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The Wisconsin engineer. Vol. 30, No. 4 January 1926

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The Wisconsin Engineer

MEMBER
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ENGINEERING
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January
1926

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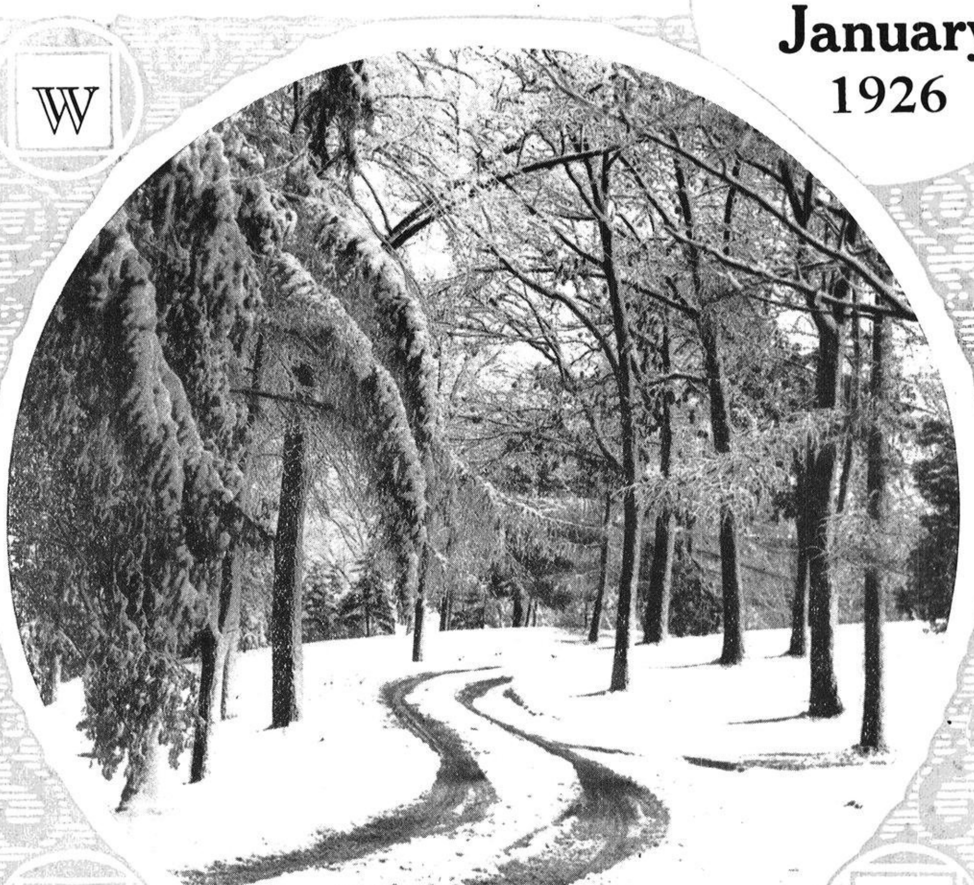

VOL.
XXX

NO.
4

The College of Engineering
University of Wisconsin
Madison

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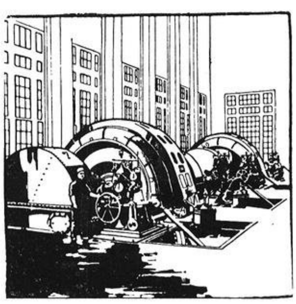

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The Wisconsin Engineer

25c A Copy

Published monthly from October to May, inclusive, by
THE WISCONSIN ENGINEERING JOURNAL ASSOCIATION
306a Engineering Building, Madison, Wis. — Telephone University 177

Founded 1896

$1.50 A Year

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VOL. XXX, No. 4 MADISON, WIS. JANUARY, 1926

THE THOMAS RECORDING GAS CALORIMETER

By R. A. RAGATZ, ch '20

Instructor in Chemical Engineering

THE quality of manufactured or natural gas distributed in most states and municipalities must now comply with certain standards specified by regulatory commissions. Of the various standards that are usually specified by law, the heating value requirement is one of the most important. It is therefore necessary for the manufacturer of gas to have an accurate device at his disposal for determining whether or not the heating value of the gas is above the prescribed minimum. In small plants such determinations are usually made only once or twice a day, but in the larger plants where gases from several sources may be mixed, a continuous record is a practical necessity.

The calorimeter of the Junkers or continuous flow type, in which the gas tested is burned at a steady rate and the heat of combustion absorbed by a stream of water flowing counter-current to the products of combustion, is the accepted standard of the manually operated gas calorimeters. The heating value of the gas is determined by multiplying the rise in temperature of the water passing through the calorimeter, by the weight of water discharged, and dividing the product by the corrected volume of the gas, which is measured by a meter.

Thus it is apparent that in making a heating value determination with the Junkers calorimeter considerable data must be taken. To obtain the actual figure for the heating value it is necessary to apply various corrections to the readings of the thermometers, barometer, and gas meter, and to go through quite lengthy and tedious computations. Furthermore, the result applies only to the gas passing at the time of making the observations, and the whole procedure must be repeated for every subsequent test. It would be a decided advantage to the gas manufacturer to have a calorimeter which would operate automatically, and which would give a continuous record of the heating value of the gas being manufactured. Such an ideal is realized with the Thomas Automatic Recording Gas Calorimeter, developed by the Cutler-Hammer Manufacturing Co. of Milwaukee.

In general, the Thomas gas calorimeter may be described as a continuous flow calorimeter, in which gas is burned at a steady rate and the heat of combustion absorbed by a stream of air flowing counter-current to the products of combustion. The essential differences between the Thomas and the Junkers calorimeters are that in the Thomas calorimeter air instead of water is employed to absorb the heat of combustion of the gas being tested, and the temperature rise of the heat

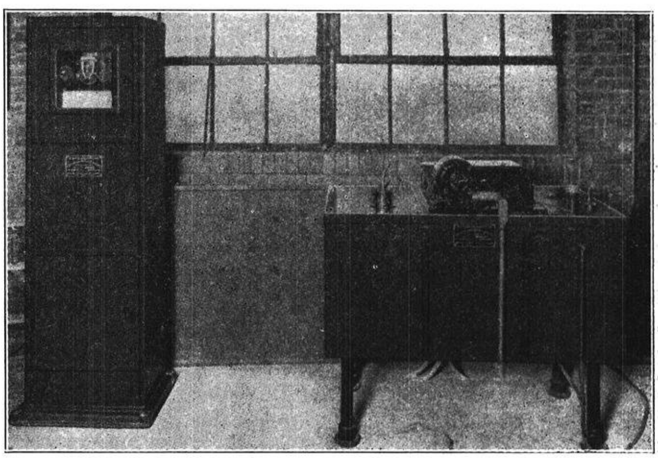


FIG 1. *The Thomas Recording Gas Calorimeter*

absorbing medium is measured by electrical resistance thermometers connected to a recording Wheatstone Bridge, rather than by mercurial thermometers.

The Thomas calorimeter consists of two separate units: the tank unit or calorimeter proper, and the recorder unit. By reference to Fig. 2, let us consider in detail the operation of the tank unit. In a large tank in which a constant water level is maintained by means of a bucket pump and weir overflow, there a

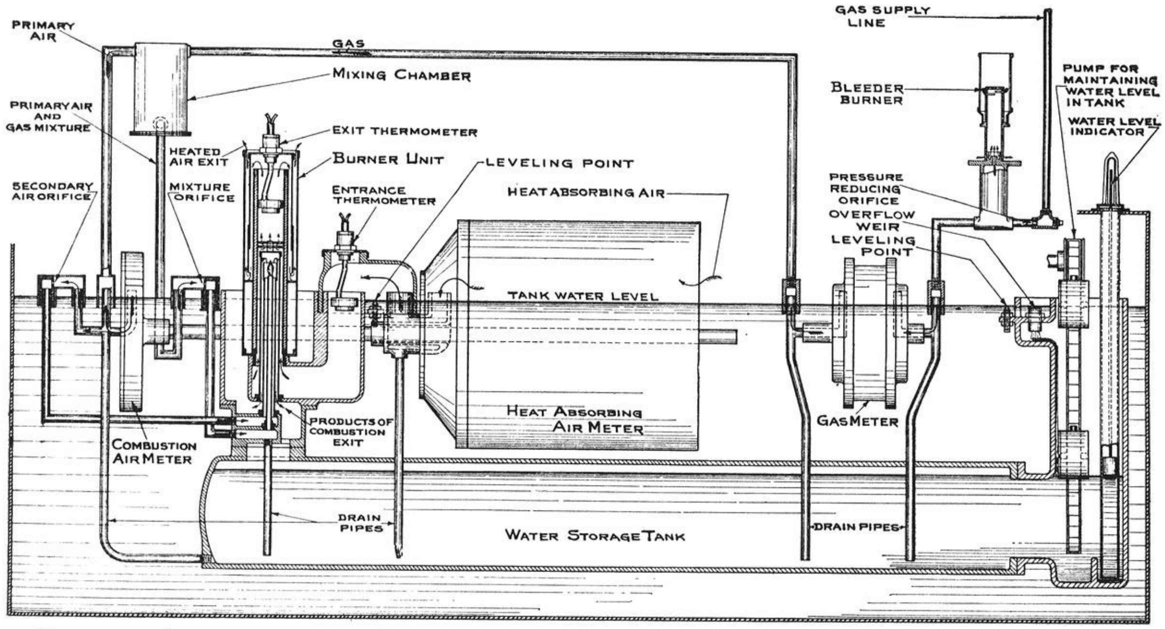


FIG. 2. *Arrangement of Piping and Meters in Tank Unit of Thomas Calorimeter*

immersed three meters, or pumps: one for measuring the gas whose heating value is to be determined, another for measuring the air to be used in absorbing the heat of combustion, and a third for measuring the air supplied for combustion. The three meters are driven by a small motor mounted on the cover of the tank. Since the heat absorbing air meter and the gas meter are geared together and are driven by the same motor, they always deliver in exactly the same ratio with respect to each other, irrespective of the motor speed.

The gas supplied to be tested should be at a pressure of 3 to 6 inches of water and should be freed from objectionable impurities such as hydrogen sulfide or suspended matter before it enters the calorimeter. The gas is admitted to the calorimeter through a pressure reducing orifice and enters a small expansion chamber. On the cover of this chamber is a bleeder flame which serves two purposes: (a) it consumes sufficient gas so that a fresh supply is constantly reaching the calorimeter, thereby preventing any considerable lag in the instrument, and (b) it reduces the gas entering the meter to atmospheric pressure. The volume of combustible delivered by the gas meter is dependent upon the gage pressure of the gas on the inlet side of the meter. Therefore, in order to eliminate the possibility of error due to varying gage pressure at the inlet, the gas pressure is reduced to atmospheric by means of the pressure reducing orifice and the bleeder flame.

The gas upon passing from the small expansion chamber through the gas meter is delivered to a mixing chamber where it is thoroughly mixed with primary air supplied by the combustion air meter. The mixture of gas and air is then delivered to the burner unit. It rises through the central tube of the burner unit and is burned at the top in a small flame. To obtain complete combustion a supply of secondary air from the combustion air meter is delivered to the flame by means of a second tube concentric with the first. The products of combustion are deflected downward and pass through the annular space between the secondary air tube and a third tube, the heat interchanger. As the products of combustion pass downward, they give up their heat to a stream of air which is flowing in the opposite direction along the outside surface of the heat interchanging tube. It should be clearly under-

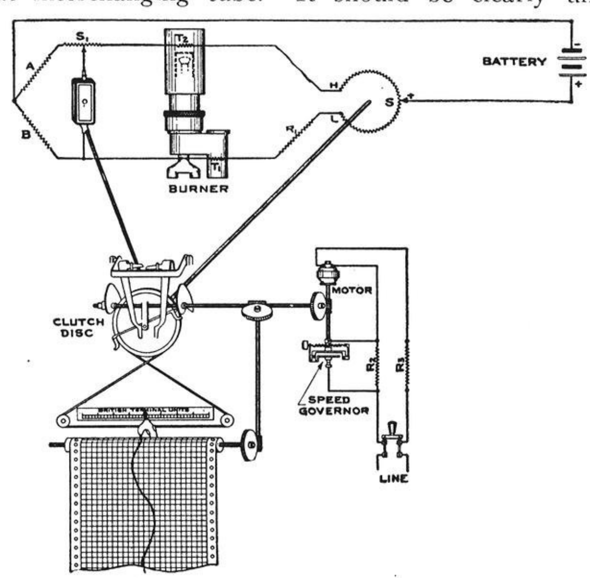


FIG. 3. *Wiring Arrangement of Thomas Calorimeter*

stood that the products of combustion and the heat absorbing air travel in entirely separate paths and are not mixed with one another. The transfer of heat to the heat absorbing air takes place entirely by conduction through the heat interchanger tube, and is so efficient that the products of combustion are discharged at the bottom of the burner unit at very nearly the temperature of the incoming heat absorbing air. As the products of combustion are cooled, considerable water is condensed which is removed by a drain leading to the water storage tank. *(Continued on page 136)*

In 1884 Niagara Falls was "shown" at night to a visiting party of English railroad men by exploding a quantity of gunpowder. — Now it is floodlighte d nightly.

THE PROGRESS OF ARTIFICIAL LIGHTING

By K. A. Staley, e '22

Engineer, National Lamp Works of the General Electric Company

LIGHT is such a fundamental necessity of man's well-being, and artificial lighting is interwoven so closely with many of the complexities of modern life, that to comprehend the progress the art of illuminating engineering has made is to embrace the development of many of the arts and sciences of the civilized world, far afield from the purely electrical.

For example, the development of the automobile and the nation's highways has grown to such magnitude that city and inter-city traffic at night is now an absolute necessity — artificial lighting of highways in effect grew out of this development. Street lighting in the cities, of course, came first; then with the development of improved highways came electric lighting for automobiles. Highways, automobiles, and light are inter-dependent.

In the commercial world, light is an equally important factor. Without industrial lighting, manufacturing would necessarily be done on a small scale; there would be no large factory systems, embracing acres and acres of floor space, and the cost of products would be based upon the small quantity production of Colonial days. The factory would be a small workshop with plenty of windows, operating only during daylight hours.

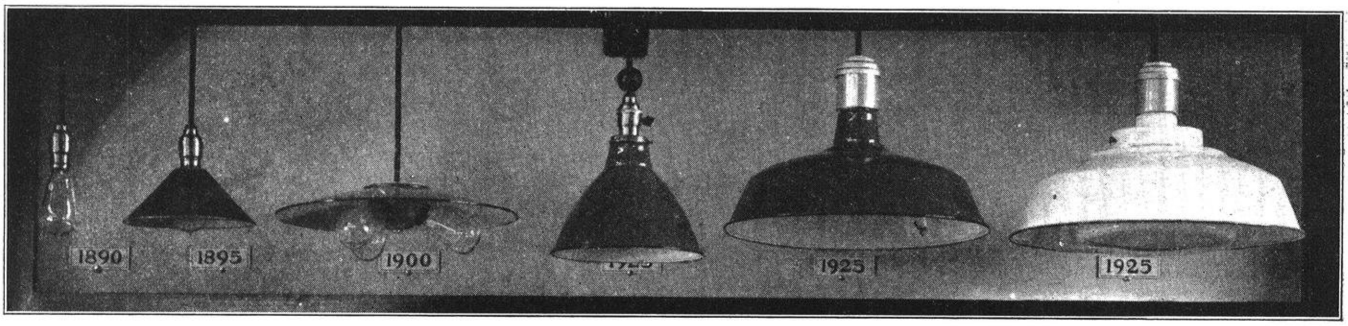
Large office buildings forty, fifty, sixty stories high cannot depend upon the unreliable sun for light. Floors underground, elevator signals, corridors, passage ways, — could only be dreams of the architect without modern lighting. Show windows, the merchant's stage, would be drab and uninteresting, and therefore valueless, without it.

