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Address all communications to THE ROSE TECHNIC, Terre Haute, Indiana.

Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 13, 1918.
A POLYTECHNIC INSTITUTE has an atmosphere that is fundamentally an inspiration for constructive effort.  

If the time which has been spent here is to have a lasting influence for good, it must be in making life constructive. Looking forward into the future your opportunities to be constructive in material and spiritual phases of life are unlimited. All of us blessed with the good fortune of living in this day and age, and in this country, have abundant opportunity to have a constructive part of the progress of the future towards a still higher and better civilization. To do your part it is necessary to cultivate the creative impulse, inquire into the "why" and "how", and enter upon the duties of life with a spirit of zeal and openmindedness.

C. F. Loweth, to the class of '26.
Smokeless Coal

All Coals are Smokeless when Properly Burned. Which then shall Bear the Name of Smokeless?

O. P. Hood, '85


"SMOKELESS coal"—this innocent phrase, seeming so simple, is charge with various meanings. To the layman unlearned in the ways of commercial nomenclature or the views of the combustion engineer, the phrase means just what it says, namely, a fuel which burns without smoke under the simple combustion conditions that he supplies. The fuel must never smoke, or he may possibly broaden his definition to include, in a Gilbert and Sullivan sense, those coals that "hardly ever" smoke. He feels justified in this view, for he knows about such fuels. A large part of our people know about the smokeless burning of anthracite, and a smaller part know of similar service from coke.

To the dealer in coal the phrase has a different meaning. It has been applied as a trade name to our semi-bituminous coals which smoke but little because of their relatively low volatile content. The commercial advantages of the classification are such that the upper limit of volatile matter has been stretched to include coals that are smokeless, by courtesy only, when judged by the anthracite or coke standard.

To the combustion engineer the phrase raises a query. Is it the coal that should be called smokeless, or is it the combustion conditions supplied by furnace, grate and draft that should be called smokeless? To him all coals are smokeless, provided he be not limited in his method of burning. Our highest volatile coal can be burned smokelessly if conditions are properly adjusted to the characteristics of the fuel.

How Define Smokeless Coal?

The term "smokeless coal" can, therefore, be considered from several points of view. If we restrict the meaning to those coals which can hardly be made to smoke with the most thoughtless handling under bad combustion conditions, then we are practically limited to those classified as anthracites, and to other fuels having a similarly high ratio of fixed carbon to volatile matter. With volatile matter removed by heating, the remaining char or coke of all types of fuel may be made to come well within this range. The anthracites have from 3 to 7 per cent volatile matter, which burns with a short blue flame without smoke. Good metallurgical coke has but one to three per cent, while heat treated fuels of other sort leave residues with amounts of volatile ranging from 2 to 15 per cent. Only a relatively few of our coals when heated according to our best present knowledge, retain physical characteristics of coherence and strength that make them immediately desirable as a commercial fuel. To give strength and coherence and acceptable form value, briquetting is resorted to. The usual binder, unfortunately, adds smoke producing material, so that a second heat treatment is required to produce a really smokeless fuel for domestic use. The carbo coal produced at Clinchfield was of this type, and its quality left little to be desired. In the future we can expect an increasing number of manufactured fuels in briquette form made of coal distillation residue with a pitch binder, and rebaked at a sufficiently high temperature to reduce the volatile matter below 8%. We can expect among these worthy competitors of anthracite in the field of a real smokeless fuel. They will have an advantage over coke in being dense like anthracite, as free from breakage, and requiring as little thought in firing. Char made from our lower rank fuels, such as lignite, is apt to be high in ash, but a smokeless fuel can be produced from them which may in time find a market. Since the processes can be widely varied as to temperature and length of treatment, we may expect a corresponding variety of char products that must be tried to determine quality. The kindling and radiant properties of cokes vary so that some will have special advantages. Good coke properly sized and handled makes an excellent smokeless fuel for domestic use, but it requires a little more intelligent handling than anthracite. Tar kettles, contractors' boilers, and steam shovels usually resort to coke when compelled to abate a smoke nuisance. If we consider the phrase "smokeless coal" as a well established commercial classification we have to consider an entirely different class of coals and a qualified meaning for the term smokeless. Our country affords coals of almost any carbon-volatile ratio,—semi-anthracite from 6 to 10, and semi-bituminous from about 3 to 6. We have comparatively little semi-anthracite, but large quantities of our best coals are classified as semi-bituminous. The term smokeless was first applied to those having, say, less than 20% volatile, but of late it has been applied to the full classification of semi-bituminous coal, some having 27% volatile. This class of coals burn with a short yellow flame (and may smoke about in proportion to their volatile content. They are in general friable coals, easily broken, so that when ready to place on a fuel bed there is apt to be a large per cent of very fine coal which tends to accentuate the smoke trouble by reducing the flow of air through the fuel bed when it is most needed. In the use of these coals the point is strongly accentuated that the quality of smokelessness is very much a function of furnace design and firing methods. Plants that have difficulty in meeting the requirements of a city smoke ordinance can frequently get by, by selecting a coal with a few per cent less volatile matter. One plant with small return tubular boilers set for anthracite coal, but burning semi-bituminous coal of 21% volatile, too frequently exceeded the smoke limit, but with coal of 17%, together with considerable care the limits were not exceeded.
4 THE ROSE TECHNIC

This raises the whole question of what is meant by "smokeless" in this sense. It is obviously a relative term, and its absolute value will depend much on the community habits. Coal of this type used in a bituminous district has considerable reason to be called smokeless by comparison. Used in an anthracite district, experience will vary according to the grade of coal and the skill used. In domestic service, too, careful firing, smoke is usually kept below an amount considered objectionable. The point should be made that the claim to smokelessness for this group is justified in direct proportion to the skill used in satisfying rather modest requirements of furnace design and firing methods, and in inverse proportion to the volatile content ranging from about 16% to 27%.

One way of determining the practical smokelessness of such a group would be to discover whether towns using such coals exclusively feel the need of smoke abatement efforts. The City of Washington was near being a semi-bituminous town. In 1917, 34% of the coal used was anthracite, 3% bituminous, and the remaining 63% semi-bituminous of about 19% volatile matter. It can be said that Washington is on the edge of having a smoke problem. In that year about 264,000 tons of volatile matter came from the coal that was burned in the district. About 7¾% of this came from coal having over 20% volatile matter. The smoke problem can hardly be laid entirely to this 7¾% of bituminous smoke. The belief is, however, that a satisfactory condition could be maintained by a reasonable effort to see that new installations were such as could be operated smokelessly, and that there was given instruction and supervision of firing methods. Smokeless operation is much more easily attained with these coals than with the high volatile long flaming bituminous coals. They are, therefore, an important element in smoke abatement efforts.

West Virginia Coals

In point of quantity West Virginia is the most important producer of semibituminous coals. There are three principal fields along the eastern side of the State: Pocahontas (including Tug River); New River (including Winding Gulf); and the Upper Potomac field in the northeastern corner of the State. The principal seams worked in the Pocahontas and Tug River districts in McDowell and Mercer counties, West Virginia, and extending into Tazewell County, Virginia, are the Pocahontas Nos. 3, 4, 5, and 6, War Creek, Davy Sewell and Welch. The coals produced from these fields are comparatively uniform, being generally low in ash, sulphur and other impurities, and high in heat value. They are excellent for steam and domestic use, and when mixed with a higher volatile coal are adapted to by-product coking. Although quite friable and breaking badly when subject to rehandling, this factor does not detract from the inherent heating value of these coals.

Between the years of 1908 and 1922, the Bureau of Mines made over a thousand analyses of delivered coals from these districts, the average analysis of semibituminous being as follows:

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<tr>
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<th>Moisture</th>
<th>Volatile matter</th>
<th>Fixed carbon</th>
<th>Ash</th>
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<tr>
<td></td>
<td>2.7 per</td>
<td>18.6</td>
<td>73.9</td>
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The Upper Potomac fields of West Virginia are Bakerstown. These coals average somewhat higher in volatile matter, sulphur and ash, and correspondingly lower in heat value than the semibituminous coals from the southern part of the State. They are considered excellent steam and domestic coals. Analysis of delivered coal show the volatile matter varies between 15.7 and 24.5 per cent, sulphur from 1.0 per cent to 2.2 per cent and ash 6.5 to 16.0 per cent. The average analysis of delivered coal is about as follows:

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<th>Moisture</th>
<th>Volatile matter</th>
<th>Fixed carbon</th>
<th>Ash</th>
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<tr>
<td></td>
<td>3.0 per</td>
<td>20.6</td>
<td>69.2</td>
<td>10.2</td>
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<td></td>
<td>per cent</td>
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Maryland Coals

All of the commercially valuable coals of Maryland are semi-bituminous, and since they closely resemble one another both in analysis and structure, they may all be considered together. Mining is confined to a comparatively small area in the western part of the State in Allegany and Garrett counties. This is an extension of the semi-bituminous in north-eastern West Virginia, and has the distinction of being one of the oldest coal mining districts in the country. The seams worked are the Barton, Waynesburg, Tyson, Pittsburg, Lower Bakerstown, Piedmont, Upper Freeport, Lower Freeport and Upper Kittanning. Analysis of delivered coals from Maryland show volatile matter ranges from 15.8 to 21.8 per cent, sulphur 0.7 to 3.3 per cent, and ash 6.8 to 18.1 per cent, with an average analysis about as follows:

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<th>Fixed carbon</th>
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<tr>
<td></td>
<td>2.3 per</td>
<td>18.9</td>
<td>71.5</td>
<td>9.6</td>
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<td></td>
<td>per cent</td>
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Pennsylvania Semi-Bituminous

The semi-bituminous coals of Pennsylvania are located principally in Bedford, Cambria, Center, Clearfield, Fulton, Huntingdon and Somerset counties in the central part of the State. The coal is produced chiefly from the Lower and Upper Kittanning, Lower and Upper Freeport, Pittsburg, Kelly, Barnett and located in Grant, Mineral and Tucker counties. The seams mined are the Upper Freeport, Pittsburg and Fulton seams. While much of this coal closely ap-

Directly north of the Pocahontas district and lying chiefly in Wyoming, Raleigh and Fayette Counties, are located the Winding Gulf and New River districts. Here the principal seams mined are the Beekley, Fire Creek, Sewell and the Pocahontas Nos. 3 and 6. These coals closely resemble the Pocahontas coals in chemical analysis. Like the Pocahontas coals, the New River and Winding Gulf coals are highly regarded for steam, domestic and by-product coking purposes. The average analysis of delivered coal from these fields is about as follows:

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<tr>
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<td>2.2 per</td>
<td>18.6</td>
<td>73.9</td>
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<td></td>
<td>cent</td>
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<td>14,051</td>
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(Continued on page 24)
The Evolution of Engineering

C. F. Loweth

Chief Engineer, C. M. & St. P. Rwy.

