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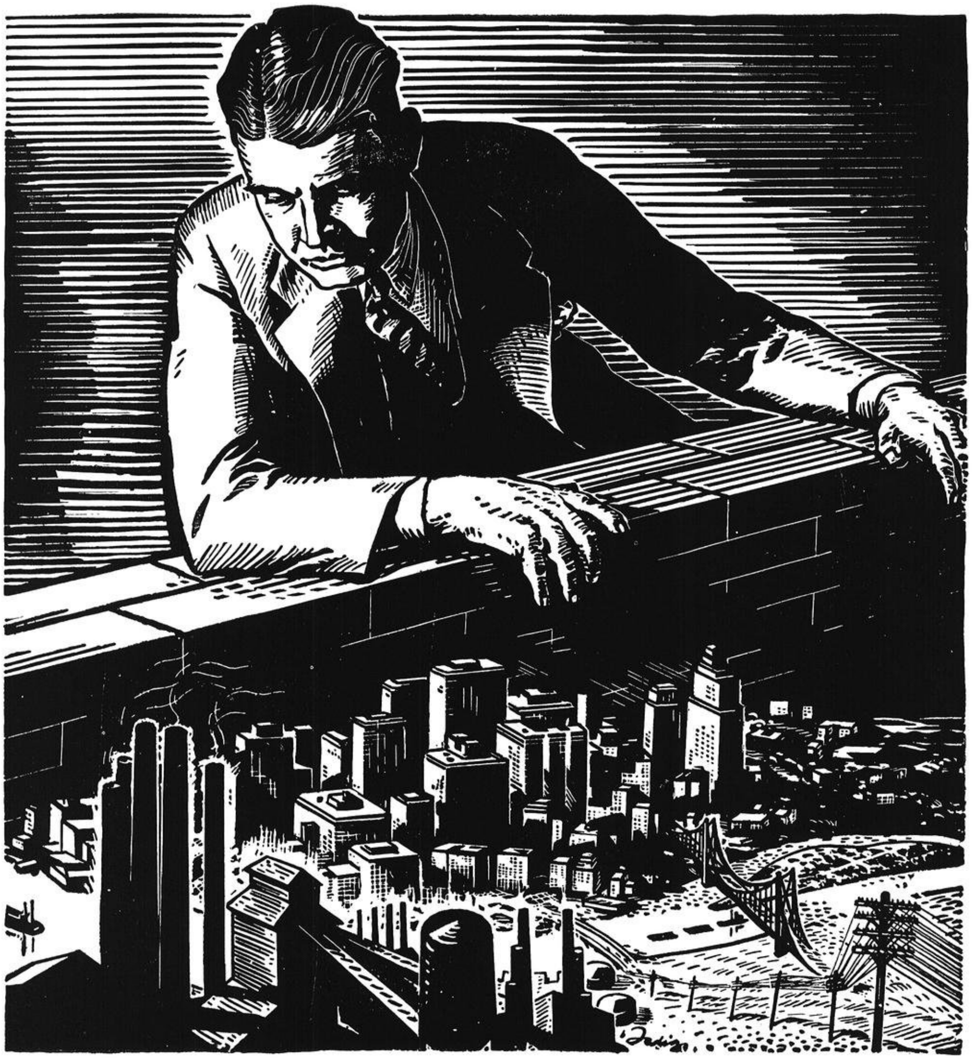
THE WISCONSIN ENGINEER

MEMBER
E.C.M.A.

NOVEMBER
1931



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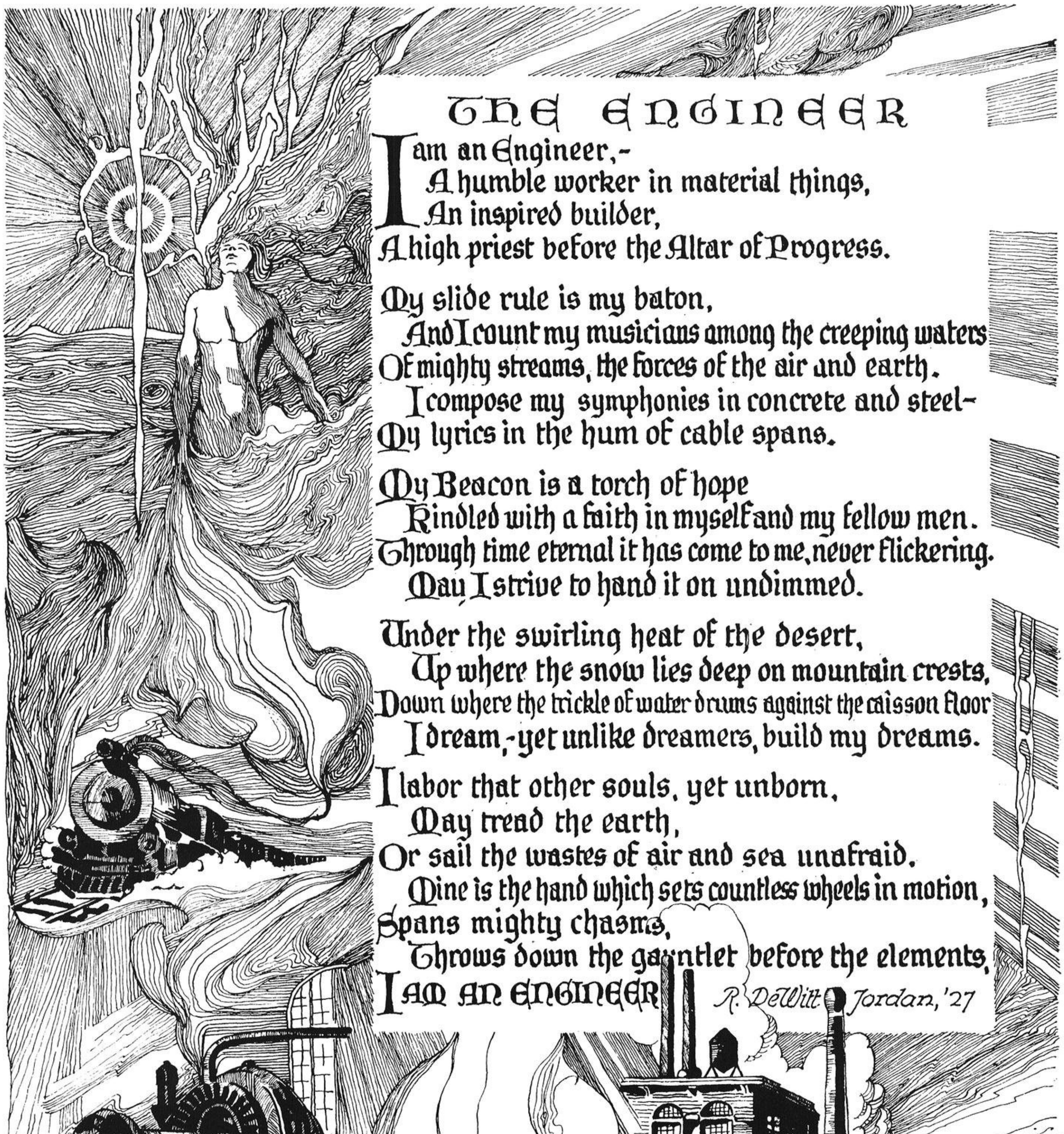

THE ENGINEER

I am an Engineer,-
  A humble worker in material things,
  An inspired builder,
A high priest before the Altar of Progress.

My slide rule is my baton,
  And I count my musicians among the creeping waters
Of mighty streams, the forces of the air and earth.
  I compose my symphonies in concrete and steel-
My lyrics in the hum of cable spans.

My Beacon is a torch of hope
  Kindled with a faith in myself and my fellow men.
Through time eternal it has come to me, never flickering.
  May I strive to hand it on undimmed.

Under the swirling heat of the desert,
  Up where the snow lies deep on mountain crests,
Down where the trickle of water drums against the caisson floor
  I dream,-yet unlike dreamers, build my dreams.

I labor that other souls, yet unborn,
  May tread the earth,
Or sail the wastes of air and sea unafraid.
  Mine is the hand which sets countless wheels in motion,
Spans mighty chasms,
  Throws down the gauntlet before the elements,
I AM AN ENGINEER

R. DeWitt Jordan, '27

The WISCONSIN ENGINEER

VOLUME 36, NO. 2 NOVEMBER, 1931

Is the City of Madison

Approaching Population Saturation?

By E. D. AYRES
Assistant Professor of Electrical Engineering

HOW does Madison grow? Like a colony of yeast cells — like a tadpole's tail — like a colony of fruit flies — these all are logical answers if we follow in the footsteps of Professor Raymond Pearl of John Hopkins University through a most interesting mathematical approach to the study of population growth.[1]

My attention to the applicability of Pearl's work to the prediction of the population growth of a city or community was first attracted by the discovery that one of the largest light and power companies in the eastern part of the United States had carefully analyzed their future load requirements on the basis of a city growth determined entirely by Pearl's mathematical methods. And again it was attracted by Hinson[2] who applied this same approach to the population served by the Southern California Edison Company. Have we then found a trustworthy approach to the prediction of future growth of population groups? The economic importance of such an approach, if trustworthy, is tremendous. In the light of the results of Pearl's painstaking labor one must be convinced that if not a panacea for all our growth problems startling facts of highly important significance and usefulness have been made available to us.

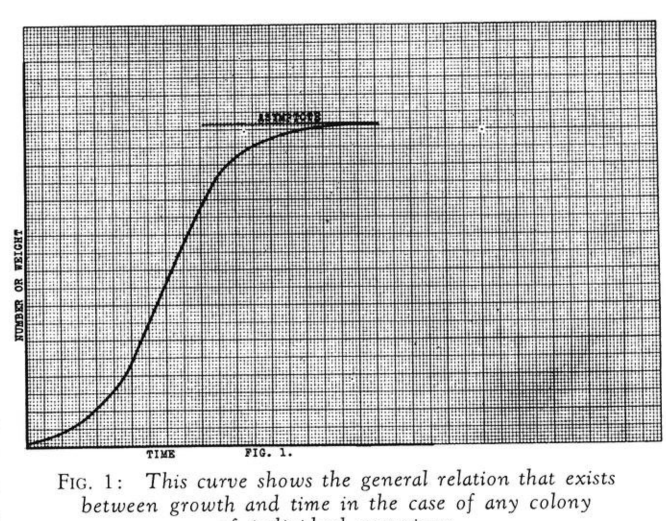

FIG. 1: *This curve shows the general relation that exists between growth and time in the case of any colony of individual organisms.*

What then is this approach to the growth problem? First let us examine a curve of the shape shown in Fig. 1. This curve rises very gently in the beginning, then with greater and greater steepness of slope until, as if its breath was spent in such a precipitous climb, it gradually settles back with decreasing values of slope, still rising until an asymptotic value of ordinate is practically reached beyond which it will not climb. The shape of this curve on the authority of great masses of observed data is fundamental for growth cycles in general. That is, a plot of the number of individuals as "y" against time as "x" for a colony of yeast cells, or say for a colony of fruit flies, would follow faithfully in shape the curve of Fig. 1. As a mammal or vegetable is a collection of individual cells, the plot of weight as "y" against time as "x" for the growth of a white rat or a pumpkin is also the skew curve of Fig. 1. Strange or evident as it may seem this same curve shape is fundamental to plots of human population versus time. This fact is amply substantiated by extensive studies.[1] Viewing Fig. 1 as a growth curve of human population it is essential to consider (1) that this population occupies a definite finite area and (2) is under the influence of a single cultural epoch.

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[1] Studies in Human Biology — Raymond Pearl, Williams & Wilkins Co., Baltimore, 1924.
The Biology of Population Growth — Raymond Pearl, Alfred A. Knopf, N. Y., 1925.
American Mercury Magazine — p. 293, November 24, 1924.

[2] Population As An Index to Electrical Development — N. B. Hinson, Transactions A. I. E. E., p. 52, January, 1930.

