, U. S. A.

THOMAS, ROY, former student in electrical engineering, is with an engineering regiment in France.

UTEGAARD, THOMAS, c '17, is at the 3rd R. O. T. C. at Camp Grant.

VALENTINE, H. D., instructor in chemical engineering, who was drafted in September and sent to Camp Grant, has been appointed 1st Lieutenant in the Gas Defense Service of the Sanitary Corps and detailed as divisional gas officer to the 89th Division at Camp Funston, Kansas.

WATSON, CLARENCE F., c '10, is 1st Lieutenant of Engineers. His address is 602 W. 6th. St., Ashland, Wis.

WEBB, WALTER R., e '17, is a Sergeant in the Signal Corps and is now at the radio school at College Park, Md.

WHITCOMB, K. F., M. E. 3, has enlisted as electrician in the Naval Reserve and is at the Great Lakes Training School.

WISE, JOHN E., e '16, a former editor of the Wisconsin Engineer, is now in the Signal Corps.

WOLFF, WERNER P., min '12, is at the 3rd R. O. T. C. at Camp Grant.

Thanks to those who have taken the trouble to furnish information, our Honor Roll this month is a long one. Scattered throughout the list are the names of students who have been dropping out of school to enlist. This is doubtless due to a recent classification of drafted men that puts students in the first group and renders them especially liable to service; the men prefer to choose the arm of the service rather than be assigned by others. Fortunately the classification has been modified so that it gives the engineering student of good scholastic record, the opportunity to complete his education. While the modification is not altogether satisfactory it should have a beneficial effect.

E. R. Stivers, c '15, a private in the 408th Depot Detachment at Camp Meade, Maryland, writes of various matters of interest: "Last Wednesday I was called into the Service as a draftee.

You are aware of the fact that I taught last year at the University of Florida. I resigned August 1st. From Florida I went direct to Chattanooga to work for the Interstate Commerce Commission, Southern District of Valuation. I was still with them when I was called. My work there was pleasant and I made good progress. When I left another fellow and myself were handling all of the ownership between us. A Wisconsin man, Jorstad, '06, was in the Mechanical Department.

About two weeks ago when I was home waiting for my final callwe had a week-end Wisconsin Party. Two cottages at Emery Grove Camp meeting grounds were utilized and we had a real big time. Among those present were Schad C. E. '16, Parlett and Fulton M. E. '16, Michel M. E. '16, some Agrics., Home Ec's and Hill Girls and fellows from '14 to '17. A few Hopkins graduate students filled out the party, bringing it up to about 30. You can imagine the great time we had singing Wisconsin songs, etc. so far from our Alma Mater. When we read the score of the Wisconsin-Minnesota game there was almost a riot.

That reminds me that I had two more thrills this morning. The first was the score of the Wisconsin-Chicago game and the second was when one of the Military bands struck up "On Wisconsin."

I can't tell you much of my camp experiences as they are limited as yet. We have not received full equipment as they can't seem to get it. So far we lack a suit, gun, overcoat and shoes. The meals are all that could be desired for camp life and the men are all very congenial.

Earlier in the year I made several attempts to get into the Engineering Corps but being only 5′3″ I was rejected. Later when the minimum height was made 5′1″ they wouldn't let me enlist as I had already received my notice to report for physical examination. As it is I am making no complaint to my present assignment but have notified them of my engineering experience and may be transferred to an engineering regiment.

Captain Owen brought back from Fort Leavenworth a memento in the form of a paper covered booklet which is the "Badger" of the class of engineer officers recently graduated from the Fort. It is called the "Roster, 2nd. E. O. T. S., Fort Leavenworth, Kansas." Many Wisconsin faces appear in the company groups that are pictured and from its company rolls were taken many of the names appearing in this month's Honor Roll. Among other interesting features of the Roster is the following poem. The motto of the Corps of Engineers is the French word "Essayons" (Let us try). It forms part of the design on the buttons on the uniforms of the engineers.