Such modern wonders as motion pictures, submarines, airplanes flying at night, "ships that pass in the night", street cars, traffic signals, subways, morning newspapers — these are things we call commonplace and yet they could not thrive and function under the visual guidance of only the sun, moon, and stars.

Because there are so many lighting fields, the illuminating engineer finds his tasks to include those of architect, artist, chemist, merchant, showman, and technician — all rolled in one. Today he has at his command a mobile commodity, in a high state of development. But his engineering work is not strictly lamp engineering — such as in the perfection of a more efficient light source. He must cooperate with the builder, the railroad man, the automobile manufacturer, the police department, the city council, the theatre owner, and the merchant — thus to function in every lighting application. That is the task of the illuminating engineer: to study the fundamental needs of the field, to see that lamps best adapted to these needs are standardized, to cooperate in the development of the most effective accessory equipment, and to promote the widest understanding of correct practice in its use.

Despite the apparent accomplishments of the pas[t] the path of lighting progress has not been a [...]

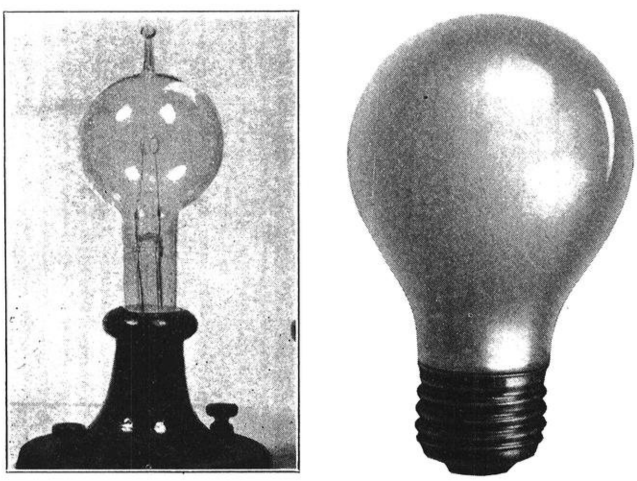
series of achievements with all the elements equally coordinated. During its growth, research and lamp development were soon far ahead of the lighting equipment development and as a result, today, after thirty-five years, there are thousands of installations of artificial lighting in use which are half modern and half antique. It is exactly as though the radio industry would concentrate all of its energies, research, and development upon broadcasting, and leave the receiving set back in its "crystal" stage.



Industrial lighting in the day of the carbon lamp seems ancient indeed. But at the same time, it was considered a great step in progress of lighting.

About 1880, when the arc lamp was first used successfully for street lighting, the public hailed it as a boon to mankind and philanthropists and dreamers concocted out of nothing both radical and ridiculous tasks for this new light:

"In 1880, H. C. Spaulding, of Boston, journeyed to Holyoke, Mass., to experiment with a new idea for lighting a city. He planned to construct towers 75 feet in height, carrying arc lights of 300,000 candlepower. This light is to be projected into the sky. Spaulding claims that as a result of filling the atmosphere with such an enormous amount of light, the city will be light as day both indoors and out. Mr. Spaulding will finance the scheme."



Old and New—(a) *Edison's First Carbon Lamp* (1879) — (b) *Inside-Frosted Gas-filled Lamp.*

Some conception of the candlepower values needed d in use today in well-designed ornamental street lighting installations may be obtained from the following extracts from 1925 statistics:

"In one residential section of the city of Chicago, 16,000 lamps installed on a spacing to include one lamp for every 150 feet of street, totals 4,000,000 candlepower."

"On Superior Avenue, Cleveland, a main thoroughfare, lamp standards of 25,000 lumens each are spaced one hundred feet apart opposite, making a total of 430,000 candlepower for two miles of street."

One writer of the period referred to above made a prophecy both novel and accurate as attested by the two extracts which show the thought of the times. The first is of 1885: the second, 1923:

"A gentleman of Norwich, Connecticut, signing himself "Philanthropist" writes to inquire: 'If the electric light may not prove a factor for reform. . . If the business streets were nightly made as light as Franklin Square, do you think men who love to be respectable would tumble into the street at a late hour to be taken home by the police. . . Isn't this modern light an antagonist to deeds of darkness and shame?' ".

"The city records of the city of Cleveland show that the installation of a modern "white way" street lighting system in the downtown section of the city reduced crime in that district 40%." "A former mayor of Chicago made the statement that 'a modern street lamp is as good as a policeman.' "

One rather interesting contrast of times and facilities for floodlighting may be gleaned from the following extracts on Niagara Falls. The former shows the earliest attempt at lighting the falls at night, and the latter described the culmination of a lighting job so crudely begun.

"In 1884, Albert Bierstadt exploded a quantity of powder on the rocky ledge beneath the American Falls in order that he might illuminate them at night for a party of English railroad men."

"Nature's most popular spectacle — Niagara Falls — is now being illuminated on a scale in keeping with its grandeur. The floodlighting of the main cataracts — the American Falls and the Canadian Falls — is accomplished by a battery of twenty-four searchlights, having an aggregate of one billion three hundred twenty million candlepower. Each searchlight contains a 125-ampere arc and is 36 inches in diameter. On special occasions trained manipulators will execute light-and-color drills with the searchlights. Vari-colored beams may be radiated in all directons, making a vertable Aurora Borealis."

Economically, there has been constant progress in the light and power industry. This has resulted in a steady decrease in the cost of light. In 1900, a 50-watt lamp gave 167 lumens of light, and cost $7.00 a year to use it 2½ hours a day. Today, a 50-watt lamp, burned the same number of hours, costs $3.42, and gives 515 lumens. In a word, three times the amount of light is provided at half the cost.

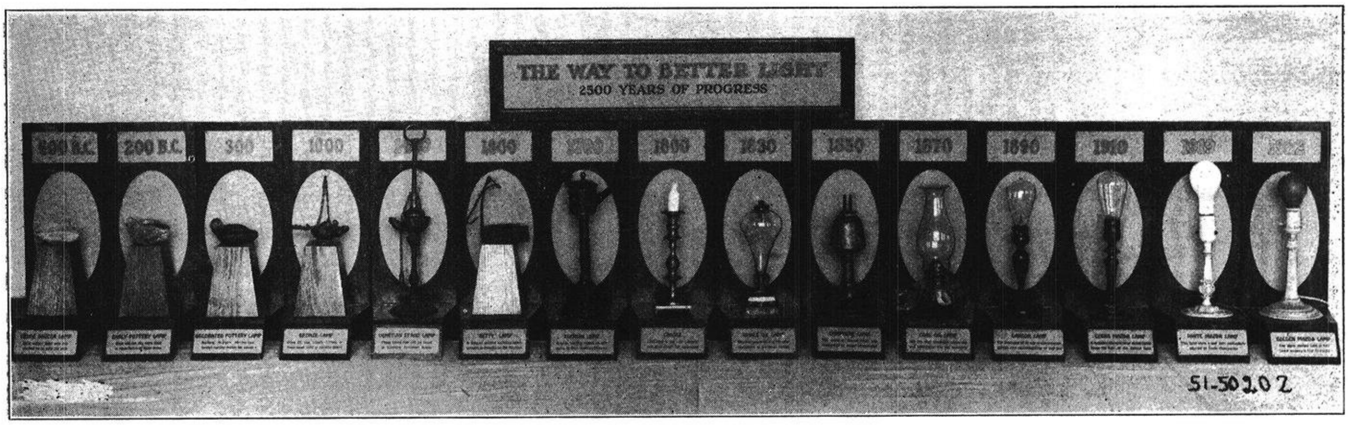
Careful estimates show that there were at the end of 1925 slightly more than half a billion incandescent and about two hundred fifty thousand magnetite arc lamps in use. They are increasing about 9% each year. The annual demand for incandescent lamps for renewals and new sockets is two hundred and seventy millions, exclusive of miniature lamps. The per capita demand for lamps in the United States is 2.3 lamps per person per year. In England this figure is 0.4; in France, 0.6; in Germany, 1.5; in Switzerland, 1.6.

The average candlepower of standard lamps has increased from 16, which prevailed during the period prior to 1905, to 71. The average wattage per lamp is about 56. In the past ten years the number of lamps has increased twofold, the average candlepower has almost doubled, the average wattage has increased 20%, and the average cost of light has decreased about one third, the net result being that the people of the United States are spending for light about three times as much as in 1915, and are geting four times as much light.

The lighting industry is now entering into a period when the stage is set for even greater accomplishments than in the past. Lighting research has been encouraged, principles of illuminating have been clearly formulated, and the most important function now is to promote educational propaganda — to demonstrate how to properly apply the knowledge which has been obtained.

Thus the illuminating engineer and the engineering student who studies illumination have a task clearly defined — that of the educator. Following the lead of the Massachusetts Institute of Technology, which university installed lighting demonstration equipment two years ago, the University of Louisville and the Spring Garden Institute of Philadelphia have equipped demonstration rooms with the purpose in mind not only to use them for engineering courses as a part of the regular curriculum, but to make them widely available to plant engineers, electricians, and executives for general educational purposes.

In the new Electrical Engineering Building of the University of Minnesota are included even more complete demonstrations and exhibits for teaching by visual means the fundamentals of artificial lighting; an illumination classroom, planned when the building was still on paper, is fully equipped with luminaries for demonstration purposes; all offices and work rooms in the building have modern lighting systems of various types; cards on the doorcases provide data for each installation.



Two and one half centuries of progress in illuminants

The solution of this problem of lighting education has had a good beginning.

TO CONSERVE HELIUM IN AIRSHIPS

By a process of electrically heating the gas with which Zeppelins are inflated and by gradually cooling it as the load becomes lighter owing to the use of fuel, two Berlin University chemists, Dr. Kurt Peters and Peter Schlumgohn, belive they have gone a long way toward solving the problems of flying and landing airships without valving gas, which is dangerous with hydrogen and expensive with helium.

Great possibilities may be seen in this scheme, especially in that the change of gas volume, necessary at different altitudes and air pressures, can automatically be made without releasing gas. On the flight of t[...] Los Angeles to America, 20,000 cubic meters of [...] were discharged, which in the case of heli[...] would mean a cost of approximately $100[...]

In these shops have been built the electric locomotives for railway electrifications in America as well as numerous other countries.

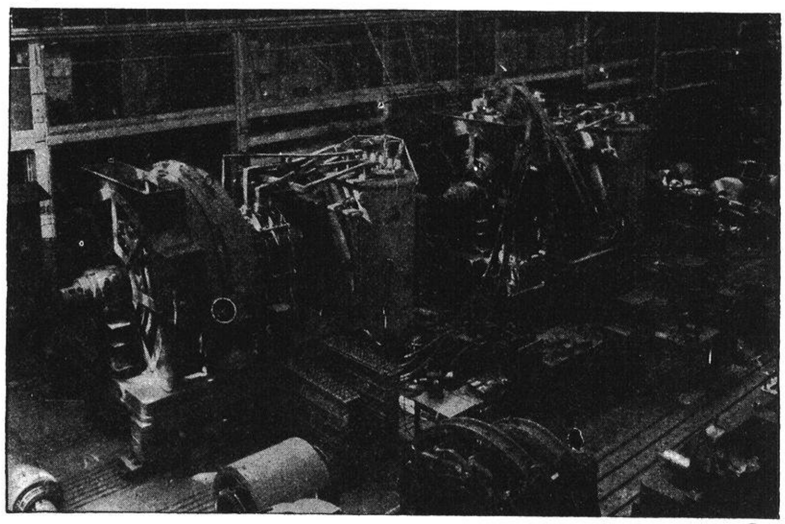
THE TECHNICAL GRADUATE IN INDUSTRY

By C. E. JOHNSON, *Senior Electrical*

IN the life of every young man who is interested in the technical side of things there are two important decisions to be made. One is the decision to go to a college or a university and pursue an engineering education; the other is the decision relative to what he is to do with an engineering education after he has obtained it. As time goes on, the latter decision is coming to be regarded as fully as important as the first decision. Cases have occurred, perhaps not frequent but often enough to illustrate the point, where the honor man of the class has failed to attain greater or as great accomplishments and happiness in later life as those who stood middle or thereabouts in the group, simply because he has failed to analyze his own inclinations along specific lines of work and has failed to make a serious study of the fields open to him.

In recent years it has become a common thing for juniors and seniors in the technical schools to look ahead to the coming of representatives of industry in the form of capable men associated with well known engineering concerns. An investigation made by a representative well known at the University of Wisconsin reveals the fact that a surprisingly large number of graduates have received their first jobs simply because of their contacts with these representatives. It is no longer the rule that these representatives of industry recommend only that line of work with which they themselves are connected; great service has been done to more han one student because an interviewer has fit to urge the student along some line of work he himself, perhaps, does not represent.

longer sufficient for a college man to say that he is going to follow mechanical engineering, electrical engineering, or any other generalized course because each day the occupational or functional classification is becoming more proper and popular. The problem confronting the student at graduation is that relative to getting into the field where, by his inherent and acquired abilities and tastes, he can find the greatest happiness in life. It is in the solving of this problem that industry should work together with the college or



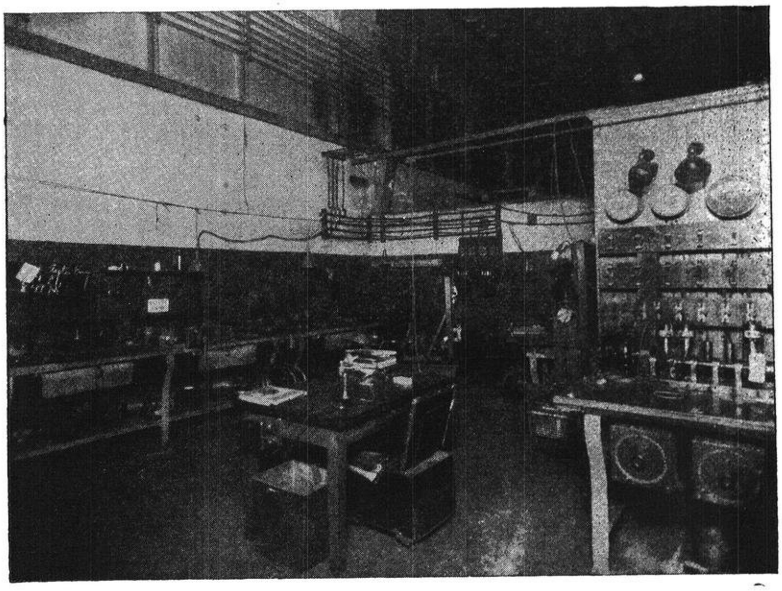
Each machine must undergo tests to learn if it will perform satisfactorily to its purchaser and if it will continue to do so during its assumed life. Much of the testing on this floor is performed by Graduate Students as a part of their course.

university, because it is up to the industry to make clear to the college just what the human requirements are. Various means are employed to establish this co-operation; perhaps one of the most successful is that of sending out able and practical men from the industry to the various technical schools to give lectures and interviews.