The population for such an area will grow faithfully in accordance with Fig. 1 as long as environmental or subjective conditions per se remain substantially the same. For example, an agricultural community subsisting on a finite area would surely generate a growth curve such as Fig. 1. Similarly for an industrial community, in each case, however, only providing epochal changes brought about by new inventions, new opportunities or a new order of things, do not affect materially the general tenor of life in the community as a whole and thus disturb the normal cycle of growth. It may then be noted that the asymptotic value represents a point of saturation or the greatest population which may subsist in the finite area under the conditions dictated by epochal conditions. The first step then in the approach to the growth problem is the acceptance of Fig. 1 as representing the general shape of the normal cycle of growth. The second step is also well supported by Pearl and lies in the recognition that any complex curve of population obtained from a plot of census data may be considered as made up of parts of skew curves. That is to say that in general a curve of human population versus time which shows irregularities and discontinuities will still follow a composite curve made up of Fig. 1 curve shapes. The plot will follow a normal cycle until some epochal change ends this cycle and starts a new one. As many parts of normal cycles will be required as epochs encountered in the growth of the community. Each major discontinuity or irregularity may thus be accounted for without the necessity of surrendering the skew curve as the keystone. The third step is the application of a mathematical expression to any growth curve which will satisfy the previous steps outlined and serve as a basis for quantitative computation and hence prediction of future ordinates of the curve. Such a mathematical expression as given by Pearl will be

$$y = \frac{k}{1 + e^{F(x)}} \qquad (1)$$

where y = population count for any value of time "x",

k = the asymptotic value of saturation figure for population,

$F(x)$ = some function of time "x", e. g. see equation (2).

On the basis outlined how then does Madison grow? The census data for Madison, Wisconsin, beginning with the census of 1850 is as follows:

Year	*Population*
1850	1,525
1860	6,611
1870	9,176
1880	10,324
1890	13,426
1900	19,164
1910	25,531
1920	38,378
1930	57,815

Considering that recent census data should have greater bearing on the future than data previous to 1890, a curve was fitted to the last five census points as shown in Fig. 2. Assuming the origin to pass through the census figure of 1890 the equation of Madison population versus time elapsed since 1890 is:

$$y = \frac{67600}{1 + e^{(1.395 - 0.0616x + 0.002122x^2 - 0.00006407x^3)}} \qquad (2)$$

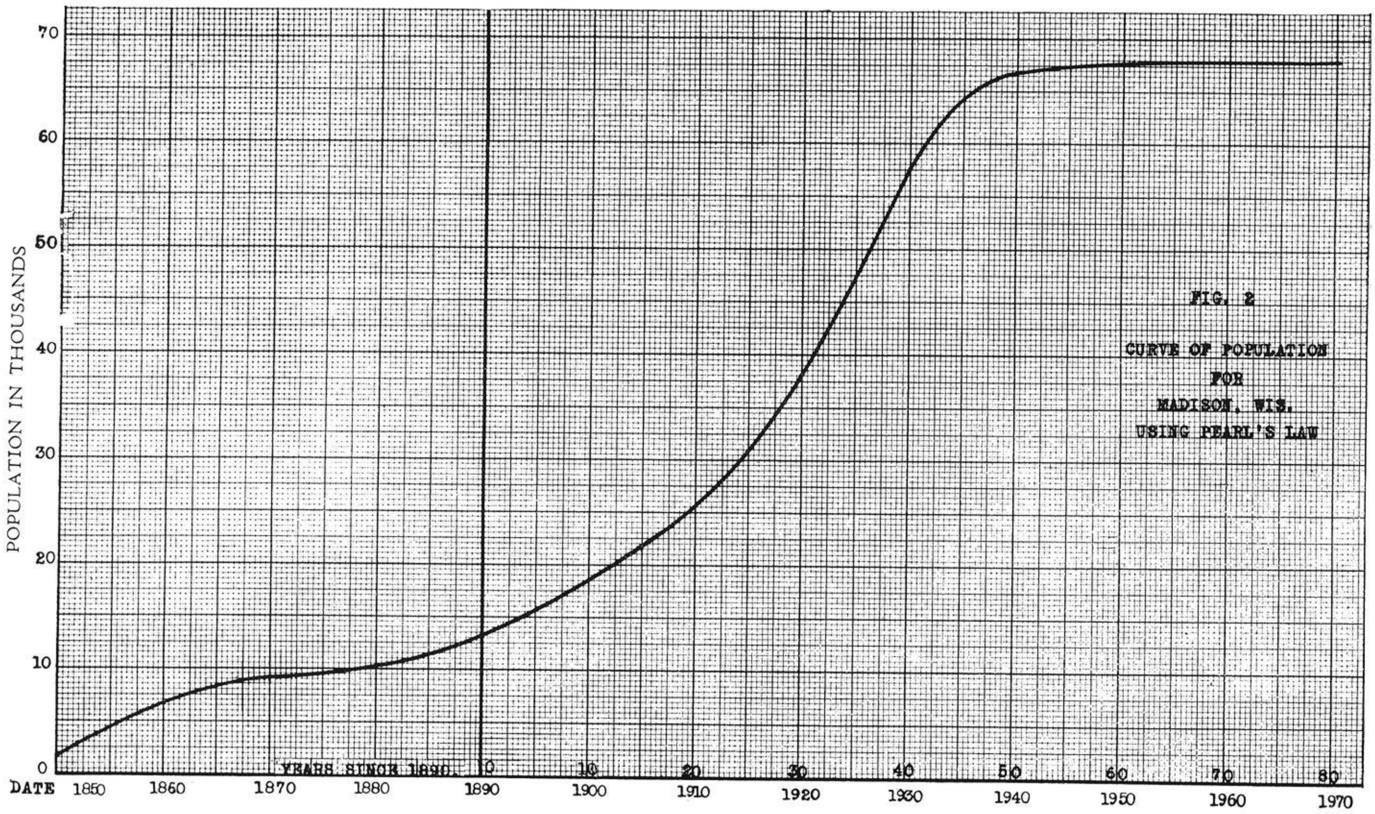


FIG. 2: *The curve shows the past and probable future growth of Madison according to Pearl's law.*

This equation states that the saturation value of population for Madison will be approximately 68,000 to be reached in the year 1945 unless some new epoch is introduced to disturb the curve. Equation (2) is only valid for positive values of "x", however, as the population prior to 1890 is interesting the entire story is given in Fig. 2. Examining the curve as a whole it is evident that since 1870 the population of Madison has followed a skew curve of the general shape of Fig. 1. Because of the fact that census values are taken only once a decade it is impossible to ascertain whether the beginning of a new cycle is exactly at 1870 or not, but as the Civil War falls between 1860 and 1870 there seems to be sufficient basis for the speculation that the new cycle apparently starting off at 1870 was due to Civil War influence.

The asymptotic value for the population growth of Madison is low when contrasted with predictions appearing in the newspapers of recent years and will be undoubtedly challenged. The author does not feel that Fig. 2 is the infallible answer to how Madison will grow. Mathematical methods are precise but the results obtained are precise in accordance with the data used. Assuming an error of 8% in the census count of 1930 for the city of Madison, i. e. a population of 62,400 instead of 57,815, we obtain an asymptotic population limit of approximately 84,500, a limit 25% greater than the value of 67,600 established. An error of 8% is undoubtedly too great a misdemeanor to lay upon the back of the census-gatherer but it serves to warn us that our asymptotic population limit is mathematically sensitive. This sensitivity means that all errors in census-gathering are magnified in the final result. However, with even a reasonable distrust of the underlying data our method should not mathematically lead us far astray.

Let us examine critically the hypothetical premises of Pearl's method with respect to Madison — first, can the census figures for Madison be considered as applying to a definite finite area? For the past years, the answer is, probably yes — for the future, probably no. Nakoma has just been annexed, other suburbs will undoubtedly follow. A careful estimate of the saturation value of population by Pearl's method would necessitate a critical examination of the census data of the past, and the effect of future annexations, with respect to this first fundamental premise of definite finite area. The limit will be higher than determined because of the effect of an expanding city boundary line.

Second, what new cultural epochs does Madison face in future? Unless an industrial boom should take place the future of Madison would seem to the casual observer to be entirely bound up with influence exerted by the State Capitol and the University of Wisconsin. Reviewing some of the discussion of the effects of epochs it seems quite possible that any great change in state government with respect to business or the people of the State of Wisconsin or any far-reaching policy with regard to the University of Wisconsin might suffice to cause the beginning of a new epoch for Madison as a city.

It is quite possible that the effect of a large transient population destroys the applicability of the Pearl method to Madison. It undoubtedly gives some foundation for greater errors in census counts and warns us that a certain per cent of Madison's population will be very sensitive to economic and social disturbances which may not be large enough to be classed as epochal in nature. On the other hand, this factor in some ways in analogous to immigration. In Pearl's study of the curve representing the growth of the United States as a whole the effects of immigration cause only a steepening of the curve with no apparent irregularity. Is the effect of Madison's transient population similar?

The author's contact with the common methods of prediction, and the attendant perplexities of arriving at any decision on a trustworthy basis, has aroused his interest in this method apparently based upon a reliable biological law. He will leave to the reader the many interesting comparisons which may be made with results obtained by other methods. How will Madison grow?

CUTTING WITH ELECTRIC ARC ACCOMPLISHED UNDER WATER

By Kyle C. Whitefield, m'32

At the recent Welding Conference held here at the University, Mr. Huggland, a representative of the Under-Water Metal Cutting Corporation of New York, told the convention members that the engineers of the General Electric Company had once proved for his special benefit that cutting by an electric arc under water was theoretically impossible. He then donned his diver's helmet, took his electrode and went down under water to a work bench which was rigged up on the bottom of the pool in Lathrop Hall where he proceeded to cut through pieces of metal by the use of the electric arc.

The arc cutting equipment of the University shops, consisting of an A. C. converter which changed the ordinary A. C. to D. C. at 60 volts and 600 amperes and a tank of high pressure oxygen was used. Mr. Huggland used his own special electrode which was a piece of hollow rectangular copper about twelve inches long and tipped with a hollow carbon electrode. The copper was taped to prevent losses of current and to provide a handle. To this electrode were attached a hose from the oxygen tank and a wire from the converter. To cut with this apparatus is simple; the cutter touches the carbon tip to the metal to be cut and then draws it away about 1/8" forming an electric arc of high temperature, which heats the metal while the oxygen oxidizes it and the oxide crumbles away under the blast of oxygen. The pressure of oxygen needed depends on the kind and thickness of the metal to be cut and upon the depth of the job below the surface. The current and voltage of the D. C. supply needed depends on the losses in the water and the kind and thickness of the metal to be cut. Losses in the water are losses due to the water conducting some of the current away from the wire and electrode.

Arc welding under water has been done, but it is not satisfactory because the water chills the heated metal of the joint too quickly and causes the joint to become brittle and weak.

An Argument for the Use of

Hydro-Electric Plants *for* Peak Load Generation

By WILLIAM Z. LIDICKER, c'27
Engineer, The Management and Engineering Corporation

IN the last 10 or 15 years, improvements in the design and construction of *steam* generating stations have steadily decreased the cost of electrical energy. The result is that in distribution systems which might be supplied wholly or in part by *hydro* plants there is likely to be a tendency, especially after a year or two of deficient rainfall, to question the wisdom of further hydro developments. This tendency by those in the electric-light-and-power industry responsible for new installations is in part due to the relative compactness and lower unit investment costs of steam generation. These two factors alone, however, do not determine the most feasible type of development, and a careful study of the water-power possibilities of the area in question would often show that a properly selected hydro plant can be very beneficial to the entire distribution system.

Eliminating from this discussion a hydro plant which, by virtue of geographical, geological, and topographical advantages, is unquestionably a sound investment, and considering a site less generously blessed by nature, it is often difficult to substantiate a decision in favor of hydro. In fact an examination of *total* annual costs and *total* annual output may appear to be conclusive evidence in favor of steam installation; and too often a decision is based on this evidence alone.

Peak Power Is Costly

The transmission systems of the present day, however, are no simple structures, and more than an *average* cost per kilowatt hour is necessary to weigh the correct worth of any generation. Obviously the unit cost of generating peak-load energy is very much higher than the average unit cost of generating energy; and if evidence of this is desired, an examination of demand charges and the low prices for the sale of off-peak power will prove that utilities have long recognized this fact. Consequently, if a hydro plant is operated as a peak-load plant and thus removes a definite load from the system during the hours of maximum demand, it is distinctly unfair to credit the plant with generation at *average* unit values. In other words, the source which supplies the high-priced peak-load generation should receive credit for energy at what it is worth, and this may be three or four times average cost. With this in mind, a study of the system demand, its distribution, and the location of capacity, together with many other factors, will frequently prove that a properly designed and corrrectly operated hydro plant will not only prove itself economical, but it will also render a very definite service to the steam stations by improving their load factor and lessening the burden of transmission line loads.