ESSAYONS

(Air: "Dixie")

I

They are calling loudly for the Engineers:
"Get out in front and take the brunt,
Pioneers, pioneers, pioneers, Engineers!"
There's a job out yonder where the front line veers—
A mining stunt; a searchlight shunt,
Pioneers, pioneers, pioneers, Engineers!

CHORUS

Then let's go out and DO IT,
For we—know how;
'Mid shot and shell we'll work like hell—
We'll do that job, and do it well;
Ho, es-say-ons! We are the Engineers!
Ho, es-say-ons! We are the Engineers!

II

There's a shell-swept corner out in No-Man's Land—
A hell on earth, where life is worth
About a dime, just a dime, yes a dime, Engineers;
And they want one company with lots o' sand
To face that fire and string barbed wire
In double time, double time, double time, Engineers.

CHORUS: (Fortissimo)

One of the American railway regiments now in France, has been assigned to duty with the British forces and assisted in maintaining transportation during the recent brilliant advance at Cambrai. A German counter-attack at Gouzeaucourt caught some of these men and they left their tracklaying to assist the British tommies in beating back the foe. An official communication from the French government says: "We must remark upon the conduct of certain American soldiers, pioneers and workmen on the military railroad in the section of the German attack west of Cambrai on November 30. They exchanged their picks and shovels for rifles and cartridges and fought with the English. Many died thus bravely, arms in hand, before the invader. All helped to repulse the enemy. There is not a single person who saw them at work who does not render warm praise to the coolness, discipline, and courage of these improvised combatants."

Further comment is contained in a letter from the British commander General Haig to General Pershing: "I have much pleasure in forwarding herewith for your information a copy of a report submitted to me by General Byng, commanding the Third British Army, on the gallant conduct of companies of railway engineers of the United States Army in and near Gouzeaucourt on the 30th of November. I desire to express to you my thanks and those of the British forces engaged for the prompt and valuable assistance rendered, and I trust that you will be good enough to convey to these gallant men how much we all appreciate their prompt and soldierly readiness to assist in what was, for a time, a difficult situation. I much regret the losses suffered by these companies."

CAMPUS NOTES

Professor Kinne's younger brother, Herbert, died suddenly of pneumonia on Christmas Eve. Two other brothers have enlisted and are on their way to France.

Catherine Maurer, daughter of Professor Maurer and a junior in the College of Letters and Science, was married on Christmas day to Lieutenant Jean Carter Witter. The young couple left for Camp Lewis, Washington, where Lieut. Witter is at present stationed.

Professor Hyland has been passing around Mi Lolas in honor of a son born December 8.

Mr. Glaettli announces the arrival of Miss Jean Elizabeth on November 21.

Word has been received that Professor Callan reached England safely.

Power, in the number for November 20, publishes an alignment chart for Babcock's formula for flow of steam in pipes by Professor J. B. Kommers.

The university central is located, at present, in Science Hall: eventually it is to be in the new Physics building. It is under the direct control of the telephone company. There are twelve trunk lines between the university central and the main office on the Square. From the university central various cables radiate to the buildings on the campus. Up to the present time each phone had separate connections, which arrangement required three wires for each phone. The rates paid by the University varied with the distance of the phones from the university central.

The rates proposed by the telephone company for the new contract were much higher than they had been under the old contract: about 60 per cent higher as nearly as could be estimated. However, in view of the fact that some of the cables were approaching an overloaded condition, the company agreed to make better terms provided a portion of the phones were put on two-party lines, and after due consideration an agreement was reached on that basis. Even with this concession the rates will be about 40 per cent higher than under the old contract.

The new system required a small amount of rewiring in the buildings and this has recently been completed. For the present the telephones in the offices of the deans and the chairmen of departments, and certain other phones that do a heavy business have been allowed to remain on separate lines.