The system of sending out able and understanding representatives to the colleges and universities is in use with many well known companies, the most notable examples of which are: The Westinghouse Electric and Manufacturing Company, The Bell Telephone Company, The Milwaukee Electric Railway and Light Company, and The General Electric Company. The writer had occasion to be somewhat familiar with the course pursued by the Westinghouse Electric and Manufacturing Company when students are chosen on the basis of the information gathered by their representative from interviews with the student and his instructors, past records, etc. The various functional departments of the organization are considered rather than an effort made to secure all Phi Beta Kappa or Tau Beta Pi men; by functional departments are meant those concerning pure research, design, application, sales, manufacturing, etc. The methods usually followed in picking men involve ratings given in physical qualities, intelligence, leadership, personal qualities, and special talent. Checks are made of the college records; opinions of instructors and classmates are also obtained to get information relative to the personality of the individual under consideration. It is, of course, impossible to fit the graduate to the kind of work for which he is most fitted simply as a result of a fifteen minute interview, but a start is made in the right direction, and after a few months of actual practical work the problem should be completed.

Graduate student training courses are recognized by the majority as an excellent means of "topping off" an engineering education. The financial remuneration is usually not very large while the student is on the course; however, returns are not and should not always be figured in terms of dollars and cents; the practical experience received together with the benefit derived from the early solution of the college graduate's greatest problem more than makes up for the temporary financial sacrifice he has made. The writer has also had occasion to be somewhat familiar with the graduate student training course given by the Westinghouse Electric and Manufacturing Company. The course covers a period of one year. An endeavor is made to find the proper place for the graduate in the industry within sixty days after his arrival. The new men are put in touch with the executives in charge of the various departments — designing, research, application, selling, etc. — and a surprisingly large number of the new graduates quickly come to a decision and are satisfied with that decision as time goes on. Credit for this can be given to the system employed wherein the young engineer is placed in that line of work toward which he feels some inclination, but about which he does not feel quite ready to make a definite decision. Two months work in almost any department is enough to make the young engineer realize whether or not he likes the work; if he dislikes the work, he is given an opportunity to "try his hand" along some other line toward which he feels some inclination.

It is a well known fact that during the last few years the proportion of men interested solely in the technical side of engineering is far too large as compared with the number who are interested in the commercial side of engineering. Records show that there are not too many purely technical men, but that there are not enough of the keen, aggressive type to take care of the commercial side. The requirements of industry are such that a definite proportion between the two types of engineers is required. The commercial side of things, notably sales engineering, has exacting requirements, the most important of which are ability, knowledge, and personality. Certainly the engineering salesman must know the design, materials, and workmanship of his goods; he must be logical, honest, persuasive, and above all, tactful. A graduate student training course offers an excellent means for obtaining the necessary qualifications so much needed by the young engineer choosing the commercial end of it.



A liberal proportion of the work in development laboratories is made a part of the schedules of graduate students looking toward careers in the field of the development of electrical apparatus. In these laboratories the fundamental principles formulated in the Research Department are applied to actual conditions.

In conclusion, a word might be said relative to what the large manufacturing companies expect and get from their program of training the technical graduate. Do the men remain in the engineering field? Do they make good? Again facts concerning the Westinghouse cours[e] are available and to the point. The most signifi[cant] facts are listed below:

1. The roll of principal executives of the

(Continued on page 11

SUGGESTIONS FOR WRITING TECHNICAL ARTICLES

By W. Otto Birk, *Associate Professor of English, University of Colorado*

EVERY magazine writer should aim to make his article attractive and clear. Though ridiculously obvious, it is pertinent to say that magazines are published to be read. Technical magazines, moreover, are designed primarily to give information. The chief problem, then, in writing for these magazines, is that of attracting and holding the reader's attention through the interesting and lucid presentation of the subject.

Attractiveness in the writing of technical articles, however, is often misunderstood. It is nothing artificial. It is not trickery intended to fool a reader — to make him think that he is to read something that is not in the article. This kind of false attraction does more harm than good, as it discredits the subject or the author. It indicates that the subject lacks interest, or that the author is incapable of finding it. Attractiveness must be got out of the subject and not superposed upon the subject. No article can be more attractive than its subject matter will permit. Neither can a technical article be made attractive to all technical men. Most of these men read their magazines as a part of their business, and if some are not interested in a new type of automatic switchboard, for instance, all the art of the writer can seldom make them interested. This condition, however, excuses no author for failing to present all the interest that his subject contains.

The Title

This statement can be best illustrated through a discussion of the title or introduction of an article. The title, whether topical or active, should give not only an index to the subject, but should state specifically the phase of the subject treated in the article. In order to enhance the attractiveness, it should include the feature. In explaining a new method of patching concrete roads, for instance, the title, "Concrete Roads," is indefinite, misleading, and uninteresting. "Patching Concrete Roads" is more definite, but lacks attractiveness because it does not contain the feature. "New Method of Patching Concrete Roads" is better: it is more complete and it creates interest; furthermore, the interest is derived directly from the subject-matter.

The Introduction

The introduction should follow similar principles. Perhaps no part of an article is more abused than the [illegible]ginning. Most writers know that the body of an [illegible]le should give the information that they wish to [illegible] but the introduction, they seem to think, is [illegible]ffing and slipping of a locomotive attempting [illegible]t grade: it makes a lot of noise, but it gets no place. Now an introduction should get some place quickly, especially in a technical article. Its purpose is two-fold: it should give all preliminary information necessary for a proper understanding of the article, and it should create interest.

The preliminary information must vary, of course, with the subject-matter. It may state more specifically and completely the phase of the subject treated; it may eliminate some irrelevant phases of the subject; it may enumerate the points to be covered; it may give background (the history of the subject or the reasons for its importance); or it may define uncommon and important terms. Whatever its particular function, the introduction should be brief and direct. In writing technical articles, particularly, the first sentence should be significant. In order to avoid wandering, a good plan to follow is that of making the initial sentence a rephrasing of the title, so as to include more of the feature and to limit the article to a narrower phase. As an example, under the title of "New Method of Patching Concrete Roads," a suitable beginning would be, "Patches made in concrete roads by the new method that has been used experimentally for two years by the State Highway Department have proved economical and durable." Other beginnings, to be sure, are possible, but those of the above type lead quickly into the subject, present some preliminary information, and create interest — interest in the subject-matter — by presenting the feature, or the most important information.

Attractiveness, in other words, is a manner of presenting the subject-matter in its best light. It is not spreading an artificial gloss over the subject-matter.

Attractiveness and Clearness

Since technical articles seek primarily to explain, attractiveness is dependent largely upon clearness. In fact, these two qualities are so closely related that it is difficult to consider them separately. The reader's attention must not only be attracted; it must be held. And it cannot be held unless he can understand easily. No matter how much he may be interested in the subject, he will not read long if he must ferret out what the writer intended to say. He has a right to expect that the article be clear enough for him to understand readily. Remember that magazines are published to be read. The writer *must* serve the reader.

In order to be clear, an article should be concise, precise, and well-organized.

Conciseness means to many writers — mostly inexperienced — nothing more than bare information expressed in sentences that read like a combination of severely compressed ten-word telegrams. Nothing could be farther from the truth. Every technical article should be brief and to the point; but since the purpose of writing is to produce an effect as well as to convey information, it should not be blunt and curt. Auxilaries, prepositions, and articles, for instance, should never be omitted when it is natural and proper to include them. Their omission makes an article inelegant and frequently unintelligible. These words are a part of the English language and should be used. Conciseness means the absence of wordiness. For example, "a brass screen" is better than "a screen that is made of brass"; "This prohibits the use of coal for generating power" is better than "This makes the use of coal for generating power prohibitive"; and "Investigation will find these filters efficient" is better than "If we investigate the matter, we shall find that these filters are very efficient."

Fine Writing

Fine writing, furthermore, should be avoided. To tell that the crane in a steel mill picked up a ladle of molten metal and carried it to the ingot molds, one need not say that, "The giant crane picked up its livid burden of molten metal and swung it through the dim recesses of the corridor while the sparks flew from it like stars shooting in the sky." This kind of writing is in no sense good; yet it is frequently found, as was the above, in amateur contributions. Unless the writer's opinion is clearly expected, a technical article should be objective and not subjective, that is, it should tell of things as they are and not as they impressed the author. The above quotation tells not so much what happened, as how the event affected the writer. Since the chief interest in most technical articles is in the results expressed, they should be written from an impersonal point-of-view; that is, the third person, passive should be used. For example, instead of saying, "First we placed the motor upon a block and then we attached the belt, etc."; or "First place the motor upon the block and then attach the belt," say "First the motor was placed upon the block, and then the belt was attached."

Preciseness

Preciseness in technical writing pertains mostly to the use of exact words and dimensions. It is as important in technical as in legal writing. In fact, the former often is the basis of the latter. Furthermore, most technical articles aim to give information that the reader can use and so if statements are not exact, they are useless. Caution should be needless, of course, against such gross misuse of words as "The iron solution that was held in suspense in the water settled to the bottom of the tank, taking with it the sediment." But hardly excusable is the indifference that calls a voltmeter, for instance, an instrument or a device for measuring voltage, or a shaft, a steel rod with pulleys. As the above examples show, inexact words always call for many words to define them. The result is that the writing is neither precise nor concise.

Though words should always be exact, dimensions need not be. An author's purpose sometimes permits or requires generalization. In most technical articles, though, exact dimensions are expected. The reason is evident. In a novel the author may say that the summer house is a stone's throw from the river; but in a technical article that aims to give usable information, the author may scarcely say that the machine shop is located a stone's throw from the foundry. Too much depends upon who throws the stone. Similarly indefinite are dimensions qualified by "about", "nearly", and "approximately". When the nature of the subject demands exactness, be exact!

The main factor in clearness is organization. People read in order to understand and remember, but they can do neither unless the thoughts are related and sequential. Every subject, of course, has its own peculiar problem; but no writing should be attempted until the problem has been determined, and some definite plan has been adopted. One of the first steps in writing an article is to decide upon its purpose. The inexperienced will do well to phrase this purpose in a complete sentence, and, if necessary, write it down, so that he can keep it before him while he is writing; for instance, "The purpose of this article is to show the difference between the manufacture of Bessemer steel and of open hearth steel." If not written, this kind of statement should be kept clearly phrased in the mind. It should then govern the composition of the whole article. The title, initial sentence, introduction, and article proper should be shaped to fulfill this purpose. Every sentence and every paragraph should reflect this purpose. If they do not, the article lacks proper organization. A good test of the organization of an expository article — and most technical articles are expository — is to reduce the paragraphs to sentences, combine those sentences into a summary paragraph, and then reduce this paragraph to a single sentence. If this last sentence is similar to the statement of purpose, the article is well organized. Though this test is too severe to be adhered to rigidly, it will help to eliminate harmful digressions that side-track the reader's attention and muddle his understanding.

For those who wish a more thorough discussion of the writing of technical articles, the following books are recommended:

Watt, Composition of Technical Papers. McGraw-Hill Book Co., New York. 1917.

Rickard, Technical Writing, Second Edition. John Wiley and Sons, Inc., New York. 1923.

Thompson, Technical Exposition. Harper and Bros., New York. 1922.

Harbarger, English for Engineers. McGraw-Hill Book Co., New York. 1923.

Frost, Good Engineering Literature. Chicago Book Co. 1911.

Swetland, Industrial Publishing. United Publishers Corporation, New York. 1923.

BILL BONES, ENGINEER

When Bill unrolled his diploma on commencement day, he expected to read: BILL BONES—ENGINEER, with the word, *Engineer*, in two-inch, shaded letters. When he learned that William Rivethead Bones was awarded the degree of Bachelor of Science in Civil Engineering, he muttered that one pass word of all good "plumbers": *Hell!*, tore up the diploma, and took a healthy semi-circular bite out of his plug of Climax.

That afternoon he tied his one suit and his two white shirts into a bundle and mailed them home. "No more use for them things, now that I'm an Engineer," and clad in boots, breeches, and a flannel shirt, his slipstick protruding prominently from a hip-pocket, he set out to engineer.

The next day he stalked into the offices of Wone and Stebster, (Inc.), for the express purpose of advising them that there was a d - - - good engineer available at the present time. The office-boy, awed by the protruding slide-rule, hurriedly rushed Bill into the sanctum of the president.

"Need a good engineer?" asked Bill. "'M lookin' for a job."

Upon looking up at Bill, the president jumped to his feet. "By gosh!" he fairly shouted, "you're just the bird I want to build a dam for us out on the Rocky River; been looking around for some young grads but you're the first real Engineer I've found."

"Hell!" exclaimed Bill, "Have a Lucky and show me the blueprints. I always wondered why those dirty bar-rats at college called me a "damn engineer", but I see now."

After a casual examination of the engineers' report and a cursory inspection of the blueprints, interrupted at intervals for the purpose of blowing smoke rings, Bill pronounced the project feasible from an economic and an engineering standpoint.

"Good," exulted the president, "Fine; I was a little afraid that the reaction didn't fall within the middle third of the base."

"'S. O. K.," declared Bill. "What's my salary?"

"Oh, say a, a, a, one hundred per day and expenses?" ventured the president.

"Well, that's all I can ethically take," Bill stated briefly. "Scribble out a Contract for Personal Services and I'll go out to the site and do a little surveying."

"Fine, fine!" said the president. "The 'gun' is in a box under the big hemlock tree, and here are the adjusting pins," as he fished them out of his pocket.

* * * * * * * * * *

Bill stood in his little box of an office deep in thought. Before him on the desk lay the plans of the dam; a much thumbed handbook, opened to page 671, had fallen to the floor, but his brawny fist still clutched his slide-rule; even in his deepest conjectures he held it as though he feared he might drop it and break the sliding glass indicator. Below him machinery rattled, shrill whistles tooted, and men, like pigmies, crawled and swarmed about on the false work of the dam, — his dam, the Big Bill Bones Dam, as it was now called.

But Bill, deeply concentrating on the problem with which he was now confronted, was oblivious to it all; he had just received a letter and it had sorely perplexed even his super-mind. It read:

AMERICAN SOCIETY OF CONSTRUCTION ENGINEERS

New York, February 13, 1925.

Mr. William R. Bones, Engineer
Big Bill Bones Dam
Rocky River, California
Dear Sir:

It pleases us to inform you that the nominating committee has chosen you to be elected president of this society at the annual election to be held here on March first. It is customary and necessary that candidates for society offices be present at the election.

Yours truly,
J. J. JEMS, *Sec'y.*

Bill began working his slide-rule which was a sure sign that his mind was working. He ran off several numbers, extracted a square root from the 'A' scale and jotted down his results. "Fifteen days to finish the dam; this is February 14, (the president just sent me a Valentine). By Golly! I can just make it. We'll finish on February 29 and the election is March 1." He paused; a shadow passed over his unshaved face. "Hell! this ain't leap year, this is 1925 and February has only twenty-eight days. Now we won't get done until March first. I can-n-n't go."

With bowed head he sat abject. Then a smile lit up his homely countenance. "Didn't want to go anyhow," he said aloud, "My life insurance premium will be due that day and I want to stay here and mail them my check."

THE TECHNICAL GRADUATE

(Continued from page 113)

such as vice-presidents, general managers, district managers, department managers, works managers, etc., contains a large proportion of men who originally entered the employ of the company as students coming from college.

2. Over 50% of the men who come remain at the end of a ten year period.

3. Over 30% of the men who leave the company enter organizations of railway properties, central stations, etc.

4. 10% of the men were of foreign birth and returned to their own country to engage in engineering work.

5. About 6% of the trained engineers returned to the colleges in the capacity of teachers, research assistants, etc.

These facts illustrate the average trend of affairs in regard to this matter of proper choice of one's lifework. They need no explanation; certainly it is evident that the technical student should begin to think seriously of his future course of action *before* he graduates, so that he can make a wise decision at that time.