THE Evolution of Engineering is the subject which I have chosen for this occasion. It seems particularly appropriate in view of the atmosphere of this place, my own life work, and that to which, doubtless, many present are looking forward. The subject is a broad one and the time at our disposal will permit of but a brief outline. I hope, however, to cover the subject comprehensively enough to justify laying particular emphasis upon a few phases which may be susceptible of practical application by all of us.

Evolution: This is a word we have heard much of late; it is much misunderstood and is wrongly restricted in its application; in some quarters it is tabooed. But I have not come with any misgivings about it at this time. We will not now concern ourselves with any fancied conflict between evolution and the first chapter of Genesis, or as to the remote ancestors of the human race. We will consider only those aspects of evolution which are tangible and the evidences of which have occurred within the life time of men now living or but recently departed.

The study of evolution, in its broadest sense, is very fascinating. It broadens the vision and makes many things of life of vital interest which would otherwise be accepted as casual or commonplace. Evolution attempts to solve the riddle of the universe, to explain how suns and stars were made, and how life in all of its varied manifestations came to be. All of these are of great interest, but it is of greater interest to realize that evolutionary processes are not confined to the dim and distant past and to the building of universes, but are in action and in evidence here and now; that they have been continuous since the dawn of creation and seem likely to go on forever. If we can grasp these facts and come to a realization that we live in a time when evolutionary processes are taking place which are probably as momentous and perhaps more numerous than ever before, then our outlook upon life will be broadened, its affairs increased in importance, life’s opportunities and responsibilities enlarged and our spiritual energies quickened.

Engineering and applied science have, in some slight degree, existed since the early cave man. The rudiments of these must have had application in building the Tower of Babel, the pyramids of Egypt, Solomon’s Temple, and in the arts and cultures of the most ancient peoples; in all cases the applications were crude and limited, and advancement was painfully slow. From the present day view point, it seems incredible that in thousands of years advancement could have been so slow.

Engineering and the applied sciences, as we now understand them, are hardly more than one hundred years old. The early methods of their application have in many cases, been radically changed and some long since have become obsolete. Here is an indication of the fact of evolution in engineering and the applied sciences.

Safe and rapid transportation of persons and property and of facilities for rapid communication of human thought are vital needs of present day civilization. Imagine, if you can, what a tremendous loss would be experienced were we left today without the telegraph and telephone, steamships, railroads, automobiles, aeroplanes, and radio.

Go a step farther and with greater effort imagine the absence of the many practical applications of steam, electricity, and chemistry.

Then call to mind that the oldest of these contributions to human progress and welfare has come into existence within the short space of three or four generations and the youngest of them within the life time of persons not yet of age.

We have just passed the hundredth anniversary of the advent of the railroad. The telegraph came about the same age. The telephone came about seventy years ago, and the telephone a little later. The automobile is barely a score of years old. Fifty years ago electricity was mostly a laboratory curiosity and had little or no practical application. The age of the aeroplane is measured by but a few short years, and that of the radio by months.

For the non-technically trained mind perhaps one of the most readily observed evidences of evolutionary changes in engineering is in the design and construction of buildings. The evidences of these changes can be found in many places, but are especially marked in our large cities. Probably most of you are more or less familiar with Chicago, especially the business district, and may have noted the transition which has, and is yet taking place, in buildings. Here the age of the oldest buildings is pretty definitely fixed as later than 1872, the year of the great fire. Side by side with these fifty year old buildings may be found others, samples of the vintage of each subsequent year. The skyscrapers of early age were six to seven stories in height, and many notable buildings were but four or five stories high. The newer buildings are twenty and thirty or more stories high, with about as many floors below the street level as the older building had above. Their increase in size is the least remarkable of the many changes which have taken place. Their design and arrangement is strikingly different, as are their structural features and the materials of which they are built.

The heights of the older buildings were limited by structural considerations, the lack of suitable materials for the more massive construction of today, and there was not the perfection in elevators, water supplies, fire protection, lighting, heating and many other essentials available for the larger present day structures. To be sure, there were counteracting influences, such as the lack of the great economic pressure for intensive use of the land, but this and other similar considerations would in themselves illustrate
an evolution along other lines than those we are now considering.

Nor is it sufficient to compare present buildings with those built as long as fifty years ago, for there are many instances, evident at every turn, of buildings constructed thirty, or even a score of years ago, according to the highest standard of their time, which are being replaced with more modern ones to better meet present day requirements.

The changes which have, and are yet taking place in building design and construction are much greater than realized by the average person. Only those intimately connected with their planning and construction are aware of the multiplicity of operations and materials now employed. The building designer of today has more intricate and complex problems and much more is demanded of him, but he has a much larger list of materials and construction methods which he can employ, all more adaptable to his use than those which were available to his predecessors. The fixtures and appliances of many kinds which are at hand and are used, are materially greater than ever before. All of these have made possible the design and construction of larger and safer buildings, of greater individuality of design and adaptation to exacting modern requirements, and, when the relative value of the dollar is considered, more economical.

The internal combustion engine, using gasoline for fuel, came into practical use slowly and with many misgivings, not more than forty years ago. These early types were wasteful, noisy, unreliable, but out of these has been developed those types without which the automobile and the aeroplane would be impossible.

Older than the use of metals by man was his use of pigments. With these the early cave man adorned the rock walls of his abode. These pigments have come down to us well preserved in many instances. Today many minds are at work an endeavor to find enduring paints which will protect the surfaces to which they are applied.

In the broad field of transportation evolution was slow, up to about one hundred and fifty years ago. The two wheel vehicle, of which the chariot was the aristocrat, and the galley, with its banks of manpowered oars, were for many centuries the highest of man's achievements in transportation; these were succeeded by the stage coach and the sailing vessel. No longer than about one hundred and fifty years ago, it entered into the minds of man that these primitive means might be improved, and slowly, painfully slow, these evolved the canal boat and the steam boat.

The average speed of stage coaches for journeys of a half day or more was not more than eight miles per hour, at the best. Canal boats, then largely used for conveyance of passengers, traveled much more slowly. One of the forerunners of the steamboat, tried out on the Potomac River in 1773, was capable of making four miles an hour. Its propulsion was by means of a jet of water drawn in at the bow and forced out at the stern. The following year a steamboat operated on the Delaware River and made six miles per hour. More than twenty years elapsed before, in 1808, Robert Fulton successfully operated the Clermont from New York to Albany, one hundred and fifty miles in thirty-two hours. This was considered so successful that it was put into regular service between those points in the same year. It was two years later when the second regularly operated steamboat was put into service on Lake Champlain.

On land, however, the ox and the horse were at this time and later, as they had been since the dawn of history, man's chief transportation aid, and they so remained until the advent of the railroad. Under these conditions commerce, upon which civilization is largely founded, and which is dependent upon
transportation, could not flourish upon land. It is recorded that in 1800 it cost twenty dollars to transport a ton of freight across the state of New Jersey, or at the rate of twenty-five cents per ton mile. Now it can be done for less than one-fiftieth of that sum, and in much shorter time.

There has recently been celebrated the hundredth anniversary of the beginning of the railroad. The early railroads were at the best but crude and inefficient, the locomotives were small, no larger and not nearly as powerful as the smallest automobiles of today. The speed was little more than that of horse drawn vehicles. Out of these humble beginnings has been evolved the wonderful system of railroad transportation of today, which has made possible the settlement and development of continents and a fullness and richness of human life which would otherwise have been far from possible.

To the railroad and the steamship has been added, well within our own time, the automobile. It further supplements the means of cheap, rapid and effective transportation required by the present progressive civilization. And now we have transportation by air, just emerging from the experimental stage, ceasing to be a novelty and fast becoming a practical and necessary transportation agency. None of these is perfected. In all progress is still the order of the day.

This age is also called the age of electricity. Only two short generations since there was little or no practical application of electricity. There are doubtless many in this audience who can recall seeing their first electric light. A small experimental electric railway shown at the Worlds Columbian Exposition in 1893 was a great novelty to many, as was also the general use of electric light, which in large measure made that Exposition more attractive than its predecessors.

The applications of electricity extends into nearly all phases of human life and effort; they are increasing with great rapidity, and to an extent far from being fully appreciated.

Our immediate ancestors marveled at the telegraph and, later, the telephone. That thought could be conveyed beyond the range of human hearing and vision. had not so much as been dreamed of by them. These have developed to a high degree of usefulness and efficiency, leading out everywhere, and appeared to be the perfection of means of communication. Yet out of them has grown the demand for something better, and we have radio, a young giant born in a day, and that but yesterday. By it we may individually and immediately be in touch with other minds thousands of miles distant. Not only is sound transmitted through great distances, but also photographs of writings and of events. It is difficult to conceive what may be the ultimate development of these latest means of communication.

This outline of the progress of a few phases of engineering and applied sciences has touched only the high spots; a more detailed review would be of interest and well worth while, but for this there is not time. If you have allowed your imagination to run along with this brief survey, supplementing what has been said with what could have been added to have filled out the picture, then I believe we may draw a valuable lesson and inspiration from the record. How did these rapid and wonderful advances of engineering and applied sciences come about? Did they grow as grass grows? Are we to take them as natural phenomena, as matters of casual occurrence? By no means. On the contrary, they have come as the result of a prodigious amount of human effort, laborious and painstaking.

Examine carefully in these and other fields of human accomplishment and three things will, I think, stand out prominently: first, that progress has been slow but progressive; second, that progress has ever been the result of the contributions of many individuals; third, that only rarely have there been individual contributors who have loomed up head and shoulders above the average.

These are the ways of evolution. They are true not only in the realm of engineering and applied science, but in the whole realm of human affairs, all advancement in knowledge, in public health and welfare, improvement in political and social relations, in the arts and all culture, and in the enlargement of man's spiritual nature are subject to the same laws of development.

If the progress of the human race in those things which tend to betterment and make for the highest civilization is viewed in the perspective of human history, then progress appears to have come quickly because so recently, but if viewed more in detail, we see that progress has always come very slowly. Following each advance in human knowledge and achievement there is wonderment on the part of the many why he did not earlier have the benefits and enjoyment therefrom. Natural laws have not changed so we know that the possibilities of communication by radio existed from the dawn of creation, but we did not find out how to so use them until today. We are told that there are sounds and colors beyond the range of human hearing and vision; these have been waiting many centuries for man to so grow in understanding that he might find some way to use them for his greater fullness of life.

The second outstanding factor in the evolution of human progress is to repeat what has been already said that progress is the result of the work and effort of many individuals. The time was when to speak of the steam engine brought to mind the name of Isaac Watts; of electricity the name of Edison; and of aviation the names of Chanute and Wright. But these names, though always to be remembered for remarkable achievements, must share with many the credit for the steam engine, electricity, and man's conquest of the air. This is equally true in all other lines of achievement.