Obviously the consideration of each hydro project is an individual study, and the conclusions depend, not only on the site itself, but on the peculiar characteristics of the system to which it is being considered as a part. It is intended here to indicate in a general way one line of thought to be followed in weighing the value of hydro capacity to any system.

Unfortunately for the most efficient operation of any generation and transmission system, the electric service utility is subjected to variations in load, the peak of which may be seven or eight or more times the minimum. In addition to the capacity necessary to carry the maximum peak, it is also necessary to have reserve capacity at least equal to the largest single source in the system. An adequate reserve is of course absolutely essential, for in general the American consumer of electricity will accept no excuses for an interruption in service. What is the result? There are large

W. Z. LIDICKER

HYDRO PERKS UP

Hydro development, after a period of inactivity, is again beginning to interest the private investor in public utilities. William Lidicker presents in this issue an argument for the use of hydro-electric plants for meeting peak-load needs—an argument that requires a radical readjustment of ideas. Heretofore, a hydro plant furnishing basic power, with a steam plant to meet the peak load and emergency demands has been the usual conception. Now it is proposed to build steam plants for basic needs with a hydro plant for peak loads and emergencies.

The hydro plant has been taking some solar plexus blows recently in its competition with the steam plant. The development of the steam turbine, the efficient use of coal, and the introduction of oil and gas as fuels have made it possible to generate power very economically by steam. In addition, hydro has been nearly killed by the tender care of its friends. Legislatures, in the effort to protect a valuable natural resource, have surrounded hydro development with protective restrictions to an extent that has made it unattractive to the private investor. All of these factors have combined to bring hydro development to a standstill. The new idea of using hydro for peak load purposes promises to bring hydro back into the picture.

proportions of the system-capacity which are used only a very small part of each day, and some at only certain times of the year. And in spite of the efforts of utility companies to raise their load factor by selling off-peak power at attractive rates, there are only a few which operate at yearly load factors greater than 50 or 60 per cent.

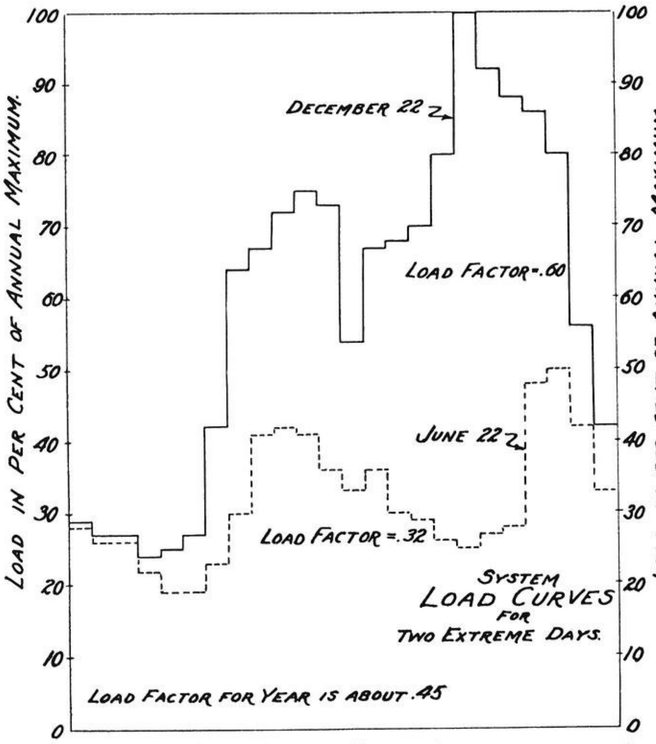


FIG. 1: *Power demands on an electric plant vary over a wide range as shown by these two extremes. In many systems, the upper 20 per cent of capacity is used only 5 or 6 per cent of the time.*

Figure 1 shows the load variation during two days for a typical interconnected system of moderate size. One day is an extreme low and the other day includes the yearly peak. A comparison illustrates the variation in daily maximums and indicates in a general way why yearly load factors are low. A careful study of the load variation hour by hour over an entire year will prove that in many systems the upper 20 per cent of capacity is used only 5 or 6 per cent of the time.

Hydro Carries Peak Load Economically

An approximation of the relative costs of peak-load and off-peak power can be obtained as follows: Assume one generator operates continuously and a second operates intermittently for about 20 per cent of the year. The first generator will produce in a year at least five times as many kw-hr. as the second one. Since total yearly fixed charges (or the cost of interest, depreciation, taxes and insurance) will be the same for each turbo-generator, the fixed charges per kw-hr. for the intermittently operated machine will be five times the unit fixed charges on the continuously operated unit. Coal costs for the peak-load generator will be considerably higher per unit of generation, due of course to irregular operation. Likewise unit operation and maintenance unit costs will be increased producing the cumulative effect that peak-load energy may reach three to five times the cost of base-load energy. It is by replacing this extremely expensive generation that hydro capacity can frequently be economically justified.

Figure 2, a flow-duration curve for a typical river, shows the per cent of a year for which a given flow exists. It is one form of expressing graphically what is known of the run-off of the area in question. This curve and the stream-flow data it represents are the basis for the output computation of almost every hydro site.

An isolated hydro plant would probably be developed to about 50 per cent time, which for the river illustrated would be a little less than 800 cubic feet per second capacity. The shaded area represents energy supplied by an auxiliary source. With the advent of interconnected systems, it frequently was economical to develop hydro plants to the extent that water was wasted over the dam during only 25 to 35 per cent of the average year. The necessary auxiliary or supplementary sources became other hydro plants, steam plants, oil engines, and so on. Now it is proposed to develop a hydro site to a still higher degree and use the hydro as a peak-load plant with a turbine capacity equal to the flow of the river at 10 to 12 per cent time as taken from a duration curve. For the site under consideration, we refer to Figure 2, and find that at 10 to 12 per cent time, the flow of the river is 1600 to 1800 c. f. s. This then is taken as the turbine capacity for peak-load installation.

Many times the point to which a river is developed is decided simply on the determination as to whether the increased output on basis of average costs will justify the increased investment in equipment and power-house, and since the available kw-hr. output does not increase in the same proportion as the increase in installation, an economical limit is soon reached. *The great argument in favor of a large installation for hydro plants is not that the output is tremendously increased, but that the energy generated is of much more value.* As an illustration, the following analysis is given. The results will be found in Table 1.

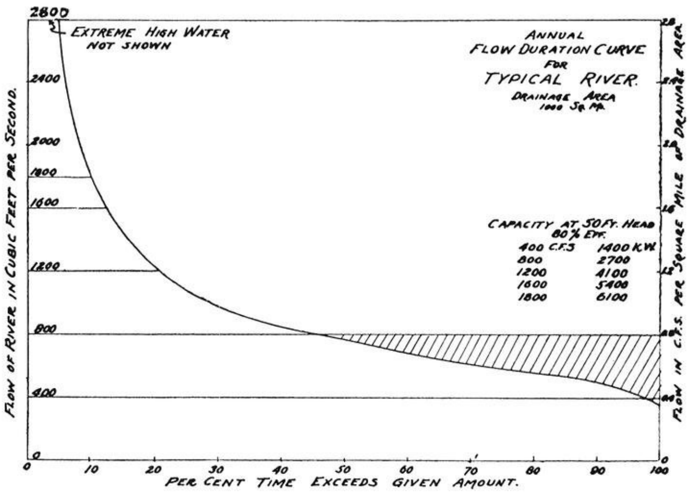


FIG. 2: *This sort of curve is the basis for the output computation for a hydro site. An isolated plant would be developed to about 50 per cent of the time, or, in this illustration, about 800 c. f. s. The shaded area represents energy supplied by an auxiliary source.*

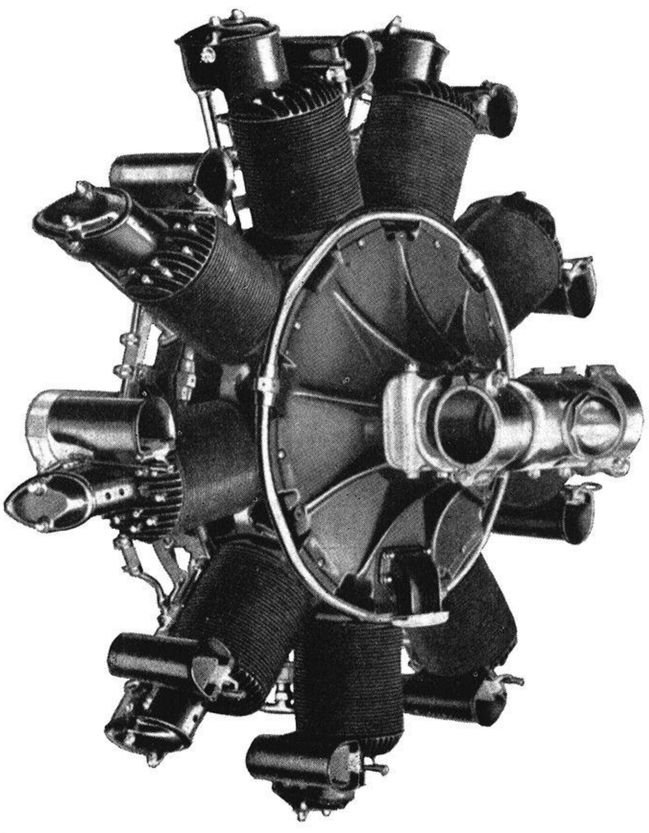
(Continued on page 43)

A Student Reviews Some Details of the Packard

Aircraft Diesel Engine*

By George H. Lorenz, m'32

ON April 30 of last year the Packard Motor Car Company of Detroit announced to the world in general and to the aeronautical industry in particular that their Aircraft Diesel Engine was complete. During the experimental stages of the engine's development, much had been heard of it, in a general way, through the newspapers. Now that it was complete and ready for the market, photographs and cross-section drawings were released, and these were of extreme interest to the engineering profession.



In 1892, Dr. Rudolf Diesel invented the oil engine that bears his name, and in 1898 an engine built in accordance with the principles laid down by Dr. Diesel and using fuel oil was operated at a much higher efficiency than had been obtained for any internal combustion engine up to that time. Some of the first engines weighed as much as a thousand pounds per brake horsepower, but as time went on, research in Strength of Materials enabled the engineers to produce a Diesel which would develop one brake horsepower per twenty pounds engine weight at 1,200 Rpm. This was a weight reduction of 490%.

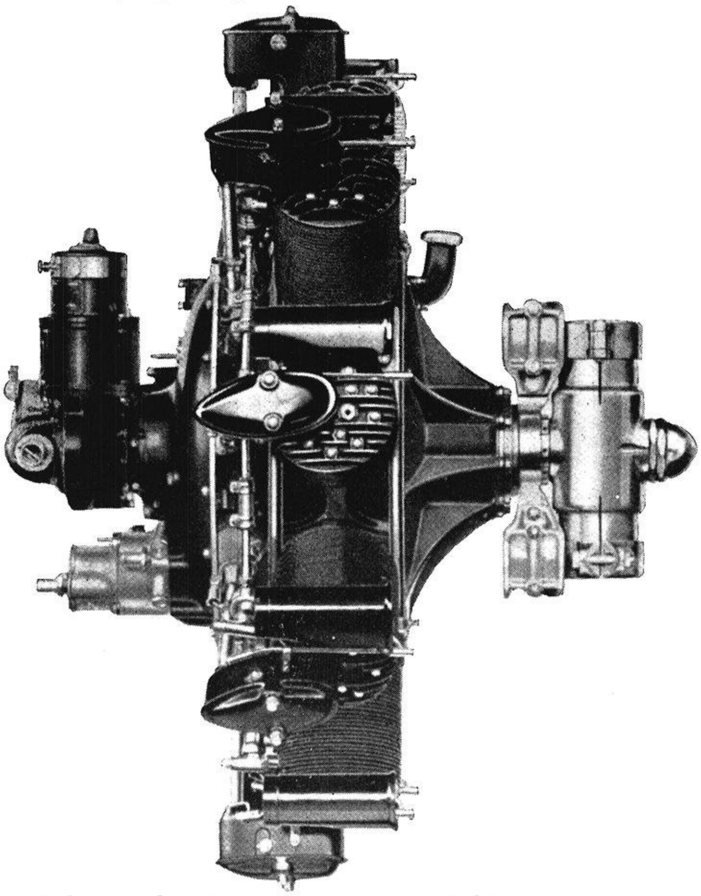
Even with this great reduction in weight, the engine was still far too heavy for aircraft work. Mr. L. M. Woolson, Aeronautical Engineer for Packard, took on the problem of developing an engine operating on the Diesel principle to be used as a power plant for aircraft. It took three years of study, research, designing, building, and testing before Mr. Woolson and his staff had solved their problem. The Packard-Diesel as announced develops 225 horsepower at 1950 Rpm. and weighed 510 pounds. This gives a weight-horsepower ratio of 2.26 pounds per horsepower in comparison to the lightest type of Diesel engine previously constructed which had a ratio of 20 pounds per horsepower when operating at a maximum speed of about 1200 Rpm.

