The Wisconsin engineer. Volume 36, No. 4 January 1932

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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THE WISCONSIN ENGINEER

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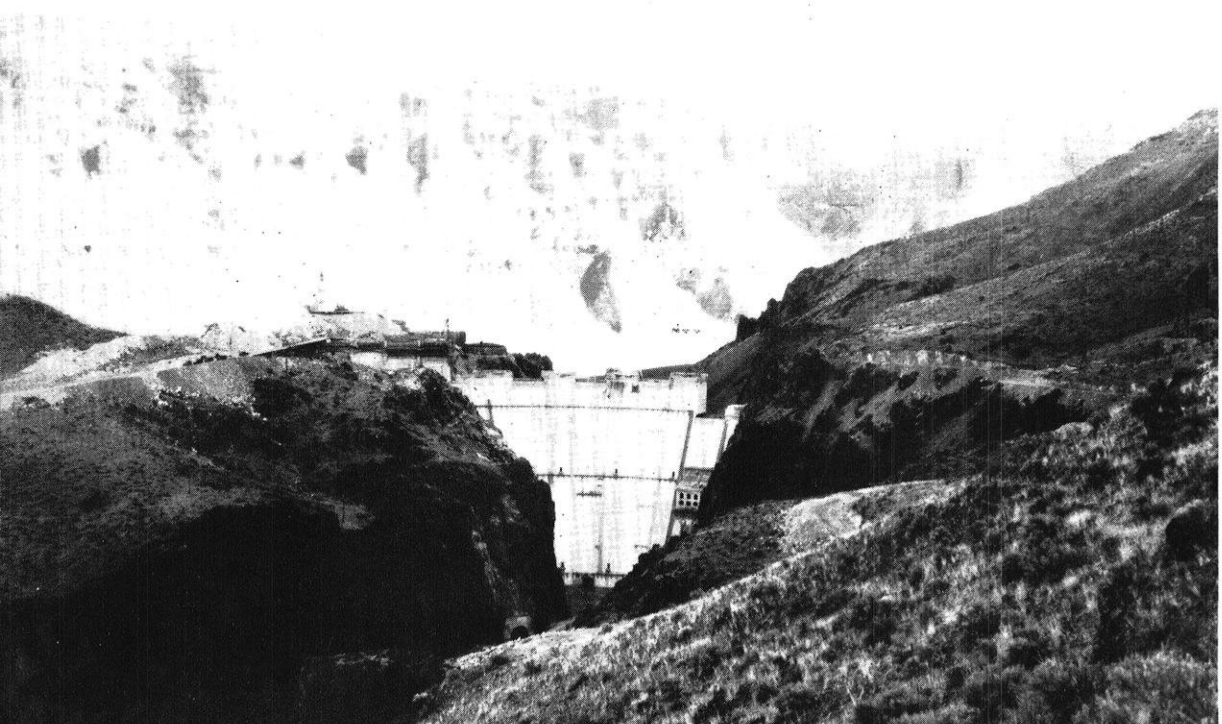

JANUARY
1932

The WISCONSIN ENGINEER

Founded 1896

25c per copy; $1.50 per year

Published monthly from October to May, inclusive, by
THE WISCONSIN ENGINEERING JOURNAL ASSOCIATION
306a Engineering Bldg., Madison, Wis., Telephones University 177W - 277

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The WISCONSIN ENGINEER

VOLUME 36, NO. 4 JANUARY, 1932

Analogies Permitting the Application of Electrical Theory to the Solution of Vibratory Mechanical Problems

By C. A. Andree, Ph. D.

IN its early stages, the development of electrical theory was aided to a great extent by our knowledge of mechanics. We spoke rather loosely and somewhat inaccurately of analogies between a current of electricity and a current of water, between electromotive force and mechanical force, between inductance and mass, between electrical resistance and friction (or mechanical resistance) and between capacitance and the elasticity (or the compliance) of a spring. These concepts aided greatly the development of electrical theory and are still useful in presenting the subject to the novice.

The development of electrical theory proceeded at so rapid a pace, however, that today the situation is largely reversed. Today to a very large extent we use the concepts of electricity to assist in understanding and solving those problems in mechanics which are vibratory in character. This is true primarily because the tools which are most useful in solving these problems were developed by electrical engineers in the electrical field. The electrical engineer bridging the gap between electricity and mechanics by means of the above mentioned analogies possessed a tremendous advantage in the field of mechanics both because of the tools at his command and because of the skill he had acquired in the use of these tools. It is to be understood of course that this advantage is possessed only in that special branch of mechanics which is concerned with vibratory forces. It is not the purpose of this paper to discuss the advantages possessed by the electrical engineer, nor to point out the reasons for his rapid advance, but rather to point out the means which enabled him to bridge the gap between the two fields.

To this end let us begin by considering first the three elements which may enter into a mechanical problem. They are a mass, a dissipative medium or resistance such as a paddle moving in water or oil and a spring. The differential equations for these three elements may be written as follows:

$$f = M\frac{dv}{dt} = M\frac{d^2x}{dt^2}$$

$$f = R\,v = R\frac{dx}{dt}$$

$$f = \frac{1}{C}\int v\,dt = \frac{1}{C}x$$

where f, a, v, and x are respectively the instantaneous values of the applied force, the acceleration, the velocity and the displacement and where M is the mass, R is the resistance which is assumed constant and C is the elasticity or compliance of the spring. In the electrical field we have the analogous elements of inductance, resistance, and capacitance with the differential equations

$$e = L\frac{di}{dt} = L\frac{d^2q}{dt^2}$$

$$e = R\,i = R\frac{dq}{dt}$$

$$e = \frac{1}{C}\int i\,dt = \frac{1}{C}q$$

where e, i, and q are respectively the instantaneous values of the applied electromotive force (e.m.f.), the current and

