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The Rose TECHNIC

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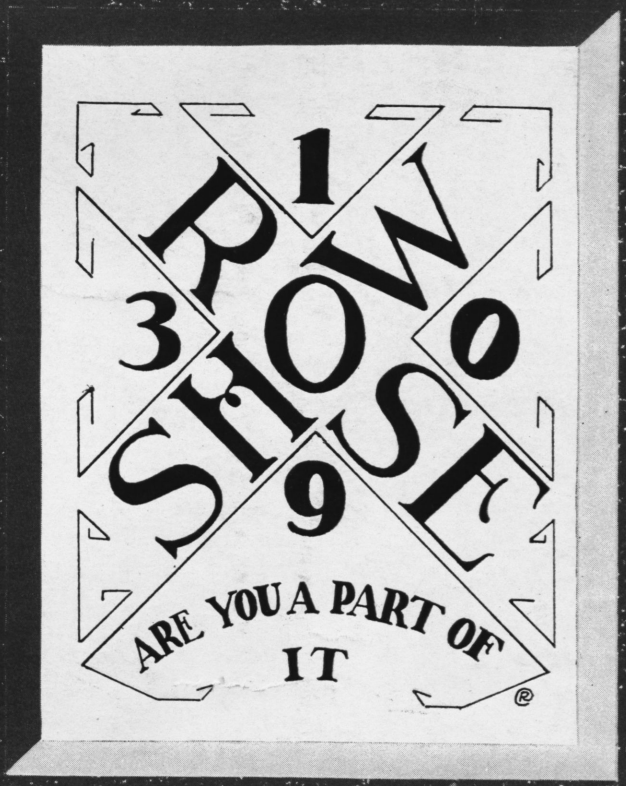
OF ROSE POLYTECHNIC INSTITUTE



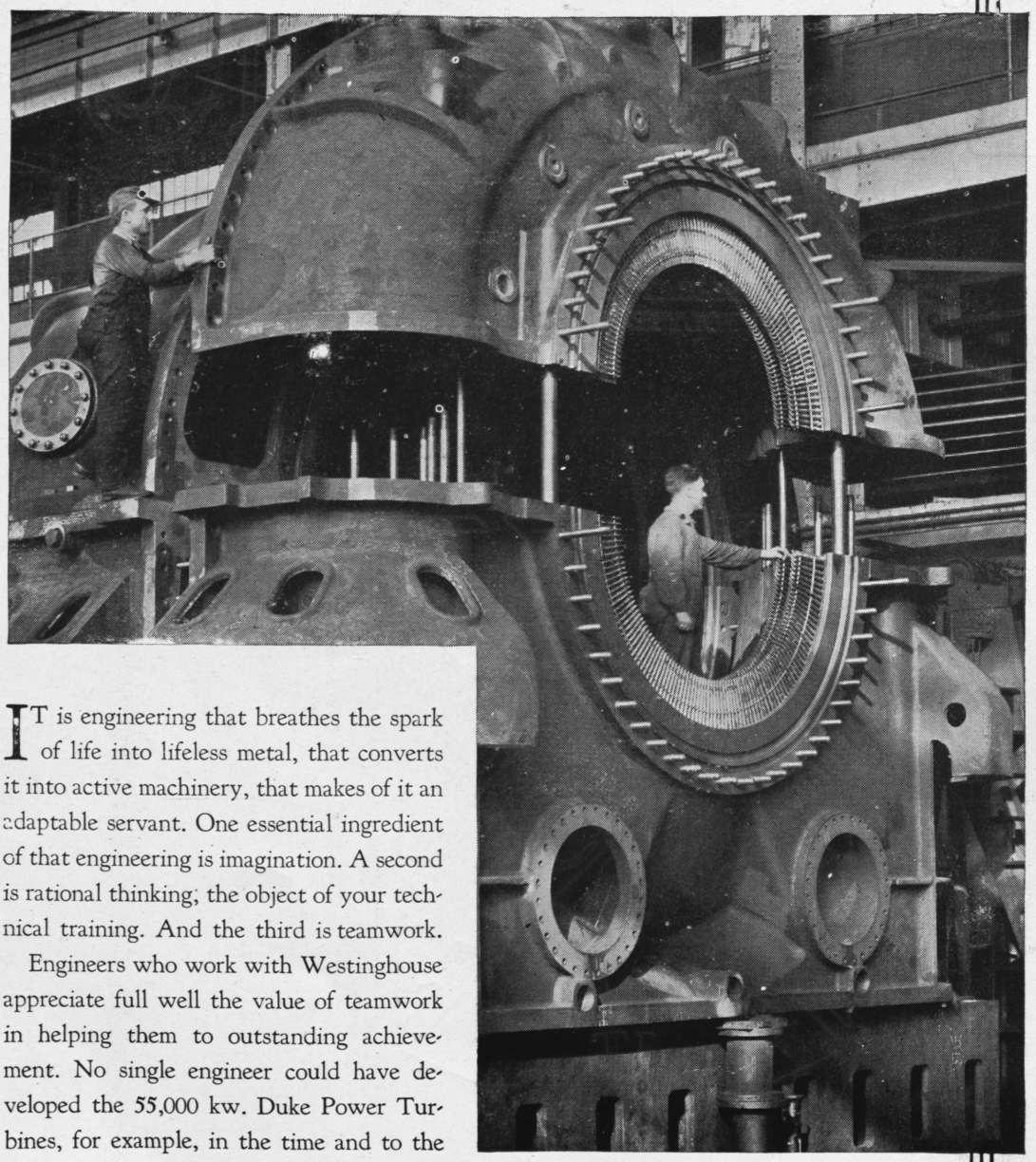
APRIL
1930

VOL. XXXIX TERRE HAUTE, IND. No. 7

Member of Engineering College Magazines Associated

DEAD METAL LEAPS TO LIFE

at the hands of Westinghouse engineers



The 55,000 kw. turbine-generator units that Westinghouse built for the River Bend station of Duke Power Company are the largest in the South.

IT is engineering that breathes the spark of life into lifeless metal, that converts it into active machinery, that makes of it an adaptable servant. One essential ingredient of that engineering is imagination. A second is rational thinking, the object of your technical training. And the third is teamwork.

Engineers who work with Westinghouse appreciate full well the value of teamwork in helping them to outstanding achievement. No single engineer could have developed the 55,000 kw. Duke Power Turbines, for example, in the time and to the degree of perfection that the Westinghouse organization did.

Here teamwork extended back to the date when George Westinghouse brought the steam turbine to America. It included men who have made life studies of vibration, of blade design, of the effects of superheated steam on metals. It embraced the foundrymen who made the huge castings required, and the packers who have mastered the science of shipping giant machinery. And it took in also the business men who create a market for such machinery and who cement together the many-fold activities of the Westinghouse institution.

Westinghouse

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WE CAN TRAVEL THE ROAD BUT ONCE

Thomas Arkle Clark, dean of men at the University of Illinois and one of the best-informed men on college and fraternity affairs in the country, recently made a list of the things he would do if he had to go through college again. Were he to begin his college days anew, he says, he would:

1. *Develop concentration . . . . work harder but not so long.*
2. *Learn to work while others are around.*
3. *Put more stress on learning how to get information than upon the information itself.*
4. *Find more difficult tasks to do.*
5. *Learn to speak in public.*
6. *Learn to play well some athletic game.*
7. *Learn to do one line of work particularly well.*
8. *Get better acquainted with his instructors.*
9. *Take fewer courses which are strictly practical.*
10. *Have an avocation which would bring him into close touch with men.*

—The Palm of Alpha Tau Omega.

THE ROSE TECHNIC

The Official Publication of the Students of The Rose Polytechnic Institute

Volume XXXIX. APRIL 1930. Number 7

OSCILLOGRAPH EXPERIMENTS

Royer R. Blair, e., '30

WHAT is the most interesting piece of apparatus in an electric laboratory? Had I been asked this question about a month ago, I doubt if I could have answered it. However, since that time, our laboratory group, composed of Mr. N. A. Baptist, Mr. D. F. Williams, and myself, was assigned an experiment which proved far more fascinating than any we had ever done, and I believe that if any of us were asked that question now, we would immediately reply, "The oscillograph."

Now in case there still exists somewhere in Rose an underclassman who didn't get a chance to ask us personally what this device in the new dark room in the electric laboratory is (and I don't believe any of them missed us) perhaps we'd better tell what it actually is. An oscillograph is a device for making visible or for recording photographically the wave forms of alternating currents and voltages. And all that isn't really half as bad as it sounds, for such an interesting experiment as making the voice visible or of actually photographing the voice is easily accomplished on this most interesting machine. Of course, this is just a novel application, for the machine really has some very important and practical uses in the field of electrical engineering. Some of its almost countless and interesting uses will be taken up later in more or less detail, but just now, I believe, a description of the oscillograph and how it operates would be in order.

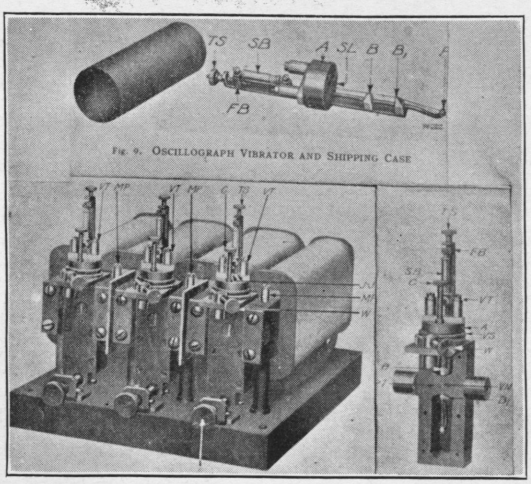


FIG. 9. OSCILLOGRAPH VIBRATOR AND SHIPPING CASE

The oscillograph owned at Rose is a General Electric product and is of the mechanical type in contradistinction to the newer cathode ray type. The mechanical oscillograph operates on the following well-known principle. A coil of wire with an electric current passing through it suspended between the poles of a powerful magnet will tend to turn so that the axis of the coil is parallel with the lines of force between the two poles of the magnet. In this case the "coil" consists simply of one turn of very fine silver alloy suspension strip. This forms part of the vibrator. Fig. 9 shows this tiny suspension trip. The round block of insulation material "A" has two binding posts mounted on it (to the left of it in the figure), and to one of these is soldered one end of the suspension strip. From there it passes down through the slot "SL" in "A", over the two ivory bridges "B" and "B1", around pulley "P" (at extreme right), back over the bridges parallel and extremely close to the strip just mentioned, up through "SL" to the other binding post to which it is soldered. By moving the pulley "P" to the right or left by means of the rod to which it is fastened (the rod sliding through holes in "A", "B", and "B1"), the tension on the strip can be varied from 4 to 8 ounces. Tension screw "TS" varies the tension, and a unique little spring balance "SB" indicates the tension in ounces. Half way between the two bridges a tiny sliver of high quality plane glass mirror ("VM" in Fig. 1) is cemented to the two strips as shown. Each of the machine's three vibrator elements is placed in a liquid-tight cell between the poles of a powerful electromagnet. (A cut-away view of the cell is shown at the extreme right of Fig 1.) Each cell has a glass window in front of the vibrating mirror, and is filled, after the vibrators are in place, with a damping fluid composed of five parts castor oil and one part of turpentine. The view in the lower left corner of Fig. 1 shows the complete vibrator and field coil unit (or "Galvanometer" as it is called and actually is) assembled. Within certain limits the vibrating mirrors are adjustable in all directions through the use of the adjusting screws "S" and "W". With the field current turned on, a very small e.m.f. applied to one of the vibrators will cause it to twist, say to the right; if the polarity is reversed, the vibrator twists the other way. It is interesting to note that the inertia of the vibrator is so small that with proper strip tension, the vibrator is capable of following any alternating current or voltage wave in frequency, magnitude, and direction of any frequency up to 5,000 cycles per second.