The engine is of the air-cooled radial type with nine cylinders having a bore of 4-13/16 inches, a stroke of 6 inches, and a displacement of 982 cubic inches. The crankcase is the one-piece barrel type construction made up from one casting with a removable diaphram containing the rear bearing support. Full skirt aluminum pistons are used in the forged chrome molybdenum steel cylinders. The master connecting rod and link rods are one-piece, I-section forged chrome nickel steel.

With the four-stroke cycle used, air only is taken into the cylinder through a valve in the cylinder head on the intake stroke. One valve is eliminated from the conventional design by using one valve for both intake and exhaust. On the compression stroke the air is compressed to 500 pounds per square inch which raises the temperature of the air to approximately 1000 degrees Fahrenheit. At this point the fuel is sprayed into the hot dense air and ignited. As the fuel burns the pressure is raised to about 1200 pounds per square inch and the piston is driven down on its power stroke. Here the operation of the engine differs from the original low speed cycle developed by Dr. Diesel, for in the original cycle fuel is sprayed into the combustion chamber during burning in such a way that the peak pressure in the cylinder remains practically constant while the piston travels a part of its power stroke. The result is a rather low peak pressure in the cylinder of about 600 pounds per square inch. This is advantageous from a structural viewpoint, but has the disadvantage of not permitting high speed operation because insufficient time is available for properly burning the fuel. In the new diesel, the fuel is sprayed into the cylinder before the pressure and temperature of the air have reached a maximum. This results in a peak pressure of about 1200 pounds per

* *This paper was presented before the Student Branch of A. S. M. E. at its regular March meeting in 1931, by George H. Lorenz, President of the Society.*

square inch as the maximum pressure is obtained just before the piston starts on its power stroke. This high pressure, about double that of the old type, presented quite a problem, structurally, but is the only known manner in which high speed operation may be attained with the com-



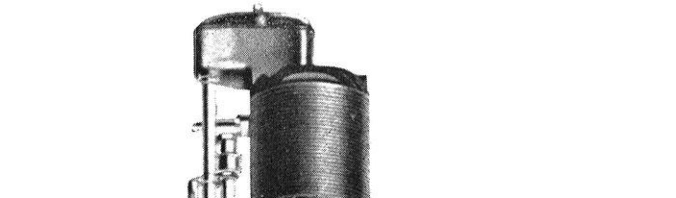
Side view showing engine accessories including starting motor, generator, and fuel and oil pumps.

pression-ignition solid-injection type of engine. To complete the cycle, the piston returns to the top of the cylinder on the exhaust stroke forcing the gases out through the single valve.

Some very interesting details were worked out in overcoming the many difficulties that presented themselves in the development of the engine. One of the serious problems to be solved in connection with an engine having high cylinder pressures is the finding of a satisfactory means of holding the cylinders onto the crankcase. The engineers must have been introduced to the airplane engine here in our Hall of Forlorn Hopes, for they decided against using studs screwed into the crankcase to hold the cylinders in place. Another factor that entered into their decision against the use of studs was that such a method for high pressures would result in a very heavy crankcase. An aluminum alloy crankcase was out of the question because of its relatively low resistance to impact or shock loads. To overcome this difficulty, the cylinders were designed with two flanges machined on the sides of each cylinder barrel with a circular chrome nickel steel hoop on the front and another on the rear to clamp the cylinder flanges tightly to the crankcase. As these hoops are tightened up a high initial stress is set up in them which places the crankcase in compression. It can be readily seen that instead of causing an increased stress in the crankcase, the expansion of gas in the cylinder actually reduces the load on the crankcase. This detail in design was one of the most important in reducing the weight of the engine.

Also, on account of the high cylinder pressures used, various devices were required to absorb the shock of the explosion of fuel as the respective pistons started down on their power strokes. The methods utilized were, first, pivoting the counter-weights to the crankshaft and spring loading the weights to hold them near mid-position, and second, driving the propeller through rubber blocks. The flexible mounting of the counter-weights and the propeller cushion relieve the crankshaft of the flywheel effect of these large inertia parts. These methods enabled the engineers to design the larger moving parts with very little increase in weight over the same parts for a gasoline engine.

The cylinders are of the closed end type, forged from chrome molybdenum steel. The cooling fins are turned integral with the barrel and the cylinders have a single valve opening in the top. An aluminum cylinder head is bolted onto the top of each cylinder to provide additional cooling through the aluminum fins. The head also provides for the box housing of the rocker arm and for the guide for the single valve. Because of the greater expansion of the gases in the cylinder, less heat is dissipated to the cooling



Longitudinal section showing propeller driver, crankshaft, connecting rods, piston, and single valve.

air, and this permits much less finning on the cylinder head than for a gasoline engine of the same size.

The fuel metering and injection system is another of the interesting and unusual details of this engine. Each cylin-

(Continued on page 44)

Editorials

ANOTHER PAGE FINISHED The life of Thomas Alva Edison is finished, and another page of history has been completed. A man of unchallenged genius and endless energy, Edison has probably done more to make modern civilization than any other one man. To him we owe the credit for the modern mazda lamp. One of his first generators, from which the modern giants have grown, is displayed in the university museum. The phonograph, by which we can listen to whatever music we wish at whatever time we choose, is the child of his brain. Edison was a man who was not content to follow the dictates and teachings of another. He went into new fields, made his own paths, and showed the rest of us how it was done.

ARE CITIES LIMITED? In an article in this issue the author attempts to show that a city, under a given set of conditions, grows according to a mathematical law and reaches a definite maximum size. We have been in the habit of thinking that municipal growth was unlimited, and that almost every city grew endlessly, at varying rates of course, but eventually swelling out and encompassing its suburbs, with new suburbs being formed beyond the extended limits. We all imagine the time when our home town will have grown to include the little lake on the outskirts, and when skycrapers will rise above the former fields of the suburban farmers.

And now we are shown that according to theory, the old home town is like any other growing thing. It grows to its maximum, and there it remains until new conditions arise which disturb the equilibrium and the size changes.

Perhaps the theory is fact. Perhaps Frost's Woods will always be woods; Sunset Point may always be a place to go for picnics, and Esther Beach may always be "across the lake".

ELIGIBILITY The old question of eligibility to extra-curricular activities has again been brought up for discussion. At a recent student forum various opinions were aired on the proper eligibility requirements for activities. One man even went so far as to suggest that the students be allowed to set their own requirements.

The activities which are hardest hit by the present requirements are the athletics, and every season we hear moans about the star who failed to get by the requirement. And at that, the requirement for athletes is far below that for any other form of activity.

At the same time that we lament the ineligibility of our stars, we find ourselves also lamenting the fact that we don't seem to win games. Our team has the brawn and size that one would expect in a championship outfit, but the results aren't there. Perhaps one could find a connection. Perhaps something besides brawn is needed to make a real athlete. Is it logical to expect that a team that has to be eased through school with a shoe horn will go out on the field and outsmart a team of equal power? Is it reasonable to expect that a man who can't follow the class in school should be a changed man in a game and demonstrate the necessary wit to lead ten others to victory? On the rare occasion when we do have an athlete with scholastic ability he turns out to be a real performer. One of our greatest ends won a Rhodes scholarship and was a Phi Bete. Perhaps if we were to insist on a higher eligibility requirement instead of lowering the present standard, the men who were left would have the brains that the others lacked. A better team might result.

And after all, our primary interest here is to gain an education, with the other activities entirely subordinate to that end. If one is to make athletics his aim, why spend the money and time going to college where there are eligibility requirements when there are all sorts of professional teams which pay money to their performers.

THE WORLD'S BIGGEST BRIDGE The longest suspension bridge in the world, the George Washington bridge over the Hudson River, was formally opened October 24. We hear almost annually of the opening of the longest or biggest bridge in the world, and they have increased in size until the present champion stands with a clear span of 3500 feet and anchor towers rising 625 feet.

The new bridge, with its mammoth proportions is a creation of art as well as an engineering masterpiece. Its 36-inch cables drop away from the towers in sweeping curves according to mathematical formulae, and the towers are braced against deflection by steel lattice-work; but with all the technicality, the sweep of the cables is attractive and the intricacy of the towers lures the artistic eye. Art students, with their patter of "interesting treatment" and "dynamic symmetry" will doubtless spend hours on the banks of the Hudson copying the contours of the engineer's creation. And yet we hear that engineers lack culture.

WHITHER BOUND? On September 24, 1831, the first regular railroad passenger service was inaugurated in this country. The Mohawk and Hudson Rail Road Company, with tracks between Schenectady and Albany, was the pioneer company, and with the old "DeWitt Clinton" pinch hitting for the English "Robert Fulton" after the latter had sprung a leak, the imposing cavalcade made the trip in the astounding time of forty-six minutes whereas it took the horse-drawn coaches about an hour and a quarter.

From that beginning the railroads have grown to their present size, with terminals of palatial aspect, and coaches resembling drawing rooms. Locomotives have grown to gigantic proportions and their running speeds have been advanced from the DeWitt Clinton's 19 miles per hour to 70 and 80 miles per hour. Track covers the country like a net and one thinks nothing of it when he boards a car in New York with the intention of stepping out of it a thousand miles or more away.

But the railroads are getting worried. Competition, which, according to our econ 1-a kills a utility, has crept in in the form of trucks and busses. The short-haul business is leaving the railroads in favor of the simpler and faster truck service, and the distance included in the short-haul is rapidly lengthening.

The question arises: in another hundred years will there be any railroads, or will they have become a thing of history? Will our grandchildren look on the rail age as having the glamour and romance that we now accredit to the stage coaches? In short, will the railroads celebrate their bicentennial?

AND WE SIT IN SECTION M Our tickets have come for the homecoming game. The stadium holds approximately 40,000 people, there are only 9,000 students, and yet we have seats which are yards and yards behind the goal posts, and at such an elevation that we dread the walk up the stairs. We were conscientious, and, upon receipt of our athletic fee card with the rest of our miscellaneous registration impedimenta, we promptly made our applications. Yet the athletic department finds the stadium already so crowded that there's barely enough room to take care of the students, and only by putting them in the end of the bowl can the situation be solved.

A discrepancy sneaks into the problem. A man with reputation and civic influence but not connected with the university cruises into the ticket office two days before the game. He cruises out again with seats in secton F. Somewhere somebody got taken in, and we have our suspicions.

Are the students considered suckers and treated as such, with the middle of the field reserved for the purpose of obtaining influential friends for the members of the athletic department? It would appear that the games, being of primary interest to the student body should be so considered and the students should be given an even break in getting seats, with the outsiders taking second choice.

NO MAN'S LAND The other morning as we were pushing the official crate up the main drag of the student section we were passed up by no less than three of the mounted officers of the law for which Madison is becoming so famous. Obviously they were out for big game, and their big game seemed to be student-driven cars, if one were to judge by the traffic which they picked out as the object of their little Lectures in Traffic 1-a. The chief of police at the local police station issued a statement at the beginning of the year that he was instituting a drive to curb the riotous college youth; and that to protect them from accidents similar to the fatalities that took place during summer school he was going to supervise student driving with especial diligence.

We rise to gripe. In the four years that we have haunted dear old Langdon Street we have seen no accident more serious than the unpremeditated dusting of fenders or the occasional osculation of bumpers. Student drivers, while they may appear wild and riotous to the conservative people who occassionally venture into student haunts, actually drive with a confidence and skill that merits applause. The two fatalities that occurred this summer occurred on streets other than in the "latin quarter" and one was on an intersection that was "protected" with a traffic light. Further, the summer school student is known to be in attendance merely as a form of vacation, and is not the type of student that drives the streets during the winter season.