History indicates clearly that continuing and enduring progress has largely come by evolution, not by revolution. If viewed in the perspective of the whole history of human advancement, such revolutions as have contributed to the permanent good have been relatively few and far between, and progress is seen to be made of an infinitely large number of increments of growth and change; these are characteristic of evolution. If progress came mostly by revolutionary methods and were of but occasional occurrence, it would then be mainly the work of few individuals of exceptional ability. Such fortunately, is not the case, for, were it the rule of nature that progress came by major contributions from the few specially endowed, then you and I with only so much (Continued on page 26)
New Miraflores Power Plant

By L. W. Lewis, '13

Assistant Engineer, Section of Office Engineer, The Panama Canal.

THE main generating station of the Panama Canal is situated at the Gatun Spillway and consists of three 3000 kw. 2200 v. generators and one 5000 kw. 6600 v. generator, each driven by a vertical type Pelton-Francis turbine. The output of generator No. 4, and by the use of auto-transformers, the outputs of generators Nos. 1, 2, and 3, are transmitted across Gatun Dam and under the Gatun Locks to the Gatun Substation at a potential of 6600 volts.

Here sufficient energy to meet the demands of the Gatun Locks and adjacent townsites is transformed for transmission at a potential of 2200 volts; the remainder is transformed for transmission at 4400 volts over the two transmission lines that parallel the Panama Railroad from Cristobal to Balboa.

It is obvious that during years of extended drought, and on account of the increased amounts of water required by lockages, as business through the Canal increases from year to year, the only apparent way to conserve water is to curtail the consumption of that normally allotted to the hydro-electric station. This, together with the fact that the hydro-electric station may become entirely inoperative by accident or other cause, are the principal reasons why an auxiliary power plant is necessary.

Two Transmission Lines

As has been mentioned above, the output of the hydro-electric station exclusive of that portion required at Gatun and in the immediate vicinity is distributed to the various receiving substations over two transmission lines approximately 45 miles long. Approximately 30 miles of this distance lies between the Gatun substation and the Miraflores substation, the distributing point for power to the Pacific Locks. This portion of the transmission lines comprises approximately 67% of the entire distance and is liable to damage by landslides, lightning, etc., in a still greater percentage since those portions of the lines from Miraflores to Balboa and Gatun to Cristobal pass over terrain not subject to slides.

With the operation of the Pacific Locks and the utilities at the Pacific end of the Canal dependent upon such a hazard the reason for locating the auxiliary generating station on the Pacific side at once apparent.

The original Miraflores power plant consisted of three 1500 kw. steam driven generators and was used primarily to supply power to the various activities in connection with the construction of the Pacific Locks. As the power demands on this station increased the capacity of the station was augmented by the installation of three similar generators from the old Gatun steam plant.

Two Problems Involved.

When the time arrived to retire these veterans from service the two principal features to be decided upon were, first, the location of the new plant and second, the type of prime-mover to be selected. Since the Miraflores substation was already equipped with generator switch gear, there was no reason why the new station should be built elsewhere with the attendant unnecessary expenditure for equipment.

The selection of the type of prime-mover presented a problem not so easily solved, but the types considered and the reasons for the ultimate selection of the Diesel engine were as follows:

Two 1000 kw. turbo-generators driven by water drawn from Miraflores Lake were first considered. This type of unit has the advantage of being cheaper than any other type, requiring as it does few auxiliaries and lends itself admirably to automatic control and requires relatively small space, as compared to other types, based upon its capacity. However, during approximately four months of the year Miraflores Lake level is maintained by lockages through the Pedro Miguel Locks from Gatun Lake. It is during this same period that the output at Gatun is curtailed owing to the need of conserving water and this feature led to the rejection of this type of unit.

The next type of station considered was a combined hydro and steam plant. This combination was well adapted to the situation involved, permitting the use of a water driven unit during the rainy season and the use of steam driven units during the dry season, but the following feature in connection with the steam units led to the rejection of this scheme.

The primary function of a stand-by station is to immediately pick up the load after it has been dropped by the main station. It is obvious that for a steam station to accomplish this purpose, the boilers must always be under a sufficient head of steam to carry the load. Such a necessity is objectionable in a steam plant since fuel must be continuously fed into the fireboxes to maintain the head of steam required, while the generators are idling on the line and carrying very little load.

About two hours is the time required at the Miraflores steam plant to obtain sufficient steam in a boiler to carry its load starting from a stand-still condition with the boilers cold, and the cessation of canal activities for such a length of time is not permissible.

The Diesel engine was the next type of prime-mover considered and it inherently overcomes the features so objectionable in the other types. While it requires water for cooling purposes, its water consumption in no way compares to that of a water wheel. It may stand idle for months without consuming fuel, but ready to start and carry its portion of the load demanded by the system. Normally it requires from ten to fifteen minutes to start a large Diesel unit and bring it up to speed to put under load and such a delay is not particularly objectionable for Canal operation. It is claimed, however, by manufacturers of this class of equipment that this type of unit can be started and put under load in less than two minutes.

In view of the desirable characteristics of this type of prime-mover, this was the type selected and...
three units were purchased from the Nordberg Manufacturing Company of Milwaukee, Wisconsin.

The Diesel engine is named for its inventor, Dr. Rudolph Diesel, a German scientist, who successfully demonstrated the theory of his engine in 1897. There are various types of Diesel engines, but all make use of the principle feature that makes this engine unique in the general class of internal combustion engines, namely, the employment of the heat generated in the cylinders by the immense pressure of compression, to ignite the fuel charge, thus eliminating the spark or hot wire ignition systems common in the ordinary gas or oil engine.

Two General Classes

The two large general classes of engines of this type are the 4-cycle and 2-cycle engines. The 4-cycle engines are self-scavenging, that is, during one revolution the piston compresses the air to a high temperature and pressure, fuel is fed into the cylinder, it burns, and forces the piston through the cylinder thus transmitting power to the engine shaft. During the next revolution the piston moves through the cylinder, expelling the gases of combustion, and in moving outward a second time draws fresh air into the cylinder for the next compression stroke. In the 2-cycle engine the cylinders are scavenged, or the burnt gases are removed, by an outside agency, such as an air-compressor, blower, or high-pressure air stored in tanks. In this type of engine there is one power stroke from each cylinder for each revolution.

In starting a Diesel engine, one cylinder is used as an air engine, and the engine is turned until combustion starts in the other cylinders. The air supply to the first cylinder is then disconnected and it is connected to its fuel supply and proceeds to perform its quota of the work demanded of the engine.

Fuel is introduced into the cylinders just prior to the completion of the compression stroke, and since the compression pressure reaches values in some engines as high as 900 or 1000 pounds per square inch it is obvious that a still greater pressure must be available to force the fuel into the cylinders and atomize it for efficient combustion. This is usually accomplished by storing air in receivers or bottles at a pressure approximately 100 pounds per square inch greater than the pressures encountered in the cylinders or by the use of a compressor. The air in the bottles of these engines is used for starting, but in order to keep these bottles fully charged so that air will be available for starting after a shut-down, each engine is provided with a compressor. A part of the output of the compressor is by-passed to the bottles after the engine is running properly until the pressure reaches a desired value. Then they are disconnected from the air line and the air from the compressor is used to feed the fuel into the engine.

Largest in Western Hemisphere

The three engines at Miraflores are identical and are of the largest built thus far in the Western Hemisphere for this class of service. They are designed to produce an output of 3750 brake-power each. Each is designed for an indicated horse-power of 5137; thus the mechanical efficiency is 73 per cent. However, they are each rated at 4000 brake horse-power by the manufacturers, since each has a 10 per cent overload guarantee.

Each engine is provided with 6 cylinders, each cylinder having a bore of 29 inches, and a stroke of 44 inches. They operate at a speed of 125 R.P.M.

The compression pressure in the cylinders is 148 lbs. per sq. in., and the maximum pressure during combustion is 570 lbs. per sq. in. The fuel is injected into the cylinders at a pressure of 1000 lbs. per sq. in. The heaviest single piece is a crank shaft section which weighs 45,040 lbs. Each cylinder complete weighs 31,250 lbs. and each piston weighs 3,600 lbs. The heaviest bedplate section weighs 28,340 lbs. The total weight of each unit including the generator and exciter is 815,000 lbs. The overall length of the unit is 60 feet, and the amount of concrete required to build each foundation was approximately 500 cu. yd. The three foundations are built upon concrete mat heavily reinforced with steel rails. This mat is 60 ft. wide, 81 ft. in length, and 6 ft. thick, and contains a volume of approximately 1100 cu. yd.

Each Is Complete Unit

Each engine and generator, together with its individual auxiliaries, comprises a complete generating unit, and may be operated under full load conditions entirely independently of the functions of the other two. The auxiliaries for each unit consist of a scavenging air compressor, a high pressure air compressor, a cooling water pump, lubricating oil pump and purifier, fuel oil delivery pump, and generator exciter.

In order that the air used for scavenging and fuel oil injection be entirely free from abrasive-forming grit and dust particles, the supply to each engine is drawn through 34 air filters. Each of these filters consists of a nest of expanded metal screens 4 in. thick and 20 in. square. Each filter is coated by dipping into a solution that picks up the dust particles by adhesion during the passage of the air through the screens. Thirty of these screens are placed at the end of an air duct where the air may be drawn from outside of the building, while the remaining four are in the end of a tunnel 3 ft. square extending from the generator pit through the foundation to an air chamber directly below the scavenging compressor. The principal function of this tunnel is to assist in the ventilation of the lower half of the generator. The scavenging compressor and high-pressure air compressor both draw their air supply from this chamber. The scavenging compressor supplies air at a pressure of 8 lb. per sq. in. It consists of two double-acting pumps, 43 in. diameter and 36 in. stroke. High pressure air for combustion is furnished by a 3-stage compressor at 1000 lb. per sq. in. On account of the high temperature resulting from the rapid compression to so small a volume, the air is lead through water cooled coils as it passes from one stage to the next higher stage.

Filtered Through Sponges

Cooling water is supplied to this compressor, to all of the cylinders and pistons and to the exhaust manifold. The main cooling water supply is drawn from Miraflores Lake through a 20 inch line which connects to a header running the entire length of the building in the basement. It is essential that the water jacket be kept entirely free of silt and marine growths since clogging any part of the cooling water system will result in hot spots and possible failure of the parts affected. Consequently, all water is screened at the intake where it is made to pass through several layers of “Luffa” sponges. These sponges are a gourd-like vegetable growth quite common to this neighborhood.
and are prepared for use by peeling off the rind, removing the seeds, and curing the remaining fibrous material.