Now let us see how this vibrator mechanism is used. Through an optical system, the rays of an arc light are directed on the three mirrors so that a beam of light is reflected from each mirror. These light

beams will be motionless if the mirrors are not vibrating, but if they are, the light beams will swing back and forth in a horizontal plane. At about 18 inches from the vibrating mirrors another mirror is set at an angle of about 45 degrees from the vertical in such a way that it projects the three beams of light vertically upward on to a translucent screen of mica. This latter mirror is rocked back and forth by a small synchronous motor about a horizontal axis at right angles to the three beams of light. For convenience, let us say the three mirrors direct their rays north. Now due to the rotation of the three mirrors on their vertical axes, the spots of light on the mica screen would move east and west, but due to the rocking action of the large mirror on its horizontal east and west axis, the spots would move north and south. Thus we have two motions combined at right angles in the same plane, and the result is that the wave form (sine wave or whatever it may be) of the impressed e.m.f. or current is traced out on the mica screen. A shutter similar to that used on motion picture projection machines is operated by the same synchronous motor that rocks the mirror and admits light from the arc when the rocking mirror is moving in one direction and cuts it out during the return motion. This prevents conflicting images on the screen.

For taking photographic records a light-tight, cylindrical metal can is mounted on the end of the machine with axis horizontal and "east and west", that is, perpendicular to the three light beams. The can has a narrow horizontal slot through which the light beams can pass. A cylindrical drum, about which is fastened a length of ordinary roll film, is rotated inside the can, being driven by a variable speed motor. Here again we have a case of two motions at right angles with the resulting wave forms spread out over the length of the film. Before using the oscillograph, the three beams of light are centered on top of each other at the center of the mica screen. Then one vibrator can be used to give a current wave, another can be connected to give a voltage wave, and the third, if left unconnected, will give a horizontal neutral axis in the center for the other two waves. The machine has an electric timing device which operates a magnetic shutter which will admit light during one revolution only of the film drum, and which will start the exposure where the lap of the film occurs.

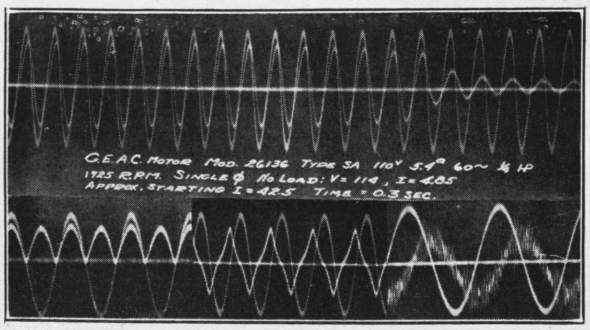


Fig. 2—Showing: (Top) Voltage and starting current for an ordinary Split Phase ¼ H. P. Induction Motor; and, Lower: (Left to right) Voltage rectification by a full wave Cuprox Rectifier; Exciting current for an auto-transformer on normal voltage; Charging current for a condenser on AC, and the supplied EMF.

Since the silver alloy strips are quite fine and still have low resistance (1.1 ohms), they must be protected from excessive current. Gold leaf fuses which will blow on a small fraction of an ampere are used to this end, but, of course, resistance must be inserted in the circuit to keep the current down. If a vibrator is to be connected across the line to show an e.m.f. wave, a series resistance of about 10 ohms per volt must be used. If a current wave is desired, a short length of heavy resistance wire is connected in series with the load to secure a small IR drop in phase with the current, and if this drop is not too large, the leads from this shunt are connected directly to the vibrator terminals. Otherwise additional resistance must be placed in series with the vibrator element.

Now to return to our story of the experiment proper. The oscillograph had been moved from its old location into the new light-tight room built especially for it, and had not yet been wired up until we started to work on it. Consequently, we had to trace and check up on all the wiring that was on it before we could think about starting it. This being done, we examined everything that could be seen from the surface, and then, not being satisfied with that, we decided to see for ourselves just how the vibrators were made. (I think that was my idea, for I've always possessed a very inquisitive nature). Sure enough, one of the vibrator suspension strips was broken. I don't think the rest of the group was particularly enthusiastic over the prospects of having to put a new vibrator strip in place, but I must admit I was rather well pleased, because I wanted to see if I could do such delicate work. Speaking of delicate work—before we finished we felt qualified to apply for positions as watchmakers! Incidentally, we found plenty of use for all six of our hands, too. These suspension strips are just .007 inches wide by .00075 inches thick, and have a most discouraging habit of acquiring all sorts of kinks and twists. Besides this, such a strip is very difficult to see unless lighting conditions are just right, and the soldering iron just mustn't be put down too hard, or said strip will immediately part company with itself. The mirrors present another very interesting proposition. They are about as wide as the narrow end of a tooth pick (.017 inches), less than a sixteenth of an inch long (.06 inches), and are .006 inches thick. They are conveniently (?) handled with a moistened toothpick. However, we finally got the vibrator back together, and to our intense satisfaction, it worked.

We took something like two dozen pictures and observed a great many more interesting phenomena, but due to limited space I have included only four of them. See Fig. 2. We were very agreeably surprised at the perfect rectification rendered by the dry metallic Cuprox rectifier. The photograph was taken at no load, but under load the wave form did not change, but merely decreased in amplitude. Several types of chemical rectifiers were tried, but only one of those tried gave good wave form. The plate showing the exciting current for a transformer is interesting inasmuch as it shows the presence of a third harmonic (due to hysteresis losses) out of phase with the fundamental, and also, because it shows how current lags behind the voltage in an inductance. On the other hand, the next plate shows how the current leads the voltage in a condenser. The voltage wave

(Continued on page 190)

Commercial Surveys for Public Utilities

Otto K. Henry, Telephone Engineer

THE growth and development of cities and suburban communities force problems of various kinds upon public utilities, many of which are peculiar to certain types of utilities, particularly telephone companies. As communities grow and extend their boundries and subdivisions of land platted, sold and built upon by individuals, the telephone company is forced to consider the extent to which the market for telephone service will develope the facilities needed, and the amount of money that will be required to furnish the service.

The study of the modern American city is very interesting. Many features contribute to community growth, such as site, whether level or rough, climate, and location with respect to other cities and towns, especially those which have already attained considerable growth and which exert strong commercial and social influences upon the surrounding territories. The transportation facilities of a community may either retard or assist development to a very great extent, and whether or not a city has deep water connections has also a very important influence on its growth. If we trace the history of the large commercial centers of the world, we shall find that they usually had their beginning as small trading posts, either on an important trade highway or on an ocean or river, so located as to attract the commerce of the nation or the world. For example, Constantinople, through which flows much of the trade between oriental ports and the rest of the civilized world; London and Liverpool and New York which, in spite of the competition of numerous other English and American seaports, are still the main gateways to their respective countries.

The first and most important factor to be considered by any public utility is the extent to which its services may be required and the particular location of the demand for its service. If it is known in advance when and where service will be required it becomes a comparatively simple matter to provide the necessary facilities to establish service without delay when petitioned for.

The demand for service can be approximately determined through a survey to forecast the future growth and development of the community being served.

In this article is presented a brief outline of the necessity of the survey and how to make it.

The industrial activity of a city is also a large factor in its continued development and the growth of many large cities can be attributed in a great measure to the fact that they early developed into important industrial centers and as such continued to attract additional establishments.

All communities are influenced more or less to the extent to which neighboring cities can divert business. Sooner or later in the development of a city, it reaches the point where it either stands still because of its advantages from location, transportation facilities, labor supply, and other factors are not great enough to enable it to overcome the influences of competing cities, or it forges ahead because its special advantages plus the initiative and resourcefulness of its citizens enable it to outstrip its competitors and to draw from them and from adjacent territory the industries, trade, and population necessary for the continued growth.

The growth of the community also involves other things, such as proper housing of its inhabitants, provision of transportation within the community, extension of water and sanitary service, heating and lighting facilities, telephone service, and the opening of streets and their improvement.

All of these things affect the telephone company. We must know in advance where houses will probably be built, subdivisions laid out, streets opened up and paved, and all other physical activities that contribute to the extension of the community. It is much better for a telephone company to get its poles and underground conduits in place before the streets are paved or boulevards and parkways developed, and to provide facilities in advance of their actual requirements.

The first and most important point in survey work is to determine what is likely to be on the ground twenty years hence, and it is here that great vision is needed. If the engineer making the survey looks over locations which he can remember as a youngster, he can visualize the progress likely to be made in the future.

Optimism is the next great asset. Above all, the pessimist must be kept off development work. Even the optimist must watch that he is in the right mood. For instance, he should never survey on a wet day, but he should wait for a fine day, when he can start out in the morning with a feeling that it is good to be alive. Many people, unfortunately, get scared at big figures and are inclined to trim down development figures in the last periods to some two or three per cent geometrical increase per annum regardless of the fact that the average increase in one year in the United States is about nine percent. Few telephone men can call to mind wastage caused through a too generous forecast; but wasteful reconstruction due to the actual growth exceeding the forecast has been common experience.

Having determined what are likely to be the property conditions at the ultimate period, the next step will be to decide when the changes are likely to materialize, whether in an early or late period, so that the factors determining the intermediate figures may be fixed.

In view of the importance of an accurate forecast, information on all points likely to have a bearing

upon property development in the area surveyed should be sought from all sources, particularly from real estate companies interested in the locality; from the city surveyor and engineer; the school authorities interested in school census; and especially from the city zoning commission if the city should be fortunate enough to have such an organization. With the rapid increase of fast moving motor traffic, town authorities will be forced to deal with street widenings and awkward corners. The consequent improvements will mean the displacement of a number of small properties, with perhaps a density of one line per building, by a large block of shops, offices or apartment buildings with a density of from twenty to fifty or more lines per building.

The next step will be to apply suitable density percentages to each class of property. It will be found convenient to fix in tabular form the percentages of density applying to the various classes of property. The table must be based upon a definite rate policy. It should also be assumed that there will be a continuous decline in rates. When preparing this table, shun the fellow who says "you couldn't place telephones in that street if you gave them away." There is a demand for service, at a price, in the poorest quarters.

The figures for the ultimate period having been fixed by application of the property density for the anticipated conditions, the difference between existing and ultimate figures should be divided between the three intervening periods. Since development studies are usually made with an ultimate period of twenty years we mean by the three intervening periods of five, ten and fifteen years. Proper allowances must be made for property changes and development in back street areas will of course come mainly in the last period.

Commercial forecasts are divided into several classes and are made safe for several different purposes. There is, first, the long-time commercial survey or complete market analysis of large or medium sized communities which are used as a basis for fundamental plan studies. These studies are made to determine the wire center of the central office area, that is, as nearly as possible the exact center of all subscriber lines radiating from the central office for the purpose of obtaining the best location for the central office from a standpoint of cost of site, economical outside plant rearrangement and desirability as to surroundings from commercial and traffic standpoints. The principle cable runs in each direction and the number of ducts to be provided in underground conduits are determined from long-time surveys as a part of the fundamental plan for exchange area.

Where a city has a number of central offices, or is a multi-office city, the fundamental plan based upon a long-time commercial survey is developed to show the boundaries of each central office district at the end of the ultimate period, usually twenty years, from the date of the survey. The amount of central office equipment and whether or not there will be more than one unit required, together with the size and type of building required to house the equipment at the end of the long-time period, are all determined by the commercial survey.

Through commercial survey it is possible to determine to what extent the telephone market will develop in certain periods, and knowing the service demands at stated intervals it is a comparatively simple matter to provide the necessary facilities in advance of their actual requirements. In this manner it is possible to plan plant additions and rearrangements from year to year in advance, thus laying out yearly programs upon a schedule in such a manner as to know definitely what is to be accomplished each year until the ultimate period has been reached. This eliminates all the elements of guess work and provides a regular yearly schedule for the engineering and plant departments.