Why should the student, who is already taxed far beyond any fair rate through property tax be forced to contribute further to the city coffers through fines that are the result of a direct attempt to "take the kids through the cut"? We don't object to policing the student quarter in the same manner that the rest of the city is protected, but it seems unfair to enter where there is no trouble, and create a "traffic situation" by unnecessary and officious policing. We would suggest that until the students, by unwarranted and unduly serious accidents, have proven themselves to merit policing they be left to themselves in which status they seem to get along very well, and let Langdon Street no longer be a no man's land and a free hunting ground for needy police.

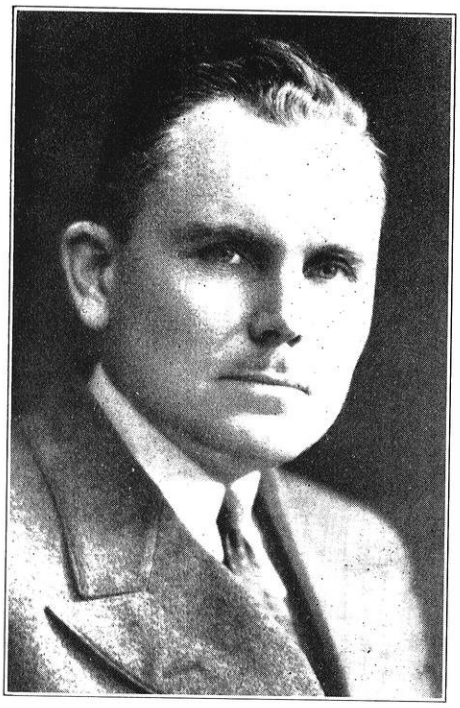
THE SLUMBERING GIANT WAKENS St. Patrick, who seems to have been on the verge of death for the past three years, apparently is convalescing — if we may regard the meeting of Polygon on November 3rd as an indication of renewed vigor on the part of the patron saint of the engineers. At this meeting of Polygon, it was proposed to have an engineers' dance, and to have an all-engineering smoker. These proposals were voted upon favorably, and the proposals are to be presented to the societies for approval.

Since the discontinuation of the annual St. Pat's parade, the only activities of Polygon have been the distribution of recognition pins and, on one St. Pat's Day, the selling of green feathers to engineers. As a result of the inactivity of Polygon, the organization of the engineering students has been confined solely to the societies and honorary fraternities. Polygon was supposed to have been instituted for the unification of these societies to further campus activities.

The proposed smoker, the dance in the mechanical engineering building, or both, if carried out successfully, would assist greatly in the unification of effort for worth-while campus activities. Stirring up lawyer-engineer feuds, with the consequent throwing of rotten eggs and wise-cracks, would, of course, be of no benefit, but the unification of the engineering student body could be productive of good results. Even if nothing more would result than the contact of the students with the faculty and with other students in other than class-room circumstances, the enterprises would certainly be worth-while. Come on, Polygon, we're behind you!

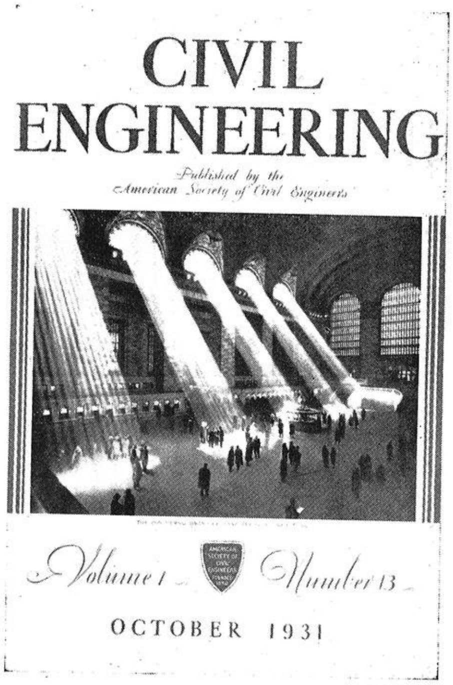
Alumni Notes

Walter E. Jessup Edits New Magazine



WALTER E. JESSUP
who leaves private practice to edit new magazine.

Civil Engineering



CIVIL ENGINEERING
the new A. S. C. E. magazine with a 15,000 circulation.

When I arise and remark in a mild tone that within the past year a new technical journal of importance was born, probably none of the readers of this magazine of uplift and enlightenment will be even faintly interested; but when I announce that the editor of the new publication is a Wisconsin grad, Walter E. Jessup, C. E. '12, I expect the news to be received by my readers with satisfaction and pleasure. The new journal is called *Civil Engineering* and is published monthly by the American Society of Civil Engineers. With Frederick E. Schmitt editing *Engineering News-Record,* as we recorded last year, and Walter E. Jessup editing *Civil Engineering,* Wisconsin at present rather monopolizes editorial honors in the field of civil engineering.

At the time of his selection as editor in August, 1930, Jessup maintained a consulting office in Los Angeles in partnership with Henry Z. Osborne, Jr. Their practice covered valuation and rate cases and municipal, hydraulic, and sanitary developments. Jessup was active in the local affairs of the American Society of Civil Engineers and in 1929 was president of the Los Angeles section of five hundred members. The section has an official publicaton, the ASCE (pronounced Ace) of which, during 1930, Jessup was editor. And he must have been good, for *Civil Engineering* soon commandered his services and induced him to move clear across the continent from Los Angeles, with its sunshine and flowers to New York City, where he nurses a few posies in a window box and tries to imagine that it is a garden.

Walter E. Jessup was born in Pasadena, California, on May 25, 1888. He is the son of Edgar Morris Jessup and Estella Andrews Jessup. His father was a civil engineer and gave his son his first taste of railroading at the end of an old-fashioned link-chain when the boy was so small that he had to leap from tie to tie. From that time on he spent his summer vacations on railway and municipal survey work, gaining a background that later gave meaning to his university work.

He entered the University of Southern California in due course and received his A. B. from that institution in 1910. He then entered the University of Wisconsin and completed the requirements for the degree of Civil Engineer, which he received in 1912. He was appointed student-assistant in railway engineering while at Wisconsin and proved himself a capable instructor. He made Tau Beta Pi and was president of the chapter in 1912. He was also a member of the old U. W. Engineers Club.

Following his graduation, Jessup went to work as instrumentman on the construction of the Los Angeles aqueduct. At the end of six months he became chief of party for Stone and Webster on the hydro-electric development on Big Creek, California. He described this development for the readers of the *Wisconsin Engineer* in the issue of February, 1914. He had previously written an article on "Precise Leveling in Private Practice", which appeared in our issue for March, 1913. A variety of experience followed the Big Creek job. He worked on the construction of water supply, highway, railway, and irrigation projects in California and Arizona. He

(Continued on page 48)

AN OLD GRAD MAKES US A VISIT

Trueblood, Wilson D., ch'22, who did Campus Notes for the **Wisconsin Engineer** back in 1919-20 and was called onto the carpet by Dean Nardin for printing a bathing beauty picture that today would be considered prudishly modest, came into town for the Purdue game and visited the sanctum. After recounting some of the gay episodes of his bachelor life, including riding a mount in a rodeo race at Estes Park and coming in fifth in a field of six with his mouth full of prayer and gravel, he got down to the matter of the Depression and, in his best Campus Notes vein, he dashed off the following epic:

Business could be worse, you know
Don't let your spirits get so low,
Remember men of ages past,
That budded down to tasks more vast.
Noah on the S. S. Ark
Looking for a place to park.
Jonah in that strange congestion
Fighting off a whale's digestion.
Cleopatra's first edition
Told of all the competition
Caesar had — think of the strain,
Both he and Rome ne'er were the same.

If your spirits still are drooping,
Do a little 'boop a dooping.
Perhaps it is the clothes your wearing.
Eat something new like Bismark Herring.
Buy your peanuts by the peck
But do not sit on burning decks.
Never take the count of ten
Remember back when men were men.

MECHANICALS

Cassoday, John B., m'25, is working out of the Wausau, Wisconsin office of Halsey Stuart and Company, investment brokers.

Meyer, Arnold, m'31, is designing electric furnaces for the Milwaukee Electric Railway and Light Company, at Milwaukee.

Schrank, E. S., m'18, is with the Wisconsin Power and Light Company at Oshkosh. He is in the engineering department.

Schrank, Joseph M., m'26, is with the Northern Illinois Public Service Company at Waukegan, Ill.

Whelan, William, m'23, gives his address as 253 Henry Street, Brooklyn, New York.

ELECTRICALS

Ackerman, Adolph, e'26, is a hydraulic designing engineer with the Aluminum Company of America.

Berger, Harold J., e'26, is with the American Telephone and Telegraph Company at Detroit, Michigan. Address: 118 Clifford Street.

Frackelton, Wm. B., e'28, is in the Industrial Department of the General Electric Company's Chicago office. He was married to Miss Beatrice Kenyon of Chicago last June 13.

Hoelz, J. B., e'06, has severed his connection with the Chicago office of the Bailey Meter Company, but can still be reached at his home address, 1815 Washington Street, Wilmette, Illinois.

Henningsen, Earle S., e'12, has been appointed engineer of the A-C Engineering Department of General Electric at Schnectady. Mr. Henningsen was at one time assistant head of 16 Test at Schenectady and in 1914 was appointed head of 60 Test. In 1915, he joined the A-C Engineering Department and after service in the U. S. Navy during the war, in the course of which he was appointed a lieutenant, junior grade, he returned to the same department, with which he has since been connected.

Van Vleet, James G., e'30, has taken a position as instructor in the Department of Mechanics at the University of Wisconsin.

CIVILS

Barnes, Ernest M., c'22, visited Madison on October 12 walking with a cane because of a recent knee injury. He is a superintendent of construction for the firm of Engstrom and Wynn of Wheeling and was taking a vacation between jobs. He was to return to take charge of a sewage disposal job at Princeton, N. J. Barnes was married on June 14, 1930 to Edythe M. Linton of Wheeling.

Bartsch, Lester W., c'31, who has been chief of party on an important piece of location for the Highway Commission at Rhinelander, has received an appointment to the Hoover Dam job. He was to go there about Nov. 15.

Behm, Wilfred W., c'29, who was instructor last year at Iowa State College, is vice president and chief engineer of the Richfield-Heim Coal Co., at Des Moines, Iowa.

Burmeister, Robert A., c'28, was married on September 2 to Lorraine I. Schmidt of Milwaukee. They are at home at 2538 Fairfield Place, Madison, Wis. Burmeister is junior assistant engineer in the Materials Department of the Wisconsin Highway Commission.

Dake, D. P., c'11, CE'17, is a consulting civil engineer at Minneapolis, Minnesota. Address: 352 McKnight Bldg.

Dahlman, John D., c'29, and **Scott, Morry**, c'29, are working on the new Forest Products Laboratory, at Madison, Wisconsin.

Donohue, Jerry, c'07, resigned in June from the Wisconsin Highway Commission and is again head of the Jerry Donohue Engineering Company of Sheboygan.

Fiebrantz, Raymond C., c'30, visited the college on September 30. He has completed a year and one-half of a two and one-half year apprentice course with McClintic-Marshall. To date he has been engaged on erection of steel in the field. He expects to go into the shops next and then spend the remaining time in the engineering department. He can be reached at 8301 Stewart Avenue, Chicago.

Fraser, Art, c'29, is in the United States Hydrographic office at St. Paul, Minnesota.

Greiling, Robert E., c'29, has a temporary appointment in the bridge department of the Wisconsin Highway Commission at Madison.

Jardine, Zac, ex-c'25, has just completed the requirements for his degree by correspondence and has been recommended to the regents. Since leaving school he spent one month in Florida laying out subdivisions. Following that he worked for two years with the Wisconsin Highway Commission. In August, 1927 he went to work for Alfred Brown of Chippewa Falls, Wis., a contractor on bridge and road work. He now has an interest in the company. Address: Northwestern State Bank Building, Chippewa Falls.

Kuenzli, Daniel H., c'29, who was working on the new court house at Milwaukee, is now in the bridge department of the Wisconsin Highway Commission at La Crosse.

Lautz, George H., c'08, is assistant chief engineer in the forest service at Washington, D. C. He entered the service at Missoula, Montana in 1910 as topographical draftsman, later becoming district engineer. In 1920 he was transferred to Washington as assistant engineer and in 1926 he became assistant chief engineer in charge of all engineering work in the various national forests.