The intake is not of sufficient elevation to supply a pressure head that will force the cooling water through the various parts of the engine so that it was necessary to top the header, known as the "raw water" header, in the basement, and by means of a centrifugal pump force the cooling water throughout the system. An emergency tap has been made in the treated water main that runs from Miraflores filtration plant to Balboa. This tap was led into another header in the basement and it is of sufficient size to provide cooling water for one engine so that the plant will not be entirely inoperative in case of failure of the raw water supply. Each engine requires 850 gallons of water per minute for cooling purposes at full load.

After the cooling water has completed its traverse through the waterjackets, it discharges into a box culvert, 4 ft. x 3 ft., running under the engine mat. This culvert serves also to carry away the waster from the oil purifying equipment as well as the discharges from the basement drainage system and the mufflers, and discharges into the channel of the Rio Grande river south of the substation.

After each engine has been erected and just prior to placing it into service, the lubricating system is filled with oil. This oil is circulated by a rotary gear pump located in the basement. It is pumped to the upper part of the engine and returns to the pump by gravity. During the periods when this oil is in circulation, and this is only when the engine is running, portions are drawn off and purified in a high speed centrifugal separator. The waste materials, consisting mainly of carbonized residue are discharged into the discharge culvert and the clean oil is returned to the system. As a portion of the oil is lost by combustion or leakage, the system is replenished by a storage tank located on the hillside in the rear of the building.

The circulating water and lubricating oil pumps are both driven by the same motor, controlled from the upper platform, known as the "Operating Platform". In the event of failure of either the cooling and control of the engine is performed, is near cylinder No. 5 on the side opposite to that shown in illustration. In the event of failure of either the cooling water or lubricating oil supply, an automatic valve operates in the fuel line to the engine stopping the fuel oil supply and shutting down the unit.

Use Crude Petroleum

These engines use as fuel a grade of crude petroleum purchased under government specification as "Bunker C" oil. The oil is pumped from the Balboa Oil Farm to a storage tank located on the hill in the rear of the building. From here is flows by gravity to a coil in the basement. So that the oil will flow more readily through the centrifuges this coil is immersed in a water bath which is heated by 30-1000 watt heaters. These heaters are divided into five groups, and the temperature range of each group is controlled by a thermostat. From the heating coil the oil flows to a group of centrifugal separators where the water and solid materials are rejected and the clean oil flows into a receiving tank. From this tank the oil is transferred by motor-driven gear pumps to a large storage tank outside of the building, from which it returns by gravity, to a header in the basement. This tank is at such an elevation that no pump is required to raise the fuel to the distributing pump on the top of the engine. This oil treating arrangement permits cleaning and storing oil at any time and although the number of centrifuges corresponds to the number of engines, their operation depends not upon the number of engines in service but upon the quantity of treated oil in storage.

The fuel oil delivery pump is located at the top of the engine between cylinders numbers 3 and 4 and consists of a small 6-cylinder piston pump operated by the cam shaft. Each cylinder delivers fuel to an engine cylinder and the total amount of fuel consumed by each engine is approximately 5 barrels per hour at full load.

The exhaust manifold, a portion of which is water-jacketed, extends through the north wall of the building and downward to a concrete muffler built under the roadway. The exhaust gases are at an approximate temperature of 650 degrees Fahrenheit when they leave the water-cooled section of the exhaust manifold. In order to eliminate excessive temperatures in the mufflers and concrete smoke stacks, the exhaust gases pass through a water spray at the entrance to the muffler. A float-operated bell alarm notifies the engine operator when maximum and minimum depths occur. Water for the spray is supplied by a tap in the water-jacket of the exhaust manifold.

An experienced operator can accurately judge the behavior of a Diesel engine by the color of the exhaust gases; a smoke exhaust indicates imperfect combustion. Provision has been made for the operator to discharge a portion of the exhaust gases to the outside of the building through a damper which he may open or close at will. These gases are taken from the exhaust before it enters the muffler.

Between the engine and generator is a motor-driven barring device by means of which the unit may be turned over slowly or "barred", for inspection purposes or valve settings at times of shutdown. This device is meshed in an internal gear attached to the rotor of the generator, but the unit cannot be turned over by any other means while this device is in mesh.

Fly Wheel Type Generator

The generator is of the fly-wheel type, that is, the rotor is a fly-wheel, with the field coils mounted on the rim. The generator is rated at 2500 kilowatts, at 80% power factor, and is a 3-phase, Y-connected machine with grounded neutral, delivering 821 amperes at full load, at a potential of 2200 volts and a frequency of 25 cycles. The stator is 18 ft. 10 in. in diameter and weights 41,875 lbs. The rotor is 13 ft. 11 3/4 in. in diameter to the face of the pole pieces and weighs 56,800 lbs. Each generator is provided with 24 poles with damper windings in the (Continued on page 18)
"Just How Are You Playing the Game?"
Marion L. Houston, '30

“For when the One Great Scorer comes to write against your name, He writes not that you won or lost, but how you played the game.”

There is no place in this world for the man who does not play fair. It is true that for a time the cheater appears to be winning and even encourages himself to believe that he is but sooner or later he loses completely, and in the end his cup of bitterness is far worse than it ever could be for the man who played fair and lost.

There are many ways of not playing the game.

It may be wasting your time or the time of others each of which should be used to the greatest advantage in the development of both mind and body. It may be your attitude toward other individuals who are less fortunate than yourself, yet, who came into this world the same way that you came, as your equal or better, entitled to the same rights and privileges as you are, and who will leave the same way as you will. Or it may be cribbing in the preparation of your school work and on examinations.

A few years ago a young man was graduated from one of the finest universities of the country. He had not led his class nor was he at the bottom of it, but while in college he had conducted himself in such a manner that the president of the Institution refused to recommend him to any corporation for a position. He went to one of the middle western states and finally obtained a position through a friend who had been graduated two years before. From the beginning his work was unsatisfactory and as he continued to work it became more so. When the head of his department could not afford to keep him any longer, he was called in for a conference. On his way in he remarked something to the friend who had been instrumental in his obtaining his position about getting an increase in salary. After he had entered the head of his department said. “I have a letter that I want to read to you.” Here is all he heard of the letter:

“It is true that the man of whom you have inquired was graduated from this Institution and inasmuch as we dislike to say anything that will injure the character of anyone, we believe that your request should be dealt with in facts. This man actually cribbed his way through college and when the faculty signed his diploma, each of them felt as if he were doing an injustice to himself as well as to the Institution he represented.”

As he passed out his friend said, “I’m sorry. It was possible for me to help you obtain the position, but I could not hold it for you.”

It is useless to say that he was discharged. After a time he obtained another position and it was only a matter of a few weeks until he lost again. After other unsuccessful attempts to qualify as an engineer he gave up his profession and is now a time-keeper on a section gang and is working with no chance of advancement whatsoever. Did it pay him to cheat?

While we have not thought of literature for some time, it was the elder Sallust who said, “Every man is the architect of his own fortune.” Perhaps he was right. The employer of today is not looking for the type of man who can produce by cheating, and while there are a few that are unscrupulous, ninety-five percent of them want men with a clean record. One of the latter of these young men of whom I have written corporation that employs hundreds of men. While success should not be measured in terms of money, he is receiving his reward for having applied himself diligently, and his life will be a great success in more ways than one.

There are certain types of individuals who will deliberately take an unfair advantage of another simply because it lies within their power to do so. This type of person is not only unfair but is cowardly. Perhaps if the unfortunate character mentioned in this article would have had the nerve to have tried to make his grades honestly instead of cribbing, he would have succeeded in the profession that he chose for his life’s work. But he did not try.

(Continued on Page 24)
The sensation and publicity of the nitrogen industry has been somewhat lessened since the war. But in spite of that fact nitrogen still holds the center of the stage in chemical engineering, and especially so in Europe. The rapid commercial developments in many countries is now being widely discussed. In Italy, in France, in England, and in Germany, the progress that is being made is nothing short of phenomenal. Of the four countries, Germany is the only one not adhering to the latest developments, mainly because her factories are older, and since the wartime equipment is too good to junk, it is still being used.

The Casale-Claude processes of manufacturing ammonia are in great rivalry. The Claude process is the more efficient of the two, but the Casale process is more easily adapted, commercially. It is now being used in about eight nations and appears to be the most formidable factor in the nitrogen situation. Those plants now using the latter process and those which are being built along the same lines will, when completed, have a combined capacity of over 500 tons per day.

Ammonia synthesis is past the experimental stage—it is now a problem of marketing and utilizing it. The resulting products have already driven Chilean nitrates from the European fertilizer industry; now an attempt is being made to replace it in the manufacture of nitric acid. Great progress has been made, and today, nitric acid from this is an actual and successful competitor with the nitric acid obtained from Chilean nitrate.
New Miraflores Power Plant
(Continued from page 10)

pole faces. The stator is wound with open slot coils and can be shifted toward the exciter, thus making all windings accessible for inspection and repair.

Each generator is provided with a 36 kw., 125 v. exciter, the armature of which is mounted on an extension of the generator shaft. These exciters are of the interpole shunt wound type.

The building is of reinforced concrete construction built around a structural steel frame. It extends in an easterly and westerly direction and is divided longitudinally into 5 bays; each of the two end bays being 39 ft. wide, and each of the 3 interior bays 27 ft. wide. Laterally, it is divided into 3 bays, each 26 ft. wide. The height from the basement floor to the engine room floor is 13 feet. The first bay of the basement contains the fuel oil treating equipment, an auxiliary high pressure air compressor, a 1500 KV-A synchronous condenser and its control equipment; the necessary transformers and switching equipment for the plant and engine motors, and two drainage pumps. The space not occupied by the apparatus is devoted to the storage of spare parts.

The auxiliary air compressor will provide the initial charge in the engine air bottles, and will also serve for re-charges should the bottles lose their air by leakage or other cause.

Regulates Current.

The function of the synchronous condenser is to regulate the reactive current on the power system that the voltage regulation on the southern end of the power system will be improved or satisfactorily maintained.

The next three bays in the basement are occupied by the foundations of the units together with their water and lubricating oil auxiliaries and piping, while the fourth bay has been excavated to a depth of 6 feet below the basement floor, and a thin slab provided to exclude seepage water, and is ready to receive the foundation of future unit no. 4.

At the west end of the building at the engine room floor level the office of the Station Engineer and a tool room are located. The first bay of the engine room floor is used as an assembly floor and machine shop. The motor-driven machine tools consist of two lathes, a chaper, a radial drill, a pedestal grinder, and a sensitive drill. In the rear of this bay the toilets and locker rooms are located. A track and roadway provide access into the building in this bay.

The next three bays are occupied by units numbers 1, 2, and 3, while the fifth and last bay is reserved for future unit 4, and has been provided with temporary wood floor at this elevation.