Archibald W. Case

The Archibald W. Case Loan Fund for Engineering Students was established this fall by Major James Frank Case, c '90, as a memorial to his son, Archibald Williston Case, c '15, who was killed while at work on the Hell Gate bridge over the East River at New York. An account of the accident appeared in the Wisconsin Engineer for November, 1916.

The University recently signed a new contract with the Wisconsin Telephone Company that has involved some changes in the service. A year ago the old contract expired. Since that time both the telephone company and the University have been studying the situation in order to reach a reasonable basis for the new contract

A determined effort is being made to revive the Civil Engineers Society, which has been inactive for several years. The matter of reorganizing the society was presented to the civil engineering students of all years, and the sentiment was so favorable that a meeting was held on December 6. Thirty seven men turned out and brought their enthusiasm with them. William J. Camlin was elected chairman and Robert F. Light was made secretary. H. H. Gumprecht and A. F. Dahlman were appointed chairmen of committees to revise the constitution and by-laws. Professors Kinne and Van Hagan, charter members of the Society, which was organized in 1902–3, were asked to assist in the revision. The revised constitution was adopted on December 13 and the officers named above were made permanent officers for the coming semester.

The features of the new constitution are the simple membership requirements and the latitude allowed the program committee. The society has always been handicapped by the fact that only juniors and seniors could be members. It was the intention of the founders to limit the programs to technical papers and lectures, and it was thought that the students of the first two years lacked the training necessary to enable them to take part in the proceedings. The result was that the live men, who appreciated the training that such a society offers went elsewhere while they were waiting to become eligible. Under the new constitution men of all years are eligible to membership. The society has gone even farther than that—the only qualification now is that a member shall be a member of the faculty or a student in residence—membership is open to all students and faculty members in the university.

Following what promises to become a regular custom the last freshman engineering lecture before the Christmas holidays was made a "festival of music, song, and story," as the program put it. Led by the Engineers' Orchestra under the direction of William J. Reuter, and by the Engineers' Glee Club, the freshmen began the training in college songs which will reach its apogee when the genial sun of springtime warms the front steps and softens frozen larynges. The orchestra did particularly well in the selection from Victor Herbert's old opera, The Fortune Teller. For the benefit of those who might be contemplating a trip to Berlin, as he explained, Professor O. J. Campbell of the English Department, read Jerome K. Jerome's description of his amusing experiences with the police regulations of that city. The full program is given below:

FRESHMAN ENGINEERS PRE-HOLIDAY FESTIVAL
of MUSIC, SONG and STORY

Engineering Auditorium, Friday, December 14th, 1917

A. Wisconsin Football Jingles - - - *"Billy" Buech, L. S. 4*

ENGINEERS ORCHESTRA

B. College Songs, Old and New

The ENGINEERS GLEE CLUB will sing

(a) Songs to thee, Wisconsin

(b) Levee Song

(c) If You Want to be a Badger
and *You* will join in singing

(c) (Repeated) If You Want to be a Badger

(d) Why Don't You Get to Work

(e) Hand me Down my Bonnet

(f) St. Patrick was an Engineer

C. In the Toils of the German Law - - *Jerome K. Jerome*
PROFESSOR O. J. CAMPBELL, JR.

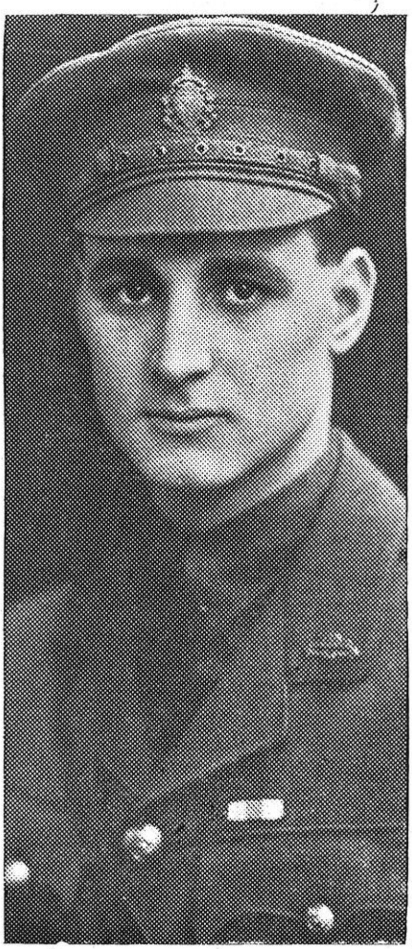
D. The Fortune Teller - - - - - - - *Victor Herbert*
ENGINEERS ORCHESTRA