Lidicker, William Z., c'27, was married on August 18, to Frida Schroeter of Chicago. They will make their home at 5550 Kenmore Avenue, Chicago, where Mr. Lidicker is engineer with the Management & Engineering Corp.

McMullen, Ralph E., c'27, wrote in May from Noxon, Montana, where he is with the U. S. Bureau of Public Roads as senior engineering inspector foreman.

(Continued on page 42)

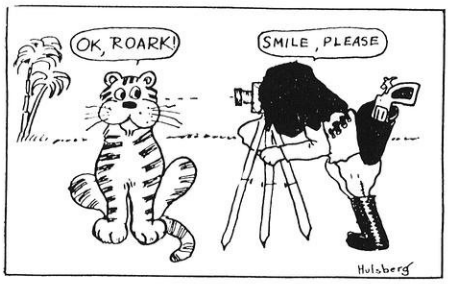
Campus Notes

TSK! TSK!

Professor Ray Owen had been entertaining the class with the gruesome details of a murder mystery. It seems that the perpetrator of the murder was a woman with an appendicitis scar, and that the scar was shaped like a half moon. Prof. Owen, before proceding with the regular class business, remarked: "If you ever happen to find a woman with a half moon shaped appendicitis operation scar, it would be well to notify the authorities."

A. S. C. E.

Professor R. J. Roark described another good way to keep from growing old when he described his adventures while "Tiger Hunting in Indo-China" at the meeting of the American Soci-



ety of Civil Engineers on October 7. Dean Turneaure addressed the group and welcomed the freshman civils who were present. Professor L. F. Van Hagan also delivered a short talk to the seventy civils who were present. The meeting closed in a cloud of cider and doughnuts.

HERE COMES THE BAND

Not content with holding a good share of the positions on the football team, the engineers must catch the public eye between the halves. And how one engineer, Paul Corp, m'33, does catch the eyes of the spectators! He is the fellow who stands in front of the band and does everything to that baton but tie knots into it. Last year Jerry Zibell, a civil, had the job, and we thought he was about as good as there was, but Corp has made us wonder just who is the best of the two. It would be interesting to hold a competive baton drill with the past and present drum majors participating. According to a report, Paul won a box of candy from the bandmaster at the recent game with Purdue. The bandmaster it seems was rather sceptical about Paul's ability, so he offered a bet that Paul couldn't toss the baton over the goal post and catch it. Paul won the candy.

RAY WEST LOSES LIFE IN AUTO CRASH

An accident in Wauwatosa was responsible for the death of Raymond West, m'33, of Mukwonago, on October 11. West with two other people, was on his way to church services when the car in which he was riding collided with another car and overturned. West was taken to a hospital, where he died shortly after the accident.

PROFESSOR BENNETT TO PATENT ELECTRIC HEATING PROCESS

A new method of causing electric heating currents to concentrate in desired strips or zones of conducting bodies, such as steel plates or tubes, has been invented by Professor Edward Bennett, of the electrical engineering department. There are numerous practical applications of the process, in particular welding and heat treating. The pipe line industry is expected to profit most from the development.

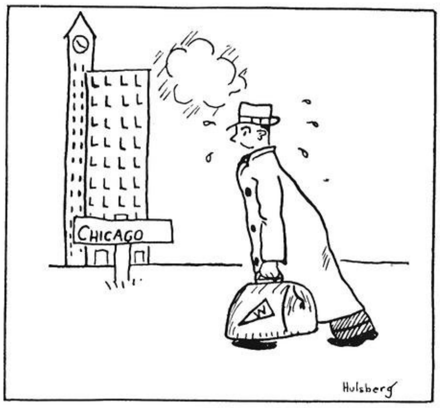
The Wisconsin Alumni Research Foundation, which was organized to commercialize scientific discoveries made by graduates and members of the faculty, will be in charge of the project. Application for a patent has already been made by Prof. Bennett, and it is expected that it will be secured, for no similar process is on record at the patent office.

H. L. Russell, director of the research foundation, stated that the discovery was only in the elementary stage, and that the successful practical application of it is as yet uncertain. If the results are successful, the invention will probably be extremely important, and the larger steel corporations will endeavor to obtain control of the device.

SENIORS TO VISIT CHICAGO ONLY ON TRIP THIS FALL

In the past, the senior electrical and mechanical engineering students have visited both Chicago and Milwaukee on the annual inspection trip. This year, however, they will only visit Chicago. It has been decided to have the juniors make a trip to Milwaukee in the spring, and to have the same students take the trip to Chicago in their senior year. Whether the men who are now seniors are to take the trip to Milwaukee in the spring is up to the men themselves, but they are urged to go even though it is not required.

Professors J. W. Watson, P. H. Hyland, and G. C. Wilson, who are to be in charge of the trip this fall, will take the students to the following places: The National Broadcasting Studios in the merchandise Mart, the South Chicago Works of the Illinois Steel Company, the Crawford Avenue Plant of the Commonwealth Edison Company, the Hawthorne plant of the Western Electric Company, the office of the Calculating Board of the General Electric Company, the Chicago Lighting Institute, the control room of the Chicago Civic Opera House, the Main Toll Office of the Bell Telephone Company, and possibly some other places of interest to engineers.



The trip is to start on Wednesday, November 18, and will end on Saturday, November 21, with the Chicago-Wisconsin football game at Stagg Field. If possible, the tickets will be bought in a block so that the ninety engineers will be together at the game.

ENTER—THE FOOTBALL PLAYERS

Perhaps you have seen a man in your classes who comes to school with his fingers a bit the worse for shoe cleats, and with a black eye or two, if not a limp. If you have, most likely it is one of the brawny engineers listed below. The following names of engineers appear on the varsity football roster: James Bingham, c'34; Nick Deanovich, m'34; James Donaldson, c'34; Gordon Ehlers, c'34; Richard Haworth, e'33; Robert Hubbard, ch'34; Corliss Kennedy, c'34; Harvey Kranhold, ch'34; Kenneth Kruger, c'32; Milton Kummer, c'34; Harold Lautz, ch'34; Robert Schiller, c'34; John Schneller, e'33; Harold Smith, c'32; George Thurner, c'33.

The following men are on the B squad: Charles Bloedorn, m'34; Leon Breuling, m'34; Arland G. Foster, m'34; James McClain, m'34; and Theodore Stone, e'34.

A number of the men appearing in this list are seen in the lineup regularly. Hal Smith, of course, is the captain, and plays a good, steady game at tackle. Johnnie Schneller, the big junior electrical from Neenah, distinguished himself in the Purdue game, and probably will in several more. Kenneth (Moose) Kruger is having tough competition from Simmons for the center position, but is in plenty of the fighting. George Thurner has done a good job at end in a number of games.

It is a coincidence, perhaps, but very nearly the same percentage of the men on the football squad are engineers as those on the cross-country squad. Out of a total of 73 men on the A and B football rosters, 20 are engineers, making a percentage of 27.4. Elsewhere on this page the percentage of cross-country men who are engineers has been figured and is found to be 26.1. Apparently we might conclude that a quarter of the engineers go out for some major sport, judging from this data.

A. I. E. E.

"The engineer must be a prophet as well as a technician", stated K. J. Affanasiev, e'32, in a talk delivered to the student section of the American Institute of Electrical Engineers on October 20. He described how the engineer must plan for the future market value of his product, whether the product is to be a car, a bridge, or a telephone exchange. The prophecy and forethought which the engineer must use was called "Commercial Engineering", which was the title of the talk. Professor Jansky spoke a few words to the group, as did Mr. Blum, of the Madison Section of the Institute.

SIX ENGINEERS RUN WITH THE VARSITY HARRIERS

An inspection of the roster of the cross-country squad shows that six of the twenty-three runners who are doing their stuff for old Wisconsin are engineers — which, if the slide rule may be trusted, gives a percentage of 26.1.

Harry Cortright, a veteran on the squad, is a senior civil. He is a letter man and a consistently good runner. Leonard Angoli and Harry Dever are two more senior civils who pace rather well. Peter Vea, e'34, has shown very good running form in practice. He is a new man, but he most likely will be used in some of the conference meets this fall. The chemicals have a good representative in Otto H. Wustrack, a sophomore.

Although the Badger football team did not show up very well against Pennsylvania, the cross-country runners showed that they deserved to be the Big Ten champions that they were last year by showing their heels to the Quaker lads. Minnesota, the next in line, is a powerful opponent, but all in all, the conditions appear to be quite favorable for another championship.

EIGHT ENGINEERS ELECTED TO PHI ETA SIGMA

The engineers rated more than their share of Phi Eta Sigma initiates at the tenth annual initiation of the group. Out of seventeen men elected to the organization, eight were engineers. Phi Eta Sigma is the honorary freshman scholastic fraternity. To become eligible for initiation, the student must have an average of 2.500 grade points per credit for his freshman year. The following engineers made the grade: Orville Carlton Frank, m'34; Wallace Gordon Gates, e'34; William Hill Norton, m'34; Robert Ingersoll Howes, e'34; Wilfred Cornelius Lefevre, c'34; Abraham Mones Max, ch'34; Philip Walter Rosten, ch'34; Albert Lee Topp, e'34.

The initiation banquet was held on October 27 in the Memorial Union. The address of the evening was delivered by Professor William C. Troutman, and the new initiates were welcomed by Franklin Lounsbury, the president of the group.

M. E. BUILDING HOUSES POWER CONFERENCE

The first official use of the new mechanical engineering building was made on June 23, one day after its dedication, when it sheltered the annual meeting and outing of the Oil and Gas Power Division of the American Society of Mechanical Engineers.

The first day of the conference saw Prof. Ben G. Elliott presiding over the conference, where a few technical papers were read. A general mixer and party occupied the evening. With L. H. Morrison, associate editor of *Power*, presiding, the second day was devoted entirely to a presentation of papers on Diesel engines. A banquet, dance, and party at the Memorial Union closed the third day of the power conference. Two papers were read, and the group started for an inspection of the Fairbanks-Morse plant in the morning. Harte Cooke presided over the meeting on the third day.

Edgar J. Kates, consulting engineer of New York City, took the gavel at the fourth day of the conference. The meeting formally closed at noon, but a number left for a special auto and bus trip to the Dells of the Wisconsin.

A number of exhibits were set up in the steam and gas laboratory, one of which, a Diesel engine, will remain for testing by students. The chassis of an automobile with the principal parts exposed to show their operation was left in the lobby as a permanent exhibit, and is well worth seeing.

(Continued on page 46)

ALUMNI NOTES

(Continued from page 39)

Mohr, Harvey W., c'30, was married in July, 1930, to Evelyn Hvam. The marriage was not announced until last June.

Oakey, John A., c'29, who held a temporary appointment as instructor in hydraulic and sanitary engineering at Wisconsin last year, is instructor in hydraulics at Purdue.

Owen, Ray S., c'04, attended the fall meeting of the A. S. C. E. and discussed a paper on original land surveys and their resurveys given by Prof. Dodge of Iowa State College.

Plotz, R. S., c'30, married Alice Marie Smith of Madison on August 15, 1931 in New York City. His address is 7102-34th Ave., Jackson Heights, Long Island, N. Y. Plotz is working for the Bell Telephone Laboratories. He has finished their training course and is now working in their New York office. He has also been working on the Bell trade magazine.

Price, Elmer E., c'23, who has been in the advertising department for Eugene Dietzgen Company of Chicago for several years, was recently promoted to be manager.

Roeming, George C., c'30, since graduation has been working in Chicago on an automobile-parking project backed by a syndicate including the Harnishchfeger Corp. of Milwaukee and the Starrett Building Corp. of New York. He was employed directly by the inventor of the parking machine, B. B. Balkema, and has worked on machine design and electrical control problems.

Thorne, John G., c'06, CE'17, has been made Waterworks Engineer for the city of Kewanee, Ill. He was formerly city manager of Maquoketa, Iowa.

Waite, Gordon E., c'30, began work with the U. S. Biological Survey in April of this year. He wrote in May from Belle Fourche, S. D., where he was working on boundary surveys.

Whitney, Edward, c'13, is now with Division four of the Wisconsin Highway Commission at Wisconsin Rapids, Wisconsin.

MORE NEWS OF 1931

In addition to the men listed under "What 1931 is Doing", in our October number, the following civils have reported their whereabouts.