Commercial surveys are also used as a basis for rate studies projected into the future and are used in various ways in considering the general development problems of the exchange area. The station and line forecast sheets of the commercial survey show the number of subscriber stations by class of service, residence and business, also the number of subscriber lines representing the expected demand of the community for service in each city block. These complete surveys or market analyses require a great amount of detail study and a complete description of the method is too long to attempt in this article.

Occasionally it is necessary to estimate the market demand for telephone service over a twenty year period for a small city or town of a size hardly sufficient to warrant a complete commercial survey as in the case of the larger city. Usually such a forecast is made without a field study and is prepared from data available in the office. This forecast may be used for determining probable central office requirements, size of building, volume of traffic, etc., but unless it is necessary to consider central office location, the forecast would be made without making a complete market analysis.

Another type of forecast called the "short time forecast" or "facility study" is required in connection with the work of the plant engineers in planning additions to the outside plant, such as feeder cable, aerial cable extensions into new and rapidly developing territory or in connection with reconstruction plans to improve the general conditions of the plant and reduce maintenance costs. Such studies are usually for particular sections of the city or town; the territory to be studied being indicated by the plant engineers on suitable maps.

There is also the commercial forecast for line and station estimate which is made up each year prior to the preparation of a provisional estimate or budget. This forecast may be based upon data obtained by a field study or market analysis or it is sometimes prepared from office records taking into account local factors and conditions. Usually such a forecast covers a period of five years from the end of the current year in order that fairly complete estimates may be made of the probable demand for service in the larger communities. For provisional estimate purposes, forecasts of this sort are made for each exchange having over 500 stations. All exchanges having 500 or fewer stations are considered as one class and a forecast for the classes as a whole is prepared. The combined totals of all these various forecasts made for the provisional estimate are used as a total for the company's territory as a whole and this total which represents a net gain in stations for the provisional estimate year as well as the succeeding four years of the five year budget period is used as the basis for estimating the revenue, expense and the new money required to develop the business.

How do you rate in Show work?

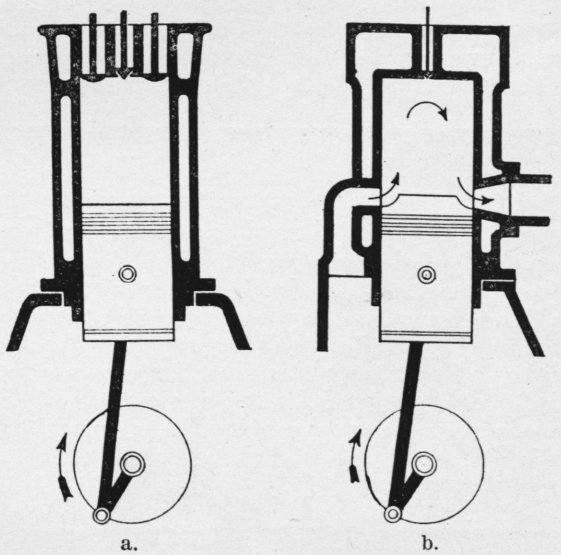
THE DIESEL ENGINE

J. T. Jones, e., '32

THE fundamental principles upon which the Diesel engine is based were first set forth by Dr. Rudolph Diesel in 1892. The fuel was to be ignited by the heat developed by air in the cylinder which is highly compressed. The fuel was to be injected during 10 percent of the stroke following the compression stroke and during the rest of the stroke the gases were to expand and give power to the piston. The combustion was to take place in such a way that the heat developed would be equal to the work done by the retarding piston. The engine was to be started by an explosion in the cylinder. An engine was built upon these principles, but an accident occured in the explosives while the inventor was trying to start it, and the attempt to build another Diesel engine was abandoned for several years.

When a few years later engineers began to experiment with the Diesel engine again they met with many disappointments. They were not able to construct an engine which was reliable enough to meet the demands of the public. The materials required for parts of the machine which were subject to extreme conditions were not available at that time. This handicap, along with many errors in design, caused quite a bit of grief to the men who were so earnestly trying to perfect it. The engine was however, well on its way to success, and year by year it was perfected until at the present time, it is built to run for days at a time with never a sign of weakening.

In general there are two types of Diesel engine. The two cycle and the four cycle engine.



a. b.

a. Cross section of four cycle Diesel engine.
b. Cross section of two cycle Diesel engine.

The Four Cycle Diesel Engine

In the four cycle engine, one explosion occurs in each cyclinder for every two revolutions of the crankshaft. The cycle may be divided into four distinct strokes:

1. Admission stroke.
2. Compression stroke.
3. Power stroke.
4. Exhaust stroke.

There are three valves in the head of each cylinder. One for admission of air, one for fuel injection, and one for the expulsion of the burned gases. Starting at the top of the cylinder, the piston moves downward on the admission stroke and the air valve is opened. The retreating piston draws the air in through this valve until the bottom of the stroke is reached. The air valve is then closed and the compression stroke begins. Great heat is generated by the compression of this air, and when the fuel is injected, this heat is sufficient to ignite it. Just before the top of the compression stroke is reached, the fuel injection valve is opened, and the fuel is injected under high pressure into the combustion chamber. The fuel does not explode, but burns uniformly. The combustion of the fuel and air is completed at constant pressure during this part of the cycle. After injection ceases, the gases expand through the remainder of the stroke.

The next stroke in the upward direction is known as the exhaust stroke. Just before this stroke begins the exhaust valve is opened. The reason that the valves are opened before each stroke begins is to allow for the inertia of the gases. As the piston moves upward all of the gases in the cylinder are expelled through the exhaust valve. From this point the cycle is repeated.

The Two Cycle Diesel Engine

In this type of engine the cycle is completed in one revolution of the crankshaft. There are two distinct strokes in this type of engine:

1. Admission and compression stroke.
2. Power and exhaust stroke.

As the piston moves up from the bottom of the cylinder it closes an exhaust port which is located in the cylinder wall near the bottom. As soon as this is closed, the port through which the air is admitted is closed. This may be either a port in the side wall of the cylinder just a little higher than the exhaust port, closed by the piston, or it may be located in the head of the cylinder, operated by a valve. When the piston reaches the top of the stroke, and the compression is at a maximum, the fuel is injected under a pressure of from 1,000 to 3,000 pounds per square inch and the combustion occurs as in the four cycle engine and the power and exhaust stroke begins. When the piston nears the bottom of this stroke the exhaust port is opened and scavenging air is forced through the cylinder in such a way as to completely remove all of the burned gases, and fill the cylinder with fresh air. This scavenging air is forced in under a pressure of from two to five pounds. As soon as these gases are removed, the cycle is repeated.

There are several interesting features to be noted on the Diesel engine. One of these is a water cooled piston. The water is conducted up to the piston by means of a telescoping pipe which moves with the

(Continued on page 194)

Freshmen. You are the gas. Show your pep.

CLEANER COAL

Kenneth Mason, ch., '31

"CLEANER coal is needed for today's markets," is a demand which may be considered to come from every industrial user of coal, for the presence of foreign matter in coal is a definite hazard to continuous boiler operation.

Someone high in authority among railroad operating men has made the statement that many coal mines have not kept pace with improvements in the use of coal as developed in this country. By way of proof he states that, "the introduction of mechanical stokers, of which there are more than 12,000 in use on our railroads, has made possible the design and construction of larger locomotives, higher sustained speeds, longer runs, and the use of lower grade fuels."

Since coal represents one of the largest items in railroad operating costs, it was to be expected that the railroads would be among the first to demand cleaner coal. However, every power plant must guard against this same hazard, for any of this foreign matter when lodged in the stoker, stops its operation and may result in a costly breakdown, or at least a delay until the stoker can be cleared. Delays are expensive.

Coal containing foreign matter causes expensive delays in boiler operation when crushed coal is used, consequently industry demands clean fuel. Iron in various forms such as broken bits of tools and machinery is the chief foreign substance, and the amount of it that finds its way into the coal is amazing. To extract this iron, large magnets are placed over conveyor belts to draw out the pieces of iron. In one plant such a magnet has earned $500 a month.

A steel plant which was using large quantities of coal in its coke ovens, received frequent reports of damage done to crushers and other machinery by tramp iron present in the coal. They decided to check up on these reports, so they hung a separator magnet above a belt conveyor that was carrying coal. The tramp iron picked up each day by that magnet reached such alarming quantities that back to the mine flew the demand, "Stop sending us iron in our coal."

As a result of that order, a 55-inch separator magnet was suspended above the conveyor that carries coal from back in the mine to the tipple. Today that magnet is earning $500 a month from reclaimed tools and equipment alone. This $500 does not include the saving in time which would have been lost at the steel plant, nor does it include the damage that would have been done had the tramp iron been allowed to remain in the coal. It covers just the usable material recovered from the coal; mine car hitchings, cutting machine bits, track spikes, heavy steel chains, and even steel shot wire. Placed at an angle above a head pulley of one section of the belt conveyor, this separator magnet has the advantage that in falling from the belt, the coal is loose and in open formation. Large and small pieces of tramp iron are pulled out and held by this silent magnetic inspector.

The producers of coal cannot be entirely blamed for the presence of tramp iron in coal, as railway employes frequently throw scraps into loaded or empty cars. In the storage yard iron may be picked up or it may fall from the coal handling machinery itself. The ease with which tramp iron can get into coal between mine and power house is leading many plants to install separator magnets just ahead of the crushers and pulverizers to protect this machinery as well as the stokers.

A typical case in a West Virginia plant is a separator installation designed to catch all tramp iron just before the coal enters the power house. Being situated near the coal fields, no large supply of coal is kept on hand, so the gondola cars dump right into a hopper under the tracks from which the coal is lifted to the bunkers above the boilers. At the bottom of this hopper, a reciprocating apron feeds the coal to crusher rolls, and after passing these the coal is lifted to the top of the power house by a bucket conveyor. These crusher rolls are cylinders with pointed teeth which mesh somewhat as the rolls revolve, so any iron is apt to break off these teeth as it passes through with the coal. To prevent accidents like this, a 36-inch separator magnet was placed at an angle at the end of the apron and just above the crushers. That it has been a success is shown by the accumulation of junk it has removed from the coal; lamps, oil cans, springs, chains, etc.

In those plants where coal is pulverized for fuel, the pulverizing machinery must be better protected than in the case described above. Small pieces of iron may be knocked off the crushing rolls that first break up the coal and although they would do no harm to an automatic stoker, they would damage the pulverizers. Then, too, bolts and nuts may fall from the conveyors, and workmen may lose tools in the coal, any of which might cause a tie-up in the fuel system. To protect such systems, magnetic separators are scattered all through the plant. For instance, at one steel plant burning powdered coal in its soaking pits, a separator magnet is placed above the coal as it enters the plant. Then others are placed in coal chutes, forming the bottom of the chute, and as the coal flows over its face, all tramp

(Continued on page 196)

Our Contemporaries—E. Kenneth Alexander

ONE of the most active of the students for the past four years is Kenneth Alexander. He is one of the comparatively few who have maintained that happy equilibrium between scholarship and activities, participating in numerous activities and yet not too many to lower his scholastic standing.

Kenneth entered Rose in 1926 from Wiley High School. He soon became acclimated to the new conditions and proceeded to make his presence known. He was elected by his class during his first year to be one of the freshmen representatives on the Athletic Board. At this time he became affiliated with the Y. M. C. A. and the Camera Club, the latter membership he continued through the remaining years. During his high school days, "Alex" was a regular man on the basketball team so when the first call for basketball was sounded he was right out in suit. He has just completed his fourth year on the basketball team. In the past season he had the honor of serving as captain of the team. He was also elected by his class to the Athletic Board in his senior year and became president of that body. By virtue of this position he held a seat on the Student Council and has shown himself to be an able leader in many ways.

"Alex" found an outlet for his literary efforts through the medium of the Modulus and the Technic. He has been conducting the alumni department of the latter publication during the past year.

In addition to carrying a lot of extra-curricular activities, Kenneth has been in the upper third and better of his class most consistently. He has been the recipient of two Rea scholarships, one at the close of his freshman year and the other at the end of his junior year. He is a member of Tau Beta Pi and is secretary of that organization.

Alexander will receive his bachelor's degree in Civil Engineering this June. In conjunction with two brother Civils he will design a reinforced concrete bridge to replace the present bridge on the road on the campus leading to the football field.

The Alpha Tau Omega fraternity claims this man as a brother and he has always been one of the strongest backers of that fraternity.

In recognition of his participation in student organizations "Alex" will probably receive an Honor Key when these awards are made in the spring.

It is certain that "Alex" will uphold the Rose standard in the future and will be a credit to the Institute. The staff wishes him all the success in the world in whatever he may undertake.

THYRITE

Lee C. Kelsey, m., '32

K B. McEACHRON, of the General Electric Co., recently announced an entirely new type of material, one that is both a good insulator and conductor of electricity. This material has been called "Thyrite" meaning gate or valve, and has the property of changing its resistance to the flow of electricity as the pressure or voltage is changed. This change in resistance is such that if the applied voltage is doubled the resistance decreases so that the current flow is increased more than twelve times. This means that if the voltage is increased sixteen times the current flow is increased more than 25,000 times.

The usual conductor with which electrical engineers are familiar does not change in resistance except when the temperature of the conductor changes. To illustrate, the tungsten filament in the Mazda lamp increases its resistance considerably as the resistance heats up; the carbon lamp on the contrary shows a decrease in resistance as the filament increases in temperature. The resistance change of Thyrite does not depend on the temperature, but on a change in the applied voltage. The new material will change its resistance as quickly as the applied voltage changes; in fact, tests have shown that the resistance can be decreased to a millionth of its original value in a time as short as one-millionth of a second.

The characteristics of Thyrite seem to be permanent. Some of the first material made is still on life test, with no change in its characteristics, even though it has carried current continuously night and day for several years. It resembles black slate in colour; the mechanical properties are similar to those of dry-process porcelain. In the manufacturing process the material is moulded to the shape required and the contact surfaces coated with metal by the Schoop metal spraying process. Disks 6 inches in diameter and ¾ inches thick are made for use in lightning arrestors for the protection of power stations. These disks have a resistance of about 50,000 ohms when 100 volts are applied to the parallel faces; the resistance decreases to less than one-half an ohm when the voltage is increased to 10,000 volts. They will carry lightning discharges having currents as high as 30,000 amperes without any signs of distress. It is possible to use the material successfully on any alternating or direct current circuits by merely providing a sufficient amount of material to prevent overheating.—*Abstract, Mechanical Engineering.*

Juniors. You, too, are Show leaders. What is your speed?

The Rhodes Scholarships

Chester Stock, ch., '32

IN the 1930 memorandum of the Cecil Rhodes Scholarships we note with interest several important changes in the method of election of scholars and the tenure of the scholarships. Before discussing these changes, however, it is desirable to recall interesting facts about Cecil Rhodes and the scholarships he provided.

Cecil Rhodes as a young Englishman of about twenty years was in Africa at the time of the famous Kimberley diamond discoveries. He entered the rush at the start and amassed a vast fortune from the diamonds. Mr. Rhodes returned to England, but before long the desire to return to Africa became too great to resist. Once back there, he began to build and finally succeeded in erecting a great empire of British Colonies in Southern and Eastern Africa. While this was a great accomplishment, Mr. Rhodes is best remembered, at least on this side of the Atlantic, as being the founder of the Rhodes Scholarships.

In his will Mr. Rhodes provided for the establishing of scholarships for students of various countries for study at Oxford university. He did this to the end that a closer relationship through better understanding might grow among the men who received these scholarships and the Oxford students, and indirectly develope friendly relations among the nations from which these men came. The stipend of a scholarship is £400 or $2,000 per year and may be held for three years. When defining the type of man he desired, Mr. Rhodes mentioned as desirable these four groups of qualities:

1. Literary and scholastic ability and attainments.
2. Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship.
3. Exhibition of moral force of character and of instincts to lead and take an interest in his schoolmates.
4. Physical vigor as shown by interest in outdoor sports or in other ways.

Participation on athletic teams is not required by the last group, but rather a mere liking and pursuance of some sport developing character. The third group does not require agressiveness or election to office as much as moral courage and interest in one's fellow men.

Scholars are selected in the various states by competitive examination to represent their states in the final selection. The men should file applications before Oct. 18, 1930, for scholarships available October, 1931. A student may become a candidate in his home state or in the state in which he has attended college at least two years. Before filing his application the student must have a written endorsement from the head of his college to the effect that he is a suitable applicant for a Rhodes Scholarship. The candidate should then, before the selected time, make his application to the Secretary of the Committee of Selection of the state in which he wishes to compete.

There are certain eligibility requirements that a candidate must meet. He must, if a candidate for the United States:

1. Be a male American citizen with at least five years domicile and unmarried.
2. By the first of October of the year for which he is elected he must have passed his nineteenth and not have passed his twenty-fifth birthday.
3. By the first of October of the year for which he is elected he must have completed at least his sophomore year at some recognized degree-granting university or college in the United States of America.

Among Cecil Rhodes' legacies is the group of scholarships at Oxford. These scholarships are constantly promoting Anglo-American amnity. The selection of men is based on literary and scholastic ability and accomplishments, physical vigor, moral force, leadership, and other worth-while qualities of character. This year there are two important changes. After two years of study at Oxford, the scholar may defer the third year until after work in his country, or he may, during the third year, matriculate in some college other than one in his country. The second change is in the method of selection, which is now on a stricter basis of merit. In each of the eight districts of six states each, the best two men from each state are selected. From these twelve men are picked four scholars.

With this as a basis we may now turn to the changes. The Rhodes scholar may postpone his third year and return to Oxford after a period of work in his own country, or he may spend his third year in postgraduate work in some school other than one in the country of his origin, on conditions approved by his own college and the Rhodes Trustees. The change that has come in the method of election of scholars places the selection on a much stricter basis of merit than formerly, and, on the whole, seems to be a better and fairer plan than the former. There are thirty-two scholarships available to the United States of America. Formerly the states were arranged in groups of three. For each of these groups there were available only two scholarships. Therefore, a system of rotation in each group was arranged so that any one state would have one scholarship each of two years but the third year would have none. The new and better method divides the United States into eight groups of six states each. Indiana, with Michigan, Illinois, Ohio, Kentucky, and Wisconsin, constitutes group four. Each of the states picks two men from its field of candidates. From these twelve men there are picked the four scholarship holders for the district composed of the six states. Students interested in any way in these scholarships should see Dr. White, who represents the Rhodes Scholarships at Rose.

Our Contemporaries—Milo Dean

FEW men in the senior class have distinguished themselves more or are more deserving of their honors than Milo Dean. He came to Rose Polytechnic Institute four years ago from Brazil, Indiana, and immediately became a familiar figure on the campus. He has truly been a credit to "Polly" and the Rose Technic feels that he is deserving of special mention.

Milo will graduate this June with a B. S. degree in civil engineering.

His popularity carried him to two class presidencies, freshman and senior. During his sophomore year he served in the capacity of class secretary. He was a member of the student council his first and fourth years.

Milo was a letter man in football, captain of the team and honorably named third all-state captain. Track was also a specialty of his and in his first year he was a member of the championship relay team at the Hoosier Relays. He is out again this year and we feel certain that he will do all that is expected of him, if not more.

He has always been interested in the R. O. T. C. Unit at Rose. This year he is Cadet Major of the Battalion and president of the newly organized Officers' Club, by authority of which he acted as chairman of the recent Military Ball. At Camp Custer last summer he was a member of the Sixth Corps rifle team and represented it in the National Rifle matches held at Camp Perry, Ohio, qualifying as an expert rifleman.

Milo never neglected his studies and has been during his four years a man near the head of his class. He is a member of Tau Beta Pi, the honorary engineering society at Rose. This year finds him with still another feather in his cap. He is vice-president of the local branch of the American Society of Civil Engineers. In his junior year he served as secretary. Whatever he has undertaken he has carried to completion in a most fitting manner. As Junior Prom chairman he well proved this fact, as a finer Promenade has been seldom, if ever, given.

The Sigma Nu Fraternity is proud of such a man as Milo, who upholds the honor of his school and fraternity so admirably. The Technic takes this opportunity to wish him the success that we feel will be his after he leaves our ranks.

Milo has always been a booster for the Technic although he has not served on the staff. We are sure that he will reflect nothing but honor upon the Institute in the future.

The Military Ball

MORE than 300 couples enjoyed the Military Ball given by the newly formed R. O. T. C. Cadet Officers Club, Friday evening, February 28, at the Rose gymnasium.

Carrying out the military idea, two large American flags covered the ceiling while smaller flags, crepe paper rosettes and streamers decorated the walls. Instead of the customary booths canopy tents were erected over the tables and chairs. The orchestra stand was decorated with small flags and flanked at each corner by stacks of rifles with bayonets attached. Machine gun bandoliers were twisted and strung between stacks, presenting a very wicked appearance. Most of the equipment was secured from Fort Benjamin Harrison. Two large canopy flies took up the east and west walls while smaller tents occupied the south wall. The orchestra stand was the first object to catch one's eye, upon entering the gymnasium. On both sides of the orchestra were other tent-booths. The tent on the east wall was reserved for the receiving line. Those forming the receiving line were Mayor and Mrs. Wood Posey, Acting President and Mrs. John B. Peddle, Colonel Andrew J. Daugherty and Mrs. Exia Hopkins, Lieut. Ole G. Hoass and Miss Josephine Laughton, Lieut. and Mrs. Richardson Selee, and Cadet Major Milo Dean and Miss Olga Wittenberg.

Among the members of the Reserve Officers Association present were Capt. and Mrs. Roland E. Hutchins, Corps of Engineers, president of the local chapter, Lieut. Colonel Benjamin E. Wimer, Capt. John McFadden, and Lieuts. E. Kemp Moore and Raymond Wells. Capt. Paul D. Harter and Lieut. John J. O'Mara of the National Guard also were present.

Zez Confrey and his eleven piece Victor Recording Orchestra went over big. Confrey, during an intermission, gave three solo numbers on the piano, "Dizzy Fingers," "Stumbling," and "Kitten on the Keys." The latter number has gained for him the title, "Man with a thousand fingers." The orchestra offered several novelty selections, trios of saxophones, trombones, violins and trumpets, as well as vocal pieces.

No military ball would be complete without "taps" and it was inspiring to see the military students snap to attention, at one o'clock, amid a profound silence, as the first few notes of that awe-inspiring, yet simple military call issued from the bugle blown by Frederick Bogardus, a sophomore at Rose and a member of the military band. Freddy received much praise for the manner in which he sounded "taps."

Research and Progress

Conducted by Lee C. Kelsey.

Tanager-Aircraft Winner

THE award of $100,000 prize given by the Daniel Guggenheim fund for the promotion of aeronautics in its safe aircraft contest recently was made to the Curtiss Aeroplane & Motor Co., designer and builder of the Tanager airplane. Features of the Tanager, the world's safest plane, include three newly designed safety devices, namely: A floating aileron, automatic wing slots and controllable wing flaps. Slot control is automatic, while the flaps in the back of the wings are operated by a crank in the cockpit. The plane is equipped with oleo and rubber tube landing gear having twice the normal give for a plane of its weight. The Curtiss Tanager was developed at the experimental plant of the company at Garden City and is characterized by its ability to take off and land in small areas.

135 Ton Steel Forging

ONE of the largest steel forgings on record recently was produced in the plant of the Midvale Steel Co., Philadelphia, for the rotor of a 115,000 Kilowatt Allis Chalmers turbo-generator. The forging is 42 feet long and weighs 269,000 pounds. When completed the turbo-generators will be installed in the Waukegan Plant of the Public Service Co., of Northern Illinois.

Dynamite

MANY interesting experiments with dynamite are at the present time being made at the Pittsburgh Experiment Station, United States Bureau of Mines.

The first is the photographing of invisible vortices produced by detonating explosives in connection with an investigation of the sensitivity of dynamites to detonation. These vortices, which are similar in shape to the rings produced by adept smokers of tobacco are produced when the shock wave from the explosive emerges from the mouth of a bore hole, gun muzzle, or steel tube in which the dynamite is detonated. The pressure in the vortex is lower than atmospheric due to the effect of centrifugal force on the rapidly revolving gases, and thus is clearly shown in the photograph as a dark line in contrast to the bright line produced by pressure waves. This work is part of an investigation to determine the mechanism by which detonation is transmitted from one cartridge of dynamite to another when the charges are separated by an air gap.

A second experiment is pressure determination. The explosion of a charge of dynamite is usually associated in our minds with a deafening concussion, but this is true only of dynamite fired in the open.

Charges of dynamite are exploded in massive steel bombs at the Station, with only a metallic "click" to indicate that the charge has exploded and that pressures of 10,000 to 20,000 pounds per square inch have been produced inside the bomb. These bombs, known as Bichel gauges, are used to measure the actual pressures produced by detonating explosives when fired in a borehole. The magnitude of the pressure is a measure of the ability of the explosive to do work. Pressures are being measured as part of the bureau's program to investigate the factors influencing the effectiveness of explosives in actual blasting.—*Engineering and Contracting.*

Tacoma's New Electric Supply

WHEN an unprecedented drough cut off the water supply used to turn the turbines in the municipal hydroelectric power plant at Tacoma, Washington, a distress call to the Navy brought the electric driven air craft carrier Lexington to the rescue and supplied power to the city over a thirty day period.

The Lexington was anchored about thirty feet from the dock and twelve cables were strung to the ship and connected to the 180,000 horse power generators. The other ends were switched into the city's power system and the vessel's dynamos set humming. Thus was electric current sent through the cables to aid the city plant's supply, and the city's main industries, many of them shut down for lack of power. This novel arrangement was used for a month until rain and the water from melting raised the water level behind the dam, holding the water, located far up in the mountains.

The aircraft carrier was easily equal to the task as any one of its four generators alone was capable of supplying the current needed by the city. United States Navy officials estimate that the Lexington's power unit could, under full power, easily supply a city twice the size of Washington, D. C. It could carry the simultaneous load of fifty heavy electric trains, or would light more than 6,000,000 fifty watt lamps. Full power is used to drive this warship at its high speed, about forty miles an hour.—*Abstract Popular Science.*

Steel Tower for Triangulation

THE extraordinary accuracy of the first-order triangulation work of the Coastal Survey is primarily due to precise instruments and economical and efficient methods conceived by the many engineers on its staff during the 113 years of its existence. With the adoption of an excellent signal lamp, the vastly improved theodolite, and the use of invar tape, it remained for Jasper S. Bilby, for many years in charge of its signal building operations, to design a steel tower as a substitute for the costly wooden

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The Rose TECHNIC

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FACULTY ADVISORS

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Importance of Summer Employment

AN engineering graduate can not be considered a finished product. Rather, he has had only a fundamental training which has placed him in a receptive mood, and he is ready to learn something about the practical side of engineering. It usually takes from one to three years of practical experience before the college graduate is ready to take on real responsibilities and to begin the practice of real engineering. Summer employment before graduation will shorten the training period after graduation. A graduate with one or two summer's experience will be given preference by the prospective employer over one who lacks this experience.

The above statements are extracts from an article by Professor Wischmeyer which appeared in the Technic of April, 1929. It would be advisable for all undergraduates to read this article.

Professor Wischmeyer goes on to say that the most important influence of instructive summer employment is its effect on the attitude of the student towards his college work. Having observed the numerous applications of the theory previously learned in the class room, the student returns to school in the fall determined to master thoroughly every subject that he studies.

The article was accompanied by the following box: "A college education is often considered a lark, but to the engineering student it should be and is a fertile source of useful knowledge. However, a comprehensive understanding of engineering methods can not be had without a foundation gained from practical experience in the professional field. Some employers recommend that students work a year or more before completing their college course. If this is undesirable, the summer months must be spent in instructive labor. Work is not only educational, but gives the student a certain self-respect which he could not otherwise have.—Editor."

To many of our readers the foregoing paragraphs may be regarded as well-known axioms, and they will say that the question is not whether it is wise to seek employment, but how can one obtain employment. There is no theoretical or empirical formula to solve the problem of finding a job. The chances of obtaining employment vary with the applicant's merit. Employers are seeking men who can qualify in many respects, not only in scholarship, or extra-curricular activities, but also in personality, perseverance, and similar indices of character. In the May issue of the Technic will appear an article entitled "The Students College Record as a Forecast of Success," written by Colonel R. I. Mees, Assistant Vice-President of the American Telephone and Telegraph Co. This article will answer questions which the reader may have on the subject.

The attitude of seniors toward employers is analagous to that of many freshmen toward fraternities. The students are afraid the employers will not offer them a job just as many of the freshmen are afraid the fraternities will not offer them a bid, and if the senior or rushee gets more than one offer he experiences difficulty in deciding which one to accept. The employers all present their offers to about the same group of deserving students; similarly, the fraternities concentrate their rushing on those freshmen who they think will develop into good fraternity men. The writer does not wish to convey the impression that rushees are necessarily those men who will later be given preference by employers, for such is not the case. Nevertheless, the analogy is interesting.

A Little More Work

DO your work—not just your work and no more, but a little more for the lavishing's sake; that little more which is worth all the rest. And if you suffer as you must, and if you doubt as you must, do your work. Put your heart into it and the sky will clear. Then out of your very doubt and suffering will be born the supreme joy of life."—Dean Briggs.

The wider our experience the more we realize that

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Loyalty, Enthusiasm, Energy, Talent—the Show deserves all you've got.

CAMPUS NOTES

Robert Mees, m., '31

The St. Pat's Celebration

SINCE the first of each year the eyes of the older students have been focused on one of the outstanding annual events of the school—St. Pat's celebration. Remembering what gay times were had in years past, they know that a good time is in store, and look forward to the next celebration.

March 17 is officially St. Patrick's anniversary and has always been enthusiastically observed by Poly students, for this patron saint was an engineer and Rose Poly does homage to him as its patron saint.

This year the afternoon of St. Pat's was given over to a theater party, all students, honor-bound attending the show at the Orpheum theatre. The artists assisting in making a talking success were unaware of such praises which they received throughout the show. In this instance the forced retirement of the vaudeville acts of a year ago really detracted from the enjoyment of the students, for the screen actors did not seem to appreciate the most complimentary "cracks" that filled the air, singly and otherwise.

The casualties were few and the management was forced to express its appreciation for the mannerly conduct, so befitting Rose students.

Green was the dominant color shown this year at Rose Gym when approximately two hundred couples found their way to the portals of another St. Pat's dance. Truly was the spirit of merriment present and all care and worry gave place to joy and hilarity, for it was St. Pat's day, and he was an engineer.

Music was provided by Lee Sinclair's syncopators, the ceiling was festooned with countless green tracers, the walls were adorned with hand painted portraits of St. Pat and his associates. Only after one in the morning, when the smoke had cleared away and the din and bustle had ceased, could we say that Rose was faithful to St. Pat, and he was an engineer.

Library Notes

A GREAT deal of scientific and technical material is published in magazines and oftentimes cannot be found elsewhere. The question arises, "How can one find this material without spending a great deal of valuable time in looking for it. One answer to this problem lies in the various periodical indexes to be found in this library.

The Reader's Guide to Periodical Literature and its predecessor, *Poole's Index to Periodical Literature* cover material in many magazines from 1800 to date. Most of the magazines indexed are of a non-technical and non-scientific nature, being more of a popular type.

The Engineering Index covers material from 1884 to date. Prior to 1919, this index was divided into several large classes with subdivision under each class, e. g., Civil Engineering has a subdivision Bridges, and under this subject are to be found indexed a number of articles dealing with Bridges. After 1919, the Index is in one continuous subject alphabet. The library does not have bound copies of the E. I. after 1927 but information concerning articles indexed may be found in the monthly issues of Mechanical Engineering.

The library will probably subscribe to the Industrial Arts index, beginning with the bound volume for the years 1826-7, and continuing to date. This index is published by the same firm as is the Reader's Guide and supplements it in that material to be found in this index is devoted to scientific, industrial and technical articles.

The Debating Team

POSSIBLY many students are unaware of Rose's debating team. Well, we do have one and a mighty fine one, under the personal direction of Professor Bloxsome. On March 12 the first decision debate was held with Indiana State Teachers' College at their Assembly hall. A hotly-contested debate was given on the subject, "Resolved, That a lake-to-ocean water-way, for ocean going vessels, should be constructed through the St. Laurence river, by way of Montreal."

The debate was analyzed by Professor Ross of DePauw, and only by one point was the decision rendered in favor of Normal, who presented the affirmative arguments. The same debate was presented on March 18 at DePauw with no decision.

The schedule leaves only one more contest, March 21, with Purdue at Indianapolis, at the state meeting of the A. S. M. E. The Rose team will present the affirmative side of the subject, "Resolved, That the Wabash-Maumee waterway should be made navigable between Lake Erie and the Ohio river."

Assemblies

March 13.

THE hour was devoted to Rose Show reports in the form of short talks made to the general assembly by the departmental heads of the school, setting forth the activity of their respective charges in connection with the Show. In the same fashion were the Senior chairmen called on to report the progress made by their group of students. It was reported that some exhibits had already been completed and all men were advised to follow this example, in completing their exhibits early, so that there may be time for the finishing touches and last-minute adjustments, which mean so much to a perfect exhibition.

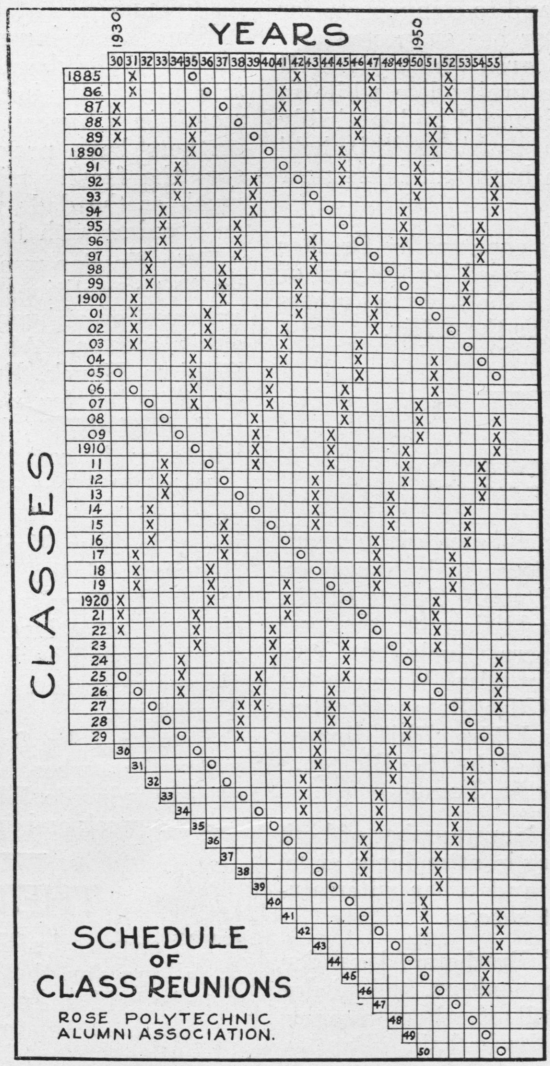
(Continued on page 189)

A BRAND new system of holding class reunions has been proposed by Professor Carl Wischmeyer, secretary of the Alumni Association. He has written to all the alumni, and the response is altogether favorable. But it is two months until commencement, and it is possible that a little discussion of the plan and chart might help to secure prompt and favorable action by the Alumni.

In the first place, there is no intention or desire to dictate what particular classes are wanted here at commencement time. On the contrary, we want as many of our Alumni as possible to return each year. The chart, however, serves the purpose of showing definitely which classes are specifically urged to come back to their Alma Mater in certain years.

In the past most classes have tried to have reunions about every five years, and every class plans to have its twenty-five year reunions. The chart points out your reunion dates for you; your twenty-five year anniversaries are specified, and at about five year intervals you are scheduled to meet here with the other classes that were in school with yours, hence a bigger and better reunion.

To read the chart: look along the top of the chart under YEARS. This is 1930, so follow that column down. Each class that has an X horizontally to its right in the 1930 column is specifically urged to come to Rose for commencement on June 14. In this same column, under 1930, is found an O opposite, or horizontal to the left of the class numerals of the 1905 class indicating that this is the year for their twenty-fifth anniversary.



Some of the classes are already busy planning their reunion for this year. T. L. Condron, '90, is taking care of the members of his class and is urging them to be present at the commencement exercises. In the class of '00 H. F. Madison is acting as the prime mover. A. G. Butler, '10, is getting his class in the spirit of a reunion. These classes are not scheduled to be here, but we hope they are able to turn out in good numbers. We desire to have someone in each of the classes scheduled to have its reunion this year send in his name so that we may know who will try to get his class together.

'04

It is with great regret that we announce the death of Mr. J. Harry Barbazette. Mr. Barbazette was one of our successful graduates and had kept up his contact with the Institute and shown a lively interest in its affairs. At the time of his death he was Manager of Operations of the Alpha Portland Cement Co., of Chicago.

'05

Mr. George H. Pfeif, Director of Industrial Relations for General Electric Co., has again visited the school. As in the past, he conferred with the seniors about jobs with his company after their graduation. We are always pleased to have Mr. Pfeif with us.

'22

Harold C. Moench has taken a position with the Indiana Consumers and By-Products Co., Terre Haute.

'25

Hubert H. Merrill has returned to Terre Haute, the place where he spent four pleasant years in our school. Whether he came primarily because he loves the place, or whether it was to accept the position of Assistant to Maintenance Engineer of The Quaker Maid Plant we can not say. A combination of both would be a happy medium. In any case, we are glad to welcome him back to Terre Haute, and wish him success in his new position.

'26

Miner L. Mitchell has started on his own, and has opened an office for general architectural practice in

(Continued on page 188)

FRATERNITIES

ALPHA CHI SIGMA

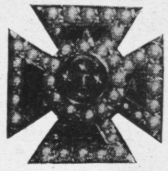
MARCH 21 saw three more men inducted into Alpha Chi Sigma. The chapter welcomes Leland Hart, Anthony Blake, and George Naanes and feels assured that their good work in fraternity matters will continue and that their professional activities will be made more successful because of such membership.

Because of the professional character of Alpha Chi Sigma a deferred initiation is necessary and to compensate for this peculiarity the local chapter has suggested and put into effect a preliminary degree which gives all members the full benefit of fraternity life while in school. This action is to be discussed and probably developed at the national conclave which will be held at Radisson Inn on one of the beautiful lakes near Minneapolis, this June.

Iota will be represented at the conclave by Brother Richard Johnson, who is much envied by the rest of the chapter. This is evidenced by the fact that others of us are planning to drive up for the affair.

ALPHA TAU OMEGA

THE Indiana Gamma Gamma dance given every year in honor of the pledges took place on March 8 at the Terre Haute House. Guests of the chapter, in addition to the new pledge brothers, included Professor and Mrs. Carl Wischmeyer, Professor and Mrs. Roland E. Hutchins, Mr. and Mrs. Phil Brown, and Professor John L. Bloxsome and Miss Lucille Young.



On the evening of March 23 a large number of both active members and pledges were in attendance at an open house. Bridge, dancing, and other entertainment made the evening a great success.

Gamma Gamma is proud of Brothers Alexander, (Captain) Sawyers, Allen, Spangenberg, and pledge Brothers Gillett and Sanford all of whom received their letter "R" sweaters in basketball. Brother Rockwood, who was a letter man of last year, was unable to participate throughout the first part of the season because of an injury. Brother Sawyers was elected captain of the next year's team.

As the basketball season is over, all eyes are turned to track. Alpha Tau had a good turnout of candidates for the cinder path squad. Brothers Stanley and Fitch have both received their letters in this sport and are out to break records.

SIGMA NU

BETA UPSILON'S delegation to the State Formal at Indianapolis, March 8, returned with glowing reports of the success of the dance. The affair was held in the famous Riley Room of the Claypool Hotel. The Indianapolis Alumni Chapter, which sponsored the dance, outdid itself in the way of decorations, and Chic Meyers and his Recording Orchestra put out some wonderful music.

Plans are being made for the annual faculty-dads smoker at the chapter house. This event was allowed to slip last year but it will be revived some time this month in a bigger and better way. In the past, the smokers have proved very successful, and we are sure the faculty will enjoy meeting all the dads as much as the dads will enjoy meeting and spending an evening with the faculty.

Beta Upsilon was sorry to see practically all of the St. Pat's traditions pass into oblivion this year. The only vestige of bygone days was the dance, but it was a big success. Alumni Brothers Valentine Mitch, William Houck, Fred Carroll, and Robert Thompson returned for it. Sigma Nu would like to see the revival of the St. Pat's show and parade next year, whatever the cost may be.

Baird F. West of the class of 1927, has accepted a new position in the Publicity department of Westinghouse in New York City. "Bud" was formerly on the staff of the Engineering News-Record. Raymond P. Harris, of the class of 1929, has also changed situations. He has left the Portland Cement Association in Chicago and gone with the Dorr Company, a firm of consulting engineers in New York City.

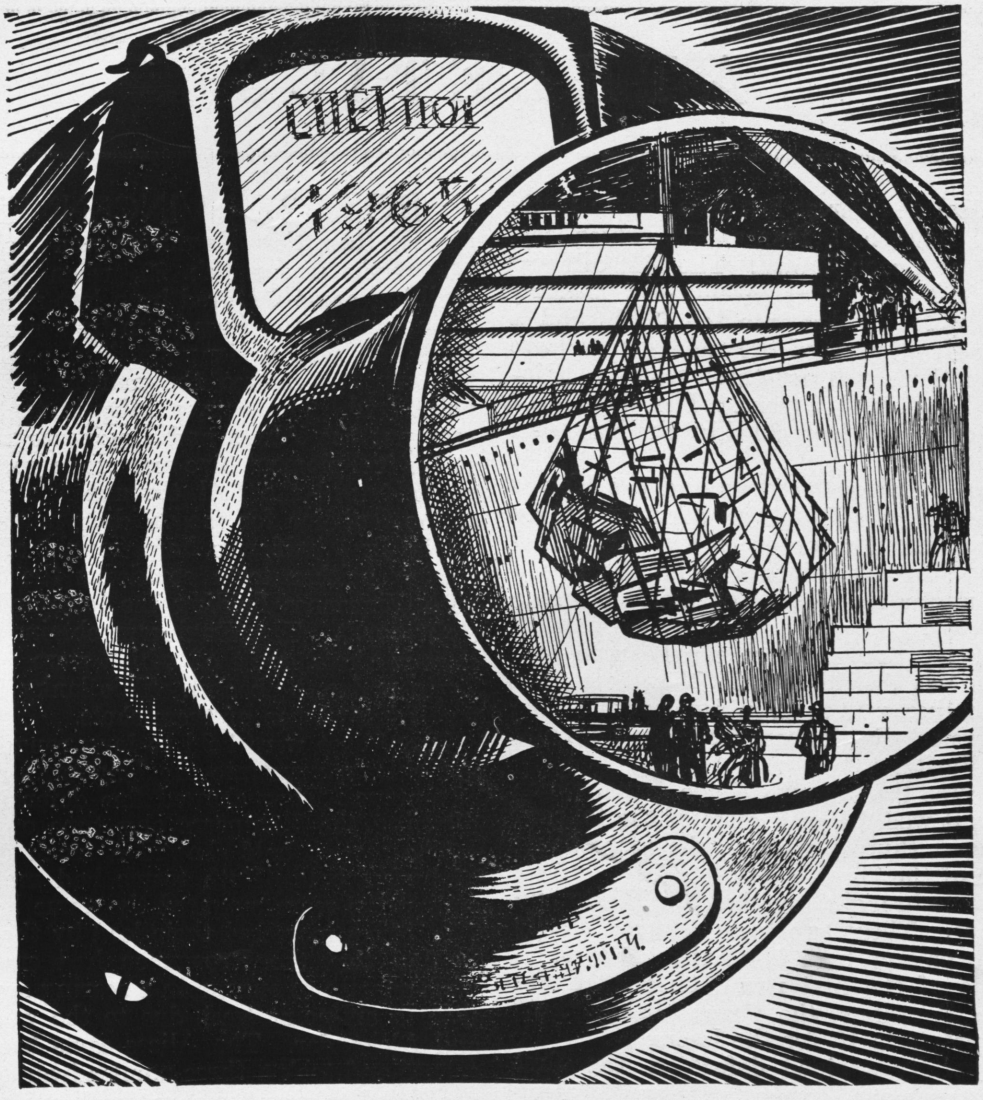
Brother John Cooley joined the benedicts on February first, when he married Miss Loretta Maroney at Edwardsville, Illinois. The newly married couple spent a week-end in Terre Haute recently.

THETA KAPPA NU

IT'S soon to be Hello Richmond for the Theta Nu fellows for that's where the national convention is to be held in June. Several of the gang from Rose are planning on going and enjoying the good times. Besides the business sessions and the banquet, side trips are to take place to various historical spots and are sure to be enjoyable. Then on the last night comes the farewell ball —what a time that will be. It will sure make all the fellows glad they went.

During the past month four of the fellows have

(Continued on page 188)



A world-wide market place

Eighty-five per cent of the world's telephones can be reached from any telephone of the Bell System. This includes those of Canada, Cuba, Mexico, and—by the new radio-telephone link spanning the Atlantic—most of the countries of Europe.

Already many American business men are using this service to expedite the transaction of foreign business and are finding it quick, convenient and profitable.

The future possibility of talking directly with almost anyone in the world who has access to a telephone is enough to stimulate any man's thinking—not only from an engineering standpoint, but because of its significance to American industry.

BELL SYSTEM

A nation-wide system of inter-connecting telephones

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES — BELL SYSTEM

"OUR PIONEERING WORK HAS JUST BEGUN"

ATHLETICS

A GREAT deal of interest has been shown in the intramural basketball tournament which was recently started by Coach Brown. The first call was given on March 3 and about seventy-five men reported. These were divided into ten teams and a schedule arranged. Seven of the nine games have been played and there still are three teams remaining, the Reds, Zeros, and Greens. The winner of the Zero-Green game will be tackled by the Red team for the championship.

The first game between the Reds and the Heroes was rather one-sided, the Red team taking an early lead and coasting through to a 44 to 1 victory. McEwan played best for the winners while Henderson averted a shutout for the Heroes by sinking a lone free throw.

The second game proved more nearly even and the winner was not decided until the final gun sounded, the score being 13 to 12 in favor of the Blue team. Weddle was easily the best for the victors and Niemi for the Puritans.

Next in line came the Zero-No Name game, which was a feature as it was the only game of the tourney to date that was a shutout victory, the score being 19 to 0 in favor of the Zeros.

The fourth game brought together the White and the Pirates teams. These two teams started slowly and the White team won by a fast finish, 25 to 5.

The last game of the first round eliminated another team, the Bareskins, the Greens being "hot" and scoring 23 points to 13 for the losers.

Having successfully avoided defeat in the first round the Red team moved to the finals by defeating the Blues 22 to 4. The Zeros also moved up, going to the semi-finals by defeating the White team 13 to 12. Detrick made two foul goals in the last minute of play to change a one point lead of the opponents into a victory for his team.

Besides creating an unusual amount of interest in the student body this tournament is also giving Coach Brown a line on the material for next year's team.

TRACK PROSPECTS

Rose students are now looking forward to the track team for the coming season, the prospects for a winning team being fair. In the dashes Rose has two letter men, Weddle and Hill, and in the middle distance races, Loving and Stanley. All of these men have earned their letters in track and should score many points in the meets to come.

The field events will suffer most due to the graduation of Captain Max White and John Derry of last year's team, but there are several underclassmen who are striving to fill these men's shoes. J. H. Dicks and Montgomery are veterans who will take care of the weights.

Probably the brightest outlook is in the relay team, there being a wealth of material in Stanley, Weddle, Hill, Witt, Dean, and Loving.

ROSE 27 — VINCENNES U. 25

THE Rose Poly Engineers won their second game of the season Feb. 23, when they annexed a thrilling game featured by a last minute rally from Vincennes at the Rose Gym by a score of 27 to 25. Rose had seen a six point lead vanish slowly and Vincennes overcame the margin to gain a three-point lead. However, a rally in the last few minutes put the Alices and Engineers at 25 all, when at the last moment, five seconds to go, Captain Alexander tossed the ball through the net from back of the foul line for the deciding points of the game.

The first half was hard fought all the way, although neither team could hit the basket, ending with Vincennes holding the long end of a nine to eight count. The Engineers obtained only a few close-in shots, most of which were secured by McEwan under the basket. This lanky freshman prospect missed seven of these shots.

The Alices were held to long range shots, not being able to penetrate the Engineers defense to any advantage. They showed fine defensive ability, not allowing the Engineers any time on their shots.

The second half showed a much different brand of basket ball. Both teams had much better luck and as the score mounted the game became spirited. The Alices increased their lead by three points, only to find that the Brownmen had erased their jinx momentarily to engage in a scoring spree that netted them a six-point lead, due to the work of Sawyers and Alexander. The Alices came back with a vengeance and took a three-point advantage. Rose then proceeded to even the count with one minute to play. Alexander tossed the winning goal with fifteen seconds to go.

Lineup and summary:

Vincennes (25)—	F.G.	F.T.	P.F.
Trent, f.	0	2	0
Hodges, f.	2	1	0
Snyder, f.	5	3	1
Everett, f.	0	0	0
Gilmore, c.	0	1	1
Mebke, g.	1	1	0
Stocker, g.	0	1	0
Enley, g.	0	0	3
Totals	8	9	5

Rose Poly (27)—	F.G.	F.T.	P.F.
Alexander, f.	0	0	2
Batman, f.	2	1	2
Fisher, f.	4	1	3
McEwan, c.	0	1	1
Gillett, g.	0	0	1
Allen, g.	0	0	1
Leitzman, g.	0	0	1
Sawyers, g.	3	0	1
Totals	12	3	12

Referee—Vaughns Russell.

(Continued on page 195)

Sophomores. Crowd those upper classmen on Show work.

Fraternities

(Continued from page 184)

been honored on the campus. Charles White was elected to Tau Beta Pi, the honor fraternity, Paul Froeb, Chester Stock, and Albert Ahlers were elected on the new Technic staff, and Ahlers was also elected as sophomore athletic representative.

With the track season on, Rose appears to have material for an excellent team as usual. Baker, Spence, and Hughes will shine in the distance events, Templeton should take the hurdles, and Ernie Leitzman should go to town in the discus and shot events.

With the pledge dance now history, the spring dance holds the spotlight. Last year this event took the form of a sport dance and from the way in which it went over last year it will no doubt again be a sport dance. It will be held at the house some time soon.

Many alumni have been back lately. Sunday, March 9, Andrews, Knott, and Lawyer dropped in from Chicago for the day. Harold York was over with the Bell representatives interviewing seniors. Others who have been back lately are Jim Proctor, Lee Berry, Allen Reeves, Francis Tapy, Marion Houston, and Walter Davidson.

KAPPA OF THETA XI

ALL of the pledges and most of the actives have been very busy lately participating in the intramural basketball tournament. With the show and the Junior Prom in the offing everyone has been up to his neck in work, figuratively speaking. In addition to this the Seniors are hard at work on their theses. So all in all last month has been a busy month.

The track season this year claims Brother Schaack who is out for pole vault. He should be a success for if there is anything Schaack has had practice in, it is throwing the Beef.

Friday, March 21, was the occasion for our annual Dad's smoker with its long tales and entertainment resting long in each Brother's and Pledge Brother's memory. Cigars and cigarettes were floating freely and were topped off with an eleven o'clock luncheon.

Brother Roy Reese dropped in for a visit before he left for the Panama Canal Zone for governmental work with Bart Smith who has been there several years. Other visitors were Brothers Lyons, Joslin, Johonnott, Merrill, Nancrede, and Pellum.

Alumni

(Continued from page 183)

Newark, Ohio. His task is not easy, but he possesses the qualities that make for success and we expect good reports from him.

'28

Theodore L. Barrett is now in the Research Department of The Carborundum Co. at Niagara Falls.

N. Y. If he can melt into that company as the grinding wheels of that company melt their way into pieces of our work, his way is bright. Go to it, Barrett!

J. Leonard Montgomery has recently accepted a position with The R. C. A.-Victor Co., at Camden, N. J. During his student days at Rose "Monty" was always interested in radio. Now that he is so connected that he may pursue his inclination, we expect a great deal from him.

When the delegation from the Bell Telephone Co. came to interview our seniors they brought quite a pleasant surprise with them. Harold A. York and James E. Payne. Both of these men are active alumni and we were also to welcome them in their new capacity of representatives of the big Indiana Bell corporation.

Assemblies

(Continued from page 182)

February 27.

TAU BETA PI announced a ten dollar prize for the best Rose Show exhibit, and the faculty offered another ten dollars for the best poster sketch.

The program consisted of talks by men representing the Bell Telephone Co., who were at school interviewing the seniors.

Mr. Fred L. Thomas, assistant to the president of Indiana Bell Telephone, spoke first. He said three fundamentals of knowledge are, inspiration of child to read and write by the parents, knowledge of the truth of the laboratory, and knowledge of use of the library. Co-operation with faculty and realization that school is your first job were advised. Mr. Thomas then introduced the rest of his party as they spoke.

Mr. R. A. Della of the Bell Telephone Laboratories told of the work done by this organization. He concluded with the idea that a man who knows what he wants should go after it and he will get it. Mr. Kitridge, the vice-president of Michigan Bell, spoke, so he stated, especially to the freshmen. High grades in school was the subject stressed by him. Mr. Thomas introduced next Mr. Barkson of the Long Lines Department. The theme of his talk was that, although Bell Telephone is a large company, the individual is not lost, but is given recognition for accomplishments. Bell Telephone is broken into small companies. Mr. W. C. Hall relieved effect of the several serious talks with a few amusing remarks on points the others had made. In conclusion Mr. Stanley, Mr. Payne, and Mr. York were introduced as the remaining men in the Bell group. Mr. Payne and Mr. York are Rose alumni.

March 6, 1930.

THE third attempt to show the motion picture "Hydroelectric Power Production in the New South" proved successful. The two reels shown recorded the development of hydroelectric power in the Great Smoky Mountains of North Carolina. They proved worth the waiting. These reels were shown through the courtesy of E. I. du Pont de Nemours & Co. A third interesting reel, "Crystals of Commerce," was shown through the courtesy of the Royal Baking Powder Co.

Oscillograph Experiments

(Continued from page 172)

shown is that of the school alternator and looks quite smooth to the eye, but, actually, all the variations shown in the charging current wave for the condenser are present in the voltage wave. The reason for the large variations in the current wave is that any very slight change in voltage across the condenser causes a current to flow, and these little currents show up as indicated on the photograph. By actual count, the frequency of these variations is about 360 cycles per second.

We took photographs of the voltage and starting current for several types of motors, but I chose the type shown, because it is of a type commonly found in the home on electric washers, etc. We found this picture quite interesting, for it shows what a large current is required momentarily to start such a motor, and it also gives a very accurate method of determining just how long it takes the motor to reach full speed. All that is necessary to do to get this time is to count the number of cycles in the current wave up to the point where it has settled down to a small steady value which indicates full speed has been reached and then to multiply this by one-sixtieth of a second, the time of one cycle. The amplitudes of the large and small portions of the current wave were measured, and the ratio of the large to the small, times the current indicated by an ammeter after the motor had started, gave the approximate starting current. To get these motor pictures a relay had to be constructed to start the motor at the instant the start of the film passed the slot in the film can, and this required an additional contact on the oscillograph timing mechanism. An old low resistance telephone ringer with some new contacts attached proved just the thing. Incidentally, this relay supplied us with some very beautiful and spectacular fire works. I was charging a 40 mfd. condenser directly from 120 volts D.C. and discharging it through the relay contacts to the oscillograph current shunt in order to get a picture of the discharge, and once during one of the discharges the contacts stuck, unnoticed by us. Well, when I tried to charge the condenser the next time, we had a most beautiful and awe-inspiring spectacle there in (what had been) the dark. From the way those contacts melted and ran together I'm inclined to think that "quick welders" have no idea of the possibilities in their chosen field. Anyway, my relay has a brand new set of Ford coil points on it now (direct from S. S. Kresge & Co.), and all is well. We all three got to see our voices and know just about as much about them now as we did in the first place. To do this we connected a microphone and a battery across the low voltage winding of a toy stepdown transformer and then connected the 110 volt winding to one of the voltage vibrators. After looking at the rough, jagged, and irregular wave forms produced by our voices, we wanted to see what a good voice looked like, so we called in a fellow who has one of the best voices in school. He sang "Chant of the Jungle" for us, and to our surprise, it looked almost as well as it sounded; the wave forms were fairly simple but very smooth, symmetrical, and steady, aside from a little variation in amplitude due to the tremolo effect in his voice.

Besides these photographs, we took pictures of the

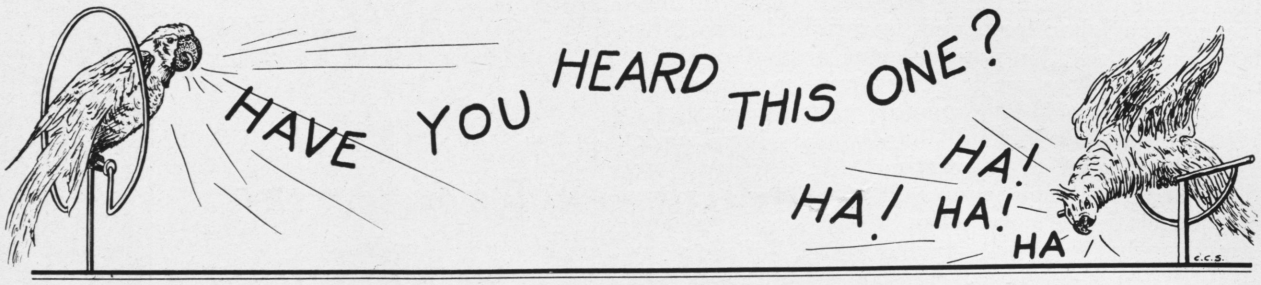
input and output of many different types of machines in the laboratory, and we might be working yet had not Prof. Knipmeyer come around one afternoon and told us we'd better start on something else. He said we'd done enough work for a thesis. Maybe we had, but I would hardly class it as work, because it was all so interesting. At any rate, we all agreed it was time very well spent, for so many facts taught in the class room were cleared up, and so forcibly driven home. In closing, I'd like to say that if I've succeeded in interesting even one person in the many worth while possibilities of the oscillograph, and if through subsequent experiments with the device, a better and clearer conception of the basic facts and principles used in electrical engineering is gained, I shall consider the time used in writing this article very well spent indeed.

A Little More Work

(Continued on page 181)

the one thing from which we can most consistently derive pleasure is work. This term work does not necessarily refer to studying or striving for the possession of legal tender, but the directing of energy toward productive enterprises. Studying is probably the most productive of such occupations, yet the law of diminishing returns indicates that beyond a certain scholastic attainment the application of the excess energy to absorbing knowledge from books is less productive than devoting this same energy to social advancement, character development, and other phases of education not related to the curriculum. The proper balance between scholastic and social functions is difficult to define as it varies with the character of the individual; but scholastic activities should receive much more attention, since social training will usually be obtained through the college associations.

More work is required to raise a B grade to an A than is required to raise a C to a B. Nevertheless, the energy expended in making the A is duly compensated for by the fact that the individual has lifted himself above the common herd. As Dean Briggs has said: "It is that little more which is worth all the rest." This "little more," applied to college life, means not only a little more studying but a little more of everything. For example, after all lessons have been prepared an additional fifteen minutes spent in making a swift but comprehensive review of the text to correlate the important facts, will make the entire evening's study much more valuable. The man who participates in extra-curricular activities can well afford to spend another fifteen minutes in outlining the functions which he must perform on the following day, and preparing written instructions for those men whom he supervises, stating what is expected of them and how the duties should be executed. Lastly, but most valuable of all, is the record of experience. This record should consist of a brief resumé of the important incidents in the day's routine accompanied by criticisms and suggestions of better methods of accomplishing the tasks. These notes can be referred to in the future when a similar situation is encountered. An extra half-hour thus employed greatly increases the value of the day's education and for it a paltry thirty minutes of sleep has been sacrificed. Only by sheer grit and determination, not brilliance of mind, can such an advantageous proceedure become habitual.



Foreigner: "I've been hunting in the mountains for three months."

Native: "Did you find 'em?"

IN GRATITUDE

She took my hand in sheltered nooks,
She took my candy and my books,
She took the lustrous wrap of fur,
She took those gloves I bought for her,
She took my words of love and care,
She took my flowers, rich and rare,
She took my ring with tender smile,
She took my time for quite a while.
She took my ardor, maid so shy,
She took, I must confess, my eye,
She took whatever I would buy,
And then she took another guy.

ICE

You're like ice.
You never pet.
My dear, you're wet—
Like ice.

You're like ice.
I don't have to be told
That you're cold—
Like ice.

You're like ice.
And another fact—
You're cracked,
Like ice.

When a young lady, from out of town, who had read of the recent flood, expressed a desire to see some of the suffering in the Wabash Valley, a certain senior took her out to Rose during examination week.

Fatalities statistics for the past year fail to mention the large number who were tickled to death.—Denison Flamingo.

HEARD ON A WINDY DAY

"Look at those yellow bloomers."

"Where?"

"Can't you see those dandelions?"—Kansas Sour Owl.

She: "Isn't the floor slippery this evening, Fred?"

He: "No, I polished my shoes tonight."

SLAP!

"Why on earth did Dave join that fraternity?"

"His girl wanted their crest for a radiator ornament on her car."

Kruzan: "Have you another one of those cigars you gave me yesterday?"

Nichols: "Yes. Do you want one?"

Kruzan: "Thanks. I'm trying to break my little brother of smoking."

Professor Bloxsom: "Your last paper was very difficult to read. Your work should be so written that even the most ignorant will be able to understand it."

Joe Shaack: "Yes sir. What part didn't you understand?"

Professor: "Explain the causes of perspiration and what effect it has on the body."

Student: "Perspiration is caused by R. O. T. C. uniforms and it makes a body darned sore."

A careful girl is Mary Dunn,
She never stands against the sun.

—Yellow Jacket.

Bruce: "C'mon, slip us a kiss."

Hazel: "Naw, I got scruples."

Bruce: "That's all right. I've had them twice."

SEATS OF THE MIGHTY

Two young boys were telling about great deeds, when one who was a professor's son spoke up and said his father occupied the chair of applied physics at Cambridge.

"Dat's nutting," replied the other, "mine occupied the chair of applied electricity at Sing Sing."—Oregon Orange Owl.

First Papa: "Do you think your son will soon forget all he learned at college?"

Second Papa: "I hope so—he can't make a living necking."—Columbia Jester.

Both quality and quantity are needed for the Show.

Deisel Engines

(Continued from page 175)

piston. The water circulates all through the piston, and then returns through another telescoping pipe. Sometimes a double telescoping pipe is used. In this case the cold water goes up through the inside pipe and returns through the space between the two pipes. Oil is also used to cool the piston. It passes from the connecting rod bearings up through a hollow connecting rod to the piston, and then returns in the same way in which the water returns.

Another important item is the fuel injection. There are two different types:

1. Air injection.
2. Solid injection.

When air injection is employed, it is necessary to have air compressors. These may either be run by the engine or run separately. They compress the air to a pressure of from 800 to 1,200 pounds. As the point of fuel injection is reached, the air valve is opened and the fuel enters the combustion chamber as a fine mist.

In the method of solid injection, the fuel is injected under a pressure of from 1,000 to 3,000 pounds. The valve passages, as well as the valves, are machined so as to give the fuel a whirling motion and it, too, enters the combustion chamber as a fine mist. The amount of fuel injected is regulated by the governor either by shortening the stroke of the pump, or by operating a by-pass valve on the fuel line. This enables the engine to operate at a uniform speed even though the load may vary.

There are many types of fuel used in Diesel engines, but they fall into three general classes:

1. Coal tar oils are produced by the distillation of coal tar, but are not commonly used in this country.
2. Vegetable Oils, such as castor oil, palm oil, etc. These are much too expensive and the supply of these is too limited for this use.
3. Petroleum Fuel Oils. These oils are cheaper and obtained in great quantities than other oils, and as a result are used more than any of those in the other groups.

Diesel engines are coming more and more into prominence and are now being used in many various ways. They are used in municipal light plants, industrial locomotives, heavy duty trucks, excavating shovels, and are beginning to find their way into aviation.

Athletics

(Continued from page 186)

INDIANA STATE 37—ROSE 31

WITH the Rose quintet playing the best game of the season and fighting desperately throughout the entire 40 minutes of play, the State Normal quintet was forced to the limit Thursday, Feb. 28, to come through with a 37 to 31 victory. The showing of the Engineers came as a surprise at the end of a season of mediocre play. From the very first whistle, the Rose team threw out a stubborn defense across the floor that had the Sycamores considerably baffled, but despite that fact, the Marksmen jumped out to an early lead only to have a desperate Rose Poly rally again put the game on even terms. Normal held a 23 to 14 advantage at the half.

In the second half Rose started a scoring spree and crept up on the Blue and White until the score was tied at 28 all. Allen sent Rose into the lead with a neat toss from back of the foul line. At this stage of the game Normal started a last desperate rally that netted them points which they retained until the game ended. Rose scored one more foul goal making the final count 37 to 31.

Alexander and McEwan led the Rose team in scoring. Each played a neat floor game and deserves a world of credit for his share. Reynolds and Horton looked the best for State.

Lineup and summary:

Indiana State (37)—	F.G.	F.T.	T.P.
Scheid, f.	2	1	5
McCallum, f.	1	2	4
Horton, c.	5	0	10
Reynolds, g.	4	4	12
Wampler, g.	1	1	3
Pierson, c.	1	0	2
Davis, g.	0	1	1
Totals	14	9	37

Rose Poly, 31.	F.G.	F.T.	T.P.
Alexander, f.	4	3	11
Fisher, f.	2	0	4
Allen, c.	2	1	5
Gillett, g.	1	0	2
McEwan, g.	3	3	9
Sawyers, g.	0	0	0
Totals	12	7	31

Referee—Goldsberry. Umpire—Adams.

Research and Progress

(Continued from page 180)

structures built. They are comparatively inexpensive, and can be promptly reared to varying heights and as readily dismantled for transportation by truck to another station for set-up.

Since a geodetic survey is one which gives consideration to the curvature of the earth, it is not unusual for ridges, trees, and buildings to obstruct the line of vision between contiguous triangulation stations, at times 25 miles apart. Towers are therefore utilized to elevate the signal light at the one station on which the observations are made, and the theodolite, with which the observations are made, at another station.

These steel towers consist of two mutually independent tripods, one inside of the other, so that no movement of the observer operating on his platform on the outer tower can jar the theodolite mounted at the apex of the inner tower and thus affect the accuracy of the theodolite. The signal lamp on which the observations are made is supported at the top of the outer tower ten feet above the theodolite. The first steel towers were only 75 feet to the top of the inner tower but were later incrased to 103 feet by additional lower sections. The tall trees found in the lower Mississippi Valley this season made it necessary to further increase the inner tripod to 129 feet with supplimental ten foot extensions available for emergencies. The outer tripod is always 10 feet higher than the inner structure for purpose of observation.

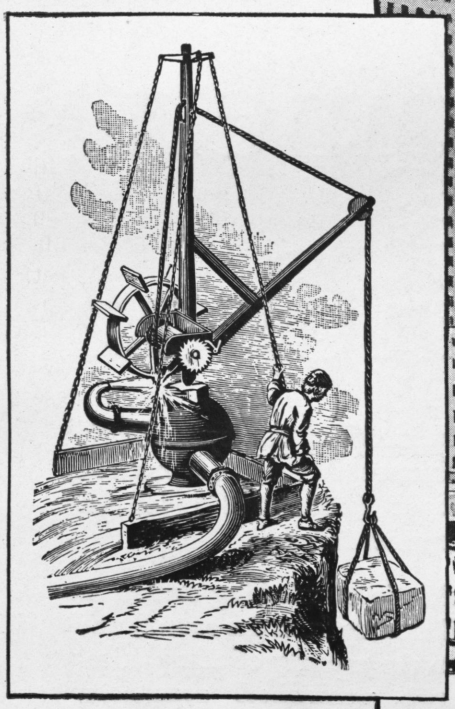
The Bilby tower was first used in Minnesota several years ago and has been in almost constant use since then on hydrographic work in Ohio, Pennsylvania and New York. During the 1929 season it has also been used on the arc of triangulation between Cairo, Illinois and New Orleans, La., which the Coast Survey is executing at the instance of the Mississippi River Commissioner.—*Abstract Engineer and Contracting.*

Cleaner Coal

(Continued from page 176)

iron is grabbed and held until removed by the plant attendant.

A very special type of installation is now being applied extensively where powdered coal is used in definite quantities in a continuous stream and where coal must be free of all tramp iron. This applies particularly to the use of powdered coal in the burning of Portland cement. Here the coal is weighed out continuously by Poidometers which deliver an exact quantity of fuel much as a valve on a gas line would do. Placed at the end of each Poidometer belt, at an angle above the head pulley, is a magnet which pulls out all scrap iron as the coal falls from the belt. In this position the magnet has no affect on the operation of the Poidometer, and the coal passes to the kilns free of all tramp iron.



One of the early phases
of Vertical Transportation

GREATER PENOBSCOT BUILDING, DETROIT, MICH.
Equipped with Otis Signal Control Elevators
Smith, Hinchman & Grylls, *Architects*

"DOUBLED AND REDOUBLED"

Detroit has astonished the world by the amazing rapidity with which it has grown in recent years.

Due to the phenomenal development of the automotive industry, Detroit has doubled and redoubled its population so frequently that statistics read like fiction.

Vertical Transportation has permitted Detroit to grow upward as well as outward and the Otis organization, naturally, has been an important factor in such record-breaking building operations.

OTIS ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD

Spanish architecture applied to hydroelectric power house at Torreon

Equipment for Power Castles in Spain

SPAIN, which has housed many of her hydroelectric installations in veritable architectural castles, has invested 2,500,000,000 pesetas (about $500,000,000) in the development of this, her foremost industry.

By closing a circuit breaker in a switching station at Central de Camarasa, 12 miles away from the source, one man will add 10,000 kv-a. to the capacity of that particular power castle—when two waterwheel generators, switchgear, and transformers built and tested this year by General Electric are put in operation. This installation will be the only automatic supervisory control installation outside North America and Japan.

Waterwheel-generator testing and study are among the assignments of recruit Test men—recent engineering college graduates. Under the supervision of an experienced "Head of Test," they carefully adjust for, and note responses to, such tests as core losses, friction losses, windage, heat runs, and high-speed runs. A valuable foundation is thus laid for industrial, sales, research, general, or miscellaneous engineering work.

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