The centerlines of the engine shafts are 15 inches below and the operating platform are 15 feet above this floor, and the extreme height of the engines above this elevation is 22 ft. 6 in.

The heights from the engine room floor to the bottoms of the roof trusses is 45 ft. and 6 in. While this height seems excessive for these engines, nothing is known at this time as to the type of engine that will be installed with unit No. 4, but this height will permit the installation of a double-acting engine.

A 25-ton electric traveling crane has been provided to assist in erection, dismantling, and repair, and although bridges are provided at the operating platform elevation between the units and from units 1 and 3 to the switchboard gallery, these are readily removable so they will not interfere with the travel of the crane hook.

Large windows have been provided to permit the utilization of as much natural light as possible. The windows in each bay are grouped for individual motor operation and their functions are controlled by push-button stations at the engine room floor. A course of ventilating louvers extends around the building under the eaves and louvers have been provided in each end of the roof. These are designed to ventilate the upper portion of the structure.

Roof Of Redwood.

The roof is of Imperial Spanish red tile laid on redwood sheathing. Redwood was selected for this purpose due to its resistance to decay and the action of termites. These characteristics eliminate the necessity of treating the sheathing with creosote and since creosoted woods cannot be satisfactorily painted, light paint applied to the underneath side of this sheathing adds airiness and spaciousness to an already well lighted interior.

The generating station is connected to the substation by a gallery which houses the main switchboard. Here all of the electrical operations in connection with the generating and substation equipments are controlled. The switchboard operator also has control over the speed of the engines by means of his control of the engine governors, and can also start or stop the synchronous condenser, but all other operations in the power plant are under the supervision of the engine operator.

Is Pioneer In Field.

While no operating data are available at this time to prove that the selection of this type of prime mover was justified and while this plant is a pioneer in this class of service, no effort has been spared to coordinate its functions and there is every reason to believe that the performance of the station will satisfy all expectations. It is certain that the operation of this plant will be closely observed by American engineers since there seems to be a reluctance on the part of engineers and central station executives on this side of the Atlantic toward the adoption of this type of unit for central station service.

In contradistinction to this attitude a growing confidence in this type of unit on the part of European engineers is reflected in the measuring application of Diesel engine drive in electric generating plants. The largest Diesel engine in the world is in a Hamburg central station and is a 9-cylinder, double-acting, 2-cycle type, rated at 15,000 brake horse-power. It is direct-connected to a 10,000 kw. generator; a rating that exceeds the entire capacity of the Miraflores plant by 2,500 kw. and is 4,000 kw. less than the entire capacity of the Gatun Hydro-Electric Station.
Graduate Obtains Distinguished Degree

THE fact that Nathan A. Bowers, who was graduated in 1910, has received a Doctor of Philosophy degree in Civil Engineering from Stanford University, was recently made known to the Institute. This was the first instance in the history of Stanford University that a degree of that nature has ever been awarded. The achievement came to Mr. Bowers following a brilliant professional record, together with three years of post graduate study and research, and was received at the graduation exercises last June.

As part of the requirements for the degree, Mr. Bowers submitted a thesis on "Engineering Failures in the Water Power Field." Beginning with the reservoir and giving attention to dams, tunnels, penstocks, valves, control apparatus, hydraulic turbines and draft tubes, the scope of the study extends from point of diversion to tail-race. The subject chosen was particularly appropriate because during sixteen years of editorial work with the staff of the Engineering News-Record Mr. Bowers has specialized on hydro-electric developments and has had frequent opportunities to personally investigate accidents and breaks in that field. To this personal experience and to heretofore unpublished and confidential data secured at first hand from other engineers Mr. Bowers added authentic information on failures gathered through an exhaustive review of English and foreign technical publications. By special arrangement with Stanford University, the confidential material contained in the thesis will be held in trust.

Mr. Bowers first joined the staff of the Engineering News-Record in 1910, the year of his graduation, going to the New York office. Two years later he was sent to Vancouver, B. C. to represent the News-Record in the Pacific Northwest, and in 1914 was made Pacific Coast Editor of the McGraw-Hill publications with headquarters in San Francisco. As part of this assignment he served as the Pacific Coast editor of the Electrical World from 1914 to 1919.

In addition to his many other occupations, Mr. Bowers has served as secretary and treasurer of the San Francisco Engineering Council for two years as well as filling the same position five years with the chapter of the American Society of Civil Engineers in San Francisco. He is also a member of the Engineer's Club of San Francisco, having recently been elected its president after a term of first vice-president. It is a distinct honor for Mr. Bowers to receive the presidency of the Engineers' Club since many notable engineers have been members during its existence. Herbert Hoover, present secretary of commerce, was a member of that club during the extent of his engineering practice in the West.

Nathan Bowers is a firm believer in student activities at Rose Tech, and in a letter enumerates their value to the graduate after college days. He cites the student council and journalistic work such as the Rose Technic as outstanding examples of student activities which contributed to his success after graduation.

The response of the Rose Poly Alumni to the first Homecoming Day ever attempted was glorious and gratifying to the efforts put forth by the committee in charge. There were more than fifty men who returned to share in the enjoyments of the day, which were led by the opening of the new dormitory.

A list of those alumni who registered is given below in order of their year of graduation.

Herbert Foltz.
NO one can retain the slightest doubt that the alumni section of the Rose Technic is one which is most often turned to by alumni. Realizing that fact, the alumni editor strives to secure all the news possible concerning Rose Tech alumni, but is in many ways handicapped. Now, if more of alumni would drop in a line occasionally especially when a change is made, we could materially add to the interest of that section. Can the staff of the Rose Technic look forward to many interesting letters from the alumni in the near future?

Another manner in which the Alumni can help the staff is to write or secure articles for publication in the Technic. As a manner of information to each alumnus, we are required to have fifty percent of the reading matter in each issue pertain to engineering. Nothing can better help us achieve recognition among Engineering College Magazines Associated than to have articles written by our own alumni. As far as material is concerned, we feel that no other technical school has better ability among its former students, and to receive cooperation from our alumni would be the finest Christmas gift we can imagine. It would last throughout the coming years.

ALUMNI NOTES

'05
E. Ernest Larkins, who was formerly practicing Civil Engineering in Buffalo, has moved to New York City. His address is as follows; Fraternity Clubs Building, 22 East 38 Street, New York, New York.

'08
Arthur S. Hathaway Jr., has been teaching engineering students at Pennsylvania State College, at State College, Pennsylvania, in the capacity of Assistant Professor of Civil Engineering. He is now Assistant Professor of Civil Engineering at the Engineering school of Northwestern University Address him at 1907 Sherman Avenue, Evanston, Illinois.

'13
L. Wallace Lewis, who after graduation began work with the electrical department at Panama, recently had an article in the Panama News concerning the use of Diesel Engines as a source of motive power for electrical power plants. He has kindly given us permission to use the paper which appears in this issue. The author is now Assistant Engineer of the Panama Canal at Balboa Heights, Panama.

'14
Walton L. Woody, the former Acting Manager, Cleveland Works, National Malleable and Steel Castings Company, at Cleveland, Ohio, is back in that city after being in Indianapolis for several months. His present address is 3383 Sylvanhurst Road, Cleveland Heights.

John T. Scott, who is with the Metals Refining Company at Hammond, Indiana, has been at his home in Terre Haute to recuperate from an illness which was not cured until he had undergone an operation at Mayo Brother’s Hospital at Rochester, Wisconsin. He will return to his position as a chemist, when he completely recovers.

When Professor Child represented Rose Tech at the International Conference on Bituminous Coal held at Pittsburgh in November, he had the opportunity of visiting with several Rose alumni. Among these graduates was Richard D. Leitch, who is the Associate Chemical Engineer with the U. S. Bureau of mines at Pittsburgh. Mr. Leitch is investigating water pollution of the waters from the coal mines in the Pittsburgh region.

Frank Casper Wagner Jr. who is with the Central Power Company of Texas, has been transferred from Sinton to Crystal City, Texas. He was previously with the Ice and Cold Storage Company of Richmond, Indiana.
The Fraternity Man

I never saw—I do not believe I ever saw—a hundred per cent fraternity man. Most all of them are fifty per cent. If we could just push that average up to 60, 70, 80 or 90 per cent of the fraternity life that we talk about in our idealism, we should actually change the whole scope of American college life. Ah, yes, we should change the whole character of the thought of the American people of tomorrow. I appeal to you for spirituality in your chapter life, for the finer things that are represented in the motto, the badge, the grip, the song, the group where perhaps not a single word is said... I am not sure that the American college fraternity is going to endure. I do not know what obstacles there are before it. I do know this: that if every fraternity man would live up to his ideals there would be no complaint on the part of the deans, no questioning on the part of boards of trustees; there would be only satisfaction, and everybody would register the conviction that the college fraternity is one of the most useful institutions ever introduced into American college life.9

* Excerpt from a speech delivered by Dr. Francis W. Shepardson, Beta Theta Pi, at the 1926 Convention of Phi Sigma Kappa Fraternity.

SIGMA NU

Activity among the Sigma Nus around the last of November was centered towards the entering of our newly purchased house at 441 North 8th Street, just across the street from the traditional Heminway Park. The combined house cleaning abilities of the members made short work of the task of straightening up the interior.

To extend a rather formal opening of the house to themselves and to the alumni located in Terre Haute, a house dance was held on Wednesday night, December 22. This affair served in more than one way. First it was a housewarming; secondly, a fitting finish to the midterm exams; and thirdly, it served as our Christmas dance annually held at this time of the year. Harry McDaniel furnished the sizzling strains that sent the addicts to gliding madly over the newly polished floors. Despite manifested desires to dance, a way was made for Santa Claus to enter later in the evening. Then followed the presentation of amusing gifts to each party present.

Sigma Nus met Sigma Nus when the peak of athlete events was held at Chicago, the last of November. The occasion of the Army and Navy game brought brothers to the Windy City from both the service schools and Rose Poly. Brother Clark Piper, late of the class of 1927, was there from West Point, and incidentally a member of the football squad. Brothers, Brodie and White, formerly of the class of 1929 represented Annapolis. Brother Brown, West, Harris, and pledge brother Menden were four who attended from Beta Upsilon. In having the opportunity to see brother Piper, the opportunity to meet brother Tobin was afforded. He entered West Point last summer after two years at Cornell, where football experience received there aided him in making the Army football squad. While in Chicago, we had the opportunity to look up Brother Steffen, who is at present with the Woolworth Company in that city.

Brother Ray Biller of Indianapolis was a visitor to the house on Saturday night, December 4, 1926. He enjoyed an inspection of the new house during his stay.