Bartsch, Lester W., has been chief of party on an important location survey for the Wisconsin Highway Commission at Green Bay. He recently received an appointment to the Hoover Dam job and was to report about Nov. 1.

Benesh, Alvin H., is with the Federal Bureau of Public Roads at St. Paul, Minnesota.

Buending, Clarence W., has been working as a carpenter with a contractor at Fort Atkinson, Wis.

Calkins, Robert S., has a temporary job with the Wisconsin Highway Commission at Madison.

Drew, Sidney D., is inspector for the army engineers at Muskegon, Michigan.

Euclide, Francis J., has a temporary position with the Wisconsin Highway Commission at Green Bay.

Ewald, Clarence F., has been with the bridge department of the Wisconsin Highway Commission at Madison since February.

Glaessner, Lawrence H., is with the U. S. Engineers at Milwaukee.

Graetz, John B., has a temporary position with the Unit Corporation of America at Milwaukee.

Hill, Millard M., is with the Wisconsin Highway Commission at Rhinelander.

Innes, John L., is registered in the Law School at Wisconsin.

Jackson, Ray, is with the Wisconsin Highway Commission at Rhinelander.

HYDRO FOR PEAK LOAD

(Continued from page 33)

A Case Is Analyzed

Let us say that, unless plenty of water is available, we intend our peak-load hydro to operate only 30 per cent of the time and that percentage is to be spread over the highest peaks. This will give us 7.2 hours of operation per day, and during the rest of the time, the plant will be shut down for ponding the stream flow. It is assumed here that such operation will not be contrary to state or federal regulations controlling minimum stream flow.)

Based on the above method of operation, 75 per cent over-all efficiency, and 50-foot normal head, Table 1 has been prepared to show the annual generation for various installations. (Maximum over-all efficiencies of well above 80 per cent are readily obtained in modern hydro plants, but in computing outputs over an entire year an efficiency 5 to 6 per cent lower than the maximum should be used.)

A study of Table 1 will bring out two very important facts: First, an 800-c. f. s. installation will permit a reduction in system peak of 2700 kw. while an 1800-c. f. s. capacity will make available 6100 kw. for reducing peak on the remaining sources of supply. Secondly, we see that peak-load generation for the larger capacity is more than double what it is for the 800-c. f. s. capacity. The off-peak generation has dropped 20 per cent with the increase in installation, but total output has increased 27 per cent. In order to bring out more clearly the value of an increase in peak-load generation, outputs in Table 1 are also given in units of value. One unit of value is equal to one kw-hr. of off-peak generation. One kw-hr. of peak-load generation will be equal to several units of value, the exact number depending on the facts of an actual case. In Table 1 one kw-hr. of peak-load generation is taken as 4 units of value, and on this basis a plant of 800 c. f. s. capacity produces 38,810,000 units of value and one of 1800 c. f. s. capacity produces 66,990,000 units of value or a 72 per cent increase. It is this marked increase in valuable output which speaks strongly for large installations.

What additional expense is incurred in the latter case? Only the cost of a larger power-house and additional equipment, and since these items constitute but one-fifth to one-third of the total cost of development, it is often possible almost to double the valuable output of a site by a 10 to 15 per cent increase in the investment.

Hydro Standby Is Instantly Available

Thus, by adding more or larger turbines to the proposed water power development, we have not only materially increased the value of the hydro plant output but removed the extreme peaks from other sources, thereby materially increasing their load factor (and hence operating efficiency), but in addition, there is provided for the system a capacity of 6100 kw. which can almost instantly be placed on the line and which will aid to an appreciable extent in carrying the system through a temporary difficulty. Should trouble occur even at the close of 7.2 hours of operation when the stored up stream flow of the day has been passed through the wheels, there will be sufficient pondage to permit operation for the short time necessary to correct the trouble or to get some standby unit warmed up and operating.

The point to which peak-load installation in any system can be carried is governed by the physical and economic factors entering into the particular problem, but in general it appears that hydro peak-load installation up to 20 or 25 per cent of maximum system demand can be justified.

TABLE 1

SUMMARY OF OUTPUTS

Turbine Capacity C. f. s.	*Installed Capacity Kw.*	*Peak Load Generation Kw-Hr.*	*Off Peak Generation Kw-Hr.*	*Total Generation Kw-Hr.*	*Total Units Of Value*
400	1,400	3,320,000	7,740,000	11,060,000	21,020,000
800	2,700	6,600,000	12,410,000	19,010,000	38,810,000
1,200	4,100	9,850,000	12,230,000	22,080,000	51,630,000
1,600	5,400	12,960,000	10,690,000	23,650,000	62,530,000
1,800	6,100	14,280,000	9,870,000	24,150,000	66,990,000

Proper adjustment has been made for decreased turbine capacity during highwater.

Knuth, Howard H., is with the La Crosse Division of the Wisconsin Highway Commission.

Matthias, Franklin T., is instructor in topographic engineering at Wisconsin.

Medler, Samuel W., is with the Milwaukee Division of the Wisconsin Highway Commission.

Newing, Charles W., is with the Wisconsin Highway Commission at Rhinelander.

Sowls, Homer, is chief of party for the Wisconsin Highway Commission at Lancaster.

Streu, Albert E., is superintendent on paving for the Streu Construction Co., of Two Rivers, Wis.

Perry, Theodore H., c'31, former editor of the **Wisconsin Engineer**, began work on October 19th in the technical department of the Badger-Globe mill of the Kimberly-Clark Co. His address is 213 West North Water Street, Neenah, Wis. **Mortensen** and **Gibson**, who were graduated last year from the course in mechanical engineering, are in the drafting department of the same company and living at the same place as Ted.

Thern, Phillips H., is with the Wisconsin Highway Commission at Madison.

Trieloff, Jennings C., is with his father who is a general contractor at Fort Atkinson.

Wertsch, Robert S., is with Auler, Jensen & Brown, architects, at Oshkosh.

Wohlgemuth, John F., has been working as a laborer with the Meredith Construction Co., of Milwaukee.

Yolton, Leslie A., is with the Wisconsin Highway Commission as chief of party on the construction of the overhead near the Fair Grounds at Madison.

Zibell, Jerome W., is running the hardware and plumbing business that was left at the death of his father. He is at Waterloo, Wis.

AIRCRAFT DIESEL ENGINE

(Continued from page 35)

der is equipped with an individual pump and spray nozzle extending into the combustion chamber. The amount of fuel injected into the cylinder is determined by the length of the pump plunger stroke. The stroke is varied by moving one end of the pump push rod back and forth in a specially shaped groove in a pivoted, oscillating arm so that the stroke is increased as the push rod end is moved away from the pivot. The pumps for all cylinders are controlled by rotating a ring inside the rear section of the crankcase. This moves the ends of the pump push rods simultaneously. The movement of this ring offers the pilot his main control over the engine speed. The spray nozzle is directly connected to the pump and is spring loaded with a stop to prevent complete closing. This is of considerable importance as it prevents the trapping of air in the fuel pump. Should air get into the fuel pump it would not function properly because of the high injection pressures used. The fuel used is a refined furnace oil; a far less expensive fuel than gasoline. An example of the low cost of fuel for this engine is shown by the following telegram sent by Mr. Woolson to his superior after a flight in a plane equipped with a Packard-Diesel:

ARRIVED OK AFTER SIX HOURS AND FIFTY MINUTES OF UNEVENTFUL FLIGHT CONSUMING FOUR DOLLARS AND SIXTY EIGHT CENTS WORTH OF FURNACE OIL STOPPING AT HOTEL CHAMBERLIN VANDERBILT OLD POINT COMFORT VIRGINA — WOOLSON.

The flight was made from Detroit, a distance of about six hundred miles. This gives a fuel cost of less than one cent per mile.

The principal advantages claimed for this engine are good fuel economy, reduction of fire hazard, elimination of radio interference by dispencing with the electric ignition system, and improved reliability. Although the power output of this engine does not equal the best gasoline engine of the same displacement and speed, great progress has been made in the field of obtaining a satisfactory solid-injection compression-ignition engine.

NEW TIP ON ADJUSTING INSTRUMENT

In a quiz in T. E. the question was asked: Describe the operation of adjusting an engineer's level. One of the men was struck with an inspiration and proceded to elucidate with the following puff of hot air:

The adjustment of the level must be very carefully done, since the accuracy of all future operations with the instrument depends to a great extent upon the skill and judgment of the engineer who has done the adjusting. A badly adjusted instrument can easily render void a whole day's work by a level party. The engineer in adjusting the level sets it up with extreme care, making certain that each leg is firmly planted in terra firma, and then proceeds to bring all parts into perfect adjustment. It is best to follow standard practice in this operation and to take pains not to damage any of the screws or other parts of this delicate instrument. In this way the engineer makes certain that his instrument is ready for accurate work.

A BUILDER AND AN EXECUTIVE

THE recent speech of Major General Lytle Brown, Chief of Engineers, United States Army, before the American Engineering Council at their annual dinner, besides describing the peace time work of the Corps of Engineers, is fraught with philosophy on that always interesting question — must the successful engineer necessarily be a good executive? We are indebted to the *Bulletin* of the American Engineering Council for General Brown's speech. He said in part:

"Long years ago when I was attending classes at a university we studied engineering. Among the structures that we studied were the steel arch bridge across the Mississippi at St. Louis and the jetties at the mouth of that river. They were built by James B. Eads whom we considered to be the greatest of all engineers, and we aspired to be like him. But one day after we had been out in the field laying out a railroad and were thinking that every engineer must be a first class instrumentman, the professor told us that Eads could not run a transit. He had to have a young fellow named Corthell to do that for him. Eads at once fell considerably in my estimation as an engineer. Years afterward I saw about the most skillful instrumentman of all my acquaintance, and that was all the kind of a man he was. His salary was about one hundred dollars a month.

"Another time, many years ago, I was a rodman and masonry inspector on a lock in the Cumberland River. The contractor on the work had failed and his bondsman came down from Columbus, Indiana, to do the work. That old contractor was a sleepy, hesitating old fellow, but what kind of a fellow was the bondsman?

"That bondsman was a white haired, red faced Irishman, with cold light grey eyes. Never have I seen such a driver of men. He would go to Columbus, Indiana, every once in awhile, leaving the old contractor in charge. In a day or two the old Irishman's buggy would be seen coming over the hill a mile away, and before he got there, all kinks would be out of things and the job would be humming along again. I used to wonder what made the difference, but could not tell except that the old bondsman was the superior in profanity. But there was quite a difference, as I have come to learn later. The old bondsman knew which man to shoot the swear words at, and the old contractor did not. It makes a lot of difference. The old Irishman never wasted any swear words on a common laborer. He shot at bigger game, at the man who was in charge at the point of trouble. He knew how to hold men to their responsibilities. Maybe the old contractor knew also, but perhaps he was afraid to do so.

"I have called attention to engineers, builders, and executives. By that I do not mean that when a man is one he may not be all three, but that is the rare exception. Only an engineer may be all three. A really good builder must be a good executive, but he may not be an engineer as we know the term, nor is a good executive necessarily an engineer.

"Really when we say engineer, we have in mind a technical man. He may be a very fine technical man and nothing else. If so, he is fitted but for the staff, so to speak; not fitted to make decisions; not fitted to lead men or to greatly influence them. He is lacking in certain well recognized qualities.

"I have heard it said that the training of an engineer has a tendency to destroy him as an executive. I have also heard it said that the training of an engineeer forbade his being a great commander. If training can destroy the native qualities, those sayings are true. I have never seen training destroy any native qualities. I have seen it strengthen them, never weaken them. It does not change them. Only failure to exercise the native qualities seems to make a man forget that he has them.

"I was intimately associated with a great executive once in a time of great emergency, and noted his actions with much care. He had the power of decision to a very marked degree, and we quickly knew what was wanted. He was a man of capacity, or, in other words, he could absorb knowledge rapidly, and had a great deal of it. He had the faculty of knowing what must be done now, what should be put off until tomorrow, and what could be put off indefinitely. The first he said do; the second he laid aside; the third he threw into the waste basket. He knew his organization and therefore who was responsible for what. He failed in one thing — he did not know how to deal with men over whom he had no authority, and therefore made enemies out of them, and they were finally his undoing.

"No man who has large responsibilties is free from executive duties no matter whether he be engineer or builder. If he directs others, he performs executive duties. To do these duties well, he must have natural qualities beyond the ordinary. The knowledge of what these qualities are may tend to call them out of slumber and summon the will to strive for their development.