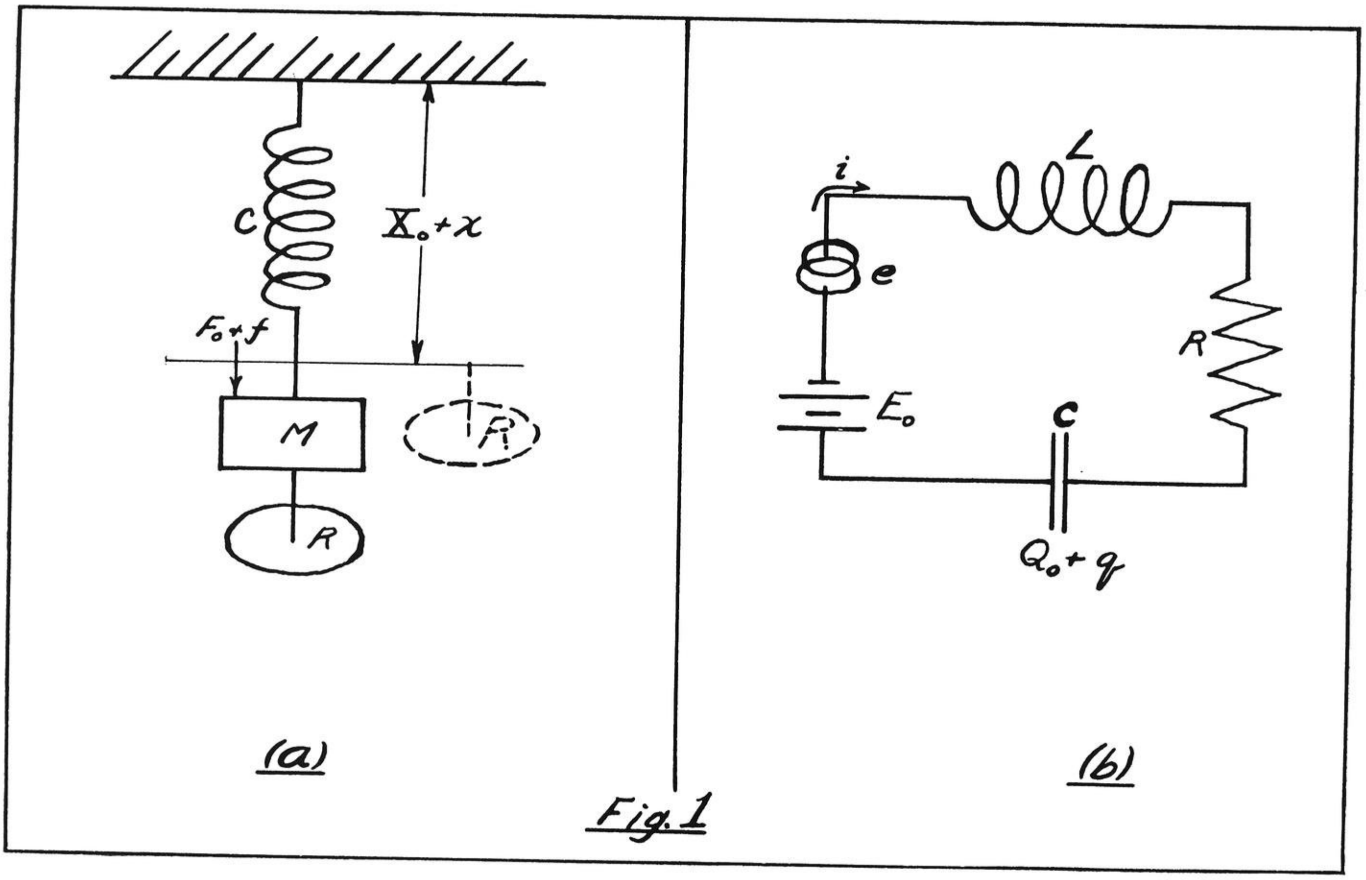


Fig. 1

the charge of electricity and where L is the inductance, R is the resistance (assumed constant) and where C is the capacitance. We note the similarity in the two sets of differential equations and by inspection we state that the following quantities are analogous since they occupy analogous positions in the two sets of equations.

Analogous Quantities						
Mechanical System	f	v	x	M	R	C
Electrical System	e	i	q	L	R	C

Now if x is positive in a given direction our equations imply that an increase in displacement in that direction represents a positive velocity and that an increase in velocity represents a positive acceleration and that an applied force is positive if it produces a positive acceleration, velocity or displacement. Now it is well known that associated with each applied force there is a reactive force, equal in magnitude but opposite in direction. To designate the fact that the reactive forces are opposite in direction to the applied forces, the above mechanical equations should all be rewritten with the negative sign if we let it be the reactive force instead of the applied force. A reactive force is negative therefore if it is produced by a positive acceleration, velocity, or displacement.

Analogous statements may be made in specifying the signs in an electrical circuit except that "direction" in an electrical circuit refers to direction along a wire and in an electrical circuit the term which is analogous to reactive force is counter e.m.f. Just as in the mechanical circuit we know that the sum of all the forces in a given direction counting both applied and reactive, must equal zero so, also, in an electrical circuit the sum of all the e.m.f.'s in a particular direction along the wire must equal zero.

Let us now consider a simple mechanical problem Fig. 1a, which contains the above three elements and determine the equivalent electrical circuit. C, M, and R represent a spring, mass, and resistance respectively. A steady force, F_0, and a vibratory force, f, act upon the mass M. As a result of this force the spring suffers a steady deflection X_0 and a vibratory deflection x. Since we are concerned only with vibratory quantities the steady terms will be neglected in the remaining discussion. It is apparent that M, R, and C are all subjected to the same vibratory displacement x. They may in fact all be considered as attached to a weightless bar B moving only laterally by translation. The force, f, may also be thought of as acting on this bar. Then since the sum of all the forces acting on this bar must be zero one may write the following differential equations, in which x is assumed to be positive downward.

$$f - M\frac{d^2x}{dt^2} - R\frac{dx}{dt} - \frac{1}{C}x = 0$$

The equation may be rewritten in terms of velocities as follows:

$$f - M\frac{dv}{dt} - R\,v - \frac{1}{C}\int v\,dt = 0$$

This equation, which completely specifies the problem contains but one velocity. Our equivalent electrical circuit will, therefore, contain but one current. The electrical circuit therefore can have no branches and must be a series circuit containing an alternating current generator, e, an inductance, L, a resistance, R, and a capacitance, C. Fig. 1b. To make the analogy complete a steady voltage, E_0, may be introduced producing a steady charge Q_0 on the capacitance, C. As stated before, these steady terms will be dropped from the discussion.

Now in an entirely analogous fashion we may write that the sum of the voltages around this circuit must be zero and arrive at the analogous equation,

$$e - L\frac{d^2q}{dt^2} - R\frac{dq}{dt} - \frac{1}{C}q = 0$$

or

$$e - L\frac{di}{dt} - Ri - \frac{1}{C}\int i\,dt = 0$$

This situation is familiarly known to electrical engineers as the case of series resonance.

Let us consider now a slightly different case where the force is applied not at the lower end of the spring but at the upper end as shown in Fig. 2a. In applying the force f, the upper end of the spring is moved with a displacement x_1. The differential displacement between the two ends of the spring is x_2. The displacement x_3 of bar B is the sum of these two displacements or

$$x_3 = x_2 + x_1$$

An increase in x_1 will move bar A downward. An increase in x_2 will move bar B downward or bar A upward. An increase in x_3 will move bar B downward. If we take a downward direction as positive all the displacements will be positive except the displacement at A resulting from an increase in x_2.

Now all the forces at B must be zero and since they are reactive forces we may write

$$-\frac{1}{C}x_2 - M\frac{d^2x_3}{dt^2} - R\frac{dx_3}{dt} = 0$$

Similarly all the forces at A must be zero so that we may write

$$f + \frac{1}{C}x_2 = 0$$

The reactive force lacks the customary negative sign in this equation because in this case the displacement resulting from x_2 is negative. The above three equations may of course be rewritten in terms of velocities as follows:

$$v_3 = v_2 + v_1$$

$$-\frac{1}{C}\int v_2\,dt - M\frac{dv_3}{dt} - R\,v_3 = 0$$

$$f + \frac{1}{C}\int v_2\,dt = 0$$

To determine the electrical equivalent of this circuit we observe that we have three displacements (or three velocities) which requires that the equivalent electrical circuit have three currents. It must therefore be a branched or parallel electrical circuit. We see that a capacitance must be common to the two electrical circuits and that one of the branches must contain in addition an inductance and a resistance while the other must contain in addition a driving e.m.f. Accordingly we draw the branched circuit Fig. 2b

(Continued on page 88)

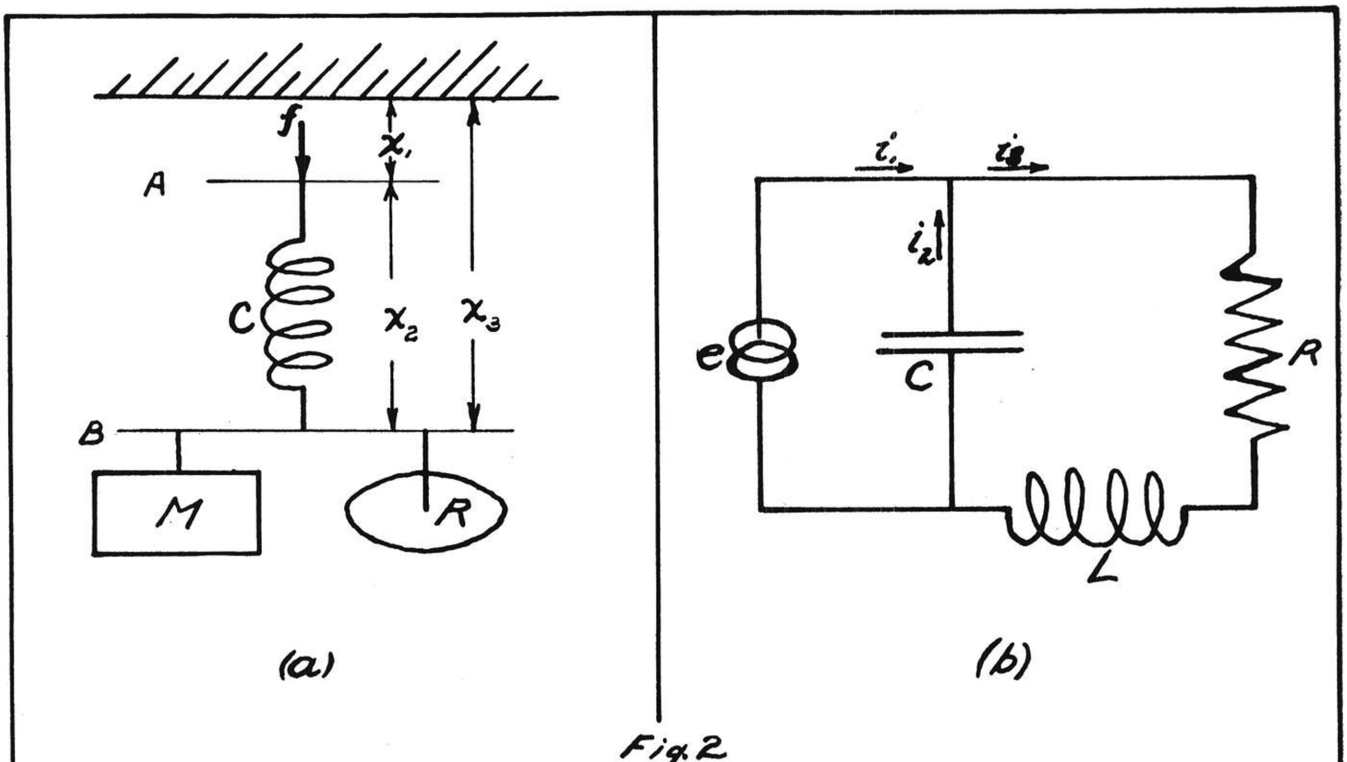


Fig. 2

Six Students Discuss The Question

Is a Winning Football Team Necessary to the University of Wisconsin?