E. General Singing
Led by PROFESSOR DYKEMA

F. Grand Finale - - - - - - - - - - *On Wisconsin*
BY ENTIRE COMPANY

ALUMNI NOTES

J. Albert Schad, c '16, is at present in the valuation department of the Western Maryland Railroad Company. His address is 2059 Kennedy Ave, Baltimore. He writes that he was disqualified for both the R. O. T. C. and the draft because of eye trouble. He is making application for a position with the Civil Engineering Corps of the Naval Reserve Force.



Major L. A. Wilmot, CE. '14, was married in England on December 8 to Miss Ada Hopkins, '11, of Madison, a sister of W. T. Hopkins, c'13. Before her marriage Mrs. Wilmot was statistician in the office of President Van Hise. Major Wilmot was a graduate of the Royal Military College of Canada. He took a post graduate course in civil engineering at Wisconsin and received the degree of Civil Engineer in 1914. He has been in the war since the earliest days; has served with distinction; and has won well merited promotion. He has see much active fighting and has been twice wounded.

Kendall B. Bragg, c '15, is an assistant civil engineer in the Navy Department and is stationed at Pensacola, Florida.

Myron Cornish, c '15, is a civilian assistant mechanical engineer in the Construction Department of the Signal Corps.

W. T. Cushing, ch '11, has left the service of the Matheisen Alkali Company and is now in the sales department of the Norton Company of Worcester, Mass.

Robert L. Filtzer, c '17, is working with the U. S. Geological Survey as Junior Classifier. He is somewhere in Arizona.

William H. Gloger, c '17, is working with the U. S. Geological Survey as Junior Classifier. His address is Congress Hotel, Pueblo, Colorado.