THETA KAPPA NU

Of principal interest in affairs of the fraternity in the near future is the annual Christmas dance which will be held at the Edgewood Cabin on Christmas night. The Christmas dance is perhaps the biggest event of the year, because at this time many alumni return to the fold to be with us during the holiday season. This year, the indications are that more of the “old grads” will return than ever before. Harold York, chairman of the social committee has announced that the music for that dance will be furnished by Ada Campbell’s orchestra, and also that good old Santa is planning to make us a special visit at that time.

During the past month visitors have been very frequent at the house. Among the Alumni who paid us a visit were Earl Dawson, ’25, of Owensborough, Ky., John McCormick, ’21 of Chicago, Ill., Max Sherwood, ’26, and E. Wayne Watkins, ’26, of Cincinnati, Ohio and Orville M. Dunning, ’25, of Schenectady, N. Y. We were also honored with visits by Brothers Bell, Sonner, and Weusting of Indiana Beta Chapter at De Pauw University.

Indiana Gamma is pleased to announce the pledging of Wayne Kehoe, class of ’28.

Theta Kappa Nu takes this opportunity to wish to everyone a very merry Christmas and an enjoyable holiday season.

(Continued on Page 22)
CLARKMEN WIN OPENING GAME

Displaying some fairly accurate shooting along with flashes of passwork at times that resembled mid-season form, the Rose Poly Engineers officially opened the season Dec. 8 at the Rose Poly gymnasium with a 32 to 20 victory over the quintet representing the Normal College, American Gymnastic Union of Indianapolis. During the greater part of the first half the two teams fought on practically even terms, only two points separating them at the halfway mark, but in the second period the Engineers found themselves in much better form.

During the greater part of the game, the play was ragged, typical of an early season game, but the Engineers displayed an offensive and defensive that gives hope for the future games of the season when the players gain a little more experience in working together. During the latter part of the game, with the N. A. G. U. five desperately trying for a rally, the play became fast and furious, and numerous fouls were committed. However, the game was held well under control, in spite of the fact that each team was hitting hard.

Rose Took Lead.

Rose Poly pulled out to a lead at the start of the game, when Kasameyer connected from the side of the floor and Thompson came right back a moment later with another shot from under the netting. Then the N. A. G. U. defense tightened while Howard put his team back into the running with a goal from the foul line and another from the side of the floor. During the rest of the period the count remained close, with the score being knotted just a few moments before the period ended. Within the last minute of this period Kasameyer came back with another goal that gave the Engineers a 12 to 10 lead at the halfway mark.

During this entire period the Rose defense had been forcing the N. A. G. U. five to take some long shots, and but few of them were made good. However, the defense of the Physical Eds was also functioning in good shape, and Rose was getting but few open shots at the goal. Kasameyer led the scoring for the period with three goals from the field, while Berry had twice located the netting and Thompson had found it on one occasion.

Thompson Shines.

But in the second period Thompson recovered his eye. He began working through the N. A. G. U. defense for close shots which he made with unerring accuracy and counted five times during the period from the field. After about five minutes of play an entirely new team was sent in for the Indianapolis quintet, but even that did not have any results in checking the onward march of the Engineers. With victory in sight they began to play a much smoother brand of ball and were holding the Physical Eds completely in check. A late rally was attempted, but it was thwarted when Coach Clark sent a host of reserves into the fray with only about three minutes to play.

For the Engineers the defense, with Goddard working at floor guard and Taggart at back guard, looked better than any brand of defense offered by the team during the last seasons. Taggart broke up the close shots with marked regularity, Thompson worked the floor in excellent shape, in addition to connecting with the netting on six different occasions, while Kasameyer and Berry teamed together at forwards like veterans. The reserve material also worked in good shape and, for the first time in years, Rose appears to have a well balanced aggregation.

Howard, working at floor guard and forward for the N. A. G. U. five, was easy the outstanding star for the Indianapolis quintet, working the floor with speed and accuracy and displaying a fair eye for the netting. Captain Freuch also fought hard for the Indianapolis five, while Overman, a substitute forward, displayed plenty of speed during the time that he was in the game. Lineup and summary:

Rose Poly (32), N. A. G. U. (20).

Berry  F  Mute
Kasameyer  F  Nilson
Thompson  C  Duerr
Goddard  G  Howard
Taggart  G  Freuch

Substitutions—Rose Poly: Reinking, Franzwa, Dean, Sawyers, Moore, Todd. N. A. G. U.: Clark, Mumenthaler, Neu, Overman, Goldstein, Rothe.

Scoring—Field goals: Berry (2), Kasameyer (3), Thompson (6), Goddard (2), Howard (3), Overman, Duerr, Mumenthaler, Clark. Foul goals: Kasameyer (3), Thompson, Goddard, Taggart, Nilson, Duerr, Howard (3), Overman.

Time of halves—Twenty minutes. Referee—Russell.
the field in the entire game gives one an idea of the caliber of defense used by Indiana Central. And the fact that the Indianapolis quintet made 15 goals from the field gives one a comparative idea of the caliber of defense used by Rose Poly. At times when the Engineers would get the ball away from the visitors at their end of the floor they would pass down to their end only to lose it to a superior defense. Indiana Central would then travel back to their end, and if Bailey didn't cage one, Franke, the tall center would eventually score two points.

The nature of the game was more on the order of a competitive contest to see which team could make the most fouls. There was a total of 29 fouls called during the game, with Indiana Central receiving the majority of 17. In spite of this uncommon feature no one man was eliminated from the game via the personal foul route. In one or two cases a player was taken out when he had received three of the demerits.

**Show Power.**

After the overwhelming defeat handed Indiana Central by Franklin College earlier in the week the visitors came here reputed as not being so powerful. The knowledge of this game seems to have gained a hold of over-confidence in the minds of some of the Rose men, which is undoubtedly one reason why they fell down in their second game of the season. During the first few minutes of the game, while the visitors were indicating their aggressiveness with immediate execution of their defense and offense, the Engineers appeared as calm as though nothing was impending. A little later, as Indiana Central continued to gradually add points to their score, Rose Poly realized the conditions as dangerous, but found themselves unable to rise to the occasion. At the start of the second half some of the old time fight began to appear in the ranks of the Engineers, but the visitor had not decreased any in their scoring power. The second half showed them holding the upper hand in practically every style of basket ball.

Franke at center was the high point man for the visitors and in the game. He scored seven goals from the field and nine from the foul line. Bailey, at forward, was the second with four field goals and one foul goal. Kasameyer was the high point man for the Rose five with two field goals. Lineup and summary:

<table>
<thead>
<tr>
<th>Rose Poly (16)</th>
<th>Indiana Central (37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasameyer</td>
<td>Bailey</td>
</tr>
<tr>
<td>Thompson</td>
<td>Harvey</td>
</tr>
<tr>
<td>Berry (Captain)</td>
<td>C. Franke</td>
</tr>
<tr>
<td>Goodard</td>
<td>G. McClanathan</td>
</tr>
<tr>
<td>Taggart</td>
<td>Smith</td>
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**TRACK PROSPECTS BEST IN YEARS**

**Letter men and recruits are expected to go big.**

ALTHOUGH the opening of the track season is several months away, most of the old reliable and new men are working out steadily in an effort to get a jump on Father Time. In regular outfits and with all necessary equipment, they go through their paces regularly although Coach Heze Clark has little do to towards their welfare at present. In a word, we would say that the men are looking good even at this stage.

There will be more letter men to greet the coach when the time rolls around than there has been in several years. In every branch of the sport there is expected a letter man and if not, there will be some new man who will be capable of performing his duties just as well as any so-called regular. In some cases it seems that a few of the men of last year's thinclad organization will be forced to step in order to win out over some of the new arrivals.

The dash men will be especially strong this year with the old heads who will take care of things in that line. Dean, a freshie hopeful, is expected to make good with a vengeance in his first season and adds considerable to the men who have held up Rose's standards in track in the past two or three years. In each event, from the 100-yard dash to the longest of the distance runs, there will be a man of repute. With Art Reinking, Stallard, and Milo Dean to burn the paths, it seems that opposing dash men will be in for tough days when they meet the cinder artists from Rose Tech.

**Middle Distance Stars Return**

In the 220-yard meets there will be Dean, Bob Wade and Stallard to compete, and this galaxy looks every bit as promising as the men named before who will work in the century dash. The same trio will bear the burden in the 440, and should account for numerous markers in this line.

The distance men will be well represented this year as well as the dash men. With Swalls and Reeves to work the mile, Reeves and Gammill in the 2-mile, and Munzt and Swalls in the half mile, prospects are more than promising; they seem almost certain. It will be remembered that Reeves was a freshman last year and that he broke one of Rose's track records, the 2-mile.

Sawyers will be looked upon to toss the javelin for a number of counters and should be able to come through often enough to aid the school. The discus throwers are to be developed as Big Bob Aitken is one of those among the missing this year and he will be missed not a little. Prospects will be in Ellis and Borries, freshmen, and Sawyers. All three of these will be given thorough training and will be in shape to work well when the season is started.

The high jumpers will be found in Barrett and White. This duet should account for a lot of markers. White and Derry will perform in the broad jump and should have been benefited by experience to such an extent that they too, will be enabled to work for the benefit of Rose.

**Fine Hurdlers**

The hurdlers are well represented when one considers the prospects of Lahti, former Clinton star, Davy, a freshman of real ability, and Derry, who broke a record in Rose hurdles. Lahti may be eligible at the start of the next term, and if so, he will be one of the best of the Frosh hopefuls and should go

(Continued on page 28)
Take a tip from the triple-threat man

He keeps them guessing, does the back, because when he gets the ball he can pass, kick or run—a triple threat.

Men preparing for industry or commerce can put themselves in an equally strategic position. It all gets back to the simple idea of being broad and versatile.

An engineer should be well up on his specialty, of course, but he should also keep an open mind for questions of finance, law and public relations—if he aspires to a high place in the councils of his organization.

Such “all-aroundness” typifies in particular men who have brought the electrical communication industry to what it is today, and who will carry it to still greater development in the years to come.

Western Electric Company

Makers of the Nation’s Telephones
A Fraternity
You and two or three others that collect twenty-five or thirty more to make the things pay.

Engineers Will Attend
The dance will be held in the Lewisburg Fireproof Garage.

A Six or an Eight
"Why do call your car "Flapper?"
"Steamline body, swell paint job, pick up, all kinds of speed, keeps me broke, and is always ready to go."

A girl swears she has never been kissed. No wonder she swears.

Friend Wife: "John, dear, what are you opening that can with?"
Hubby: "A can opener, of course."
Friend Wife: "From what I heard I thought you were opening it with a prayer."

Father: "Remember son, beauty is only skin deep."
Son: "That's deep enough for me. I'm no cannibal."

Full Dress
Co-ed (answering the door-bell): "Time for the dance?"
Frosh (beholding an evening gown for the first time): "Yes, put on your dress and come on."

"Is he a nice boy?"
"No, dear, I think you'll like him."