In spite of the small amount of interest shown by Wisconsin students in the recent Cardinal poll upon the matter of the dismissal of the football coach, athletics is not a dead tradition at this university. In track and basketball, Wisconsin is a consistent winner; the baseball team last year won a Big Ten championship; intramural sports attract large numbers of students; and such unorganized sports as bowling, canoeing, skiing, swimming, and skating have their host of participants. This symposium of student opinion is offered with confidence that it will interest our readers and present ideas that will be new to many of them. Just what do we mean by a winning team and just what is the value of an athletic victory to a university?

WISCONSIN NEEDS A WINNING FOOTBALL TEAM

HAROLD F. SMITH
Captain of the 1931 Team

The question at once arises as to just what is a winning team. What percentage of its games must be won in order to be considered a winner. Among people who know sports, a winning football team should be victorious in about seventy-five per cent of its games.

By winning games a college team puts its school prominently out in front. Alumni take pride in pointing to their school as a winner. Alumni have a right to be proud of their school, and, because of the fact that the football team is so conspicuous in university life, shouldn't it be one of which an alumnus could be proud?

A good football team arouses student interest. Students, too, are proud of a good team. Their interest should be rewarded with victory instead of apologies and alibis for victory.

Finally, when the matter is all drawn down to cold, hard facts, Wisconsin needs a winning football team to pay the athletic debt. Football pays the way for all other sports, and supports the intramural program. There is a large bonded indebtedness on the field house. Empty seats in the stadium will raise no money to support the program. Money must be made on football games, a winning team will do the trick.

WISCONSIN CAN PRODUCE WINNERS IN ANY ACTIVITY

By FRANCIS D. MCGUIRE
Senior Civil

If Wisconsin were to abolish intercollegiate football today, there is no doubt that the school would continue to be the same high caliber university it has always been. On the other hand, the school authorities would be constantly annoyed and, shall we say, "badgered" by the press, the influential alumni and the legislature.

The statement that college football of today is played for the purpose of developing character and sportsmanship on the part of the players, and fostering friendly relations with other schools is greeted with a broad smile by most people. The real object of playing football seems to be to make money, advertise the school, and provide a good show.

At Wisconsin football does make money, though perhaps not enough to satisfy everyone. We do not need to advertise, and we do not put on a good show. The University of Wisconsin is said to be "one of the few really great institutions of learning in the United States". In all of our activities, classroom, research and extra-curricular, and in the quality of graduates, we prove this statement to be true.

With one exception our football teams of the last eight or ten years have not been truly representative of Wisconsin. It is true that these teams have shown defensive strength and the ability to fight against odds, but they have not had that spark, color, dash, or "cocky" attitude that should represent Wisconsin on the football field.

Wisconsin needs a couple of winning football teams, not just to quiet the knockers but to show Wisconsin supporters that this school can produce winners in any activity it undertakes.

INTRAMURAL SPORTS NEED NOT BE EXPENSIVE

By JOHN A. STRAND
Manager of the Wisconsin Engineer

As athletics in general, and football in particular, have been the subject of much discussion the last few weeks it might be appropriate to try to determine the relation of the football team to the University. Just how important is it that we have a winning team?

It has been said that a winning team is one of the best means of advertising our school throughout the country. That this advertising will result in more students and greater prestige is not certain. So far as our experience and thought allow us to state, it would seem that the real students, the ones coming to school and not to college, are attracted more by the academical advantages, the opportunity to enter into worthwhile activities and the cultural development offered by a school than by the prowess of its football team. Some schools that are admittedly the best in the country have weak teams or no teams at all.

At the present time the football receipts carry the financial burden of all other intercollegiate sports except basketball, which barely supports itself. The receipts from football this fall were $72,000 below estimates, and this drop in revenue has necessitated a severe cut in all other intercollegiate sport programs. It is granted that a winning team is necessary before large profits can be obtained from the football schedule. The point of debate is "Is an extensive major and minor sports program desirable?" The old conception of an amateur sport was that the physical exercise, the co-ordination and sportsmanship senses developed were sufficient remuneration for the effort expended. This feeling has changed till we now find athletics a career for a few university students, with scholarship of secondary importance. The emphasis in intercollegiate competition is placed upon winning, not on the game itself. The physical exertion required in most varsity sports does not allow sufficient remaining energy for academic purposes. It does not seem to us that intensive athletics, of the kind demanded in intercollegiate competition, can justify a large expenditure of money. If this be true the funds derived from a football team are not needed, and from a financial standpoint a winning team is unnecessary.

We think that physical exercise of some sort is absolutely necessary for the best development of the student; a vicarious appreciation of athletics does the student no good. If varsity sports are discredited, what means of gaining this exercise remain? There has been developed even now on this campus a satisfactory system of athletics that is open to all. The intramural program has grown steadily, and has the advantage of providing a means of exercise, the benefits of which may be enjoyed by the mass of the students, something never possible in varsity sports. The games are played for the joy of playing; they do not demand excessive physical exertion and long practice. The cost is negligible, and is borne by the teams entering competition. Thus, the demand for athletic competition is satisfied at no great expense; there is no need to draw upon football receipts for funds, and the last reason for the creation of a winning team is overcome. We hope the time will soon come when the emphasis upon the winning football team is removed.

ARE WISCONSIN'S FUTURE GREAT MEN ATTRACTED BY FOOTBALL VICTORIES?

By Earl W. Wheeler
Senior Civil

Must Wisconsin have the publicity that winning teams will bring? Must we advertise to bring students here?

Was it winning teams that brought men like Van Hise, Birge, Babcock, and a host of other successful men to Wisconsin?

The real spirit of football is a love of the game — the joy of competition — the camaraderie arising from teamplay. This original, worthwhile spirit has steadily languished in a hectic endeavor to produce winning teams by fair means or foul. We have come to feel that a university is a failure unless it produces winning teams.

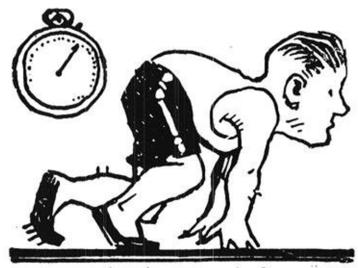
We believe that the function of the football coach is not simply to turn out a winner but to teach his charges teamplay and the spirit of the game. No man should be allowed to play on the varsity eleven until he has acquired the true spirit of football. Such idealism is scoffed at today. Nevertheless, it is the attempt to live up to high ideals which carries us higher up the ladder of civilization.

If our coach instills the true spirit of football in his charges can we ask more? If we are believers in the virtue of loyalty, we must believe in "Wisconsin — win or lose — Wisconsin".

WISCONSIN RESENTS MEDIOCRITY IN ANY LINE

By Harry C. Dever
Member of Cross Country Team

Why such a clamor of protest from students and alumni of Wisconsin when she suffers a poor season in football?



Are they poor losers? The answer is, yes, and the reason is two-fold.

First, those who have affiliated themselves with Wisconsin have, with few exceptions, done so because they believed that Wisconsin was the best and finest University that they could attend. They are proud of the school and proud to be known as part of it. It is nationally renowned for its beauty, for the high-caliber of its graduates, for being a splendid institution of learning, and, over the length of its life, its athletic records are as enviable as those of any other school. The Badger State and University is noted for progressiveness; our motto is "Forward" and we like to feel that, "If it can be done, Wisconsin can do it!" This is why a losing football team hurts. It evidences inferiority and the pride of those connected with our school do not want to see such a condition prevail.

The second reason, unlike the first, is in no way sentimental. It is largely based upon dollars and cents and cold facts.