Engineering Review

J. P. SMITH AND R. A. MILLERMASTER

LARGEST SYNCHRONOUS CONDENSER

The largest condenser of the synchronous type ever built was recently put into service on the 220,000-volt transmission system of the Mount Shasta Power Co., of California, partly supplying San Francisco and the surrounding Bay country with electric energy. The condenser, placed in operation for voltage regulation in the high potential transmission system, has a rating of 40,000 kva. at O per cent leading power factor and 25,000 kva. at O per cent lagging power-factor. It is used, however, with a lagging power-factor characteristic only during times of starting or light load, during which time the line voltage might rise to an abnormally dangerous point. Under ordinary load conditions a leading current in the condenser is desired to correct for normal voltage drop in the system.

The condenser was built by the Westinghouse Electric and Manufacturing Company and was placed in operation in the same substation with two other synchronous condensers of similar design, but having ratings of 20,000 kva. each at O per cent leading power-factor. The new machine will operate at 11,000 volts and has a synchronous running speed of 600 r. p. m.

—*Power*

THE ASYMMETER

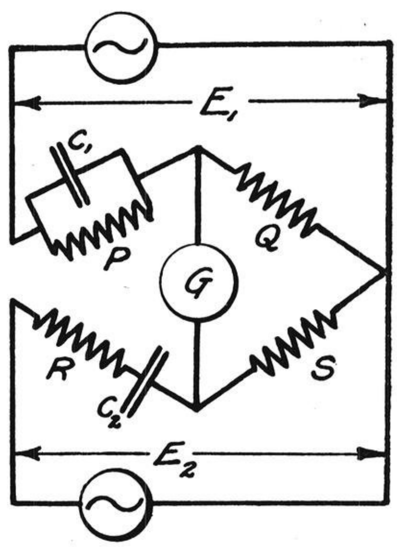
FOR INDICATING CURRENT AND VOLTAGE SYMMETRY IN THREE PHASE SYSTEMS

A recently developed instrument gives a direct indication of the state of symmetry of the current and voltage in a three-phase system, and thus facilitates detection of irregularities before these have serious consequences. Hitherto it has been necessary to compare three readings in order to determine the state of balance of the system; but the asymmeter exhibits a vector diagram which is symmetrical or distorted according to conditions in the system. On the face of the voltage asymmeter there is engraved an equilateral triangle, the sides of which (about 10 cm. each) represent the voltages between lines. From the apexes of the triangle and inside the latter there come three fine metal wires which are attached to a red disc, 6mm. in diameter. The other ends of these wires are attached to the three movements of the instrument. When the voltage conditions of the system are symmetrical, the pulls on the three wires are equal and the red disc is brought to the center of the triangle; but directly the balance is disturbed, the position of the red disc is changed. The three wires from the disc to the apexes represent vectorially the voltages of line to earth. A siren connected between the neutral of the potential transformer and earth gives an audible signal increasing in intensity with the amount of asymmetry. In the current asymmeter the movements are essentially differential ammeters and the adjustments are such that the red indicating disc moves from the center of the triangle to one of the apexes of the triangle if the excess current in the corresponding line amounts to 50% of the maximum current.

—*Elect. Zeits.*

MEASUREMENT OF DIELECTRIC LOSSES AT HIGH VOLTAGES

The dielectric losses in high voltage cables are usually determined by measuring the effective capacitance and resistance loss of the cable in some form of A. C. bridge, usually of the Wien type, especially adapted to work at the high voltages involved. The Wien bridge used so far involves the use of an air condenser insulated to withstand the test voltage. One modification of this bridge, by Rosen, consists in interchanging the source and detector; this enables a low-voltage mica condenser to be used as the standard.



Another modification, by Atkinson, consists in opening the condenser-arm junction of the above bridge. The two halves of the net work are then fed at different voltages; for example, E_1 = several kv.'s and E_2 = 300 Volts. These voltages are derived from the same transformer and are easily adjusted for exact quality of phase. The high voltage is applied to the test specimen only. An ordinary mica condenser can be used at C_2 and none of the resistances need be constructed for very high voltages. Both S and Q may be small so that the possibility of error due to distributed capacity in these resistances, which constitutes the main defect of Rosen's bridge, is very slight.

—*World Power*

(*Continued on page 134*)

Editorials

R. H. Sogard

THE CONVENTIONAL THINKER Most people accept the way things have been done as the way things should be done, without even assuming that a better way might be found. If this were true of every one, there would be no progress in the world and civilization as we know it now would not exist. Even if nine hundred and ninety-nine out of every thousand are conventional thinkers and never have a new idea, the one man in the thousand that breaks away from the established method of doing things and thinks out a new way is the man that moves the world a little bit farther on the road toward a better and finer civilization.

For thousands of years buildings were erected by building up massive walls of brick or stone and resting the floors on these walls. Then about a generation ago an engineer in Chicago got away from this conventional method of building and devised the steel-skeleton form of construction, first used in the Home Insurance Building in Chicago. From this new idea has developed a new method of design and construction that has made possible the fine buildings of today. Likewise, new methods of heating, lighting, plumbing, and all the other thousands of details that go to make up our modern building are made possible because some man was not satisfied that the method then in vogue was the best method.

In other words, the man of progress is not a conventional thinker. He is the man who has the ability to analyze, to question, and to demand proof. And more than that, he is the man who has the ability to think out better ways and methods of doing things than are being used by the so-called conventional thinkers.

THE FACULTY ENTERTAINS An editorial in the Saturday Evening Post some time ago propounds the idea that college degrees in themselves are of little value because about half of the undergraduates don't want to be educated, and that they come to school for any reason except to be taught. The editorial further states that college faculties, realizing full well the futility of imparting sound learning to more than a small proportion of their students, tactfully gave up the job and said, "If we can't teach these youngsters, we'll rationally entertain them for four years"—hence (quoting further) many of the snap courses and superficial work.

The conditions may or may not be the same at other schools, but the following will apply to our own engineering college. The Post editor was correct in saying that some are here for anything but learning, but it is not true that half of all engineering students are in that class. Look around in any of your professional classes, and you will find few who do not intend to apply their training in some form to secure a living. The freshmen who start in engineering because of indifferent curiosity, or as a mere variety of pastime, usually disappear during the first year.

If the Post editor would put in four years in an engineering course, we doubt exceedingly if he would accuse the faculty of setting out snap courses as entertainment. As a freshman he would "sweat" over drawings which are in endless demand; as a sophomore he would spend many an hour trying to find a volume of a hypocycloidal solid of revolution; when a junior he would groan over the Carnot cycle; and as a senior, he would heartily curse the intricacies of alternating currents. It is true that an engineering course is beyond no one with average intellect and reasonable industry, but neither is the course one long glorious good time.

No, gentleman of the Post, we cannot agree with you that half of all engineering students are here for entertainment and half of them for learning.

PRICE OR QUALITY A Green Bay paper notes the fact that "buying a cheap article makes you feel good while paying for it, but disgusted while using it." School work, especially technical school work, happens to be a thing where the purchaser (who is the student) adjusts both the quality of the article and the price. The quality of an education may be measured by the mental training which a man possesses when he is graduated, and the price has been the effort and care which he has put into that mental training.

Many students buy a cheap article in their college course: their work is vague, poor, late, or inaccurate. Their principal idea is to "get by", to merely roll comfortably along and do nothing which they are not specifically required to do. That is exactly the same feeling which an uninformed person has when he imagines he is a keen one at business by purchasing a twenty dollar guaranteed all wool suit, at an alley emporium. After the first rainstorm in which the wearer is caught, the selfsame wonderful suit displays its wonderful powers of shrinking, fading, and losing form. In precisely the same manner, the wearer of a cheap education will be caught in no less uncertain storm when his superior demands something which he cannot do or which he does inaccurately or too slowly. The shrinkage in that case consists in the man being "shrunk" out of his job, or at least out of chance of advancement.

(Continued on page 133)

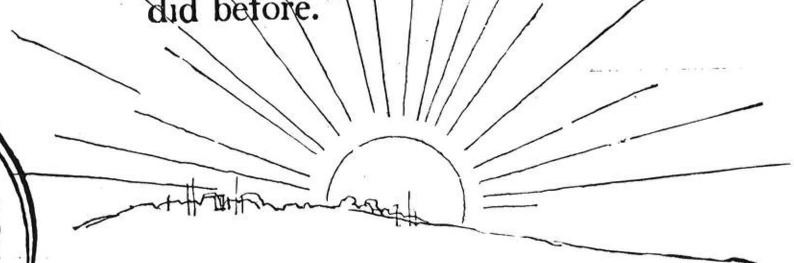
"Our pioneering work has just begun"

RECENTLY some one said to a prominent official of the Bell System:

"Your pioneering work is done. You have created a system that makes a neighborhood of the nation."

The executive replied:

"Our pioneering work has just begun. Each day brings new problems, new discoveries, new developments, all calling for broader-visioned handling on a larger scale than ever before. If I were a young man again in years, I would choose the telephone business for my life work even more quickly than I did before."



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Number 54 of a series

Campus Notes

PHI KAPPA PHI ELECTS ENGINEERS

Phi Kappa Phi, all university honorary fraternity, to which elections are made on the basis of both scholarship and participation in worthwhile campus activities, announces the initiation, on December 16, of the following engineers:

L. E. Brooks, m '26; H. W. Hiemke, ch '26; C. E. Johnson, e '26; L. H.. Matthias, e '26; R. A. Nelson, c '26; and H. C. Wolfe, e '26.

PROFESSOR ROOD'S SNOW PLOW STORY

In the days when Professor Rood worked on an electric railway, a raging blizzard swept down upon his line, and the big rotary snow plow was ordered out, with Mr. Rood in charge. Late at night the big plow swept into a little town and along the main street, hurling the snow clear of the track on either side with great violence. At that point the track was paved with Belgian granite blocks. One of the blocks was loose and was lying so that it was picked up by the plow, whirled through the blades of the great fan, and sent hurtling into the night. It crashed through the side of a frame shack, declares the veracious professor, went clear through the room, passing over the owner of the shack and his wife who were in bed, went through the next wall into the kitchen, across the kitchen, through the next wall and out into the night again, taking the cook stove with it. What could be more truer?

DR. NEWKIRK LECTURES ON SHAFT BEHAVIOR

"In experiments on shaft behavior a critical point of speed is reached above which it was formerly supposed that the shaft could not be run; a new assumption of behavior, however, was made to replace the former, and from this latter assumption it was shown that equilibrium could exist at points above the critical speed", declared Dr. B. L. Newkirk, professor of mechanics at the University of Minnesota for many years, and now research engineer with the General Electric Company, in an illustrated lecture on "Shaft Behavior", given before the junior and senior engineering students in the Engineering Auditorium, Dec. 14.

"Theoretical considerations of shaft behavior do not apply so well to practical applications", said Dr. Newkirk, "not because the shafts are not so well-balanced as in a turbine, for example, but because with long, unrigid bearings it is extremely difficult to determine the actual length of the shaft.

" 'Whipping' can be produced", said Dr. Newkirk in conclusion, "by a cramping of the shaft, and this 'whip' will cause vibration. Due to oil in the journal bearing, when the critical speed is reached, this 'whip' will act as a stimulus of the right frequency and set the shaft into vibration."

OUR MONTHLY DRAMA

Professor, How Could You?

CAST: Professor P. H. Hyland and a Frosh

ACT I

Curtain rises on Prof. Hyland in street attire, standing in lobby of Engineering Building. Enter Frosh, evidently unable to see the directory.

Frosh: "Say, do you know where I can find a geek around here named Pat Hyland?"

Prof. Hyland: "His office is on the next floor at the end of the hall on your left. If he isn't there, go in and wait. He will be in soon."

Exit Frosh

ACT II

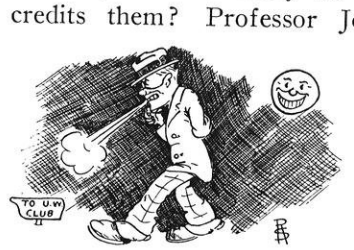
Scene in Prof. Hyland's office. Frosh is seated on the edge of the chair, waiting. Prof. Hyland enters and removes hat and coat. As he does so, the Frosh drops his jaw and his eyes hang out. Prof. Hyland drops into his chair.

Prof. Hyland: "I am the geek named Pat Hyland. Is there something you want?"

Exit Frosh

THE ABSENT-MINDED PROFESSOR

Are professors really so absent-minded as tradition credits them? Professor Jesse Kommers testifies as follows: "I spent an evening at the University Club recently, and when the time came to go home, I accepted the invitation of Prof. Van Hagan to ride. He dropped me at my door and I entered the house to be greeted by Mrs. Kommers with, 'What did you do with the car?'; so I kept my coat and hat on and walked the two miles back to the club, and brought home my own car."



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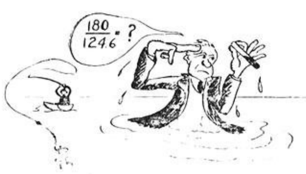
WM. J. MEUER, PRESIDENT

ENGINEERS HOLD FIFTH ANNUAL CHRISTMAS GATHERING

In keeping with the spirit of *camaraderie* which prevails in the college, more than 300 engineering students, and members of the faculty and their families celebrated the fifth annual Christmas get-together of the College of Engineering, in Music Hall, the evening of December 15.

A talk on Christmas spirit by Rev. R. W. Barstow comprised the first part of the program. Following the address, Prof. E. B. Gordon, of the School of Music, led the gathering in singing Christmas carols. A 20-piece orchestra, composed of engineering students and children of the engineering faculty, furnished the accompaniment to the group singing.

The celebration was carried out under the guidance of Dean A. V. Millar and a committee of ten freshmen. The freshmen who aided in making the event a success were G. C. Ward, W. C. Addison, J. Mattson, R. W. Brown, C. P. Ewald, M. Hersh, J. H. Larson, G. W. Curron, E. A. Wegner, and J. J. Kurth.



The specific gravity of Milwaukee River water is 1.444, according to Clarence Moe. When Moe miscalculated his jump to the city's tug during the recent inspection trip of the senior Civils, he sank to his hips. Two cubic feet were submerged; pure water weighs 62.3 pounds per cubic foot; and Moe weighs 180 pounds, including the samples of paving in his pockets. Therefore, the specific gravity 180 over 124.6 or 1.444.

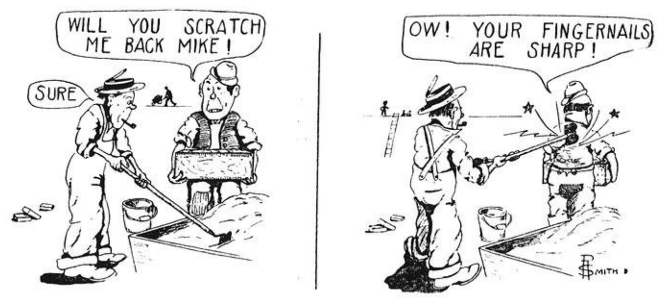
CALENDAR FOR SECOND SEMESTER OF ACADEMIC YEAR, 1925-1926

Feb. 4, 5	Thurs., Fri.	Registration days, second semester
Feb. 8	Monday	Classes begin
Feb. 22	Monday	Washington's birthday: legal holiday
April 7-13	Wed.-Tues. (incl.)	Spring recess
April 17	Saturday	Examinations for removal of conditions
May (30) 31	Monday	Memorial day: legal holiday
June 7-15	Monday-Tuesday	Final examinations
June 14, 15	Monday-Tuesday	Examinations for admission
June 18-21	Friday-Monday	Commencement exercises

EXTENSION DIVISION INTRODUCES 20-WEEK COURSE IN AUTO ELECTRICS

A step which will be of direct, practical benefit to the garage men of Madison and vicinity is the introduction of a 20-week course of evening training in automobile electric service work under the personal supervision of Prof. E. L. Consoliver of the University Extension Division. Previous to his becoming a member of the University Extension faculty, Professor Consoliver was director of the School of Automotive Electricity, Milwaukee.