E. C. Herthel, ch '15, is now with the Sinclair Refining Company, at 133rd and Forsythe Avenue, East Chicago, Indiana.

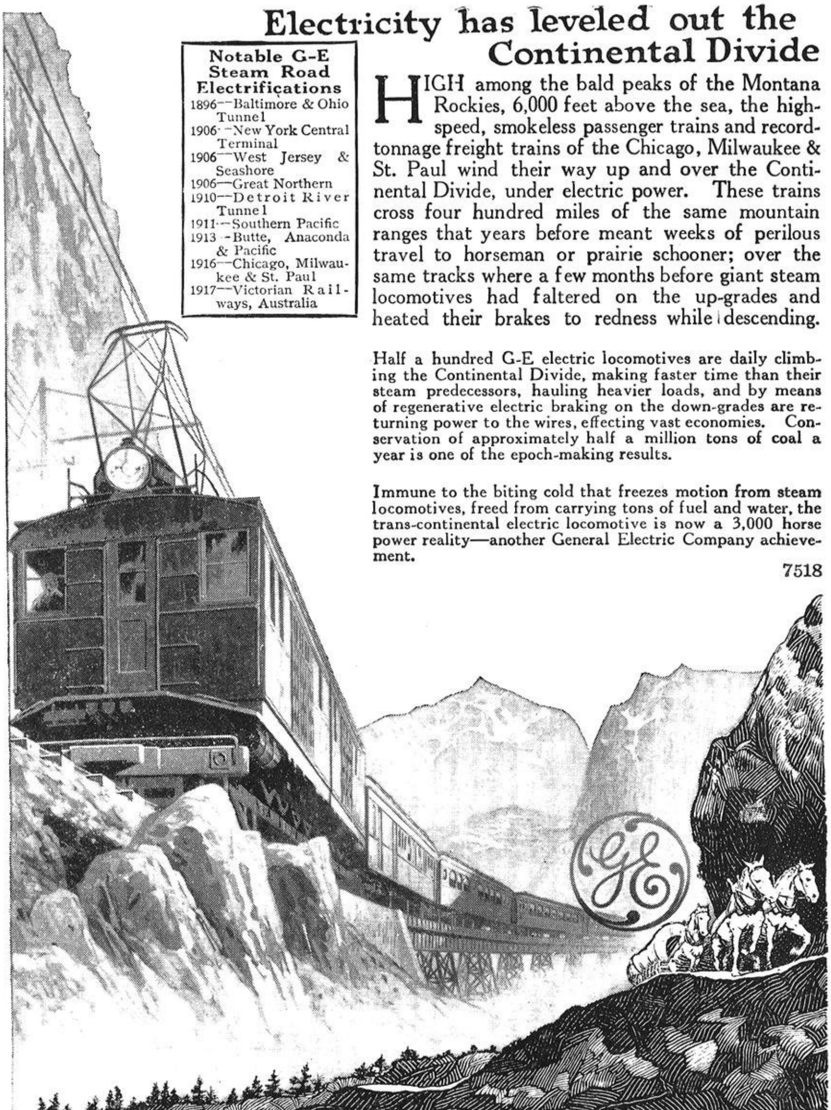
W. R. McCann, e '15, who for the past two years has been with the Public Utilities Commission of Illinois, is now in Washington, D. C., as Assistant Purchasing Officer of the Emergency Fleet Corporation.

M. O. Reed, e '14, has been with the Cooley and Marvin Company consulting production engineers of Boston and Chicago, as junior engineer since October. At present he is making investigations and studies in connection with scientific management at the Hannah's Manufacturing Company at Kenosha.

Louis F. Reuter, c '15, was married on December 1 to Emma R. Riesen of Milwaukee. He is now engaged in making special investigations and studies for The Milwaukee Electric Railway and Light Company.

H. H. Rogers, ch '12, is now with Williams, White and Company, of Moline, Illinois.

Lester C. Rogers, c '15, at present assistant superintendent for the Bates and Rogers Construction Company on the Detroit-Superior subways in Cleveland, is applying for admission to the 3rd officers training camp.



Electricity has leveled out the Continental Divide
Notable G-E Steam Road Electrifications
1896—Baltimore & Ohio Tunnel
1906—New York Central Terminal
1906—West Jersey & Seashore
1906—Great Northern
1910—Detroit River Tunnel
1911—Southern Pacific
1913—Butte, Anaconda & Pacific
1916—Chicago, Milwaukee & St. Paul
1917—Victorian Railways, Australia
HIGH among the bald peaks of the Montana Rockies, 6,000 feet above the sea, the high-speed, smokeless passenger trains and record-tonnage freight trains of the Chicago, Milwaukee & St. Paul wind their way up and over the Continental Divide, under electric power. These trains cross four hundred miles of the same mountain ranges that years before meant weeks of perilous travel to horseman or prairie schooner; over the same tracks where a few months before giant steam locomotives had faltered on the up-grades and heated their brakes to redness while descending.
Half a hundred G-E electric locomotives are daily climbing the Continental Divide, making faster time than their steam predecessors, hauling heavier loads, and by means of regenerative electric braking on the down-grades are returning power to the wires, effecting vast economies. Conservation of approximately half a million tons of coal a year is one of the epoch-making results.
Immune to the biting cold that freezes motion from steam locomotives, freed from carrying tons of fuel and water, the trans-continental electric locomotive is now a 3,000 horse power reality—another General Electric Company achievement.
7518
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GENERAL ELECTRIC COMPANY