"She's very photographic."
"Really?"
"Yes, sits in a dark room and awaits developments."

She: "I can't light this match my foot is too small."
He: "Scratch it on you-er—better let me light it."

Grad: "What salary do you think I'm getting?"
Undergrad: "Ah, about half."
Grad: "Half of what?"
Undergrad: "What you say."

He: "We're coming to a tunnel, are you afraid?"
She: "No, not if you take that cigar out of your mouth."

In the parlor there were three.
She, the parlor lamp, and he.
Two is company there's no doubt
So the little lamp went out.

She Reads the Law
Slim claims his new girl reminds him of a traffic cop. She always has her hand out, tells him to "Go Ahead", and when he does, she hollers "Stop."

...It Filled the Bill
"Write me a story," said the teacher, "that contains some reference to religion, modesty, and to the nobility. "And it must be short."

Ten minutes later Johnny raised his hand. "Well Johnny, let's hear what you have written." And Johnny read: "My Gawd," said the Countess, "take your hand off my knee."

Mistress: "Are you married?"
Applicant: "No'm, I bumped into a door."

Old News New
"I'm a father!" cried the young clerk as he rushed into the office. "So's your old man," replied the boss. "Get to work."

Some girls are like low priced autos—good lines, but not much under the hood.

She: "The only men I kiss are my brothers."
He: "What lodge do you belong to?"
Modern machinery is Timken-equipped machinery. This is evident from the speed with which Timken Tapered Roller Bearings are being adopted by the greatest makers and users of every type of mechanical equipment. Therefore whether your engineering career leads to the design, construction or use of machinery you will be increasingly called upon to deal with Timken Tapered Roller Bearings.

You are sure to find Timken anti-friction properties a great means of conserving power and lubricant. You will also find precision, endurance and refinement best assured by Timken ability to carry both thrust and radial loads. And you will find Timken POSITIVELY ALIGNED ROLLS, Timken Taper, and Timken-made steel universally considered as supreme contributions to modern bearing practice. All these economies and betterments give Timken Tapered Roller Bearings their outstanding place throughout modern engineering. From this universal success come the resources and leadership of the Timken institution.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN
Tapered
ROLLER BEARINGS
Where dependability is vital

In connection with a new pumping station at Milwaukee, Wisconsin, additional feeder mains were required. It was necessary that one of these should carry an unusually large proportion of the water supply, and 54-inch pipe was decided upon. Although pipe of material other than cast iron had a lower first cost, Cast Iron Pipe was chosen because the possibility of interruption to service had to be reduced to a minimum.

The photograph above shows a section of pipe being lowered into the ditch in the process of laying it.

The Cast Iron Pipe Publicity Bureau
Peoples Gas Bldg., Chicago

Fraternities

(Continued from page 16)

ALPHA TAU OMEGA

A. T. O.'s are preparing for their annual Christmas Formal. This is the biggest dance of the year and under the direction of "Tommy" Reed the dance is sure to be a success.

The Thirtieth Biennial Alpha Tau Omega Congress was held in Tampa, Florida, from December 29, 1926 to January 1, 1927. Gamma Gamma will be well represented. Bros. Booth and Crutcher have already signified their intentions of being among those present.

The chapter is well represented on the current basket ball squad. Bros. Kasameyer, Franzwa and Sawyers are giving direct material aid to the team. Brother Alexander is in charge of the freshman squad and with his knowledge of the game he will no doubt develop some fine material for future varsity teams.

ALPHA CHI SIGMA

Those who are interested in chemistry and its advancement in technique and scope of practice would very much enjoy attending the professional meetings of Iota chapter. These meetings are held each month and at least two topics are presented. The subjects in the past have ranged all the way from "Radium: Its Extraction and Uses" to topics such as, "Late Methods of Low Temperature Carbonization of Coal." "The Chemistry of Germ Cultures and Bacterial Growth" has also been presented. It is the chapter's occasional custom to ask some business man or minister to be present and informally talk from his viewpoint. Thus these attending are sometimes led beyond the pale of engineering, and many pleasant sessions have been the result.

These monthly professional meetings are to be continued during the next year, and effort will be made to make them thoroughly instructive and educational. Various members of the Rose faculty will be invited to attend and give short talks. Iota wishes more than ever to emphasize the professional character of Alpha Chi Sigma fraternity.

The annual Christmas party will be held at the home of Kenneth Metcalf, 1718 N. 10th Street, on the evening of December 28. Many of the alumni have signified their intentions of being present. Among those already heard from are Clarence L. Corban '26, Ernest Pifer '26, Everett C. Gosnell '25, Garnet Phillips '25, Gustave H. Pfeiffer '25, and John Sanford. Many novel surprises are planned for the event, which promises to be a complete success.

THETA XI

The Theta Xi fraternity holds its annual Xmas dance at the chapter house on the night of December 22. The affair is a favor dance and promises to surpass any of the dances held so far this year. The real true-blooded Santa Claus from the far north has ben asked to be with

(Continued on page 81)
Worthy Members of a famous family—

the larger Brown & Sharpe Automatic Screw Machines

The record production of Brown & Sharpe Automatic Screw Machines is a by-word from Detroit to Delhi. The two “big brothers” of the family, Nos. 4 and 6, share this fame in their field,—the rapid production of larger turned parts.

Both machines are built sturdily, to take heavy cuts. All the work turned out is consistently accurate. Several exclusive features insure ease of control, simplified tooling, and, above all, economical operation.

The No. 24G Screw Machine Catalog describes the Brown & Sharpe line of modern screw machines, including the Nos. 4 and 6. Everyone interested in the latest development in Screw Machines and their important part in modern production methods should have a copy. We shall be glad to send a copy at your request.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.
Valve knowledge means money saved

The valve illustrated above is all-iron. It is for use with fluids that destroy brass and bronze. Because it is inexpensive, serviceable, simple, durable and compact, it is extensively used in oil and gas fields and refineries, mines, smelters and all classes of manufacturing plants. But for many purposes it would never do: Crane special brass, ferro-steel or cast steel would be essential.

Crane knows its metals. It knows their tensile strength, their reaction under all pressures and temperatures. It knows how to get uniformity in its valves. Such knowledge, in your hands, means ability to save your employers’ money. For the preparation of a class paper or after you begin the practice of your profession, you will find Crane always glad to put all its knowledge in your hands. Rather than seeking to sell you materials, it will seek to help you find exactly the equipment you need.

Smokeless Coal

(Continued from Page 4)

proaches the southern West Virginia coals in matter of quality, some of it is inferior. Analysis of delivered coals show that it ranges from 0.6 to 3.1 per cent sulphur, from 6.1 to 17.5 per cent ash, and from 15.2 to 25.8 per cent volatile matter. The average analysis of delivered coals from Cambria, Clearfield and Somerset counties being about as follows:

| Moisture | 2.3 per cent |
| Volatile matter | 19.3 “ |
| Fixed carbon | 71.3 “ |
| Ash | 9.4 “ |
| Sulphur | 1.6 “ |
| B. t. u. | 13,789 |

The term “smokeless coal” is a challenge to the combustion engineer. None of his art is needed to make anthracite and coke burn smokelessly, but as increasing amounts of volatile matter are associated in the fuel, more and more demands are made upon his skill in furnace design, in adaptation to service, and to care in operation to keep within absolute or even practical smokeless limits. Illustrations can be found of smokeless performance of every fuel, so that the statement can be made “that it can be done.” That it is not done simply indicates that it is not wanted badly enough to pay the price. Most engineering is a compromise among conflicting requirements. Smokeless operation usually requires the cooperation of several interests, sometimes management of a high order, and often a degree of care and attention difficult to buy. Financial and operating limitations are many. All of these elements enter into the practicability of attaining smokeless operation, and obviously each case must be considered by itself.


Just How are You Playing the Game?

(Continued from page 11)

He cribbed, and in doing it he took an unfair advantage of those who were his friends, of those who had confidence in him and were willing to help him, and he failed completely.

Now quoting Polonius’ words in Shakespeare’s Hamlet, “To thine own self be true; and it shall follow as the night the day; thou canst not then be false to any man.” Your success depends entirely upon what people think of you, and in order to make people think well of you, you must play fair. If you do not, it is not a question of whether or not you will lose, but how long it will be before you do. It is not necessary for someone to tell you when you are not playing fair for that was provided for in the structure of man hundreds of years ago. Play fair. It pays. You may not think so now, but if you do, there will be a time when you will be exceedingly glad that you did. Think it over.
MANUFACTURERS of motors and generators formerly took the stand that the staunch construction of their apparatus rendered protective devices unnecessary.

Now they know that there is a limit to the life of even the best built motors or generators—that overloads and short circuits are destructive and costly. Industrial engineers and executives have found it far cheaper to give their equipment the finest protection available rather than trifle with inadequate forms of protective devices.

I-T-E Circuit Breakers have, for almost 40 years, been giving electrical machinery and power circuits the right kind of protection—insuring such equipment—every minute—every day—year after year—against burn-outs and destruction.

THE CUTTER COMPANY
ESTABLISHED 1888—PHILADELPHIA
When writing to advertisers please mention Rose Technic.

CUTTER
U-RE-LITE • • • I-T-E CIRCUIT BREAKERS
Concrete Handling Equipment
Steel Derricks - Industrial Cars
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ALL CLASSES OF STRUCTURAL STEEL FABRICATION

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A. C. RASMUSSEN, '09
Chief Engineer
FRED B. RAY, '20
Asst. Chief Engineer
ROBERT T. REINHARDT, '11
GORDON K. WOODLING, '20
RUDOLPH A. JAENISCH-Ex., '16

Christmas and

Mewhinney's

CHOCOLATES

The Ideal Gift—Convenient, inexpensive, and appreciated. Nearly all the Better Druggists in Terre Haute sell MEWHINNEY'S Chocolates.

“She’ll Know they’re the best if they’re Mewhinneys

A. B. MEWHINNEY CO.
TERRE HAUTE, IND.

The Evolution of Engineering
(Continued from page 7)

of humility as would assign to us but the average measure of understanding, might readily despair of our ability to make any contribution.

Have there been failures? Are failures a part of the scheme of evolution in human progress? Yes, the way has ever been strewn with failures. Failures have but more surely pointed the way in which improvement lay. Progress has ever come by taking the best at hand and adding to and improving it. In the laboratory there may be a thousand experiments before the result desired is found. It is so in all human endeavor. The lamentable failures are those which are not promptly discovered and discarded.