The course covers all phases of automotive electric service work, including ignition, storage batteries, starting and lighting systems, and service station management.



WANTED—

It is extremely doubtful whether these want-ads, culled from a number of small town newspapers, received replies:

"Single room by elderly gentleman with electric lights."

"Room by young man with both kinds of gas."

"Men to can peas with a reference."

"Nice young man to run a pool hall out of town."

"Man to run concrete mixer with speaking knowledge of German."

WIRED WIRELESS FOR TRAIN CONTROL

A wired wireless system for continuous train control by means of safety devices, operated by high-frequency currents, has been demonstrated by the Pere Marquette Railroad. A locomotive traveling at fifty miles per hour was stopped in the initial tests by applying brakes controlled by wired-radio impulses. The system was invented by Thomas Clark of the Tecla Electrical Laboratory.

The carrier current is sent into the rails of the track from a transmitter located along the route. Loop collector coils under the cow-catcher intercept the waves. The apparatus sends a 28,000 meter wave to indicate the track is clear and a 22,000 meter wave to act as a caution signal. The energy picked up by the coils actuates a visual signaling device in the engine cab. If a red light flashes it indicates danger; yellow, caution; and green, a clear track ahead. The red lamp is illuminated only when a train is in immediate danger of collision. If a train is occupying a block, the rail surface within that block becomes automatically demagnetized and another train, entering from the rear or front, will have its red light flashed and the brakes automatically applied.

Any tendency of the engineer to exceed the speed necessary in the "caution" zone results in partial application of the brakes so that when the "danger" zone is entered the brakes are automatically set.

—*Scientific American.*

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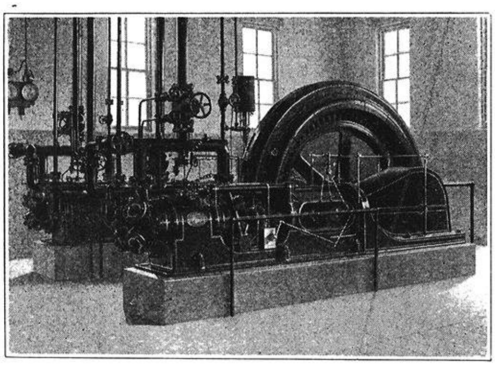
658 State St. Next to Lawrence's



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Alumni Notes

R. T. Homewood

CHEMICALS

Cleveland F. Nixon, ch '23, can be reached c/o Western Clock Company, La Salle, Illinois.

Walter G. Traub, ch '22, became the father of a daughter, Harriet Anne, on August sixth. Home address: 1959 Beachwood Drive, Hollywood, Calif.

Joseph L. Walton, ch '24, was married on October 24, 1925, to Miss Catherine Roberts.

CIVILS

Ernest M. Barnes, c '22, is living at 1117 Chapline St., Wheeling, W. Va. He is still doing estimating work with Engstrom & Company. Mr. Barnes visited the university during the holidays.

George E. Bean, c '24, is manager of the Tanner Concrete Construction Company of Idaho. He went up to Two Rivers during the past summer to bring back his manager (Formerly Miss Mercedes Zander ex '26).

Elmer W. Becker, c '24, was married on October eighteenth to Miss Eunice Finger of Fond du Lac, Wis. Becker is employed as junior engineer in the city water works department of Milwaukee.

J. Gardner Bennett, c'18, CE'25, is teaching in the department of civil engineering at Denison University, Granville, Ohio.

John Berg, c '05, C. E. '10, is serving his second term as State Engineer of South Dakota, Pierre, S. D.

Harold W. Bille, c '21, is with the Atlas Lumnite Cement Co., with headquarters at 134 So. La Salle St., Chicago.

Walter P. Bleecher, c '14, became the proud father of a son, Walter Phillip, Jr., on September twenty-eighth. His present address is 142 Langdon Ave., Watertown, Mass.

C. G. Burritt, c '09, has changed his address to 922 Second Ave., South, Minneapolis, Minn.

William J. Camlin, c '18, former business manager of the Wisconsin Engineer, is manager of the building-forms department of the Building Products Co. at Toledo, Ohio.

Carl B. Christianson, c '22, left the I. C. R. R. on January 1 to accept a position with Engstrom & Co., 419 Wheeling Steel Corp. Bldg., at Wheeling, W. Va.

John T. Dresen, c '20, is Resident Engineer in charge of work at Niles Center, Illinois, for Consoer, Older, & Quillan, Chicago. The work consists of sewer, water main, and pavement construction, around $1,300,000 worth of work being installed this past year. Dresen visited the university during the holidays.

Irving R. Haddorff, c '24, is in Florida, taking part in the big boom.

William MacLeod, c '24, is assistant office engineer with Consoer, Older, and Quillan, Chicago. He has to do especially with structural work connected with pump house and bridge designing.

F. C. McIntosh, c '13, has changed his address to 10 East North Diamond Street, Pittsburgh, Pa.

Melville C. Neel, c '20, is efficiency engineer at gas plant, Metropolitan Utilities District, Omaha, Nebraska. He writes, "My wife and I took a 2,000 trip through the Rockies this summer crossing the Continental Divide over the new Independence Pass which on account of the snow was rather a nerve-racking experience. My work at the Gas Plant has been interesting, because I do the surveying, designing, drafting and constructing. I have had a chance to carry out my own ideas with but little interference and have also had the opportunity to learn something of the operation of a gas plant. We have just recently completed a 4 million cubic foot holder which was quite an experience for me."

G. R. Schneider, c '22, has been with Engstrom & Co., general contractors at Wheeling, W. Va., since February, 1925.

Philip K. Schuyler, c '21, who taught last year at the University of North Carolina, sends in his subscription from Mexico City, without saying what he is doing there. His address is: San Diego No. 9, Mexico, D. F., Mexico.

Ralph Smith, c '25, is working on sewer, water main, and pavement constructing at Niles Center, Illinois, for Consoer, Older & Quillan, Chicago.

ELECTRICALS

J. E. Bodah, e '25, superintendent of the railway properties of the Wisconsin Public Service Corporation at Manitowoc, has been appointed master mechanic of the company at Green Bay. He writes, "Come on in fellows, the water is fine and not half so cold as it looks, in fact I find the railway game a gay life — new problems and new interests each day, especially since busses have been giving us such keen competition." Bodah is living at the Y. M. C. A. at Green Bay, Wis.

A. J. Goedjen, e '10, is manager of the Menominee and Marinette Light and Traction Company.

Edward H. Kietzmann, e '24, is engineer with the Beloit Gas, Water and Electric Company at Beloit, Wisconsin.

Ernest M. Lunda, e '22, is railway equipment engineer at Grand Rapids, Michigan. He is working with some of the latest developments in the electric railway field.

G. S. Meyrick, e '22, is an engineer with the Wisconsin Public Service Corporation at Green Bay. He is living at 418 South Jackson Street, Green Bay, Wisconsin.

Thomas "F" Miller, e '24, is with the Wisconsin Telephone Company and has been working out of the Appleton office.

Chauncey M. Morley, e '21, announces his marriage on December 23, to Sue Thompson.

Rueben J. Pech, e '24, is load dispatching for the Wisconsin Public Service Corporation from the Green Bay center. He keeps close watch over the "white coal".

Fred Rahr, e '24, is power statistician with the Hoberg Paper & Fibre Company at Green Bay.

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506 State Street **THE CO-OP** E. J. GRADY, Mgr.

Edward Schildhauer, e '97, E. E. '11, has changed his address from Allied Chemical & Dye Corporation, 61 Broadway, New York, to c/o The Solvay Process Company, Syracuse, New York.

O. H. Wing, e '24, is test engineer for General Electric at Schenectady, having been recently transferred there from Erie, Pa. His address is 246 Union Street, Schenectady, N. Y. Mr. Wing visited the university on his way home to Eau Claire, where he spent the holidays.

Timothy P. King, e '24, is operating at the Green Bay Steam Plant of the Wisconsin Public Service Corporation. He has invested in a closed car of the latest model, and is making the most of it.

L. P. Works, e '19, is Assistant Manager of the Wisconsin Public Service Corporation. He is responsible for the operation and maintenance of three steam plants, seven hydro plants, about 500 miles of transmission lines, and a large number of substations. His home is at 1025 Emilie Street, Green Bay, Wisconsin.

Yussuff Zia, e '24, when last heard from, was anxious to leave his teaching job in Turkey and come back to "the good old U. S. A."

MECHANICALS

Harold "Red" Addington, m '24, is in the heating department of the N. O. Nelson Mfg. Co., Salt Lake City, Utah.

Arnold C. Besserdich, m '25, is very much interested in his work with the Sanitary District of Chicago. He writes, "Now they have given me an opportunity to show some of my genius on the subject" (design of a Refuse Incinerator Plant). "It is the steam and gas, however, which we thought was given too heavily to us while at college, that is really most beneficial to me at present. Of course I mean my knowledge of steam and gas which probably doesn't reach far at that". Besserdich is trying to get a solution to the "simple" problem of the design of an orifice that will give constant discharge under variable head. He says, "Probably some of your calculus sharks can find a solution for it". His address is 3345 Union Ave., Chicago.

W. H. Carson, m '23, is assistant professor of mechanical engineering at the University of Oklahoma, Norman, Okla.

Norman F. Koch, m '24, is power statistician with the Wisconsin Public Service Corporation. He appeared in a public swimming exhibition recently. He is living at the Y. M. C. A. at Green Bay.

Victor E. Shimanski, m '25, is a student engineer with the Trane Company of La Crosse. He recently announced his engagement to Miss Ruby Norton of La Crosse.

B. A. Weideman, m '25. is still with Leach Company at Oshkosh, Wisconsin. He writes, "At present I am making catalogue cuts and designing jigs and pressed steel dies for our new -7S mixer. - - I'm wondering if I'm to be the second of our gang to enter the matrimonial field? The little lasy I introduced you to is to become Mrs. Weideman before many months are over. Have any of the other fellows said the good word 'I will' "? Weideman's address is 50 Elmwood Ave., Oshkosh, Wis.

MINERS

E. Azcon, min '24, is efficiency engineer at the Elm Orlee Mine, Butte, Mont.

C. C. Gladson, min '24, has been made manager of the Detroit branch of Ladish Drop Forge Company of Milwaukee.

T. D. Jones, min '22, has been made superintendent of the Bismuth Plant of American Smelting and Refining Company at Omaha, Nebraska.

Marcus W. Link, min '21, is Mining Engineer for Lafayette Fluorspar Company (a U. S. Steel Company subsidiary) at Mexico, Kentucky. In addition to the work in mining, Link has had an important part in the construction of a large concentrator, and in exploration.

Louis Mann, min '21, Min. E. '22, whose address is 406 Virginia Apartments, Butte, Montana, is interested in some gold prospects in western Montana. Mann will probably run into conflict with the "blue sky" laws if he writes such enthusiastic letters and along with them sends samples in which free gold can be seen.

Gilbert G. Grieve, min '22, has charge of one of the shifts at the coke plant of the Youngstown Sheet and Tube Company at Indiana Harbor, Indiana. Grieve has a small daughter at his home in East Chicago who takes up a considerable portion of his spare time.

Otto A. Ray, min '20, is northern representative of the Chicago Pneumatic Tool Company with headquarters at Ironwood, Michigan. Ray reports great success in introducing C-P drills in the Lake Copper and Iron Districts.

D. C. Roscoe, min '25, is Research Engineer with Bethlehem Steel Company at Bethlehem, Pa. Roscoe has completed the three months apprenticeship course given by them and is one of the successful group of fifty from more than 200 who took the course.

Lloyd M. Scofield, min '21, is geologist for the Pickands-Mather Company with headquarters at Newport Mine, Ironwood, Michigan.

Chen-Kueh Tsao, min '21, Min. E. '22, has resigned the position of instructor in mining at the Shantung Mining College, China, and has accepted the position of Professor of Geology at Nankai University, Trentsin, China. Many of us at the University of Wisconsin remember Tsao's ability as a vocalist and have never been able to replace him when we have had guests at Mining Club dinners.

W. A. Knoll, min '12, Min. E. '22, has been promoted to the General Underground Superintendency of the Pickands-Mather Company operations on the Gogebic and Marquette Iron Ranges in Northern Wisconsin and Michigan. His address is c/o Newport mine, Ironwood, Michigan.

Gilbert W. Wegner, min '23, is starting for Poland and Silesia for the Anaconda Copper Mining Company interests to examine some zinc properties which they have taken over from German interests. From his graduation to date, Wegner has been employed at the International Smelting Company, Trele, Utah, a subsidiary of Anaconda.

Edward C. Wolter, min '23, has been made general foreman of the Open Pit operations of Chino Copper Company at Santa Rita, New Mexico. His address is c/o Chino Club, Santa Rita, New Mexico.

There is no truer test of a man's qualities for success than the way he takes criticism. The little-minded man cannot stand it. He crawfishes. Then when he finds that excuses won't take the place of results, he sulks and pouts. It never occurs to him that he might profit from the incident. —*Selected.*

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INDUSTRIAL products enter a world of use and abuse —and upon their long-lived, dependable performance, manufacturers are judged.

Performance—upon which repeat orders are based—is not entrusted to "any old bearing that will fit the space," but to one in keeping with the manufacturer's reputation.

Bearings govern so many operating factors, that their selection is the very foundation of good machine design.

For more than 35 years, manufacturers of dependable equipment have designed their products around Hyatt Roller Bearings. They are built for continual hard service—require but slight attention—and once installed, last a lifetime.

Later on, when you are called upon to consider the bearings for new or existing equipment, remember that Hyatt Roller Bearings will solve problems for you as they have for many other engineers.

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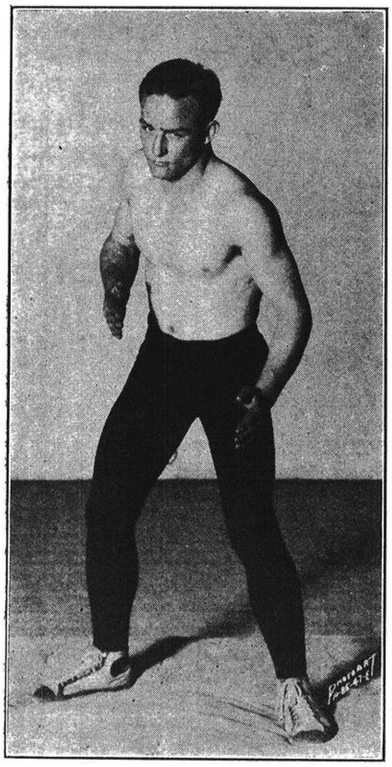
Athletics

B. R. Teare

WRESTLING

With a goodly nucleus of engineering grapplers upon which to build his squad, Coach George Hitchcock is fast rounding into shape Wisconsin's wrestling team. The College of Engineering has the greatest representation on the squad, which numbers about one hundred. Coach Hitchcock himself spends part of his time instructing engineers in the shops, and the captain, Lisle Zodtner, is a senior chemical. Besides the captain, "W" wearers that are out for the sport this year include Splees and O'Laughlin, both junior electricals. Other good engineering material is represented in Chao, sophomore civil, Brackett, senior electrical, and Randecker, sophomore mechanical. At the close of the football season the wrestling squad was increased by the addition of many good men from the football squad.