Wisconsin's athletic program, including intercollegiate activities and an extensive intra-mural sports program, is almost entirely supported by the receipts of football games which seem to be the only contests that interest the public or the students. Poor teams result in lowered gate receipts which means a curtailment of all of the university's sports, with a possible exception of basketball, which is more or less self-supporting.

While the University is primarily engaged in increasing the intellectual capacities and mental development of those who come here, it realizes that a healthy body is an asset to a healthy mind. A super-mind in a weak body is like a high-powered, finely tuned engine in a light chassis that

(Continued on page 88)

Engineering Education in Russia

By R. C. Disque, e'08
Academic Dean and Professor of Electrical Engineering, Drexel Institute

TECHNICAL education in Russia naturally bears the stamp of detailed planning and complete subordination to the aims of the Soviet Union. Like the gigantic five year-plan itself the Russian system of education represents an attempt to solve a complicated problem by the formulation of plans, both general and specific; by strict adherence to those plans; by close centralization of authority; and by unquestioning obedience on the part of the entire population. The whole scheme of education must as yet be considered an experiment to determine whether a large body of people will order their lives over a long period of time in accordance with pre-conceived plans and specifications, all for the sake of economic welfare.

It will be the purpose of this article to set forth the main features of the present Russian plan of technical education, as described by Professor Serge P. Tambovtzev in an admirable report prepared for the Society for the Promotion of Engineering Education and presented at the last convention of the society.

The Russian School System

Engineers and technologists of all levels are to be trained in Russia according to what we call the cooperative plan. Unlike our cooperative plans, the Russian plan places the responsibility of training engineers on the industries themselves. Since the industries are owned and controlled by the state, they must function as parts of the administrative machinery of the state, and be intimately geared to that machinery. Their duties comprise both production and education in equal measure, and they are responsible for results in both fields.

Specialization may be said to begin normally at eight years of age, after four years of attendance at pre-school establishments like kindergartens. At this age the children of industrial centers enter the so-called factory seven-year schools. In these schools the pupils are definitely directed toward work in the industries; and they supplement their work by actual contact with the factories and industrial plants. At fifteen the graduates of the seven-year schools enter either the three-year technicums to be trained ultimately as engineers and technologists, or the three-year factory plant schools to be trained as skilled manual workers. The curricula of the technicums correspond roughly to those of our senior high schools and underclasses in college. Part of the technicum graduates qualify as technologists of medium qualifications and part go on into the higher technical schools after an apprenticeship in industry. At the end of the technicum course, the students are about eighteen years of age. Those selected to become engineers and specialists of superior intellectual attainment enter the higher technical schools, which correspond to the higher years of our technical colleges. At the end of the course in the higher schools, another selection is made of those destined to become teachers and research engineers by being trained further in the two-year pedagogical institutes. These institutes constitute the capstone of the entire structure of technical schools, corresponding in a general way to our graduate schools. The graduates are normally about twenty-three years old.

Lest this system be too rigid and exclusive, there is a collateral road to higher education in the form of the so-called Workers' Faculties, for the benefit of those who for one reason or another are unable to be cared for in the regular sequence already described. These are high-pressure schools which may be entered at or above sixteen years of age. The curriculum comprises three years of intensive study in preparation for the higher technical schools; during this period the students, being adults, are presumed to be able to prepare themselves in much less than the normal time.

There is also a collateral system of schools for the education of peasant youth between the ages of twelve and twenty who may not have had access to the normal sequence of studies. Unlike the Workers' Faculties, these schools are not related to any definite specialty.

Control

Such a detailed plan requires elaborate administrative machinery and great centralization of control. First and last, engineering education is only a part — a very important part — of the great all-Russian plan, which is administered by the State Planning Commission, the famous Gosplan. This commission operating as the executive arm of the Soviet of People's Commissars bears the whole responsibility for shaping and guiding the ambitious program of Soviet Russia. Its powers are enormous and far reaching, subject always to the authority of its legislative master, the Soviet of People's Commissars. It is divided into two great parts, one to administer the affairs of the U. S. S. R. itself, the other for the autonomous republics. We shall trace the line of authority through the former only, since the latter is an exact counterpart of it.

Immediately under the State Planning Commission fall the committees known as the People's Commissariats, a dozen or so in number. These might be compared to the cabinet portfolios of our government. They comprise transportation, agriculture, finance, foreign affairs, trade, interior, economy, education, and so on. The industries, holding responsibility for both production and technical education, fall under the People's Commissariat of Economy. They include the usual groups such as chemical, electrical, power, automotive, coal, textiles, oil, and aeronautics. Co-

*This paper appeared in the *McGraw-Hill Book Notes* published recently.

ordinate with the industrial groups under the Commissariat of Economy are two technical commissions to advise and guide the industries in matters pertaining to research and education, namely, the Board of Research Institutes and the Supreme Committtee of Engineering education. The Commissariat of Economy has as one of its executive arms the so-called Sector of Cadres, which, as the name indicates, prepares organization schemes, allots funds, and coordinates the whole field included under that Commissariat.

Each industry is charged with the double duty of producing its quota of commodities and of maintaining a complete set of standard schools all the way from the seven-year schools to the pedagogical institutes. In fact the tendency has been to supplement the regular sequence by an elaborate system of part-time factory schools to perfect the educational equipment of all persons in the plants. The plants thus tend to become great centers of education. Their work in the educational field is coordinated and guided by the Supreme Committee of Engineering Education.

The higher technical schools, the technicums, the three-year factory schools, and even the seven-year factory plant schools operate exclusively on the cooperative plan, but with many points of difference from the American cooperative plan. First of all, the students in the medium and higher schools are without exception acquainted with the tools and machinery of production, all having come through the factory schools or Workmen's Faculties. In fact many are highly skilled workers. Alternation proceeds throughout the course in periods depending upon the student's progress and upon local conditions. In general the periods tend to lengthen toward the end of the course. The practical and theoretical work are very intimately connected, both being carried on in the plants themselves. Under the Russian system, the plants must devote their resources and energy equally to production and education. They cannot be relieved of any part of their educational responsibilities except by satisfactory proof of their inability to carry them.

The obligations of the student are equally definite and binding. His studies and his progress are not his private affair; they are his assigned duty in the campaign to achieve the aims of the Soviet State. His ambitions must be tuned to that spirit; what competition exists between students must be based on service to the state and distinctly not on private fortune. Education is entirely free, as is also subsistence; both are provided by the state which fixes and controls them.

One of the important purposes of the Russian high command is to wipe out every possible social distinction between manual and intellectual work. This is presumably to be accomplished through control of wages, the theory being that social distinctions are based principally on wages, and by controlling wages, the state can control both. This is not the least interesting phase of the great experiment.

The plan as here outlined places final authority in the hands of political bodies, as it must be in every political state. At the head of the whole system stands the Conference of the Soviets, operating through a Central Executive Committee, and under this the Soviet of People's Commissars. These supreme bodies are political in the sense that their membership is based on representation of all the interests of the state, at least all those considered important to the aims of the state. The membership of these supreme bodies must necessarily be chosen for loyalty to the political purposes of the state and for administrative rather than special abilities. To insure intelligent control over technical and scientific affairs, a very powerful executive body known as the State Scientific Council, the well known G U S, is organized under the People's Commissariat of Education. This council is made up of representatives from a great variety of bodies, including the various commissariats, the State Planning Commission, the trade unions, the army, the navy, engineering societies, and many others from both the U. S. S. R. and the federated autonomous republics.

The powers of the State Scientific Council are enormous. It lays out general plans of education in the state as a whole and in all fields; fixes curricula at all levels; determines programs for practical and theoretical training; directs all forms of research; fixes student quotas; sets qualifications of entrance and promotion; approves the appointment of professors; and selects text and reference books. Its word is law in its field subject only to the higher political authorities.

Conclusion

One's estimate of the Russian plan depends, of course, on his social philosophy. To one like the writer, schooled in the Anglo-Saxon tradition, such centralization of authority as that plan contemplates is very unattractive. To assume that the individual is made for the state is to reverse what seems to us to be the proper relation. That the aims and purposes of the central authority are for the moment applied to the promotion of the welfare of the individual does not convince us, for then arises the question of human wisdom. Can any body of men or women, however chosen, be expected to possess enough wisdom to exercise such vast powers with even a fair chance of succeeding in any objective however clearly conceived? History does not seem to give an affirmative answer to this question, even in military enterprises, where success might be most confidently expected.