The executive qualities are the same as those of a commander. They are such as make possible rapid and accurate decisions, and constancy in abiding by them. These qualities are quick intelligence, sound judgment, energy, a strong will, and far, far above all else, a great moral courage. These qualities are greatly aided by a broad general knowledge of men and affairs. Knowledge of the fundamentals and appreciation of them is required.

"These requirements bring to mind thoughts of what the education of a young engineer should be. I fully agree with my old professor of engineering when he used to say: 'We will give you the general principles, the fundamentals, and enjoin on you to keep them in memory as the foundation without which no lasting structure can be built. You may elaborate on them all through life and make the structure as complete as you please. They will always support you.'

"Our engineering colleges will not have failed at all in their mission if they turn out once in a while an executive great enough to be President of the United States. They may give and emphasize the fundamentals of engineering and show the way to a broad general knowledge so as to encourage all to attain it, though as a matter of fact only those of great industry and capacity will attain it.

(Continued on page 47)

CAMPUS NOTES

(Continued from page 41)

ROMARE INVENTS ACCURATE THERMOSTAT

A thermostat that maintains temperatures without perceptible variation has recently been invented and put into service in a number of university departments by O. E. Romare, mechanician of the college. The most accurate of previous devices has had a range of variation of at least two degrees, whereas the new device gives practical uniformity. Romare's apparatus is being used at the university greenhouses to control air temperatures and in several laboratories to control the temperature of water baths. The new device is electrically operated. It contains a transformer that steps down 110-volt alternating current to 6-volt direct current. A mercury switch is used to prevent sparking when contact is made and broken.

INSTRUCTOR CONVERTS GAS ENGINE TO A DIESEL

A 5-h. p. gasoline engine has been successfully converted into a Diesel engine of practically the same power by Orville C. Cromer, Madison, instructor in mechanical engineering. The project was the subject of Mr. Cromer's thesis last year when he held a fellowship in mechanical engineering. He has had much experience with gas engines both during the war, when he was connected with the aviation service, and during a period when he ran his own machine shop.

The problems involved in this conversion of the engine were, according to Mr. Cromer, rather complicated. The high compression necessary in the Diesel engine made it necessary to decrease the bore of the engine and to redesign the head. The new parts were designed by Mr. Cromer, who also made the patterns and cast the parts himself. Tests show the redesigned engine to have almost the same power that it had originally with the larger bore.

WITHEY TOWER NEARS COMPLETION

Towering far above the present skyline presented by the picturesque architecture of the university buildings rises the new Withey Tower from its foundation in the vacated steam and gas lab behind the engineering building. This eighth wonder of the Western World, towering over parking area 6, and cutting out the light from the drawing rooms on the lee side of the west wing of the engineer's temple, is to be the housing for the million-pound column tester in which mighty fabrications of steel and rivets will be crushed and bent like matches, and the data accruing therefrom will be compiled into more pamphlets to be sent out over the world. Until now, the famous Empire State Tower of New York was considered the foremost achievement in the field of engineering, but those who know state modestly that when it is completed the new Withey Tower will far surpass and other structure, being the highest and most powerful tower south of Lake Mendota and north of University Avenue.

"Isn't there some fable about the ass disguising himself with a lion skin?"

"Yes, but now the colleges do the trick with a sheepskin."

Washington Dirge.

A BUILDER AND AN EXECUTIVE

(Continued from page 45)

Before one of the committees of Congress last year I thought that I saw a tendency to regard the engineer as a purely technical being who had no mind for anything but cold facts and figures. So he is if his capacity is limited to such things. And if he is so, then he is not fitted to solve great problems of engineering, because other factors than cold facts and figures enter them. Their solution is for the benefit of humanity, and unless he understands society in its economics, its law, and its psychology, his solution of the physical problem will be at best a entirely blind one and may result in his being pilloried as one without vision or sense. His work must have the benefit of all the capacity and the knowledge that within him lies. It will even be of benefit to know politics, for it benefits the traveller to know pitfalls in order to avoid them."

DIGGING IN

THE secret is not in how to study, it is in how to review. Try this simple system.

Take your notes as you have been taught to. Then buy some three-by-five filing cards. Look over your notes and use a red pencil. Some parts are easy to remember. There are other parts that are "the veriest devil". That formula in chemistry or name in history or declension in Latin. *These are the key points in the lecture.* Write small and enter these high spots on your three-by-five cards. One side of such a card will take care of the real posers in any one lecture.

Now you have the difficult points all together on cards. . . . . Tuck those cards into your pocket. Then, during the spare moments of the day, use those cards. The ten minutes before dinner or waiting for a date, or loafing after one. Your success in that chemistry course isn't going to depend so much on getting every day's work, although that is important. It depends on your not forgetting the work that has preceded. You have the key points of this and other courses in your vest-pocket notes.

Here is where system enters. Get busy at the beginning of the term. You will find that your pack of cards rapidly grows. Mix them all together — chemistry, French, history, math., and biology. Now be careful. Every morning select a certain number from that pile for review — let us say ten. Make it an absolutely rigid point that these ten are read over carefully during the course of the day. You have got to hold yourself to a schedule. Where, when, or how you read them makes little difference, but get them read and be thorough about it.

Then replace them. One card came early in the course. You know everything on it thoroughly. Place it on the bottom of the pile. It will be quite a time before you meet again. Another you are not so sure of. Put it in the middle. That means you will run across it again in, say, two weeks. Finally, you meet a card which represents a lecture of yesterday. It was difficult and you know that you have not mastered it. So put it near the top, where you will get at it again in the very near future.

The idea is to guarantee that you keep reviewing your entire work during the course of the year. Also, that you keep seeing the stuff you have mastered in rather long intervals, while you have the material you have not mastered served up to you every few days.

Another point. *Do exactly the same thing with the books you read.* Don't blame you memory because you read through a book once and then fail it on an examination. Anyone but a genius will do the same thing. Be reasonable — and systematic. Get the hard points of that book down on your cards. One card will generally cover from ten to twenty pages, dependent on the nature of the book. But treat your outside reading just as you would treat your lectures.

Finally, you run bump into the examinations. If you have been following my suggestions you are more or less "all set". Your review is practically done because you have been seeing to it every day. However, you take all those chemistry cards out of the key pile. Go through them and check all doubtful points with a red pencil. Do it again and the puzzlers should have a blue pencil this time. Then, finally get the points which are still beyond your ken down on separate cards and hammer away at them. There won't be more than three or four cards. Lastly, the day before the examination, read over your general notes carefully and then go to a picture the night before. — G. H. ESTABROOKS, Colgate University, in *The Intercollegian.*

OWEN OFFERS PROBLEM TO POTENTIAL SLEUTHS

The following statement of facts, issued by Professor Ray S. Owen, reads like the old gag: A steam ship has three funnels and a red life boat; how old is the captain?

Mendota Problem Number 5

There are three surveyors: Smith, Robinson, and Jones. They are instrumentman, rodman, and axeman, but not respectively.

They are working for three land owners: Mr. Smith, Mr. Robinson, and Mr. Jones.

1. Mr. Robinson lives in Madison.
2. The rodman lives half way between Middleton and Madison.
3. Mr. Jones earns $485.00 a month.
4. The rodman's nearest neighbor, one of the landowners, earns exactly three times as much as the rodman.
5. The rodman's namesake lives at Middleton.
6. Smith beat the axeman playing billiards.

Who is the instrumentman?

However, on close perusal and considerable reasoning, it will be seen that the problem admits of a definite solution. For further particulars and the answer to the situation see Mr. Owen or his staff.

"The engineer has dramatically increased the efficiency of production and finds that in his race of progress he has outstripped the economists who distribute that production."
—Engineers' Bulletin, Denver.

NEW CIVIL ENGINEERING MAGAZINE

(Continued from page 38)

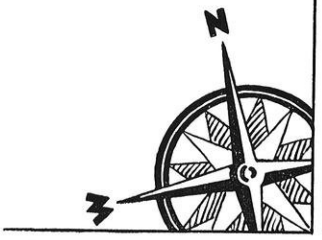
also had experience in the investigation, design, and valuation of irrigation and power projects.

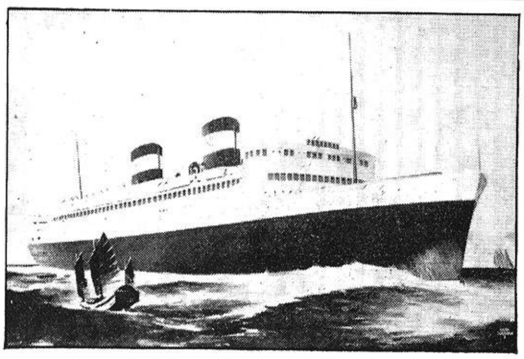
During the war Jessup saw sixteen months of service in France as first lieutenant in the 39th Engineers. He is a member of the Society of American Military Engineers and is a captain in the Engineers' Reserve Corps.

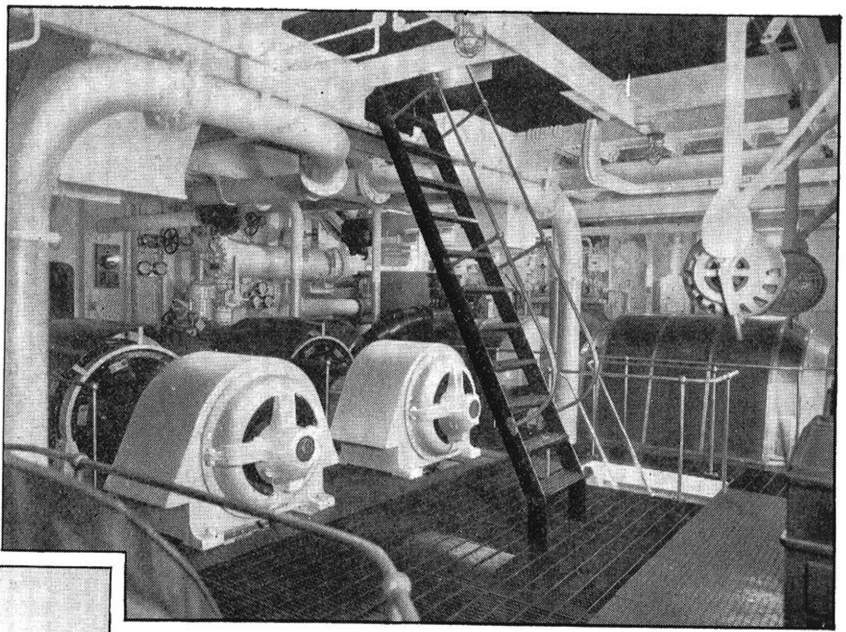
His profession has always been able to interest Jessup in its organized activities. The willingness to take a part in the work of professional societies, which he displayed during his college days, was carried over into his active career. Besides his connection with the American Society of Civil Engineers, he was a member of the Pasadena Engineers Club and the Joint Technical Society of Los Angeles. He was secretary of the latter organization during 1930. He was one of the founders of the Los Angeles Alumni Club of Tau Beta Pi and served as its secretary-treasurer for fourteen years.

Jessup married a Waukesha girl, Marian Tytherleigh Moses, at Los Angeles on September 29, 1919. They have three children: Eleanor Catharine, 11; Walter Edgar, Jr., 9; and Andrew Tytherleigh, born last September.

Filling one of these ornery little spaces without obviously sticking in "filler" is one of the hardest things about putting out this magazine. It might be just as well to let it go the way it is.







Typical engine room of a modern all-electric ship

POWER PLANTS AFLOAT

ELECTRICITY, having revolutionized industrial methods, is well on its way to a conquest of the seas. Already, more than seventy ships are propelled by electric energy — liners, merchantmen, tankers, tugs, and every other type of seagoing craft.

Owners and masters alike praise the steady, dependable power — the speed without vibration — the economy of operation — the convenience of electric auxiliaries. Travelers have found new delight in the extraordinary comfort of electric propulsion and in the luxury of electric appliances.

The all-electric ship — a complete mobile power plant and system of distribution — is largely the achievement of college-trained men who have supplemented technical theory with practical experience in the General Electric Company.

Many of these engineers are now maintaining the prestige of General Electric not only in marine electrification but in every other department of design and application. Others, newly graduated, are gaining, in the Company's Test Department, a training which will enable them to join the ranks of electrical leadership on land and sea.

95-881DH

GENERAL ELECTRIC