Captain Lisle Zodtner, *Senior Chemical*

More interest has been shown in wrestling this year than before, and the large number out made necessary the addition of a trainer to the squad. Many other Big Ten schools however get out even more men; Illinois and Iowa, for example, get three or four hundred out. A more restricted system of awards used at Wisconsin and the fact that the coach cannot give all his time to the sport probably cuts down the number of wrestlers here, and with a change of the system of awards, and a full time coach, wrestling might be given a better show.

The squad has been progressing very well and should be in good shape for the first conference meet with Iowa on January 16, and since from a third to a half of the men are from the College of Engineering, it will no doubt give a good account of itself.

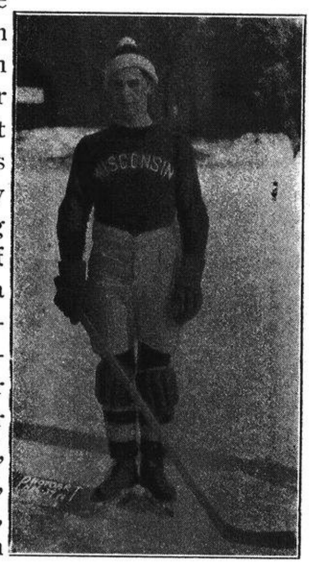
ENGINEERS WIN SKI TOURNEY

At the Lake Placid inter-college ski and skating tournament held at Saranac, New York, on New Year's day, the University of Wisconsin carried away highest honors, winning one trophy meet, tying for first in another, and altogether winning four individual honors. This fine showing was due principally to the excellent work of two engineering students, Hans Troye, and Knute Dahl, frosh electricals from Norway.

Dahl's speed brought him in first in the seven mile cross country race; Troye finished second in this event, and besides, placed first in the ski jump, breaking unofficiallly the record with a leap of 138 feet. Altogether these embryo plumbers garnered thirteen of Wisconsin's eighteen points in the meet, which was no small contest. Many large schools, some Canadian, were represented, including Columbia, Yale, Harvard, Dartmouth, and Michigan. The College of Engineering may well be proud of these winged frosh, whose fine showing is the result of hard work on the part of Coach Iverson as well as on the part of the men themselves.

HOCKEY

Since the beginning of cold weather, when Coach Kay Iverson arrived to take charge of winter sports, preparations have been in the making for a hockey team that will be stronger than ever. The material this year is good — the only man lost from last year's varsity is Manierre, and, with a goodly number of engineers working on the squad, it looks as if Wisconsin would put out a real fighting team. Representing the College of Engineering are Whiteside, senior civil, Lidicker and Ruf, junior civils, Teich, sophomore civil, Britton, sophomore electrical, and Cahoon and Carrier, sophomore mechanicals. Coach Iverson is well satisfied with the showing made by the engineers in the game itself, and in addition, he has little to fear from them in the line of scholastic inelegibility.



Lidicker, *Junior Civil*

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We will tell you what to use to cure that cold or other minor ill.

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A First Semester Mistake that Can Be Corrected

As the first semester ends, lots of fellows—Engineers among 'em—are thinking about the mistakes they have made and resolving to do things differently during the second term.

We're suggesting a resolution for you—and it has nothing to do with studying harder, attending classes more regularly or getting papers in on time. It's much easier than that, but just as important.

It is to take better care of your money. If you're one of the lads who carries his money in his pocket, spends it here and there, and later wonders where it's gone to, raise your right hand and resolve to open a checking account at the Branch.

You'll be amazed at how much you can cut down the overhead by doing business by check, and how well you'll know where the money's gone.

95% of the student body does business through the Branch Bank —if you're in the five percent, get over with the wise ones next semester.

BRANCH BANK OF WISCONSIN

STUDENT BANKING HEADQUARTERS—STATE AT GILMAN

itself, and in addition, he has little to fear from them in the line of scholastic inelegibility.

To get the squad into good shape for the coming matches, Coach Iverson scheduled a practice trip for the hockey team during the Christmas recess. Games were played with the strong teams of Duluth, Virginia, Eveleth and others. In this section of Northern Minnesota hockey is one of the foremost sports and is of a fast and furious brand. These games meant splendid practice for the team and should put it into fine condition for the coming conference tests.

SWIMMING

Although the fish squad has been practicing for a long time, actual work under coach Joe Steinauer did not begin until the latter was released from his duties as trainer for the football squad. So far, the coach has not worked the men intensively, and does not know what their best amounts to. However, there is a large number of men out, numbering about sixty in all, and among them are many letter men and stars from last year. The College of Engineering, of course, is well represented by a number of good swimmers, including Bardeen and Post, junior electricals, Abendroth, junior civil, Devine, Thompson, Wiechers, Wray, Mattison and Bowen, sophomore electricals, Cody, sophomore chemical, and Comstock, sophomore civil. After a few more stiff practices, some extensive time trials will be held, from the results of which the coach will pick the team to represent Wisconsin, and beginning with Michigan at Ann Arbor, the team will be given a chance to show what it can do in real conference competition.

BASKETBALL

Long before the football season was over, Coach "Doc" Meanwell started basketball practice, but it was not carried on with real intensity until about a month ago. Several scrimmages were held with the frosh team, and although the varsity showed improvement, no brilliant playing was uncovered. The season was opened with a loss to the North Dakota Aggies, the score being 16 to 11. Cardinal passing was good, and the men were not slow, but when they reached the basket, there was a hitch somewhere, and the ball would go wide of the basket. However, the Aggie veterans had played and won several games, while it was the Badger's first game, and it had been rightly expected that the opponents had a strong team.

The next game was with the South Dakota Aggies; it followed a week of hard practice, for the Badgers were determined not to be beaten again. Far from losing, the Cardinal five romped at will over the Jackrabbits, and at the end of an unexciting game, the score was 48 to 9. The match showed that Wisconsin was not entirely without strength and that a marked improvement in playing ability had taken place.

(Continued on page 133)

PLAN FOR THE ELECTRIFICATION OF PALESTINE

A new engineering scheme, which will use the sun's energy to provide electrical power for all Palestine, make water available for the irrigation of thousands of dry acres, and provide a new interior port for ocean shipping and canals for inland transportation, has been suggested by a French engineer, M. Pierre Gandillion, and accepted for execution by several French business men.

The project consists in utilizing the falls that can easily be created between the Mediterranean and the Dead Sea by carrying the water of the Mediterranean over a 260-ft. ridge by means of canals, pumps and a great siphon and from there letting it drop to the Valley of the Jordan and from there down into the Dead Sea, a total vertical distance of more than 1,500 feet. The Dead Sea is an inland lake and only as much water as the sun can easily evaporate will be thrown into it.

M. Gandillion estimates that the sun now evaporates all the water that the Jordan carries into the Dead Sea at the rate of about 92 cubic yards or 2480 cubic feet per second. That it used to evaporate much more is shown by a series of terraces at different levels on its borders, formed when the water was higher and the surface exposed to evaporation by the sun's heat therefore greater. The new plan will raise the level of the Dead Sea and evaporation by the sun will take care of the additional and regulated inflow. It is believed that evaporation of 135 cubic yards a second is easily possible and the inflow from the Jordan is to be augumented by that amount.

The scheme will necessitate the building of a sea-level canal from the port of Haiffa, on the Gulf of Akka, to a point about four miles inland. It will end in a great basin where ocean steamers can turn. From there on, either navigable canals with locks or acensional water pipes will be built to reach the ridge at Afoule, a way station. At that point a one and one half mile tunnel will be bored through the rock, and the water will run into chambers at about 262 feet above the level of the Mediterranean and about 1,125 feet perpendicularly above the Jordan, where a hydraulic turbine will be built. Another drop of 394 feet is available between the Jordan and the Dead Sea, making a total drop of over 1,500 feet.

In all a crude force of 617,000 horse power will be generated, said Gandillion. Of this, 190,500 horse power will be used to lift the 135 cubic yards of water a second from the Mediterranean over the 260-foot ridge, leaving enough power for the electrification of the entire Holy Land with its railroads, industries, and agriculture.

The fresh waters of the Jordan and the Sea of Galilee need not be poured into the Dead Sea with the salt water of the Mediterranean, but can be diverted and used to irrigate thousands of acres of dry land.

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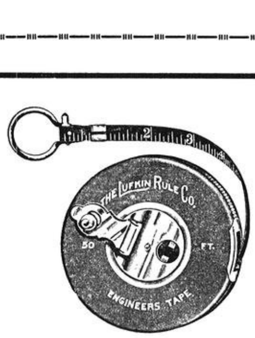

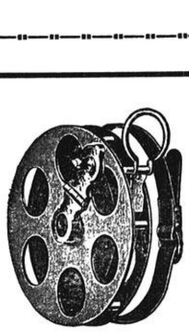

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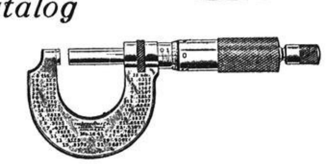

THE LUFKIN RULE CO.
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Please mention The Wisconsin Engineer when you write.

BUILDING A SUBGRADE OUT OF DUST

By L. T. Sogard, c '24

The casual observer seldom realizes that too little rain can cause a great deal of trouble in concrete paving construction beyond the drying up of the contractor's water supply. The evils of too much rain are readily appreciated by all of us, but the evil of too much dust is seldom felt beyond the slight discomfort it affords those upon whom the excess settles.

Especially is trouble met on projects where the batched materials are conveyed to the mixer by trucks. As the grade becomes dry, the trucks, continually travelling upon it, pulverize the dirt to a depth of several inches until it becomes exceedingly powdery. It is no more possible to build a subgrade of this fine material and expect it to hold its shape under the continual trucking to which it is subject, than it is to build a subgrade of mud and expect it not to rut. In fact the dust is even worse than mud, because, while the mud will remain somewhere between the form lines, the dust follows every whim and fancy of the passing winds over an area measurable in square miles, thereby necessitating the importation of more dirt at the expense of the yet unconstructed shoulders.

Sprinkling calcium chloride in the dust the night before the subgrade was to be built was tried on a certain job, but it readily developed that the amount of this salt necessary for any efficacious treatment was far in excess of what could be used without throwing to the winds all regard for economy.

Sprinkling with water was the next resort, and it proved quite effective. A garden hose was obtained similar to the one used to keep wet the burlap covers placed on the newly laid concrete. A short time before each stretch of subgrade was built to correct elevation, it was sprinkled thoroughly. The trucks helped to stir up the dust enough to effect quite a complete wetting. This wetting converted the dust into a substance which an optimist might call dirt, (and, at heart, a contractor has to be an optimist). This dirt was quite workable and readily lent itself to being constructed into a true subgrade. Upon completion and checking for elevation, the prepared subgrade was again thoroughly soaked. The packing action of the trucks, passing to and fro over this wet subgrade, caused a seal-coat of hard mud to form as it dried. This held up quite well under the heavy traffic.

Whenever possible the trucks were routed outside the forms during the preparation of the subgrade. However, they were re-routed over the finished subgrade as soon as it had been soaked, for it was discovered that if the dirt dried without the packing action of the moving trucks, the hard crust or seal-coat did not form. That subgrade which was far ahead of the mixer was sprinkled several times during the day to further insure the binding power of the seal-coat.

THE INTERNAL COMBUSTION BOILER

By J. P. Smith, c '26

All designs of boilers are based on the principle of bringing the flame of the fuel into the closest possible contact with the water in the boiler. If this is one of the main ideas, why not burn the flame inside the water? Is it possible to burn a flame in immediate contact with a liquid? It is, as every kind of liquid fuel burns in the liquid as long as the quantity of air or oxygen is large enough to insure complete combustion. This idea is fully demonstrated in the working of the internal-combustion boiler, the principle of which is to maintain a flame burning the liquid in order to evaporate the latter. During the years of experimenting, liquid hydrocarbons of a specific gravity between .8 and 1.2 have been used. Tar oil from Belgium, coal tar from Germany, Astatke from Baku, waste oil from America, and different kinds of oil from every part of the world have been tried. More than sixty different kinds of oil have been used, and all could be burned without difficulty.

The fuel, crude oil, etc., and the air which is necessary for the combustion are supplied to the burner under a pressure which barely exceeds that of the steam. The temperature in the center of the flame is approximately 1,800 deg. Cent. This temperature diminishes to the periphery of the flame, so that between the center of the flame and the periphery a rapid fall of temperature takes place. Since a permanent stream of burning gas has to pass this fall of temperature, it is evident also that last traces of carbon-monoxide must be converted into carbonic acid. In leading the combustion in such a way the possibility is insured of burning the fuel more completely than in the open air. The combustion under pressure brings the molecules of the fuel into better contact with the oxygen, therefore, under pressure and in water the most complete combustion can be obtained.

The mixture of gases which pass from the steam generator to the steam reservoir contains 60 per cent steam and 40 per cent of gases. These are the same gases which work in gas and oil engines, the only difference being that in such engines the amount of steam is much less.

The presence of this great quantity of gas in the steam makes the condensing engine impossible; i. e., the exhaust steam can be condensed, and as feed water be pumped into the boiler, but a vacuum cannot be used, because vacuum pumps of a very large size would be required. But this fact is not a serious disadvantage. The main idea is to save as much fuel as possible, and to obtain the highest efficiency. If this is possible without condensation, it is all the better. Instead of the condenser we have an air compressor, which takes less space and needs less repairs than the condensation plant.

—*Engineer, London.*

ATHLETICS

(Continued from page 130)

Next came the game with Marquette, for several years a rival with whom the games were about evenly divided. The contest was decidedly rough, and featured by a large number of personal fouls, ending, however, in a decisive victory for Wisconsin, to the tune of 42 to 26. The victory from Marquette is shown by the score to have been not a matter of luck, and as Marquette is not considered a weak team, prospects for the season look exceedingly good. If the team does not slump, but continues to improve as it should, we may look forward to a successful basketball season.

HOW TO LOSE A FAT JOB

College men just out of school are possessed of ideals. Most of them suffer disillusionment when they come into contact with business ethics and the practices of the people they meet. An incident that occurred in an engineering office in which I worked during the past summer will illustrate the sort of thing I have in mind.

One of the leading draftsmen in the office — a man who was receiving a salary of between $300 and $400 a month — risked losing his position and good fortune by padding his time card about twenty per cent. He was finally apprehended and discharged. In this case the man lacked not only ethics; he lacked common sense.

EDITORIALS

(Continued from page 118)

IN PROPORTION To discover a man who has attained success without conscious effort is indeed a rarity. If the life of a successful individual were examined, one outstanding fact would seem quite certain; and that is, that his degree of success depended in large measure upon his efforts in that direction. An investigation will show that in any profession or career, in any condition of life, an individual gets out of that interest in direct proportion to what he puts into it.

This relation between effort and value is sometimes ignored by self-sufficient students. To "get by" merely, to get credit for a certain subject — seems to be the sole reason for their existence at the university. If an engineer is satisfied with the idea of acquiring a superficial knowledge of the course instead of a thorough understanding of it; if he is satisfied with getting a hazy and rather indefinite impression of the course he is pursuing, and where it is leading him; if he is content to rest his oars and think that by some miraculous means he will acquire an education and competency to perform his duty in the world outside; he will pay heavily when the world demands of him its dues.

It is only by giving his best to his studies that the student can derive the greatest value from them; it is only by giving his best to his particular activity that one can expect to receive the best that activity has to offer; and it is only by giving nothing but the best to any interest in life that one can receive the utmost value in return.

Re-making the World with Precision Tools

IT is difficult to comprehend the tremendous changes made possible in the world by the introduction of practical precision tools. The astounding mechanical progress of the past 50 years, which has completely changed man's environment, would have been impossible without them. They place within reach of all the standards without which working methods in the metal trades would be primitive.