We are especially distrustful of centralization in matters pertaining to education and research, for our experience seems to offer much evidence of the value of a variegated pattern. A decentralized system like ours tends to become a laboratory in which experiments may be freely tried; when mistakes are made they affect a relatively small area, and when success is achieved, the results become available to all. This may seem very haphazard to some people, but the fact remains that it has brought our educational system to a high state of effectiveness. The cooperative plan itself, now so confidently embraced by Soviet Russia, is an outstanding fruit of the American process; but its most ardent champion would not dream of imposing it upon all.

So far as research is concerned the case against centralization is still stronger. Perhaps the epoch-making advances in science and technology might have been made under the guidance of some supreme commission; but this is hard to believe. The list of such advances is a very long one, but

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Alumni Notes

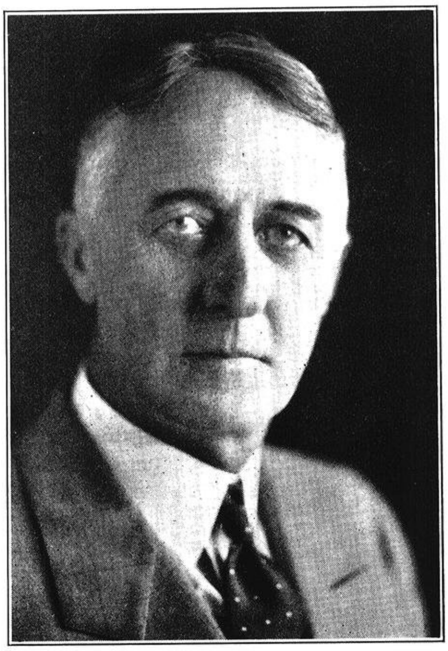
Burgess Honored for Work in Science

Charles Frederick Burgess, Wisconsin '95, president of the Burgess Battery Company and the Burgess Laboratories, received the Perkin Medal of the American section of the Society of Chemists in Industry in New York on January 8 for outstanding work in the field of electro-chemistry. The medal has been awarded annually since 1906.

Dr. Burgess has been unusually successful in three fields of activity, as teacher, scientist, and business man. Following his graduation from the course in electrical engineering in 1895, he was appointed instructor at Wisconsin. He was made professor of applied electro-chemistry in 1905 and professor of chemical engineering in 1909. He organized the department of chemical engineering at Wisconsin. During this period he was active in research and consulting practice and was a liberal contributor to the modest pages of the *Wisconsin Engineer*.

His success in applying his knowledge of chemistry and engineering to the problems of industry attracted the attention of business men to such an extent that in 1910 he organized an industrial research laboratory of his own under the name of Northern Chemical Engineering Laboratories. This later became the C. F. Burgess Laboratories. By 1913 the demands of business were so great that he resigned from the faculty of the university.

The development of the dry battery was the first big project of his laboratory. He took personal part in the experimentation that resulted in over fifty patents and the material improvement of the dry cell. The Burgess Battery Company was organized in 1917 and quickly became known throughout the world. He applied the principle of over-voltage to dry cell construction when the price of zinc



CHARLES FREDERICK BURGESS

mounted rapidly during the war and threatened the infant company. He also substituted terne and tin plate for the zinc bottoms in dry cells at a considerable saving in cost. His many developments in this field resulted in such an accumulation of data that the United States government sent its chemists and engineers to his plants to acquire this knowledge when it became necessary to construct new types of cells and batteries during the World War. The company has grown until it now has three plants in the United States, one in Canada, and one in England. Its products have been an essential part of the epuipment for Commander Byrd's exploring parties and have been flown over both poles.

In 1928 he became associated with the late Professor Samuel W. Parr and reorganized the Standard Calorimeter Company into the Burgess-Parr Company to make scientific instruments of which the Parr calorimeter is the best known.

Dr. Burgess has to his credit many and varied scientific accomplishments of which only a few can be mentioned here. One of the first was the development of an electro-chemical method for removing excess brazing metal from bicycle frames. The method was so simple and effective that it soon displaced the old filing and grinding process. He perfected a fused salt aluminum electrolytic rectifier that worked beautifully. His outstanding technical contributions were probably in the development of a process for making electrolytic iron and alloys from such iron. His studies furnished the basis for the commercial production of electrolytic iron in the United States and his method became well known as the Burgess process. His studies in the corrosion of iron in concrete were considered so valuable a contribution that in 1911 the Western Society of Engineers awarded him the Octave Chanute Medal.

In 1907, Professor Burgess was a member of the international Jury of Awards at the St. Louis Exposition. In 1908 he was made president of the American Electrochemical Society.

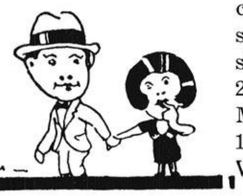
Charles F. Burgess was born at Oshkosh on January 5, 1873, son of Frederick and Anna Heckman Burgess. He was married on June 25, 1893, at Milwaukee to Ida M. Jackson. He spends much of his time in his Florida laboratory.

CIVILS

Anderson, Arthur J., c'28, is instrumentman for the C. M. St. P. & P. Railroad with headquarters at La Crosse. He visited the college on January 6 and, among other items of interest, told about a scheme he worked out for relining spiral curves ahead of a rail gang. After some experimentation, he devised a routine that was rapid, accurate, and required only one assistant and a stakeman.

Bartleson, Glenn S., c'25, visited Madison on December 3. He is with Pearse, Greeley & Hanson, hydraulic and sanitary engineers of Chicago and is living at 1730 Juneway Terrace, Chicago. For three years, from November, 1928, to September, 1931, he was stationed at Peoria for the company and engaged in the construction of a sewer and a treatment plant said to be the largest activated-sludge plant in Illinois outside of Chicago. His wife is Vera Harrison, L. S. '24, of Milwaukee. They have a daughter, Shirley Joanne, born June 30, 1929.

Homewood, Robert T., c'27, former editor of "The Wisconsin Engineer" and formerly instructor in hydraulics at the university here, was married on December 28 to Miss Catherine O'Malley of Madison. They will be at home at 1106 West Franklin Street, Richmond, Virginia.



Howson, Elmer T., c'06, western editor of "Railway Age" and editor of "Railway Engineering and Maintenance", and of the "Railway Engineering and Maintenance Encyclopedia", has been elected vice-president and director of the Simmons Boardman Publishing Company, New York, publishers of engineering trade magazines. He has been associated with Railway Age since 1912.

Macaraeg, Juan, c'11, writes: "As president of the Southern Islands Society of Engineers and Architects of Cebu, Cebu, Philippine Islands, I am acting as chief editor of the organ of the society. The name of the paper is the 'Journal of S. I. S. E. A'."

Merkin, Abraham L., c'10, is assistant engineer with the board of transportation of the city of New York in the bureau of design. At the present time he is engaged in the design of the proposed Sixth Avenue subway.

Peterson, Eugene J., c'31, late in the summer shipped as seaman on the S. S. Steel Age of the Isthmian S. S. Co., 50 Trinity Place, New York City. He expected to be in San Diego on New Year's Day. Pete had had experience as a seaman previous to this trip.

Salter, G. D., M.S.'24, is with the Sanitary District of Chicago. Address: 910 South Michigan Avenue, Chicago.

Tschudy, Lionel C., c'23, is field engineer with Emery Peck & Rockwood Development Company. At present he is at the Hamilton Dam on the Colorado River of Texas. Address: Box 14, Llano, Texas.

Weaver, Warren, c'17, professor of mathematics at the University of Wisconsin, has announced that he will resign at the end of the present school year and join the staff of the Rockefeller Foundation.

Zufelt, Jerome C., c'26, is water works superintendent at Sheboygan. He supervised the construction of the plant, which was completed within the year, and was selected to supervise its operation.

MINERS

Azcon, Ernesto, min'24, is mine engineer with the Esmeralda Unit of Cia Minera de Penoles at Esmeralda, Coahuila, Mexico.

Jourdan, Ralph, min'21, is assistant manager of the Utah division of the American Smelting and Refining Company in Salt Lake City.

Ray, Otto, min'20, is the western representative of the Chicago Pneumatic Tool Company in Salt Lake City, Utah.

ELECTRICALS

Adam, Louis G., e'23, is with the American Telephone and Telegraph Company in New York City.

Kurtz, Edwin B., e'17, former staff member of the "Engineer" and now professor of electrical engineering at the University of Iowa, is the author of a bulletin on "Oklahoma Wind-Electric Power", which has been published by the Oklahoma A. & M. College. He prepared the material while he was head of the department at the Oklahoma institution.

Rodenbaeck, G. A., e'05, address: 707 Fifth Avenue, Salt Lake City, Utah.