In the evolution of human progress, there has been an ever widening circle of influence tending towards progress. We have seen that better materials of construction call for better methods. These bring about better structures, means and facilities. The improvement in these, in turn, calls for still better materials and methods. So each progressive step makes possible and demands more progress along other lines. The advances in engineering and applied sciences have done much more than add to man’s comfort and convenience. They have not only made it possible, but have at the same time been a great inspiration for his advancement in art, culture, in social and political relations, in a better understanding of his intellectual and spiritual nature and of his destiny. A Polytechnic Institute has an atmosphere that is fundamentally an inspiration for constructive effort. If the time which has been spent here is to have a lasting influence for good, it must be in making life constructive. Looking forward into the future your opportunities to be constructive in material and spiritual phases of life are unlimited. All of us blessed with the good fortune of living in this day and age, and in this country, have abundant opportunity to have a constructive part in the progress of the future towards a still higher and better civilization. To do your part it is necessary to cultivate the creative impulse, inquire into the why and how and enter upon the duties of life with a spirit of zeal and open mindedness. The fund of knowledge today is vastly greater than a generation ago and yet it is but a spark to that which the coming generation will fall heir to. To keep the spark of knowledge alive is something, to fan it into a flame is much more. The mere laborer for hire does the first; to do the latter is to be constructive, to justify the training which it has been your privilege to receive and repay in some small measure the debt to those who have handed down the knowledge which makes life for all today expressively richer and fuller than ever before. I bespeak for you the largest success and trust you may prove worthy successors of those who in whatever profession you may choose to follow have won immortal names.

Gratitude

“Are you the man who saved my little boy from drowning when he fell through the ice?”

“Yes.”

“Where’s his mittens?”
ALUMNI NOTES
(Continued from page 15)

'18
John W. Bolton has left the Frank Foundry Company at Moline, Illinois to accept a position with the Leuenheimer Company at Cincinnati, Ohio on December 1, 1926. His present position concerns work in brass foundrys.

'24
F. Ray Martin, has moved to 625½ Kentucky Avenue, Paducah, Kentucky. He was, until recently, an instrument man with the Illinois Central Railroad at Jackson, Mississippi.

Alexander L. Sherwood who undertook to follow the life of a journalist after graduating, has accepted a position with the Publicity Department of the Westinghouse Electric and Manufacturing Company at Pittsburgh, Pennsylvania. He was with the Associated Press at Detroit, Michigan. His present address is in care of the Downtown Y. M. C. A., Pittsburgh.

Shortly after his graduation from the Institute, G. Raymond Fitterer accepted a position in the laboratories of the Stanley Tool Company, at New Britain, Connecticut. At the present he is with the U. S. Bureau of Mines at Pittsburgh. Along with his work he is studying for his master's degree at Carnegie Institute of Technology.

'25
Orville M. Dunning after graduation went directly into testing with the Radio Department of the General Electric Company at Schenectady, New York. He is now employed in the same department but concerned with problems of design and improvement of Radiolas. Orville was a visitor to the institute on Saturday, December 4, when in a meeting with the officials and boosters of the radio club, he assured them that the General Electric Company might find it possible to assist them in their venture.

Charles E. Moench left his position with the Atlas Portland Cement Company at Hannibal, Missouri to return to his home in Terre Haute where he is recuperating from an illness.

'26
Clarence Corban is with the U. S. Bureau of Mines at Pittsburgh, where he is conducting a series of investigations on the problem of clinkers in Central Power Plants. He is also taking advance work at Carnegie Institute of Technology which will lead to his master's degree.

LOST AND FOUND
Through the kindness of Dr. J. C. Bohm, a former resident of Terre Haute but who now practices medicine in Tacoma, Washinton, our attention was called to his finding of a class pin of Rose Poly for the class of 1894. The initials C. M. R., engraved on the back of the pin, which lead the authorities at the institute to suspect that it might be the property of C. M. Ridgley of the class of '96. Inasmuch as there were few members of the class of 94, it was Dr. Bohm's belief that the pin would be highly valued. Should any alumnus be interested, he can address Dr. Bohm at 2002 N. Proctor Street, Tacoma, Washington.
Athletics

(Continued from page 18)

well in track during his stay in the school for engineers.

Barrett will be expected to toss the shot for some nice distances this season and he will have a number of others to bear with him in the campaign. Ellis and Borries are a couple of yearling men to aid in this line. The pole-vaulting will be taken care of by White to good advantage.

One of the best tracks to be found in this part of the state will be at Rose when our oval is completed. The straightaway, which has a possible 220-yard length, will be one of the best features of the track and will be the scene of several hectic heats. At present only 120 yards are completed, the delay being attributed to the lack of necessary cinders. The entire course is graded and fairly well packed, but the finishing touches are as yet to be applied.

Most of the men are out and in training each evening although the campaign is several months in the future. A few are out for basketball and will not be available until the close of the court season, but basketball is a wonderful conditioning sport and the men in question should not be far from track condition when they don the thinnies. The necessary equipment has been handed out to those who care to go through their paces in strict style and a few are being prevailed upon to get into condition as soon as possible.

With this host of material Coach Clark is looking forward to a banner year in this type of spring athletics and it seems that his hopes will be rewarded in a large measure. The schedule for the year:

April 9—Triangular Meet: Butler, Oakland City, Rose. (Here)
April 16—E. I. S. N. (Heer)
April 23—Triangular Meet (Indiana Central, N. A. G. U., Rose) at Indianapolis.
April 30—Terre Haute Relays for high schools.
May 7—Hoosier Relays at Danville.
May 14—Little State Meet at De Pauw.
May 21—Big State Meet at Bloomington.
Coach Clark is contemplating taking four or five men to an indoor meet at Louisville, Ky., about the middle of March, although nothing definite is known at present. A similar meet at Indianapolis may find a few Rose men among the competitors.

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us on that night, and will distribute the favors and
remembrances to those present. Leo Baxter and his
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music that could be asked of any five people. In all,
the affair appears to be one which will long be re-
membered by all those who attend.

The Theta Xi Mother's Club entertained the mem-
ers of the fraternity with a dinner bridge on the
night of December 16.

Most of the boys will remain in Terre Haute over
the holidays, their homes being so far away that they
are unable to make round trip connections during the
vacation period. Brothers Shaw, Collins, Trautman,
Corp, and Dufendach will remain at the house.

Brothers Muntz and Leake will go to their respective
homes to spend Xmas.

During the holidays brother Leake will represent
Kappa chapter at the 63rd annual convention of the
Theta Xi fraternity to be held at the Benjamin Hotel,
Philadelphia.

Bro. John Garrigan dropped in on us over the past
week end. He is employed by the Pennsylvania R. R.
in Casey, Illinois.

Bro. J. Pellum and Johnnie Leake are expected to
motor from Louisville to attend the Xmas dance.
Alumnus H. Merrill '25 honored us with his pres-
ence December 11 and 12.

Word has been received from Bro. R. Dix that he
is attending the University of Montana.
Research and Progress

(Continued from page 12)

The absorption methods have been improved, and through the use of refrigeration, it is no longer necessary to use caustic soda to clean the gases. Furthermore, this synthetic ammonia is now being neutralized with nitric acid, forming a crystalline ammonium nitrate. This product is then mixed with gypsum in an equal amount and sold as a fertilizer in competition with Chilean nitrate. The air-nitrogen industry is pushing steadily ahead in its commercial as well as technical aspects. In the United States the same revolution is practically true, but in a modified sense.

GREENTREE tunnel, near Pittsburg, Pa., seems to have attracted much attention, due to the extensive repair work it has recently undergone. The mere fact that the tunnel was repaired, however, is not the noteworthy fact; it is the engineering ingenuity and skill by which the work was accomplished that deserves mention.

Briefly, the tunnel is of double track bore, 4,716 ft. long, and walled with a concrete lining two ft. thick which was placed in the tunnel by the pneumatic method. Under the strain of a few years these same walls showed signs of disintegration. At first this cracking was allowed to continue, but longitudinal cracks up to 300 ft. long latter appeared and the need for repair became apparent.

The “how” of repairing was then felt. A three ring brick arch from spring line to spring line would suit the purpose, but the chipping required to maintain sufficient clearance meant an excessive cost. The final decision was to grout the cracks, replacing the disintegrated concrete with gunite. Two months after the work was started 4,143 barrels of cement had been used for grouting. The results obtained are of the best type and fulfill the three objectives of the repair work; those of sealing the cracks, making the packing solid, and stopping practically all seepage.

The causes of the disintegration of the concrete are many. The structure and porosity of the concrete is the major one of importance, for it allows the infiltration of sulphur water from overlying beds and causes a leaching out of the cement. In addition the mechanical and chemical action of the locomotive blasts and the action of frost plays an important role in the cracking of the lining.

Prior to the application of the gunite, all the inferior concrete is removed until the durable surface is exposed. Then anchor bolts are placed at approximately 24” centers to which is attached a galvanized network. The surface of the tunnel to be repaired is then cleaned and sand blasted, immediately after which the gunite is applied (never less than 2” thick). The mesh itself must be 1” from the finished gunite surface.

This method of repairing then, accomplishes the following: (1) is seals the cracks, (2) solidifies the packing and overlying strata, (3) stops all seepage, (4) prevents the infiltration of air and sulphur water, and (5) hinders further locomotive blasts and frost action; it is the latest in tunnel repairing.

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That's what Howard D. Ege had in mind in his early schooling at Grand Island College. It was actively developed during 1919-21 when he worked nights in a Lawrence power plant while completing work for his B. S. in Engineering at Kansas University.

Ege doesn't scorn the well-known dictum of Socrates—"Know thyself." But he gets more of a kick out of the practical application of "Know others."

Today—five years after enrolling in the Westinghouse Graduate Students' Course—he directly controls a staff of fifty persons. And he's responsible for coordinating the efforts of 1500 employees—half of them men and half of them women—on the production floor.

Ege is Production Supervisor in the Coils and Insulation Department at the East Pittsburgh Works. He is the link between the entire Westinghouse organization and thirteen foremen who directly supervise the work of hundreds of employees. He is engaged in a production job which turns out finished parts with a shop value of more than $1,000,000 a year.

How Westinghouse offers opportunity to engineers differing widely in outlook is demonstrated again in Ege's case. From the time he conceived his ambition to work with men his path has followed a straight line. His training course at East Pittsburgh was in Works Management. This lasted about a year. Then he became Chief Clerk in the Coils and Insulation Department. Only one year later he became Supervisor, reporting directly to the Works Superintendent of Production.

To the man who wants to work with men rather than with materials, Westinghouse offers promising opportunities.
The laboratories and shops of industry are the sources of many of the enduring attainments of our times. In the General Electric organization is an army of 75,000 persons, co-operating to make electricity do more and better work for humanity.

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In the last ten years one American manufacturer—the General Electric Company—has created machines having a man-power forty times as great as that of all the lives lost in the Napoleonic wars.

In the years to come, when the college men and women of today are at the helm of industry and of the home, it will be realized more and more that human energy is too valuable to be wasted where electricity can do the work better at lower cost.