The vernier as a mechanical principle of indicating very small dimensions was invented by Pierre Vernier in 1631. The first practical application of the principle to a measuring tool for metalworkers was not made, however, until 1851, when Jos. R. Brown invented the Vernier Caliper.

The manufacture of this highly useful tool by the Brown & Sharpe Mfg. Co., dated from that year. Today, hundreds of styles and sizes of tools embodying the vernier, and measuring to one thousandth of an inch, are made by this company and distributed all over the world.

The first and original Vernier Caliper, so far as is known, invented in 1851 by Jos. R. Brown, the founder of the Brown & Sharpe Mfg. Co.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

ENGINEERING REVIEW

(Continued from page 117)

RADIOACTIVITY AND EARTHQUAKES

The recent severe earthquake felt in California and Montana and the mountain slide in Wyoming have aroused interest in the theory of Professor J. Joly, English geologist, on radioactivity as the possible cause of quakes. It is a well known fact among scientists that throughout the entire earth's crust minute quantities of radioactive elements exist, mainly thorium and uranium, which are constantly producing heat by breaking down at a rate quite independent of the pressure and temperature found in the outer parts of the earth . The granites, which are in the outer layer of the earth's crust, contain approximately as much of these radioactive elements as the basaltic layer, which is deeper, and this latter is twice as rich as the denser and more basic layer of peridotites.

Continents are essentially composed of granite embedded in a sub-stratum of basaltic composition. This has a lower melting point than the granite, and increases in volume about ten per cent at its melting temperature. And since the basaltic layer is self-heating due to its radioactivity, Professor Joly states that it lacks only the latent heat of fusion to become fluid, and further that at the present rate of disintegration it must again become fluid in about thirty million years. When this expansion has reached its greatest point, the surface crust is correspondinly raised and increased in area about 650,000 square miles. The surface tension becomes so great that continents and ocean floors are split apart. Tidal action starts a slow westerly drift of the still solid continents, and the superheated-stratum, which originally lay beneath a continent, now comes to lie beneath the ocean floor which melts away from below until the increasingly rapid loss of heat from the ocean checks and finally ends the process.

The reverse action now begins. Crystallization in the liquid basaltic layer takes place, the vastly increased land area contracts and settles down into the solidifying sub-stratum and the margins of the continents especially are marked by intense compression, producing immense depressions and upheavals. This in brief is the cycle whereby the excessive heat due to radioactivity is accumulated and lost, during which succeeding cycles the ancient Eurasian ranges and the fairly recent Himalayas and Pacific ranges have been thrown up during the different geologic epochs. That such a cycle is nearing completion in the Pacific region is known, due to current observation on the steady sinking of the ocean floor and the regularity of the tremors, most of which are so slight as to be recorded only by the seismograph, but which occur regularly every ten or fifteen minutes.

WHY TECHNICAL MEN SHOULD WRITE

One of the large industrial establishments has an official department, the function of which is to browse through the current literature of its subject in a search for talent.

Genius, interest, ingenuity, resourcefulness, straight thinking, facility of expression are as essential to the successful conduct of a great manufacturing concern as machinery and mechanical skill. It is no small part of the work of an executive to keep up his organization, to surround himself with the best in brains and knowledge and ability. The discovery of a man may be as important to the progress of an enterprise as the discovery of a process, or the invention of a machine. And the company that finds the best men and fits them into its personnel and develops their possibilities is bound to be a leader. And so the company referred to has all the books and papers in its field, all the proceedings of related societies, all the reports of lectures and meetings and discussions examined to see who is saying things, and what they are saying and how they are saying them. In this way they are brought into contact with men who are actively interested in similar fields, and through their writings, the things they say and the way in which they say them, get a cue to their potentialities as possible units in the organization. Many a man has written himself to the fore out of nonenity and obscure surroundings. The best way to perfect and organize one's own knowledge of a thing is to tell it to others. To tell it with the definiteness and precision of the written word requires self-questioning and analysis that often leads to a more profound insight into the subject on the part of the author himself. Many a gem of useful knowledge is interred with the bones of its possessor. Many a man who has the know-how, misses his chance because those who could use his knowledge do not know him.

USE OF SUPERCHARGERS

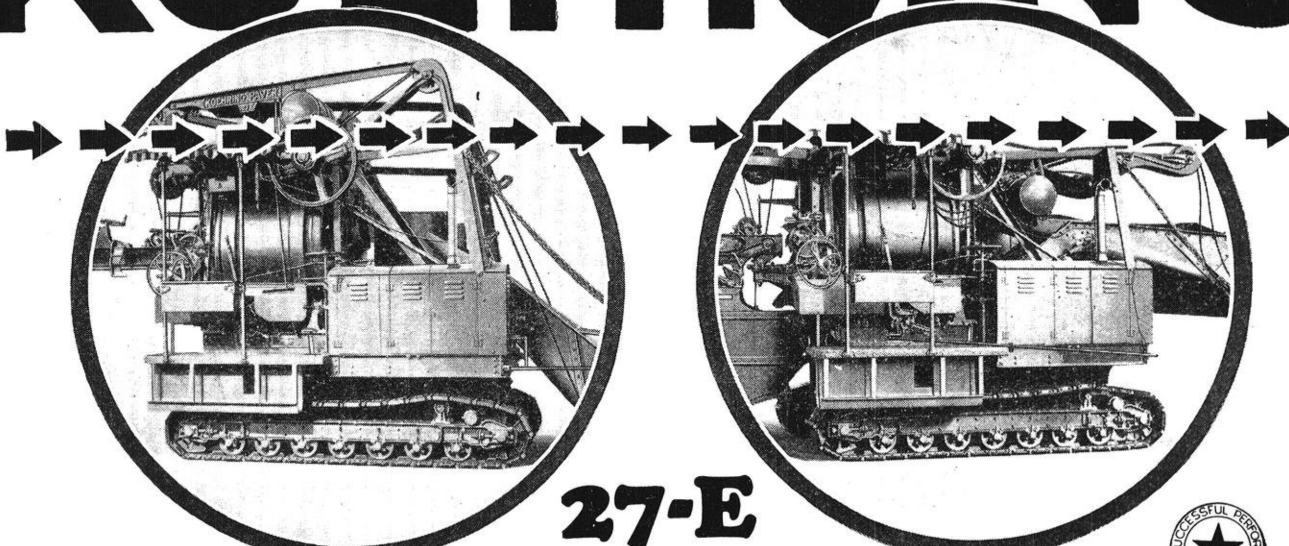
The use of the centrifugal supercharger recently developed for airplane and automobile racing motors by Dr. S. A. Moss, has been extended to Diesel-engine installations on sea-going ships. A more thorough scavenging of burnt gases from the cylinder is the result, which in turn has made possible notable increases in power and speed. —*General Electric Review.*

CABLE FOR HIGH FREQUENCY CURRENTS

The well known skin-effect by which A C is distributed unevenly over the cross-sectional area of a solid conductor, the current density being greatest at the outer surface, though negligible at usual frequencies used in electric-power distribution, becomes of considerable importance at the frequencies used in wireless telegraphy. It is necessary then, when large currents have to be conducted along cables, such as currents at radio frequencies, as in the case of the transmitting apparatus of high-powered wireless stations, to design the cable in a special manner in order to reduce the impedance to a minimum.

One method used in the Postal Telegraph System in England is to compound the cable from many insulated conductors, 6561 being used in a recent instance,

The Greater KOEHRING



27-E

Upper steel frame is hinged directly above the level of the top of the drum, giving the paver shipping height, with frame collapsed, of 11' 3". Frame is collapsed by taking out a few bolts, pins and unions — about a thirty minute job in the field.

As much as we have urged contractors to study Koehring construction, few Koehring owners seem to care much about *how* the Koehring gets *results.*

They seem satisfied to know that between the man on the operating platform, and the concrete on the subgrade is a responsive, *smooth, speedy functioning unit* that delivers a greater yardage to the subgrade than is ordinarily expected from the drum capacity! That's what means extra profits for them!

Of course they know Koehring Heavy Duty Construction is "*there*" —*must be* because of Koehring record of low maintenance, reliability on the job—and long service life!

SIZES

Pavers—7-E, 13-E, 27-E. Auxiliary equipment and choice of power to suit individual needs. Complies with A.G.C. Standards.
Construction Mixers—10-S, 14-S, 21-S, 28-S. Steam, gasoline or electric power. Mounted on trucks or skids. Rubber tired wheels optional. 28-S on skids only. Complies with A. G. C. Standards.
Dandie Light Mixer—107-S. Two or four cylinder gasoline engine. Power charging skip, or low charging hopper and platform. Rubber tired steel disc wheels or steel rimmed wheels. Complies with A. G. C. Standards.

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A-3010-I

all connected in parallel by joining the ends. Each of the wires was coated with insulating enamel, and covered with a protecting layer of cotton, three wires being twisted together to form a unit. Three units so formed were twisted together, and the operation repeated until eighty-one wires had been laid together, when the strand was covered with silk. Eighty-one of these strands constituted the cable. From this construction, any wire in a given length of the cable, passes thru the same phases with regard to the longitudinal axis as any other wire, so that the impedances of all wires are equal, irrespective of the skin effect. The insulation of each wire however, prevents the

—*Engineering.*

ANOTHER METHOD OF TELEGRAPHING PICTURES

Gertrude Ederle, champion swimmer, had hardly left the water in her attempt to swim the English Channel during August, before her picture, taken during this particular swim, appeared in American newspapers.

The public has already become accustomed to seeing telegraphed pictures, but it is impracticable to send these by submarine cable, because a cable does not operate in the same manner as a land telegraph wire. The familiar methods of picture transmission by wire show their own earmarks on close scrutiny, although there is no real objection to this, for it does not injure their news value. If you study closely the pictures transmitted by one of these land processes, you will find that they are made up entirely of parallel lines crossing the picture, each line changing from thick to thin and back again as frequently as necessary to bring out the desired combination of light and shadow. This method is almost automatic.

Peculiarities affecting submarine cable transmission make it difficult, however, to employ this process in transmitting pictures across the seas. Hence, another system, not open to these objections had to be devised.

By means of this transoceanic system, which is one of four processes devised by LeRoy J. Leishman, of Ogden, Utah, the picture to be transmitted is divided up into five degrees of tone value, every area of shade being outlined. These boundaries are traced with a stylus attached to two relatively moving scales, the readings on which comprise a record of absolutely every movement described by the stylus in the tracing process.

This mechanical process is based upon the fact that all lines are either straight or curved, and that all curved lines can be divided into components that are arcs of circles. When the arcs change, a single reading of the scales records the fact. All these readings are in letters, instead of figures, and the sum total of them comprises a message that can be transmitted by telegraph or cable. The code also indicates the exact depth of tone of each shaded area. A sample of the code by which Miss Ederle's picture was transmitted to America from England follows:

LONDON COLLECT 233 FIRST 50
NANEWSAL NYK
FOLLOWING FIRST HALF PHOTOGRAPH
EDERLE ABOUT TEN MILES GRISNEZ
CODE BEGINS JDBTD XXBTA XXLGA
JDLGA JDBTD UIGIS UJGGU UGGFU
UFGEA UFFWA UFFSQ UGFLQ UJFDQ
UTEVQ VQEWA VSFAQ VVFDA VXFWA
VXGAQ WAGAQ WBFQ VWGJA VWGKA
VTGKA VQGGQ VMGFQ

At the receiving end, the decoding device is operated and a synthetic picture is built up that is an exact duplicate of the original photograph. So accurate is the reproduced picture that it will superimpose with the original to 1/100 of an inch.

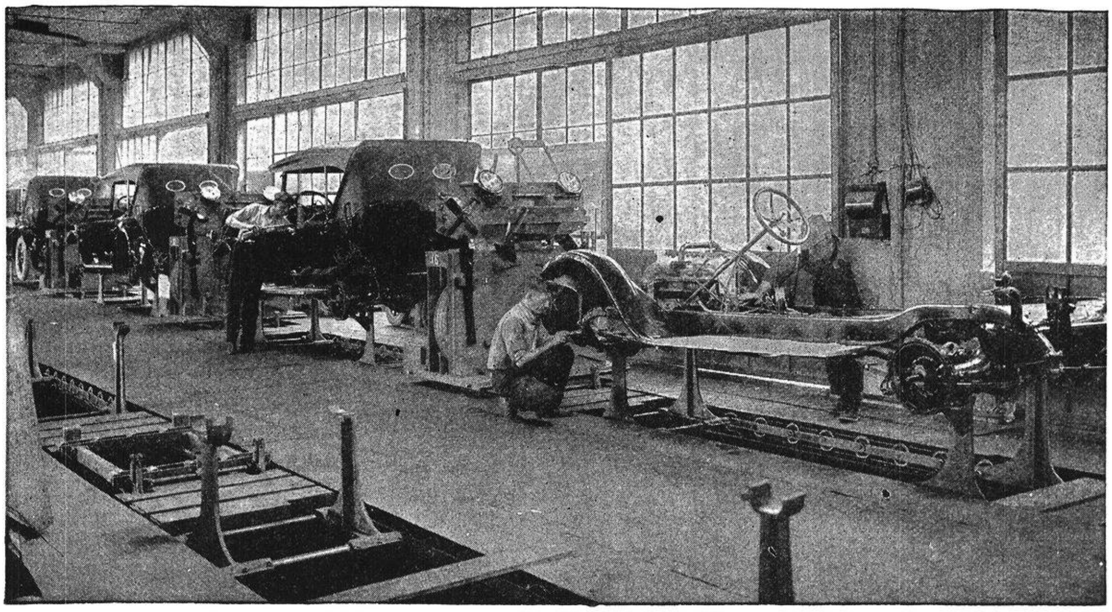
THE THOMAS CALORIMETER

(Continued from page 108)

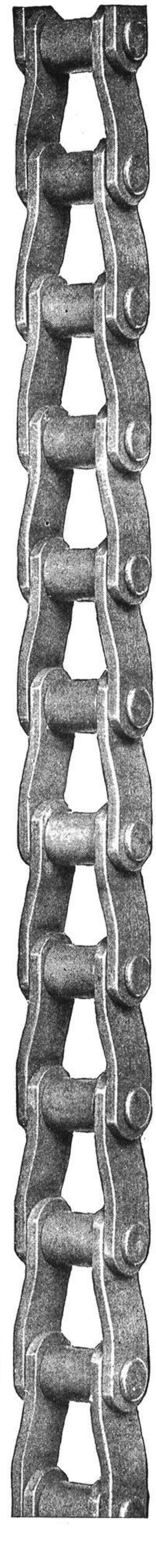
The heat absorbing air meter supplies air to the burner unit in a definite ratio with respect to the gas supplied. An electrical resistance thermometer located near the exit of the heat absorbing air meter gives the temperature of the heat absorbing air as it enters the burner unit. The heat absorbing air passes upwards through the space between the heat interchanger and the outer burner jacket and absorbs the heat from the products of combustion. A second electrical resistance thermometer is employed to obtain the temperature of the heat absorbing air after it has taken up the heat from the products of combustion.

Fig. 3 shows diagrammatically how the recording system operates. Two resistance thermometers, one at the temperature of the heat absorbing air delivered to the burner unit and the other at the temperature of the heat absorbing air after being heated by the products of combustion, are in adjacent legs of a Wheatstone Bridge. The recorder mechanism automatically keeps the bridge in balance by varying the point of contact S. The position of this point of contact when the bridge is balanced depends upon the temperature differences of the two resistance thermometers, which in turn depends upon the heating value of the gas being burned. That is, the higher the heating value of the gas the greater will be the difference in temperature and resistance between the thermometers located at the inlet and the outlet for the heat absorbing air.