Schrage, Charles T., e'21, doing personnel work with the American Telephone and Telegraph Company in New York City, has recently moved to 10 Boulevard, Glen Rock, New Jersey.

Wagley, Oswald O., e'05, is superintendent of power sales with the Milwaukee Electric Railway and Light Company. Address: 2416 E. Edgewood Avenue, Milwaukee.

Zia, Yussuf, e'24, is technical director of municipal affairs at Istanboul (Constantinople). He was recently reported in press dispatches as opposing the replacement of the famous pontoon bridge between Galata and Istanboul with a suspension bridge. He argues that the suspension bridge would be more costly and less accessible than the pontoon bridge.

MECHANICALS

Bickelhaupt, I. A., m'14, with his wife and family, spent the early part of September visiting relatives in San Diego.

Bruce, Robert H., m'22, who was construction engineer for the Crowl Building Company, has returned to Madison. Address: 611 South Few Street, Madison, Wisconsin.

Dorner, Fred H., m'05, was elected one of the vice-presidents of the American Society of Mechanical Engineers for 1932.

Mollerus, Frederick J., m'24, announces the arrival on November 16 of a seven and one-half pound baby boy, Frederick J., Jr. Address: Antofagasta, Chile.

Schulz, Thos. Norberg, m'22, writes from Oslo, Norway: "I left the Pelton Water Wheel Co. about three years ago to spend a couple of years with the F. A. B. Mfg. Co. in Oakland, California, designing oil engines. Last summer I was called to this country to start with the Akers Mek. Verksted, a shipbuilding and diesel engine concern. They had just completed a large machine shop and were going through quite an extensive reorganization and modernizing program. I spent the first year as assistant shop superintendent and a short time ago got my appointment as manager of the production department, which is an entirely new department.

"Practically all the work here is done on a piecework basis, and until now it has been left entirely to the individual foreman to set the prices; now this is going to be handled entirely by my department, as well as the controlling and routing of the work. We are at present employing about 1100 men." Address: Vestgrensen 7, Ullevald Havebu, Oslo, Norway.

Simpson, William D., m'31, is in the engineering department of the Buffalo Forge Company of Buffalo, New York. He appears to be enjoying his work and has survived the personnel cuts which have been effected since his start.

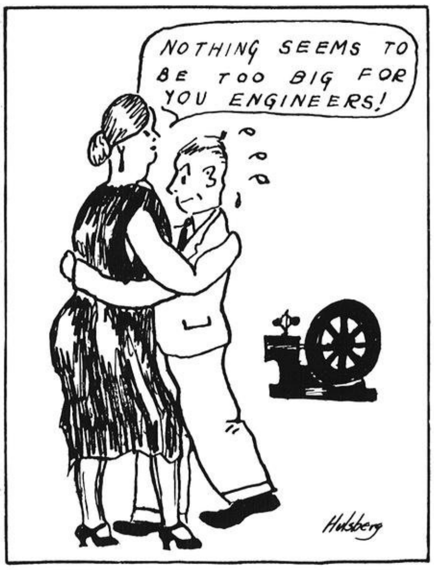
Sladky, A. C., m'11, resigned as assistant general manager of manufacturing with the National Enameling and Stamping Company, and is now factory manager for the Perfex Corporation in Milwaukee.

Campus Notes

PROM CHAIRMEN TAKE NOTICE

A good orchestra, plenty of room for dancing, punch, free checking service — and all for (1) dollar. "Not on this campus," resounds a multitude of voices. Yet Polygon seems to have accomplished this feat, conducted a dance with the previously-mentioned qualities, and did not come out in the red. For proof, ask anyone who attended the All-Engineer's Dance on December 11.

The lobby of the new mechanical engineering building provided the room for dancing, one of Thompson's orchestras supplied the music, and Polygon, it seems, supplied the punch and the free checking service. The floor was dangerous to life and limb at first, but the wax finally wore off sufficiently to permit safe dancing. As an added attraction, a cigarette lighter and a vanity case were given to the man and girl (respectively) who succeeded in identifying the most of the numerous bewhiskered pioneers of science whose pictures appeared about the lobby. All that was necessary to fill a lull in the conversation was to escort the one-and-only to the steam and gas lab, or the museum and explain the intricacies of the parts displayed there. And all the while, an airplane was suspended precariously over the heads of the dancers.



Lieut. and Mrs. Mead, and Mr. and Mrs. McNaul were chaperons. Numerous other faculty members attended the affair.

FRANK MATTHIAS EDITS "TRANSIT"

Frank T. Matthias, instructor in topographical engineering, will most likely find his experience as editor of the *Wisconsin Engineer* helpful in his new job as editor of the Chi Epsilon *Transit*. *The Transit* is the official publication of Chi Epsilon, national honorary civil engineering fraternity. Frank, you will remember, was the very capable editor of the *Wisconsin Engineer* two years ago, and is now the faculty advisor of the magazine.

TAU BETA PI INITIATES

The number thirteen apparently was not unlucky for that many engineers who recently were initiated into Tau Beta Pi, the honorary engineering fraternity. The following men were initiated: Elbert R. Rice, m'32; Otto R. Herrman, c'32; Robert H. Paddock, c'32; Herbert F. Hoffman, c'32; Henry M. Haase, m'32; Clark V. Bullen, e'32; Bernard Ensman, e'33; Wesley R. Winch, e'32; Kenneth J. Rhodes, e'32; Elwood H. Addison, e'32; Mitchell L. Dack, e'32; and Royal H. Wood, m'33.

The initiation banquet took place on December 17, at which time the much-coveted keys were presented. The Wisconsin chapter of Tau Beta Pi was founded in 1898. Membership is based chiefly on excellence in scholarship, but character and activities are taken into consideration when members are elected.

PROFESSOR SHOREY TELLS OF FIRST CROSS-COUNTRY TEAM

At the annual banquet of the cross-country team on December 1, two of the first Wisconsin harriers, Prof. E. A. Shorey, and C. S. Dean, told how the first team was organized in 1905. Dr. Elsom acted as toastmaster and introduced the two veterans. Prof. Shorey is now a member of the mining engineering department of the university.

FRANK P. WOY, JR., PINCH-HITS FOR DAD

When Professor Frank P. Woy was taken ill on December 8, it was thought that the students in engineering administration would have to forego the lecture for that day. Prof. Woy's son, Frank P. Woy, Jr., came to the rescue, however, and conducted the classes for the day while his father recuperated at home.

EE's PRESENT PICTURE OF MICHAEL FARADAY

Michael Faraday's achievements are so numerous that three students were required to give the story of his life at the combined meeting of the student branch, and the Madison branch of the American Institute of Electrical Engineers. K. J. Affanasiev, e'32, presented a paper on the electrical researches of Faraday. Paul E. Patterson, e'32, presented a paper having the title "Faraday's Chemical Researches". Mitchell L. Dack, e'32, told of "Farady's Private Life".

A framed picture of the father of the dynamo was presented by the student group to the electrical engineering department of the university at this meeting.

SHOREY AND EASTWOOD WRITE BULLETIN

Methods of increasing the recovery of zinc from Wisconsin ores from 75 per cent to 85 per cent and upward are described in a bulletin on the *Flotation of Southwestern Wisconsin Zinc Ores* prepared by Edwin R. Shorey, associate professor of mining and metallurgy, and La Verne W. Eastwood, research fellow in mining and metallurgy, both of this university. The bulletin is issued as No. 73 of the Wisconsin Engineering Experiment Station.

BENNETT SHOWS FACULTY NEW WELDING METHOD

Prof. Edward Bennett demonstrated his new method of heating the edges of plates and tubes for welding purposes to his colleagues on the faculty at a meeting of the Research Conference in the Mining Laboratory on the evening of December 14. Actual welding was not possible with the available epuipment, but the heating effects were successfully shown. Following the demonstration, Dean H. L. Russell, director of the Wisconsin Alumni Research Foundation, described the efforts of that organization to commercialize the results of faculty research. Ten or a dozen ideas are now in various stages of development. Professor Bennett's heating method was mentioned as outstanding in its apparent promise. The meeting was in charge of Prof. F. M. Dawson, chairman of the research committee.

TURNEAURE AND MEAD ARE Y. M. C. A. TRUSTEES

Dean F. E. Turneaure, of the college of engineering, was recently reelected trustee of the Madison Y. M. C. A. at a meeting of the nominating committee on December 1. D. W. Mead, professor of hydraulics and sanitary engineering, is also a trustee of the city "Y".

CIVILS SEE MOVIES OF HOOVER DAM

Professor Warren J. Mead, well known to civils for his engineering geology lectures, thrilled them at their meeting on December 9 with a talk and moving pictures of Hoover Dam. He described how models of the proposed dam were tested at Fort Collins. Another reel of film showed how gold vein is systematically hunted by engineers and geologists in Alaska. About ninety civil engineers heard the lecture, which was sponsored by the A. S. C. E.

MECHANICALS HEAR OF RUSSIAN CONDITIONS

A feature of the meeting of the American Society of Mechanical Engineers on January 14 was a talk by Mr. Elwood Reising on conditions in Soviet Russia. His talk was illustrated with slides.

FOOTBALL

The football team finished sixth in the Big Ten conference this year, the order being as follows:

1st—Northwestern, Michigan, and Purdue, 4th—Ohio State, 5th—Minnesota, 6th—Wisconsin, 7th—Indiana, 8th—Chicago, 9th—Iowa, and 10th—Illinois. Wisconsin defeated Bradley, North Dakota, Purdue, Chicago, and Illinois, tied Auburn, and lost to Pennsylvania, Minnesota, Ohio State, and Michigan.

As usual, the general cry to fire the coach was raised — this season with rather more success than usual, since a general investigation into the athletic situation was begun by the athletic council. The results of this investigation so far have been the resignation of Coach Glenn Thistlewaite, and that of Athletic Director Little. No new coach has been appointed as yet.

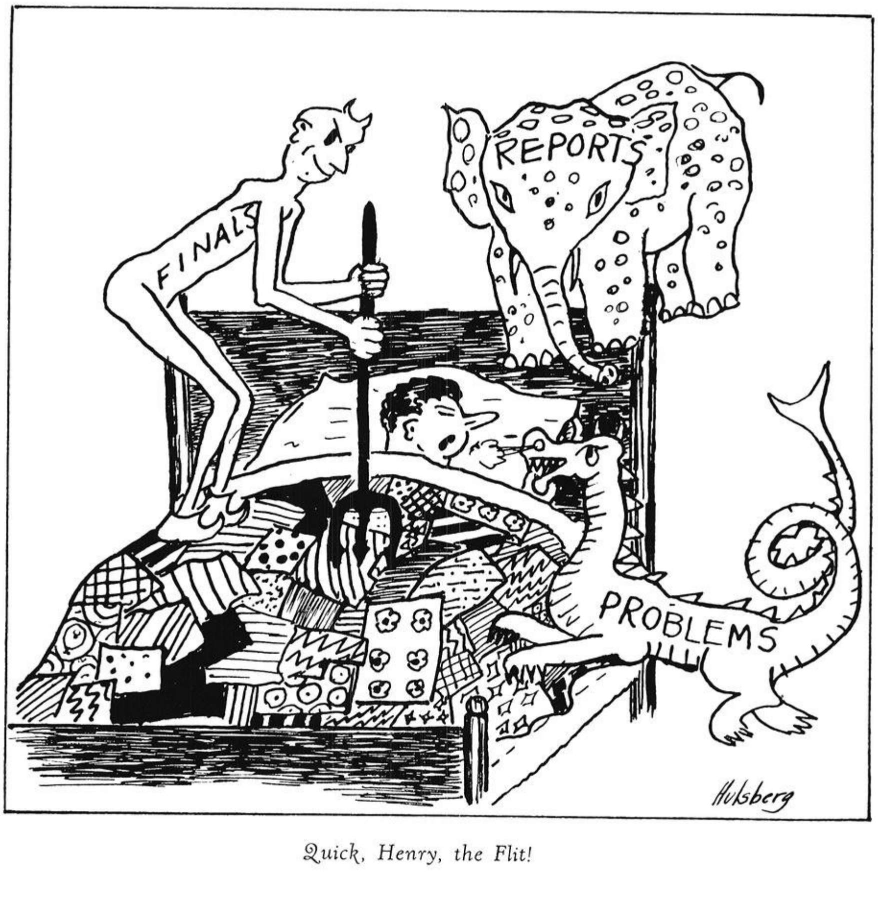
Hal Smith, c'32, leaves his post as captain this year. Kenneth Kruger, c'32, also has completed his last football season with the varsity. George Thurner, c'33, John Schneller, e'33, Bob Schiller, c'34, and Richard Haworth, e'33, are the outstanding engineers who will be veterans on next year's squad.

OWEN RUNS FOR RE-ELECTION

"Coming into the council two years ago, Professor Owen has proved to be one of the most effective members of that body," says the *Daily Cardinal* about the professor of topographical engineering with regard to his intention to run for re-election to the position of alderman of the city of Madison. Professor Owen has a new plan for the division of the city of Madison into twenty instead of ten wards, as it is at present.

RICHARD SHERIDAN HYLAND, 8 LBS.

"Born kicking for dear old Purdue," said Professor Pat Hyland of his new son, "just as school let out on Tuesday, January 12, at 3:30 p. m." Prof. Hyland claims the little fellow arrived wearing a basketball uniform of Purdue, Pat's alma mater. The name is Richard Sheridan Hyland, the weight eight pounds. Congratulations, professor!



Quick, Henry, the Flit!

Editorials

OUR OWN YEAR BOOK In spite of the recent flurry in the press concerning Badger page rates and various kindred matters, the Badger management is adamant and declines to listen to the request that such rates be brought within reach of the contributing societies. They prefer to maintain the price where it has been set by former managements, and let the public take it or leave it.

A college year book, to serve its full purpose, should include a complete historical register of the activities, societies, and events to which the college has devoted its time during the year. If the management sees fit to maintain the price of space in its publication at a prohibitive level, the organizations of comparatively weak financial status find it impossible to foot the bill and are forced to forego representation. When such is the case, the purpose of the annual is defeated and the book loses its value.

The engineering organizations have found the situation at Wisconsin to be a little beyond their financial capabilities, and have dropped out of the Badger little by little until this year there will probably be no sign of the "engine works" when the Badger is released to its subscribers.

If successive managements of the year book see fit to let the situation go unaltered, and to pay no attention to the desires of those for whom the book is ostensibly published, it is not out of the question that we publish our own engineering college annual. Such a book can, if its publishers so desire, be put out at a cost which the organizations can meet without excessive financial burden. Properly handled, a publication of this type could be produced on an income derived from subscription and advertising, allowing all the organizations to have free representation. Are we going to be forced by financial limitations to publish our own college annual and to surrender the Badger to those interests who now seem to consider it untouchable? Is Wisconsin drifting away from unification to the extent of being split into separate and independent colleges?

RELIEF MEASURES? The installation of an intricate system of automatic traffic control signals has been recently completed in Madison at reported costs ranging from $10,000 to $20,000. The signals are intriguing affairs offering relief to the bored motorist who finds ordinary driving tame and uninteresting. The man who can predict the behavior of the light is rare, and the common people hurtle along the street when they see a green light, and then pause, baffled and panting, as the color changes from green to amber and then to combinations of red and white.

At the same time that the traffic system was being evolved and put into operation, the legislature in the Capitol was wrangling and scrapping over proposed measures of relief which would afford funds for the alleviation of conditions brought on by the depression.

The situation would appear rather paradoxical. Solemn legislators argue the prospects of getting more money for relief of the needy at the same time that a municipality sees fit to spend a considerable sum for a system of traffic control which had to be abandoned during the rush of Christmas traffic to avoid hopeless congestion.

ELECTIVES The fall semester has almost gone its way to leave us gasping and weak from the battle with finals. Early registration with its accompanying problems of what to take and how to get it into the schedule along with the required credits has left us wondering just what we finally did decide to elect, and whether that was what we really wanted anyhow.

During our four years at college, we spend three years struggling with loaded schedules of required credits. In our last year we are given comparative freedom, and have access to ten or twelve elective credits with which we must try to get a smattering of the many courses about which we have heard and whose subject matter has intrigued our fancies.

It seems a shame that we must choose between so many opportunities, and let so many of the courses of which we would like to have some knowledge remain unsatisfied desires. Our college life offers unique opportunities for education, and in the present system we must pass up most of the chances in order that we may finish our course, get our degree, and start chasing our million with the least possible expended time. There would appear to be a basis to the argument that technical schools are rushing things when they turn us out after four years. It may be that a five or six-year course would be of sufficient added value to warrant the extra time which it would take from our short existence.

THE ENEMY In a recent issue of one of the popular magazines appeared a full-page illustration with the caption "The Enemy". The illustration portrayed a group of men, thrown out of work by the more efficient machine, watching the progress of a building excavation in which power shovels and trucks were being used.

The propaganda which decries mechanized construction methods as unfair to the common laborer and disrupting to social harmony should find little favor with the engineers. Machines are coming into use because they make it possible to lower unit costs. If a contractor were to follow the advice of the propagandists he should, in effect, replace all his machines with men, give the men a minimum of equipment, and let them go at the work bare-handed. Such a procedure would make for the employment of more men on any one job, but at the same time it would raise unit costs to a point where the present construction programs would be out of the question.

There is plenty of work that should be done, — highways over the entire country are in need of improvement; buildings are being planned and constructed; river and harbor programs are being put into effect. If real relief is desired for the working men, let the work be done at as low unit cost as possible, and let more units of work be done.

Such a program would at the same time give men employment, and result in an increased number of improvements. Why should we look backward for our means of relief?

ENGINEERING EDUCATION IN RUSSIA

(Continued from page 81)

those that come at once to mind all represent individual, not corporate, and surely not political, enterprise. From the ancients down through the centuries, through Faraday, Maxwell, Hertz, Pasteur, Lister, Loewenhoeck, and Fleming to Planck, Einstein, and Bohr, the story is quite the same. Those familiar with the history of their science would not lightly trust research to the mercies of any political group in the face of this experience.

The Russian experiment in engineering education stands or falls with general plan. Many of us think we know what the outcome will be; whatever may be its chances of success it is an experiment well worth watching.

ELECTRICAL THEORY APPLIED TO MECHANICAL PROBLEMS

(Continued from page 77)

which satisfies these requirements. To arrive at the same convention so far as sign is concerned the arrows representing the currents must be so drawn that $i_1 + i_2 = i_3$ where, of course, the velocity, v_3, of the mass and resistance, is analogous to the current, i_3, through the inductance and resistance, and where the velocity, v_2, of the force f, is analogous to the current, i_1, through the generator e, and where the velocity, v_2, of spring C is analogous to the current, i_2, through the capacitance C. This circuit is commonly known to electrical engineers as the case of parallel resonance. The differential equations which specify this circuit are given below.

$$q_3 = q_2 + q_1$$

$$-\frac{1}{C} q_2 - M\frac{d^2q_3}{dt^2} - R\frac{dq_3}{dt} = 0$$

$$e + \frac{1}{C} q_2 = 0$$

or in terms of currents, —

$$i_3 = i_2 + i_1$$

$$-\frac{1}{C}\int i_2 dt - M\frac{di_3}{dt} - R\,i_3 = 0$$

$$e + \frac{1}{C}\int i_2\,dt = 0$$

So far this paper has aimed to show only the method of deriving an equivalent electrical circuit for a given mechanical problem. The methods of attack in solving such a circuit which are available to the electrical engineer have not been discussed. They are well known to electrical engineers. For the mechanical engineer who is interested in the solution of such problems it appears to the writer far more convenient to carry these methods of attack over into the field of mechanics and there develop them rather than to ask the mechanical engineer to follow this development in a field in which he is not familiar. It is hoped that this may be done in a later paper.

IS A WINNING FOOTBALL TEAM NECESSARY!

(Continued from page 79)

cannot withstand the vibration of its own motor. This is why a "Sports for All" program has been instituted here and in universities elsewhere. Until other provisions for supporting these activities can be obtained at Wisconsin, football gate receipts must be kept as great as possible. On this basis, the most effective tool is a winning football team.

SCHOLARS NEED THE THRILL OF ATHLETICS

By Perry R. Ferguson

Cadet 2nd Lieutenant, R. O. T. C.

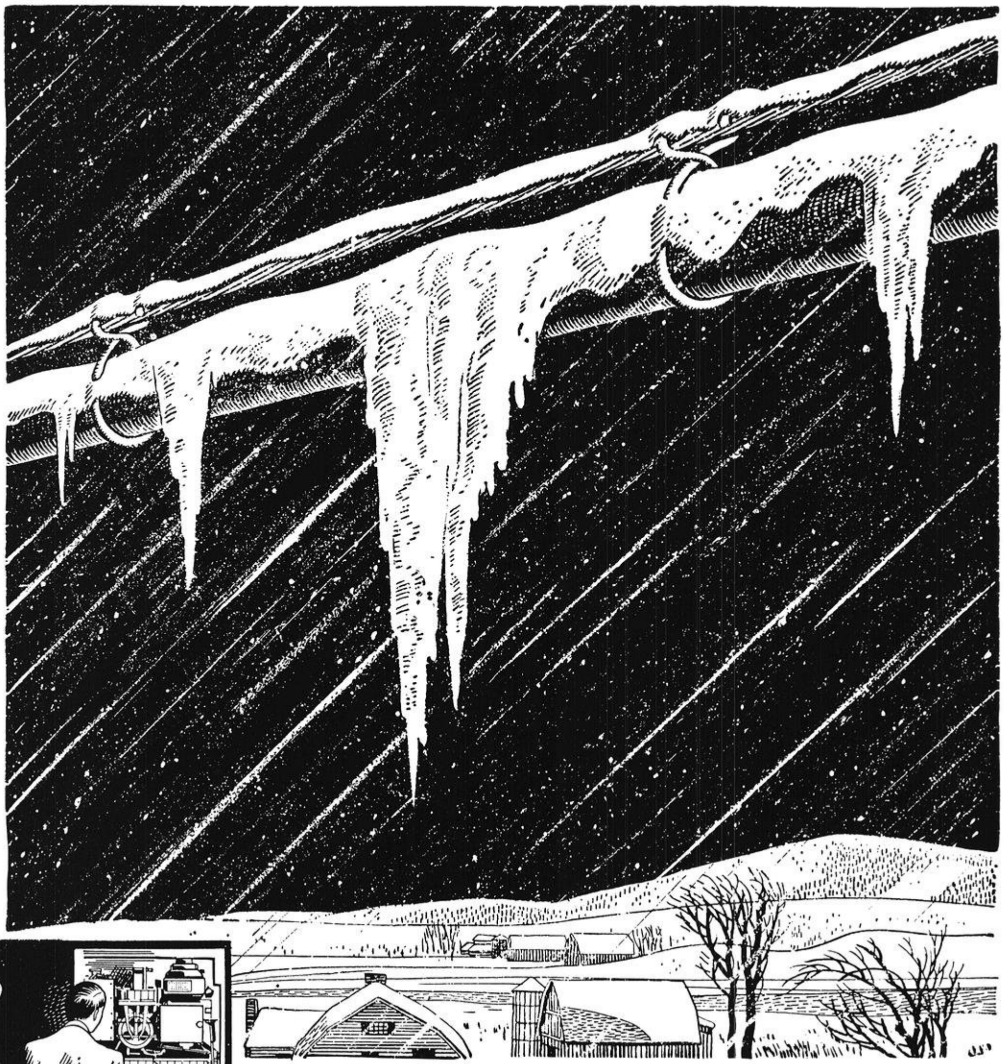
A winning football team is a necessity to the University of Wisconsin. By a winning team I mean one that wins the majority of its major conflicts and never gives up fighting even though hopelessly beaten.

There is a certain romance in going to a school such as Wisconsin when it has a winning football team. Students come here to one of the finest of universities to get an education, but coupled with the knowledge-getting process there should be a school spirit, something that would hold the student body together. This is best created by winning teams in the major branches of intercollegiate sports, especially a good football team.

Since time immemorial man has received delight and pleasure from watching athletic events between men who are masters to their art. All of us like to see a good scrap and we get a lot of pleasure in seeing two good teams fight it out on the gridiron, especially if our team is winning. Even though a person may receive the best mental and physical training that a large university can offer, it does not take the place or the pleasure of seeing a master athlete at work.

In condeming a football team, we are sometimes prone to overlook the pleasure, spirit, and color that it installs into otherwise drab college days.

There is also a financial gain brought about by the crowds that a winning football team draws. An income from this source, if handled properly, will go far in providing athletic instruction and intramural sports for the student body.



But the telephone conversation must not freeze

A sudden cold snap might seriously interfere with long distance telephone service were it not for the studies made by Bell System engineers.

They found that temperature variations within 24 hours may make a ten-thousandfold difference in the amount of electrical energy transmitted over a New York-Chicago cable circuit! On such long circuits initial energy is normally maintained by repeaters or amplifiers, installed at regular intervals. So the engineers devised a regulator—operated by weather conditions—which automatically controls these repeaters, keeping current always at exactly the right strength for proper voice transmission.

This example is typical of the interesting problems that go to make up telephone work.

BELL SYSTEM

A NATION-WIDE SYSTEM OF INTER-CONNECTING TELEPHONES