The Thomas calorimeter gives a continuous record of the total heating value of the gas supplied to the calorimeter, expressed in B. t. u. per cubic foot at standard conditions: 60°F., a pressure of 30 inches of mercury, and the gas saturated with water vapor. The use of air as the heat absorbing agent in the Thomas calorimeter in conjunction with an electrical system of temperature measurement makes the readings practically independent of variations in tank temperature or barometric pressure within certain limits, or of reasonable variations in the speed of the motor operating the meters. The reading indicated is the heating value of the gas under standard conditions.



Here successive steps of final assembly occur as the cars slowly proceed to the end of the conveyor
The weight of each car is carried on eight chain rollers



THE SWIFT *and* SURE ADVANCE OF MECHANICAL HANDLING

Strictly speaking a conveyor is installed as a means of transporting goods. It would be expected to carry them at least cost.

But that is not all. That alone is not sufficient to account for the rapid advance of mechanical handling in America.

Conveying contributes to the success of industry in many other ways.

In progressive assemblies, conveyors have reduced the cost of building automobiles, stoves, threshing machines, washing machines and tires. They have made labor more efficient and ended much drudgery.

In foundries, conveyors carry the flask while pouring, carry the molds to the shakeouts, handle the sand and the castings, and carry the iron and steel to the furnaces.

In hundreds of industrial plants, Rex Conveyors have broken the bottle necks of production and have balanced production by securing an even flow of material through the plant. They have saved valuable floor space, and cut out idle machine time. In one automobile plant, the conveying system has been developed to such an extent that under the same roof two cars are now produced where one was built before.

The business of building material-handling machinery is still young. Much progress is being made annually in the engineering of this new science. Each year its markets are broader.

Whether you are a student, graduate engineer, or manufacturer, it might be well to see what this expansion of Mechanical Handling holds for you.

The Chain Belt Company will gladly answer the inquires of anyone interested.

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It is tight, flexible, easily made and non-corrodible. There are no bolts to rust out. It makes changes of alignment or insertion of special fittings a simple matter. It can be taken apart and the pipe used over again, without any injury. It is not subject to damage in transit. In fact, it embodies practically all of the desirable qualities in an underground joint.

The use of this type of joint, together with the long life of Cast Iron Pipe, makes for extremely low maintenance costs.

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THE BELL & SPIGOT JOINT
THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems

The readings of the calorimeter are not affected by variations in the speed of the motor because the meters delivering gas and heat absorbing air are geared together and always deliver their respective volumes in the same ratio irrespective of the motor speed.

If the meters of the Thomas calorimeter were operating in a fluid having negligible vapor pressure, and if both the gas and the air for absorbing heat were free of water vapor, the temperature rise of the heat absorbing air in passing through the burner unit would be unaffected by barometric pressure or by the initial temperature of the heat absorbing air. This would be the case, for variations in barometric pressure or tank temperature would change the actual weights of gas and heat absorbing air delivered in exactly the same proportion, and hence the temperture rise of the heat absorbing air would be unchanged.

But the meters of the Thomas calorimeter operate in water, which has an appreciable vapor pressure, and the presence of water vapor in the gas and in the cooling air complicates the theory somewhat. The presence of the water vapor makes the temperature rise of the heat absorbing air dependent upon both the barometric pressure and the initial temperature of the heat absorbing air. The effect of barometric pressure upon the readings of the instrument is quite small, a change in the barometer from 30 to 28.5 inches producing a 0.2 per cent change in the heating value indicated, if the tank temperature is 80°F. The tank temperature, however, has quite a pronounced effect upon the temperature rise of the heat absorbing air as it passes through the burner unit. For example, if the calorimeter is operating on a 520 B. t. u. gas, the temperature rise of the heat absorbing air will be 37.20° F. if the inlet temperature is 50°F., but if the inlet temperature is 90°F., the temperature rise will be 35.52°F. However, the nickel wire selected for the resistance thermometers has a resistance-temperature relationship which compensates for this effect quite exactly. That is, though the temperature rise is not the same at different inlet temperatures as shown by the above example, the resistance differences between the inlet and outlet thermometers are nevertheless almost the same, irrespective of inlet temperatures between 55 and 90°F. The net result is that the heating values indicated by the recorder are practically unaffected by variations in tank temperature from 55 to 90°F., or by variations in barometric pressure or motor speed. The manufacturers guarantee the instrument to be accurate within one per cent if the tank temperature is between 55 and 90°F.

The development of the Thomas calorimeter has involved a large amount of research. The Cutler-Hammer Manufacturing Co. has sent several models to the laboratories of the Chemical Engineering Department of the University of Wisconsin to be used for cooperative research. The data obtained in these researches have been factors in changes of design which have improved the precision obtainable.

BETTER LIGHTING NEEDED IN INDUSTRIAL PLANTS.

In a paper read before the Illuminating Engineering Society, February, 1920, entitled, "A Survey of Industrial Lighting in Fifteen States," R. O. Eastman submitted some very interesting data regarding the lighting conditions in industrial institutions The survey comprises some 446 institutions, in which lighting was considered by 55.4% as being vitally important, and by 31.6% as being moderately important, and by 13% as being of little importance. Practically 58% considered that lighting was as important as power in the operation of the plant, and a small proportion would give more attention to lighting than to anything else.

In considering the present condition of lighting as found in the various plants, only 9% ranked as excellent, about ⅓ ranked as good, 29% fair, 18.8% poor, 3.5% very poor, and 7.8% partly good and partly poor. It was found that the lighting in the offices was far superior to that in the shops; 19% being excellent, 36% good, 31% fair, and only 13% poor and none very poor.

On consulting the executives regarding what factors were most important in considering lighting, the following facts were revealed: Increase of production 79.4%, decrease of spoilage 71.1%, prevention of accidents 59.5%, improvement of good discipline 51.2%, and improvement of hygienic conditions 41.4%. Manufacturers who have good lighting appreciated its value largely from the standpoint of its stimulating effect upon output.

There is no question that any intelligent man who carefully considers the necessity for good lighting in an industrial plant, will agree that it is impossible for a person to do as good work, either in quality or quantity, in poor light as in good light, but yet the result of a careful analysis discloses the fact that only about 40% of industrial plants are furnishing good light to their workers and 60% are operating under poor lighting. It is hard to understand why such a proportion of concerns can be satisfied with a condition which is universally admitted to be a curtailer of efficiency and a prolific causer of accidents. The principal cause of this condition is that those in charge of such establishments have not given the attention to lighting that it demands. They do not know what constitutes good lighting, and in their absorbing interest of other factors of production have overlooked a vital one.

Every safety official should deeply interest himself in the lighting of his plant and insist upon good lighting as much as good goggles, good guards and other necessary accident prevention equipment. Every production manager should insist upon good lighting because the efficiency of the working force is increased by the condition of the lighting furnished. The plant physician should examine the lighting, for eye strain and eye fatigue are directly affected by poor lighting, as is the hygienic condition. Well lighted plants are invariably cleaner than poor lighted places. Plants equipped with Factrolite Glass in all windows are well lighted.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.,

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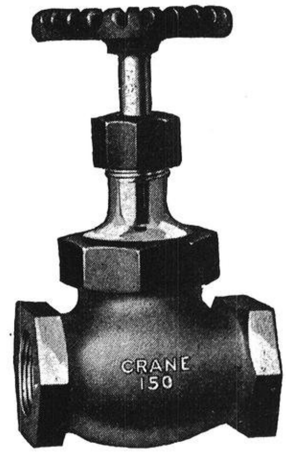

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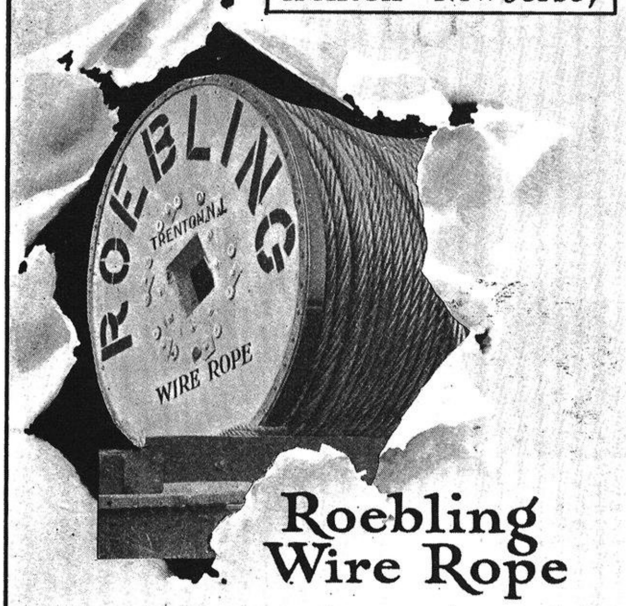

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Lab Lightning

Douglas F. Miner

SOME of the men at Clark University mentioned it first. "Doug surely lives in the Lab," they remarked. Later, too, at Worcester Polytechnic Institute, instructors made the same comment. And Douglas F. Miner, himself, agrees that he did—and does. That makes it unanimous.

"Big league lab work" was his aim as he turned to Westinghouse after graduation in 1917. But not until his return from overseas service two years later could he settle down to the lab. Now—at thirty-three—he's in charge of experiments at our Engineering, High Power, and High Voltage Laboratories, with a staff of twenty-five to direct.

He can unleash artificial lightning of 5,000,000 horsepower in 5/1000 of a second. At his bidding the world's largest single-unit transformer will step current up to a million and a quarter volts.

He has demonstrated the greatest artificial arc on record—fifty-five feet in length. To further his experiments a single generating plant, capable of producing on short circuit a million horsepower, has been erected.

There is a practical reason for these super-tests—for this equipment in advance of what the world uses now in its daily work. This, for instance, is frequently the attitude of a Central Station customer: "Of course your apparatus meets our needs today—takes every test to which we can put it now. But what of 1950? Will this insulation stand the load we will use then? And how many volts will these arresters bear?"

They come to Miner for the answer. He gets it from the laboratories. He produces under a roof the same conditions which nature, or time, may be holding in store for Westinghouse equipment.

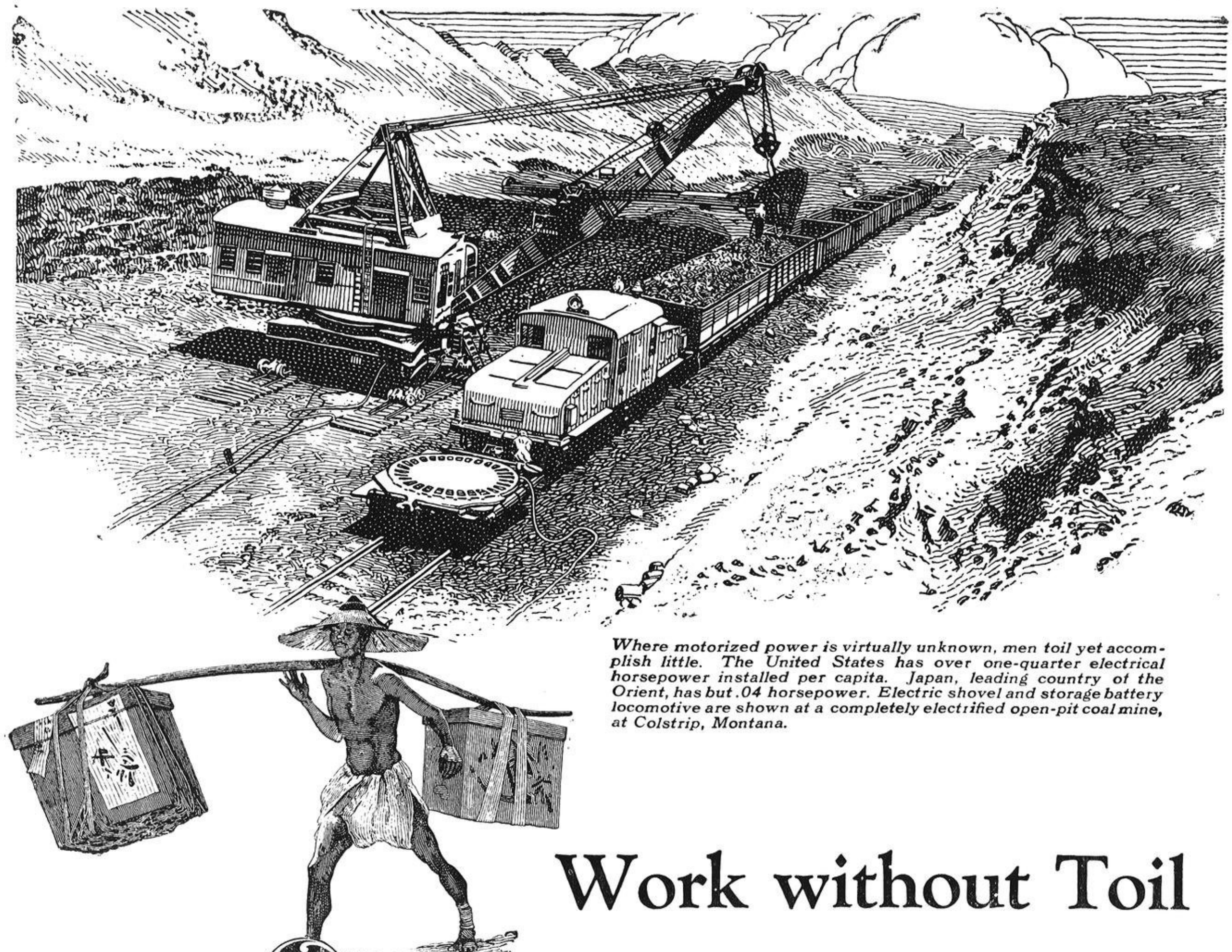
Such is the pioneering of Westinghouse Laboratory Engineers. They are "experimenting in the tomorrow"—the step between research and application. They are finding growth, reward, congenial work, while following a bent for trying things out.

The question is sometimes asked: Where do young men get when they enter a large industrial organization? Have they opportunity to exercise creative talents, or are they forced into narrow grooves?

This series of advertisements throws light on these questions. Each advertisement takes up the record of a college man who came with the Westinghouse Company, within the past ten years, after graduation.

Westinghouse

WESTINGHOUSE ELECTRIC



Where motorized power is virtually unknown, men toil yet accomplish little. The United States has over one-quarter electrical horsepower installed per capita. Japan, leading country of the Orient, has but .04 horsepower. Electric shovel and storage battery locomotive are shown at a completely electrified open-pit coal mine, at Colstrip, Montana.

Work without Toil

G-E Motorized Power—an ideal combination of electric motor and control properly fitted to the individual task—is at work the world-over, relieving workers more and more for better and more profitable pursuits.

A new series of G-E advertisements showing what electricity is doing in many fields will be sent on request. Ask for Booklet GEK-1.

Ten or twelve hours a day toils the coolie. If he carries all he can, he moves *one* ton *one* mile in *one* day. For that he receives twenty cents.

Cheap labor! Yet compared with our American worker, receiving at least twenty-five times as much for an eight-hour day, the coolie is expensive labor. In America we move *one* ton *one* mile for less than *one* cent. The coolie, working by hand, accomplishes little; while the American, with electricity's aid, accomplishes much.

Plenty of electricity and cheap electricity —these are two great advantages which America enjoys over the rest of the world. While our present generating capacity is 20,600,000 kilowatts, new developments call for 3,000,000 kilowatts more per year.

To college men and women— potential leaders—will fall the duty of finding more and still more work for electricity, with less and still less toil for our workers. For the task is but begun!

95-141DH

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK