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Rose Technic Staff
*Rose-Hulman Institute of Technology*

# The Rose TECHNIC

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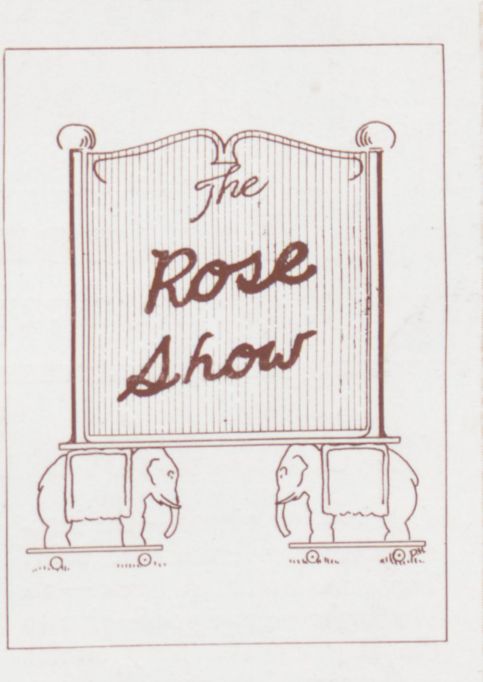


APRIL
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# *The San Francisco Ferries*

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SAN FRANCISCO now has the finest ferry fleet in all the world. Recently there were added to it four Golden Gate Diesel-electric auto ferries; one Southern Pacific Diesel-electric auto ferry; one Northwestern Pacific Diesel-electric auto ferry; and the Key System's two electric-drive giants — the largest passenger ferries ever built. These modern steel boats — all Westinghouse-equipped—give to the Bay cities a ferry service unsurpassed for speed and safety, cleanliness and comfort.

The big jobs go to big organizations. Westinghouse attracts young men of enterprise and genius because it daily provides opportunities for pioneering and outstanding work which smaller companies can seldom offer.

The Key System ferries are each equipped with two 2,250-shp. Westinghouse main propulsion motors; one 1,900-kilowatt Westinghouse generator; and one 3,010-hp. Westinghouse-Parsons turbine. The Southern Pacific, Northwestern Pacific, and Golden Gate boats likewise have Westinghouse propelling motors and generators. Auxiliary units, such as motor-drive pumps and steering apparatus, are Westinghouse on all these ferries.

**Westinghouse**

# THE ROSE · TECHNIC

PUBLISHED · MONTHLY · BY · THE · STUDENTS · AND · ALUMNI · OF · ROSE · POLYTECHNIC · INSTITUTE · · ·

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*DO not forget that your education is costing a great deal more than you or your father will ever pay for it. Therefore, return in glorious light for all the oil, that is being poured into the lamp of your life.*

*—Graham Taylor*

# Price Regulation of Public Utilities

*By L. C. Kniptasch, e., '30*

INDUSTRIAL development recently has caused the foundation, or beginning, of numerous enterprises. Among them are monopolies; that is their products are sold at prices not governed by competition. In many cases excessive prices have resulted. Various commissions have been established to set a fair price to the public. To determine fair prices they must find out the rate of profit in competitive and monopolized industries.

The prices charged for industrial products are equal to the expense of production plus a fair profit to the owner. A regulation of prices which interferes with the cost of production leads to a retarding of the economic efficiency of the company. Then the profits of monopolized enterprises should be different in different enterprises, according to the degree of intelligence used in planning and managing them. An attempt to establish a uniform rate of profit on the physical valuation of the plant is the right thing. Since the profits of the monopolized must be different to secure economy of production, the profits which can and should be alike are the average profits. The profits of monopolized industries, must be regulated so that the average profits of each is the same as that of competitive industries.

**THE products of public utilities—what shall we pay for them? Who shall fix their price, and being fixed, how are they to be regulated? Every municipality has confronted a like question; few have answered it satisfactorily. Here is a possible solution to the problem.**

A monopoly is formed when the advantages secured by production on a large scale becomes so important that a single producer offers greater economical advantages over that of several producers. For this reason there is no competition in public utilities. If there if no regulation of prices, the capital invested in monopolies would bring in a much larger return than the capital invested in competitive industries. This usually leads to stock watering by promoters. This is where the Public Service Commission comes in. They are given the power to regulate the prices that should be charged the public.

The Public Service Commission of Indiana began operation May 1, 1923. The Commission's power over public utilities rates, service, securities, issues, and the consolidation, purchase, or lease of public utilities. The Commission is composed of several departments. One of these, the Engineering Department makes detailed appraisals on what is known as the reproduction base. In making appraisals on this base, three different kinds of unit prices have been used. These three kinds of prices are: Five-year Average price for the period 1921 to 1925 inclusive, Spot prices as of January 1926, and Estimated Original Cost prices. For the spot price appraisals and the estimated original cost appraisals, the items of land and structural overhead are used and are about the same. In making appraisals using present day prices, the basic difference is in the price level only, while in making appraisals using the estimated original cost price basis, they assume that the property is to be reproduced under the conditions prevailing at the time that the property was produced, together with the prices that were probably paid by the company in producing the property originally.

In making an appraisal using the five-year average price basis the commission appraises the land by finding people who are familiar with property values in the immediate vicinity of the land to be priced. Information is gathered from two classes of people. Those who are likely to be conservative in their estimate of land value. In this class comes the banker. The other class, those who are inclined to be optimistic and forward looking concerning land values. Real estate dealer fall in this class. Data of this kind must be gathered from at least six sources. These estimates are reduced to a common basis, such as front foot, square foot or acre. The ability of the parties from whom the information is gathered is taken into consideration. A figure is then adopted by the engineer in charge of this part of the work.

The next part of an appraisal is the pricing of the materials. Because of the variety of these materials, it is necessary to use different methods in arriving at a average price. The commission has prices on cast iron pipe, poles, wire crossoons, transformers, meters and all material and supplies that any one of the different public utilities might use. These prices run back for a great many years so it is very easy to get any kind of an average price desired. Other materials such as valves, fittings, hydrants, valve bores, etc., prices over ex-

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# Co-operation

*Cooperation is an essential requisite in engineering. The graduate who is able to meet the demand of his employer and work with him makes the best engineer. The employee who can successfully obtain the best from his men builds up the bigger business. Cooperation is the keynote of all success, to the laborer and the official alike.*

*—Editors Note*

RECENTLY two instances were brought to my attention of graduates who failed to meet with the success expected of them. Both were men of exceptional scholastic ability. The reason given for their failure was their inability to cooperate with others in their work.

In the modern organization of industry, engineering projects are so large that the work must be subdivided in order to accomplish results within a reasonable time. The chief engineer may design the general layout of the job, but the development of details must be delegated to assistants. Of necessity there must be proper cooperation. The assistant must follow out the ideas of the chief. It is not his business to criticise his superior, or to work out what he may consider a better design. If he insists upon doing it he will probably be fired as a nuisance.

The habit of cooperative effort should be formed in college. One of the great advantages of games like football, basketball and baseball is the team work. Mediocre players with good team work will often defeat a team composed of better individual players.

It is natural to be self-centered, especially for vigorous, alert young men. It requires effort,—and some experience,—to realize that others may be as smart as we are. Nor is it easy to look at matters from another's point of view. But this is essential if real co-operation is to be secured. There must be agreement among the persons co-operating. It is not likely that a number of people will think alike in all respects. Hence there must be give and take in the discussion until a conclusion satisfactory to all is reached.

Then, when an agreement is reached regarding what is to be done and how, there must be a readiness to undertake the part which falls to each one. The spirit of "Let George do it" is fatal to effective cooperation.

I shall never forget a meeting I was privileged to attend some years ago. An important lawsuit had been adjourned in the midst of a trial. A council of war was being held to determine what could be done in aid of the case before the trial was resumed. The men present were all important executives,—some were presidents of other companies.

After some discussion the eminent lawyer who presided over the council said, "These are the things that should be done. Who will be responsible for this and that?" One after another, these busy men said: "I will secure this information," "I will see that person," "I will prepare that exhibit." Not a man suggested that he was too busy to undertake the task assigned him.

I thought to myself,—now I know why these men are executives.

The object of business organization is to get things done. A man may have ability, but if he is not on hand to do the thing required at the time it is required, business will not use him. He may have excuses, anyone of which may be valid. But too many excuses, no matter how valid they may be, will soon cause him to lose out. Reliability is a major asset and the habit of proving oneself reliable is a most valuable habit.

Ability to secure the co-operation of others is even more important. It is the secret of success as an executive.

The same qualities that make for cooperation in the follower make a good leader,—ability to see the other fellow's view point, willingness to concede that others may have better judgment in certain matters than we, entrusting work to others instead of trying to do it all ourselves. Indeed, in the modern organization of industry the same man is usually a leader for men under him and a subordinate to those above him in authority.

One of the most important qualities in leadership is the habit of success. Men like to be associated with a winner. This is a quality that can be cultivated,—and nowhere better than in college. The man who is stimulated to extra effort by a difficult problem—who does not stop when he has put the required time on his lesson unless he has mastered it, he is the man who is likely to succeed. A first success is a powerful stimulant toward future successes, and soon a habit of success begins to be established. If nothing else were learned in college, the self confidence that comes with successful accomplishment would be worth all it costs.

# The Tragedy of Waste---*Stuart Chase*

*By Jred O. Andrews, e., '29*

IN writing this book Stuart Chase has done more toward changing our opinions of the present economic system than perhaps any other author. He has taken our seemingly satisfactory system and has broken it down bit by bit until we wonder if any part of it is free from waste. Chase sees the economic system not from the standpoint of an individual actually a part of it, but from the viewpoint of an observer at a distance. He calls his view the aeroplane view of the economic system.

The present system of waste can be divided into four major channels. We can briefly state them as follows: Production of non essentials, idleness, bad technical methods, and the waste of natural resources. Each of these is developed clearly and concisely and is shown to be truly an economic waste.

As far back as history can trace human wants have always been a source of economic waste. The greatest waste, however, in all time is being carried out in our present system. No two people are alike physically, but they are indeed alike when they attempt to satisfy their wants. The economic superiors purchase the real objects, while their inferiors, not to be outdone, are forced to satisfy themselves with the cheap substitutes. As a result, we have the wastes of consumption creeping in. All are attributed to the habit of the economic inferior of trying to outdo his superior. Adulteration of food, jerry building, artificial stimulation in the clothing industry, quackery in medicine and religion and greatest of all, the needless waging of war between nations of similar culture, are the main sources of waste in consumption. Those objects which contribute to our well being, we call wealth; but those which are detrimental to us, we call illth. Hereafter, we will speak of waste in consumption as illth.

**ACCORDING to the economist, the excessive waste of money, resources, etc., as practiced by the American public today, should be one of dire concern. In this era of general prosperity we overlook the word, "waste." As a word of warning, Mr. Chase has written this excellent book, "The Tragedy of Waste."**

Illth, sadly to say, takes from us not only our wealth but also takes 25% of our wealth producers. A safe estimate discloses that, of the total able bodied wage earners in the United States, one-fourth of the total is devoted to the production of illth. Our most expensive waste has always been war. Not alone does war squander the greater part of a nations' wealth, but it, likewise robs the nation of its most productive individuals—those who should be contributing to instead of sapping, the nation's treasury. As conclusive of the tremendous burden levied on a government by its wars, we give the following statistics. They were compiled, not by the Pacifist's League, but by Dr. Rosa of the Bureau of Standards. The figures make up the Budget of 1920. ($5,686,006,000).

| | |
|---|---|
| Expenditures for past wars | 68% |
| Expenditures for future wars. | 25% |
| Total for wars | 93% |
| Expenditures for Civil departments | 3% |
| Expenditures for public works | 3% |
| Education and science | 1% |
| Total for peace | 7% |

From these figures it is indeed evidence where the major part of the taxpayer's dollar goes.

A great peace time weapon of illth includes the patent medicine industry. With a few exceptions, patent medicines can be condemned as decided economic wastes. Moreover, some are actually health destroying and often contain habit forming drugs. Advertising is the elixir of the industry. Prevent the producer from advertising in florid terms the great benefits contained in each and every bottle and watch the industry become extinct. Investigation of a fat-reducing pill disclosed that the pill contained the head of a tapeworm coated over with gelatin. No wonder the pill was so effective as many users readily testified in published advertisements.

Quackery is not used exclusively in the medicine industry. We find the old desire of obtaining something for nothing often capitalized. For example the Oriental University presented diplomas in almost any profession in existence for the mere payment of two hundred dollars to care for postage, materials, and a few other minor expenses. New York State alone contains over 2,500 persons illegally practicing medicine and law. Add to this number the number of healers, mediums, seers and mystics, and we can readily see the wasting of millions of dollars annually.

Now let us turn to the advertising industry.

Does advertising actually create dollars? It does not. If it did one might think of the 600,000 people engaged in the industry as gainfully employed. Advertising merely transfers dollars from one individual to another. Mr. A can take Mr. B's customers away from Mr. B if he is skilled in the art of advertising. But does he materially benefit the customers? Nine chances out of ten he offers them the same grade of merchandise in a different package and charges more for his product. Advertising is merely an artificial stimulator. It creates wants where economically no wants should have been created. It urges people to buy when they know they cannot afford to do so. Thus we have a serious problem confronting us.

Our next great channel of waste is due to idle manpower. Chief contributors include: intermittent employment, due to temporary lay offs; seasonal unemployment; unemployment due to business cycles; and residual unemployment. The number of unemployed on any given working day from the above causes is estimated at six million of 15% of the total wage earners in the United States.

Poor management and lack of coordination among industries make up another channel of waste. Intensive study of the situation by economists has resulted in the formation of a list of the most common contributing factors to waste. This list shows definitely that the greatest of all wastes in production is due to poor management. The fact that in a boot and shoe factory the employees were idle one third of the working day waiting for material shows that something is radically wrong with the management. In a certain mens' clothing factory nine hours of the average week of forty-eight hours were wasted due to seasonal fluctuations, ten hours were wasted through bad shop methods, and three hours were wasted due to the performing of unnecessary work. The loss amounted to $225,000,000 annually.

Psyschology and physiology are almost wholly ignored by manufacturers. Yet experience has shown repeatedly that output has been increased by reducing the working day from ten to eight hours. Likewise, a typist increased her output by merely moving from a room where a trip hammer was working outside the window to another room where the noise was absent. The difference in rhythm of the two objects caused a strain on the mind which hampered her efficiency.

Duplication of factories is also included in the lack of industrial co-ordination. Factories which could easily supply the entire demands for a product are working at about 50% capacity, while another plant which should never have been established helps produce the remaining supply. Oversize factories are due to the varying demand placed on them. The factory must large enough to meet the greatest demand. Then when the peak is passed the factory must return to normal production and utilize but half of its capacity. Instead of factories increasing their capacity by building in the slow years, we find them expanding when labor and materials are very scarce. Needless to say, an unnecessary expense is incurred.

Contrary to public opinion, peak loads are not always due to seasonal and monthly fluctuations. They occur in the laundries every Monday, in the meat packing industry on Monday and Wednesday of every week, and in many other industries. Such peak loads are due to habit or customs and are very expensive.

Too much criticism can not be made of the existing methods of controlling the supply of necessities. Restriction of output dumping, and destructtion of produced goods contribute to the method. The fact that an industry runs 50% capacity in order to keep the price of an article above actual value, is very determined, indeed. But where a corporation dumps into the ocean that which already has been produced for man's wants, it is high time that a resolution in the present system should be carried out. We execute a man who brings death to another, but we uphold the man who brings worse than death to thousands merely because they cannot pay an exorbitant price for the necessities of life.

Up to the present we have said nothing of the wastes in distribution. Yet cost of distribution increased from 20% of the total cost of the product to consumer in 1850 to 50% in 1920. Mr. Herbert Hoover in his report as Secretary of Commerce for 1924 summarized the wastes in distribution under seven main heads as follows:

1. Too many links between producer and consumer.
2. The waste in transporting inferior goods.
3. Decay arising from delay and repeated hauling.
4. Inadequate marketing facilities.
5. Uncontrolled distribution.
6. Destruction of agricultural capital due to temporary low prices.
7. Waste due to speculation and hazardous chances resulting from above causes.

These are the main reasons why we pay $2.00 for a 75c product.

Sales forcing has become the watchword of many present day industries. Regardless of the utility of an article, it must be sold. High powered sales methods require high powered salaries and operating expenses. Thus we have an increase in cost greater than the decrease effected by greater sales. To prevent going into bankruptcy, the company passes the extra cost on to the consumer.

Along with the wastes already discussed we have that waste due to an excessive number of retail establishments. Exclusive of automobile agencies, there is one store for every twenty-five families in the United States. How some of them manage to survive is a mystery, for of the stores which had accounting systems, one fifth of the total was found to be operating at a loss. Hundreds had no accounting system so it is impossible to determine just how many were making money.

Closely paralleling retail wastes are the wastes in milk distribution. In Rochester, New York, the milk wagons of five independent companies go up and down the same streets delivering milk. Often the drivers leave milk at the same apartment house. Yet we allow this to happen every day in practically every city of any size and make no effort to remedy

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# Henry Ford---A Pioneer in Aerial Transportation

*By James Lawyer, e., 29*

HENRY Ford added the making of airplanes because he is a manufacturer of motors and is interested in every phase of motor transportation. He is doing a great deal of experimenting to see whether it is possible to produce an airplane which will require no more skill in its management than does a motor car, which can be manufactured and sold so cheaply as to be within the means of a large number of people, and which will be as safe from accident as is the motor car.

In his shops the men are working on a number of models, and they are running two air lines from Dearborn—one to Cleveland and the other to Chicago. They carry Ford's own goods except for a mail contract.

Ford began his first air lines in April 1925. These lines have been flying daily, except Sunday, over a 260 mile course to Chicago and return, and 127 miles to Cleveland and return, a total of 744 miles per day. They have not had a single accident. The loads vary from 1,000 to 1,500 pounds per trip, in addition to 150 gallons of fuel, 14 gallons of oil. On one occassion a plane was flown to Cleveland with a complete Ford car, body and all. They have maintained an average speed from Detroit to Chicago of ninety-six miles per hour with loads.

**AERIAL Transportation is yet in its infancy, and is far from being satisfactorily established. Yet it is practical to term it, the coming mode of transportation. Every new undertaking needs a leader. Mr. Ford, with his airlines, and extensive reseach, merits this distinction.**

Over 1,000 trips were made by Ford planes during the first year of their service, covering a distance equal to more than eight times around the world and at a rate of about 100 miles per hour. The Maiden Dearborn No. 1, which made the anniversary Chicago flight on April 13, 1926, has a record of 302 trips during the year, carrying 298,008 lbs. of freight over 68,632 miles.

Ford now owns the Stout Metal Airplane Company which he purchased for about $450,000 and which manufactures an all-metal plane. He has an airport at Dearborn and also a mooring mast for dirigibles.

He has given more attention to the airplane than to the dirigible but he believes that each type has its place in aerial transportation. The airplane seems to be well fitted for fast express work, and the dirigible will take the long main routes, with the planes acting as feeders.

The biplane, with its fabric planes and wire and wooden bracings, has to be made by hand, and he was not interested in hand production. Also the metal airplane may be left outdoors in any weather without danger of harm.

He started with these two fundamental principles: A commercial airplane must have (1) the ability to accomplish the most ton miles per horsepower, and (2) the ability to stay in the air the most hours per day. What should be expected from an airplane is what he is working for, and that is:

(1) Absolute reliability of structure under all conditions of weather or fire hazard.

(2) Absolute dependability of power plant, accomplished, possibly, by multiple engines.

(3) A speed of 100 miles per hour, with full load, on not more than three-fifths of the maximum horsepower.

(4) Pilot located forward to assume unobstructed vision when planes become common over air routes, particularly in bad weather.

(5) A pay load of at least four pounds per horsepower with fuel for six hours of flight.

(6) Ability to operate twenty hours per day in the air with load.

He has accomplished all that he started out to accomplish. The Ford all-metal plane is a six-passenger cabin design with the pilot's cockpit under the leading edge of the large cantilever monoplane wing.

The passenger cabin is equipped with six deep upholstered seats and with plenty of leg room for the tallest of passengers. For long trips the two rear seats fold together to form benches on the side facing each other, with a card table arranged between. For mail and freight service, the seats are done away with and the cabin space kept clear.

Forward of the passenger compartment are two partitions about 3 ft. apart, enclosing toilet facilities.

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# Adoption of the Automatic Telephone

*By Albert E. Baker, e., 29*

THE automatic telephone, which is being installed by telephone companies all over the country, must undoubtedly have many advantages or it would not be adopted in preference to the old exchange.

In the discussion of the economic aspects of the automatic telephone we will discuss the items which follow:

(1). The disadvantages encountered in the present exchange.

(2). The reason for the rapid increase in the number of automatic exchanges.

(3). The cost of such an installation.

(4). The advantages of this type of telephone.

(5). The economic effect this installation has upon the female help employed by the company.

In order to have a telephone exchange with human operators, a school must be run in conjunction with the exchange. A girl must spend a certain amount of time in this school for training operators before she is able to take up the duties of the switchboard exchange girl. For a period of the three months required to train girls to be an operator, the employee is considered as an expense to the company. All the time the girl is in school she receives a salary which is equal to and sometimes greater than that received by clerks in department stores.

**THE Automatic telephone is rapidly replacing the older manual method of receiving the proper connection. Economically, what are the advantages of these automatic exchanges? This article has been prepared primarily to answer that question. Read it and know.**

Because of the fact that the average girl or women employed in such a company does not depend entirely upon her own earnings for a living, but upon the wages of some other member of the family, they soon become independent and indifferent as to whether they stay with the company. This unavoidable dissatisfaction among employees causes an increase in the number that must be employed and trained from time to time and likewise the expense in running the school.

The telephone operator will get sick or have a headache occasionally since illness is a common thing to any of the human race. Consequently one of two things will result. The operator will be cross and irritable to the subscribers, make many mistakes, and furnish poor service to them. Should the sick operator lay off, (it often happening that many are off sick at the same time) it is necessary to put an inexperienced operator in her place. An untrained operator will furnish slow service, make many mistakes, and cause many interuptions in subscribers' conversation.

The number of calls per hour varies from hour to hour during the day. The fact has been long established among telephone companies. Each oprator has before her a small instrument on which she keeps tab of the number of telephone calls she has answered. Readings are taken from hour to hour from these instruments, and form the readings of these instruments a curve is plotted showing the number of calls per hour for 24 hours. From this data the company is able to tell how many operators are needed from hour to hour.

From the diagram on page 9 it can be seen that it is necessary to employ a full crew only during certain hours of the day. If the operators did not work in shifts but worked straight time, a full crew being duty at all times, the cost of furnishing telephone service would increase many times and as a result the cost of the phone to the public would increase the same amount. Thus in order to make the cost of operation as low as possible, at different times of the day and night a larger or smaller number of operators are on duty.

We will take the Terre Haute telephone exchange as an example to show how the number of positions on the switchboard are filled per each hour of the day.

In all there are fifty-four switchboard positions. From 10 P. M. until 6 A. M. ten operators work in all these fifty-four positions each operator having a certain number of these positions to work in. At 6 A. M. five more operators are added, 6:30 six more, at 7 o'clock twenty-four more are added to this number, and between the hour of 9 and 11:30 there are fifty-four girls to fill the fifty-four positions.

While the above arrangement is the most economical and proper system of switchboard arrangement still it has its disadvantages. If at any time the fire department or ambulance should make a run, which is likely to happen any time of the day or night, every one calls his neighbor to inquire as to where the fire or accident is. Consequently there

is a sudden and unexpected increase in the number of telephone calls.

Should such a fire or accident occur, which does occur many times a month, when there are only ten operators on duty, it is not possible for the operators to handle all of the calls. While the calls made by people making inquiries are not so important, the regular number of night calls which are of more importance cannot be handled. Since such things as fires and accidents are always unexpected it is impossible for the telephone company to forsee such happening and enlarge the size of the force on duty in time to handle the increased number of calls.

Since the telephone operators job is a trade that must be learned, and since it requires from three to four months to learn this trade, there has risen a telephone operators' union. Due to the type of work these persons are employed at, their union has far more power than any railroad union or coal miner's union. Therefore it is possible for the operators to make unreasonable demands upon the company and the company must comply with their demands. Should the exchange girls strike at any time, the entire city is affected. Business within the city and with neighboring cities would be almost dead. Immediately business houses would begin to operate at a loss and consequently many employees of the houses would be out of work.

The following is an example of the power of the operator's union. The operators of the local company made certain demands upon the telephone company in 1918. The company considered these demands unreasonable and did not wish to grant them to the employees. But the company had to agree to the terms of the union in order to furnish the service it was selling. As a result the demands made upon the company, it was necessary to increase the price of service in order to pay the higher priced labor.

Telephone companies and all other companies employing female labor say that the price of such labor is increasing by bounds. For this reason a company never knows even for as short a length of time as six months in the future what their labor will cost them.

The automatic telephone which we are now ready to discuss was given rise to because of the discourtesy and indifference from time to time of the operators. But at that time automatic equipment was expensive and labor was cheap, therefore few if any automatic exchanges were installed.

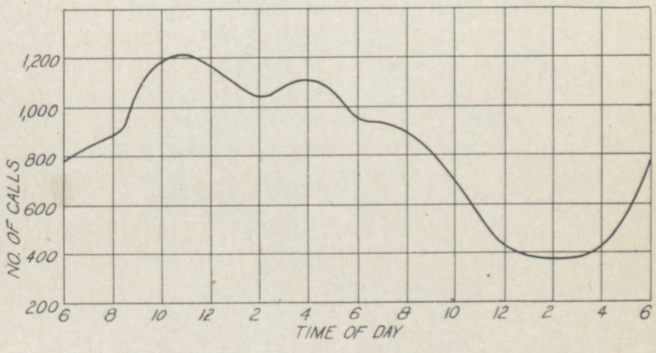
Not many years after the automatic was made practical the telephone operators in several cities went on strikes. Immediately the telephone companies saw the advantages of the automatic. It is because of the strike here in Terre Haute several years ago that the automatic has been installed here.

The cost of the installation of this new type of exchange in Terre Haute is about a million dollars. But the old equipment is fairly well worn out and it would soon be necessary to install a new outfit so therefore there will not be such a great loss in doing away with the old outfit. While the company has only 17,000 subscribers the automatic outfit has a capacity of 100,000.

With the introduction of the new type of telephone there is absolute secrecy of conversation except on party lines. Although in the old exchange it was against the rules of the company for operators to listen in on conversations it was a common thing for them to do so.

With the automatic the company is able to handle as many calls any hour of the night or day as it is able to handle during the busiest time of the day. In other words the company is able to furnish maximum service at all times.

There will be no interference of service due to strikes, the expense of training operators is done away with, and there will now be a standard price




for telephone service in any one city having the automatic system.

It is said that if any company can hire capital at any-ways near the same price that labor would cost for the same task the company prefers to hire the capital. In order to purchase any device, machine, or mechanism capital is required. The interest paid on the capital used for this purpose is termed the wages of capital.

The big economic question we must now consider is, how will these girls who were employed as exchange girls make a living. Since it is just recently that automatic exchanges are being adopted it would be different at the present time to get a general outline on its effect upon the operators as a whole. But we can take the local exchange for an example and see what is being done for the operators there.

Some of the girls who were working in the exchange are married therefore it would not be necessary that they should receive other jobs. Many of the operators secured positions long ago which position they took when the company made the "switch-over". Some of these positions are on private switchboards. Many merchants have agreed to hire one or more of the girls. The company is doing its utmost to secure jobs for those of its old force that are out of work. Therefore it looks as if there will not be many of the girls in need of work.

At the "switch-over" each girl received a bonus of ten percent of the amount of money she made between March 1, 1927 and the date of the switch-over. This bonus which the girls received should make it necessary for the community to aid a girl financially while she is seeking another position.

# Research and Progress

Conducted by Herman Moench

## *Some Developments in the Examination of the Structure of Materials*

THE suitability of metals for various uses depends upon their properties, both physical and chemical. Those who are interested in the use of metals, such as the mechanical and the chemical engineer, will therefore, desire to know the basic principles involved in the study of these properties and, subsequently, the factors which influence them. After these factors have been determined, the next step is to learn to control them.

Metallography is the science of dealing with the anatomy of metals and teaches how the structure changes with the influence of the thermal and mechanical treatment. It is the means by which physical properties are explained on the basis of structure. The structure is ordinarily studied by microscopic examination, although recently an extremely fertile and interesting field of study has been opened by the development of X-ray diffraction and patterns of metals and the physical interpretation of them in terms of malleability, ductility, and toughness. About ten years ago it was thought that the microscope had yielded its basic store of knowledge. However, the actual record of accomplishment appeared to be hardly a tenth part of the potential resolving power of the best optical systems. This led to the development of high power metallography. As the resolution gradually approached the theoretical limits of available optics, further steps into the structure of matter were taken with the ultra-violet microscope and the new objectives of very high resolving power.

It has been thought that magnification in excess of 1500X is of little value on account of the lessening or resolution with increasing magnification. It is possible now to secure sharp images at high powers and, furthermore to secure the potential resolving ability of the best optical systems. It is now possible to photograph an image under a magnification of 6000X with the same degree of definition that it was formerly possible to secure under only 1000X. Particles of matter so small that their dimensions are measured in millionths of an inch or in terms of a few hundred atom diameters, can be resolved clearly. When hardened steel is tempered, the story of what happens can be followed and watched clearly. These small particles can be made to grow or disappear almost at will by suitable thermal or mechanical treatments.

What the ultimate limit of vision is, no one, of course, can say. Now we are working on the theoretical limit of vision with present optics and visible light. The possibilities of ultra-violet light are still in the infancy of exploration. The phenomena of reflection and absorption of ultra-violet light are quite different from those of ordinary light in regard to the same structures.

The possibilities of the ordinary visible light have not been exhausted. Increased numerical aperture has been obtained by a new monobrom-napthalene immersion objective of 1.6 N. A., being studied in the Bell laboratory. The equipment used for high magnifications with visible light is the Zeiss Martens metallurgical equipment. Since the short wave lengths are refracted more than the longer ones, it is possible to secure higher magnifications with visible light by excluding the longer waves with suitable filters and leaving a light in which the blue range is predominant.

The ultra-violet equipment was designed by Kahler and Von Rohr of the Zeiss works in 1902. Theoretically the ultra-violet equipment should have opened many paths of investigation since its possible resolving power was almost twice as great as the best apochromatic objective of 1.4 N. A. It has not, however much to its credit in the way of original discovery. Higher resolving power depends largely upon the technique of preparing the specimens as well as upon the equipment. Monochromatic light is used since ordinary optical glass will not transmit ultra-violet, and many materials can not be used in correcting the lenses. It is now possible to obtain glasses which will transmit ultra-violet, and it is probable that there may be obtained a corrected objective for a band in the ultra-violet region. The source of light is a spark between cadmium electrodes. The light is dispersed spectroscopically and the 2750-Angstrom line isolated for use. Lenses corrected for this wave length can not be used for other wave lengths. Exact focusing is essential. The image may be focused on a flourescent screen by means of a device called the "searcher eyepiece," but with the low intensity, an exact focus can not be insured. To remedy this condition mechanical focusing is used. The slow motion adjustment of the microscope has a drum with a graduated scale, each scale division denoting a change of focus of 2 u. By the use of a pointer and scale the motion is amplified so that the 2 u may be divided into 32 parts. The approximate focus is secured by means of the "searcher eyepiece" and the finer by the mechanical method. With the high power objective the focus is so exact that increments of 1-16 u are used.

One of the chief benefits derived from the ability to use very high magnification successfully has been in the study of the allotropic forms of iron. Whereas formerly the magnification permitted only groups of crystals to be studied, it is now possible to study the habits and formation of the individual itself and to draw conclusions concerning the effect of the individual constituents upon the mass as a whole.

The use of X-ray examination of materials has

served to obviate manufacturing difficulties and to aid in the search for new scientifuc principles which may serve in turn to correlate and explain known facts or to help in the development of new products. The greatest usefulness seems to be in the discovery of new facts upon which to base future manufacturing processes.

Practically all work of this sort depends upon the measurement of interatomic distances. These are too small to measure directly, being of the order of a hundred millionth of a centimeter. By using X-rays of known frequency, it is possible to use an X-ray diffraction apparatus as a micrometer for the measurement of these small distances. An accuracy of one part in a thousand has been abtained. This type of apparatus, which was developed in the laboratory of the General Electric Company, is now in use in the School of Chemistry and Physics at the Pennsylvania State College in studying the properties of metals and their alloys. By measuring these distances, it is already possible to predict some of the mechanical properties of metals, and to tell what happens when they form alloys. It can be shown why copper is more ductile than iron, and why iron is more ductile than arsenic. These predictions of properties are made on the basis of structure. In general, the plastic, ductile, and malleable metals such as copper, silver, gold, etc., have face-centered cubic structures, and the less ductile ones, such as chromium and tunsten, have body-centered cubic structures. Plasticity, as applied to single crystals, has to do with the slipping of planes of atoms upon adjacent planes. It is related to ductility, for in order for a substance to be ductile, it must be plastic in addition to having sufficient strength to prevent it from the strain of pulling it through a die. It has been found that, all other conditions being the same, mechanical working produces slipping along those planes in the crystals which have the greatest number of atoms. It is a characteristic of crystal geometry that the planes of the maximum atomic population are the farthest apart, This means that the atoms in an individual plane are so closely packed together that the mutual attraction is strong, while the distance between adjacent planes makes a weak bond between them, allowing the planes to hold together while slipping over each other. There is a logical analogy between the theory as applied to a single crystal and to a group of crystals. Similar arguments can be applied to the properties other than ductility.

The principle of the ¼-ray diffraction scheme is a "slit effect." We know that when ordinary light is passed through a narrow slit interference produces a series of different colored bands called diffraction bands. There is a definite relationship between the size of the slit, the distance between successive bands, and the wave length. Sharper images are secured with narrower slits. A series of such slits is known as a diffraction grating and spreads sun light into a diffraction spectrum. Fine ruling is required in order to make the size of the slit bear the proper relation to the wave length of the light. Twenty-five thousand lines to the inch is about the fineness required for sunlight. In studying the properties of X-rays when they were first discovered, an attempt was made to secure data on the diffraction characteristics. The wave length of X-rays is so short that the finest gratings were too coarse. The idea was conceived that the parallel planes of atoms in a crystal might produce a slit effect just as the diffraction grating. The idea proved to be correct. The diffraction pattern secured can be interpreted in terms of spatial arrangement by means of the application of the proper mathematics. The spatial arrangement can in turn be compared with the known physical and chemical properties of the substance.

—Contributed by Melburn Heinig, ch., '28.

## *The Neon-Electric Stereoscope*

IN synchronous machinery it is sometimes desired to determine the angular relations between the rotating element of the machine and the rotating field with which it is to keep step. Such a measurement has been found to be best accomplished by some optical method, usually by means of a form of stroboscope, an instrument for studying a periodic or varying motion by means of an intermittent light.

The common form of stroboscope to be found in the laboratory consists simply of a disc, which is painted in alternate black and white sectors, attached to the shaft of the machine, and an arc lamp actuated from the same source which supples the machine. Suppose, for example, that the machine to be considered is a four-pole, synchronous, alternating current motor, to be operated from a 60-cycle source and, therefore, to rotate at 1800 r. p. m. or 30 r. p. s. If, then, a disc consisting of four white sectors on a black background, be fastened on the shaft of the motor and the light from the arc lamp, which reaches a maximum 120 times a second, be allowed to fall on the disc, it will be illuminated four times during each revolution, or every time it turns through 90 degrees. Since the four white sectors on the disc are spaced 90 degrees apart, each sector will occupy the position of the preceding sector at the time of the preceding light maximum. Due to the phenomenon of the presistence of vision, the image of the disc which reaches the eye of the observer appears to be stationary. But if a load is applied to the motor, the rotor no longer remains exactly in step with the field and this change can be detected by a shift in the positions of the sectors or, in the case of a heavily loaded induction motor, by the apparent slow backward rotation of the disc, thus in the laboratory we "count the sip" by determining the speed of the apparent backward rotation of the sectors.

The method outlined above is suitable only for approximate results, the greatest limitation of the apparatus being that the arc does not give sharp intermittent flashes but rather a continuous variation in intensity. In the attempt to overcome the blurring which results from this effect, recent de-

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*Published Monthly by the Students of the Rose Polytechic Institute*

# The Rose TECHNIC

*A Magazine Pertaining to Engineering and Allied Sciences*

*Member of Engineering College Magazines Associated*



## *Rose Show Well Under Headway*

### April 19, 20, 21, Will Not Catch Student and Faculty Unprepared.

Loyalty and honest effort have shown themselves to be one of the most prominent traits of students at Rose in this new undertaking of blazing the trail to a new exhibition of Rose spirit. The evidence of this fact may readily be proven by merely listening to current discussion and watching off-hour activity in and about the school. Even the originators and promoters of this new feature have been surprised at the great expansion of ideas and suggestions which have made all so enthusiastic.

Through meetings held each week for the getting together of the faculty and students in charge of the various branches of the activity, every point is carefully checked and rechecked, revised and reconsidered in order to bring out only the best that can be offered. If an exhibit is discovered which will be better than one already on the list of that which is to be performed by a certain department, it is substituted while the former is thrown out. Or if an eye-opener is found and no exhibit on the list is in the least week in nature, then the discovered item of interest is added on. In this manner a program must be presented which can be none other than unsurpassed by any possible program compiled to demonstrate to the public just why Rose Poly engineers are so well known throughout the engineering world as the engineers who can deliver the goods.

### Show to Be Widely Advertised

Home folks as well as those in the vicinity of them are being acquainted with the fact that Rose Poly is going to really do something which will be many times worth the effort, anxiety and change expended in order to witness the events. Local newspapers in the home towns are seeking to get this item of news and follow it through well knowing that to miss it would be to neglect a news item interesting to their readers.

Not only is the news value being realized throughout the state but also by the papers and items of current events here in Terre Haute. The public is being willing to realize that the exhibit is a big thing and is a smack of progress in the advancement of their home school.

In addition many other methods have made prominent the coming of the show. Among these the attractive show cards cannot be forgotten. Not only is the coming of the show to be remembered but also its significance and purpose—the attractive souvenirs and programs which shall extend the show far beyond the three days of its existence.

### To Be Real Test of Department Strength

For the first time in Rose history the five different engineering departments will have a chance to demonstrate just what they know and how they can apply it. This test will be much different than that one occuring on St. Pats because there it is merely a question of numbers and of getting the fellows out to do the work, as to who can get out the best floats. In this show of skill every department must put to practical application that which he has learned in such a way as to make it interesting as well as informational to all. In this way a variety of exhibits will be available to the extent that it will be necessary for spectators to come the second time in order to get all that is to be had.

According to plans being carefully prepared for the show the Architectual department will have available a model of the well known Civic Opera House being erected in Chicago. This is to be a fair size structure representing one of Chicago's newest and better designed buildings. It is therefore recognized as a mark of progress in the architectual field. In addition to this model other models will also be on exhibit featuring prominent structures. It is also expected that enough material will be assembled to make the exhibit of this department interesting to home owner and builder.

Features of the other departments are numerous and varied and will not fail to support the high standards being attained in all throughout the show.

## *Show Preparations Show Progress*

*By Maurice L. Piker, ch. e., '30*

THE recent mid-term examinations and St. Patrick's Day activities caused a temporary halt in actual preparations for the Rose Show that is to be held April 19, 20 and 21st. Since that time students and heads of the various committees have been striving to make up the lost time. It is assured now that the show, which is the first in the history of Rose, is destined to be a success in every respect and will serve the very purpose for which it is intended. The show is being held not only to show people what the term "Engineering" signifies but as a greater purpose to show the people what Rose is doing and what is can offer the students who enroll each year.

Professor C. C. Knipmeyer, acting as general chairman of the show, has the following students and professors aiding him in making a success of Rose's first adventure into the field of engineering shows: General Exhibits Committee—Dr. B. A. Howlett, general chairman; Alexander Babillis; student chairman; Student chairman of general courses—Rex Adams, Chemical; Wayne Kehoe, Electrical; Mechanical, Alexander Babillis; Kenneth Mason, Civil; Benjamin VanVactor, Military; Richard Markle, Architectural; Wayne Dodson, Physics; James Shew, Shops. Program and Ticket Committee, Professor Albert Faurot; Publicity Committee, Professor Roland Hutchins, Guides Committee, Professor Claude Settles; Space Assignment, Dr. F. C. Wagner; Placards and Signs Committee, Professor O. L. Stock; Power and Light Committee, Professor Russel Mason; Decorations Committee, Professor Alfred Child.

In every department the students have been working faithfully and have brought about desired results, thus eliminating possibilities of last-minute rushes and worries. Each student head of the departments has undergraduate chairmen of each class, thus having someone to see that orders are carried out in each class and that no work is allowed to lag. The appointments to the chairmanships were made by election in each class of each course.

The fact that Physics and Military are not recognized as general courses does not mean that these two important departments will not have parts in the show, for it seems that they are not only going to be represented, but that they are going to have some of the best features of the three-day show. The Shops have been assigned about 30 students which allow every machine to be exhibited at some time during each evening.

Desirous of having the maximum number of visitors at the show each evening, in order that the people of this vicinity may become acquainted with the school. Professor Hutchins, chairman of the Publicity Committee, has been addressing numerous luncheons of various civic clubs in this vicinity, making trips to nearby towns addressing clubs there and has been doing some fine work in that the members of the clubs have signified their desires and intentions of attending the show. Dr. Wagner and Dr. White have spread the word at even farther radii and have brought back some good results. The students are doing their part, getting their exhibits in order as well as they can at this early date, all of which signifies that the first Rose Show is going to be a success and lead to many more.

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## *The Regulation of Public Utilities*

(Continued from Page )

tremely long periods of years are difficult to obtain because types of manufacture change, the items to be priced being after absolute or of comparative recent design. The average prices of these items are obtained by estimating the rise or fall from a cost price which is known. A study of price fluctuation of equipment similar to this and for which data is available is necessary.

Buildings and structures are appraised according to the ground occupied, area of floor space, or cubical contents. The quantities of the various kinds of building material necessary for the construction of them is estimated. The price of the complete structure is determined by applying unit prices to these qualities. The unit prices in the cases also is an average of the prices prevailing over the five-year period.

The plant and general equipment is usually thought of as material and supplies. It has been shown how the materials were appraised. The materials under plant equipment are appraised in a like manner except these are materials not yet in use and therefore the cost of placing them is not taken. Under general equipment are items such as automobiles, office furniture, equipment, tools, instruments, ets. The price of these is readily obtained as it does not change so often.

In all public utilities the cutting of pavement has to be taken into consideration. The amount and kind of pavement cut can be obtained easily as the companies before cutting pavement to lay mains, conduits, manholes, cables, or any underground equipment have to get a permit from the city engineering department. This will show the kind and amount cut. The cost of cutting pavement is not allowed where the property was laid prior to the laying of the pavement. The cost of cutting pavement to make repairs on the underground equipment is an operating expense and should be paid for out of the company's maintenance fund.

To all the property items referred to above there is another item of cost of physical property that must be added. This item is called structural overhead expense. As the name implies, it is an overhead expense that applies to structures. The different elements of cost in this structural overhead expense apply to different parts of the property in varying amounts, but it is found to be very practicable to introduce it in a lump sum. The structural overhead percentage is not applied to the cost of materials and supplies because these quantities have

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ST. Patrick's Day was celebrated by the Chicago Rose Tech Club in the way of a dinner held in the Engineers Club. We had one of the largest turnouts—coming to hear Dr. White who was our special guest from the Institute.

Dr. White had been in Chicago attending meetings of the North Central Association of Colleges and Secondary Schools.

He told us many interesting things which this association was doing, and especially how for about 20 years Rose has been on the accredited list of colleges and secondary schools in the North Central district, which embraces 38 States, representing 348 Colleges and 2084 Secondary Schools.

Some rather significant requirements to remain on the list were passed at these meetings. A check of the scholastic requirements at Rose, against those of the Association, showd that the Institute parallelled them in almost every deail.

One of the interesting things Dr. White told us was about the recent change in the credit system, which has involved the use of credit points. This was something new to the older alumni, and proved an interesting point of discussion. He also outlined and explained the new curriculum at Rose. The alumni felt that this was a change for the better.

The faithful steam roller was brought out and shined up for the spring election, and put into office, Wetherbee '92 as President, Brooks '16, Secretary and Treasurer.

The men of '08 expressed especially their desire to go back to commencement for their twentieth reunion, and it looks as though there will be a good turnout from the Chicago Club in June. The following alumni were present at the dinner: Hammond '89, Condron '90, Mills Ex '91, Wetherbee '92, McDargh '96, Arn '97, Jones '02, Gilbert '03, Post '03, Robertson '05, Snider '05, Goodman '07, Post '07, Bernhardt '08, Fisher '08, Hathaway '08, Bercaw '10, Rehm '12, Ostrander '13, Reese '13, Brooks '16, Manson '16, Austermiller '17, Long '18, Woodruff '19, Reinmann '20, Whitlock '22, Donham '23, Field '23, Wright '23, Waltman '24, Schahfer '24, Wilson '24, Griffith '25, Jenkins '25, Mischler '27, Wilson '27, Wilkens Ex '28.

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THE following article taken from the Terre Haute Tribune's Column "Forty Years Ago" is another reminder of the extent to which Rose Alumni are scattered through the world. It will be remembered that Baron Taro Tsuji, M. S. '92, C. E. '96, is now a member of the House of Peers at Tokio, Japan.

### Jap Student At Rose Poly.

"The Japanese student who has been expected to arrive at Rose Polytechnic from Kansas City arrived yesterday (March 27). His name is Taro Tsuji (Soo Gee). He is about 30 years old, and has been in this country two years, most of the time at Kansas City, studying civil engineering. He also spent some time studying it at the Imperial School of Engineering in Tokio, capital of his native country, which has since been consolidated with the University of Japan.

"Mr. Tsuji's father is vice minister of education, a very responsible position in Japan. Upon his return to that country the young student's chances for a high position in the government are favorable. President Menhenhall says he will take his place in the sophomore class at Rose Poly. In some studies he is probably ahead of his class, while in others he may be behind. He speaks very good English, and can be readily understood, although many of his words are articulated so quickly that unless particular attention is given they may not be understood.

"His accent, though not strictly correct, has not the broad foreign twang peculiar to most foreigners. He is about five feet two inches in height, with dark hair and eyes, and a very pleasant and expressive face."

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### '99

Of interest to the mechanicals at Rose is the notice that Noble C. Butler, Jr. has left the Vacum Oil Co. to take a position with the Standard Oil Co., and is located in New York City.

### '13

The 1928 edition of the "Tower," the University of Detroit's annual publication, is to be dedicated to Russell E. Lawrence, dean of the College of Engineering it was announced this week by staff members of the year book. This is considered one of the most signal honors that can be bestowed on a faculty member by students of the university.

For 12 years Dean Lawrence has been an active figure in the university's expansion. Under his administration, the College of Engineering has grown from a department of the School of Commerce and Finance to a separate college on an equal footing with the other colleges of the university.

The engineering school now boasts the largest enrollment of any of the university's divisions.

Approximately $12,000 will be expended on the "Tower" in an effort to make it the best annual ever

published and to furnish a model for future years.

Dean Lawrence is one of the prominent alumni of Rose, graduating in the class of '13.

'23

J. Russel Snyder, M. A., who is with the Kentucky Actuarial Bureau, can be reached at his new address at Louisville, Ky.

'24

Leon S. Maehling, Industrial Engineer for the Equitable Gas Co., is now located at Pittsburgh, Pa.

'25

Clarence A. Anderson has been transferred to the Chicago office of the Illinois Bell Telephone Co. Mr. Anderson has been located at Forest Park, Ill., as Student Engineer for the telephone company.

Orville M. Dunning, who has been with the General Electric Co. in the Radio Department at Schenectady, New York since graduating from Rose, is now with the Slaughter Radio Co.

'27

The Roxana Petroleum Corp. at Wood River, Illinois is operating a Ricardo "Anti-Knock" engine, made in England; this is the only one in this country. Edward Dunning, mechanical, who has been with the Pierce Petroleum Co. of St. Louis, Mo. as Research and Lubricating Engineer, is doing gasoline research work for the Roxana Corp. at Wood River.

Richard C. Kadel has left the prosaic work of Engineer of Maintenance of way with the C. and E. I. Railroad at Danville, Illinois. He is now with the American Bond and Mortgage Co. of Danville.

## CALENDAR

Rose Alumni should sit up and take notice of the new day for graduation exercises. Instead of the traditional Thursday—it seems that 'way back in the perspective of time that Thursday has always been the day—the exercises are to be held on Saturday, June 9th. this year. Knowing the reluctance of Rose to change anything traditional, the Alumni should feel highly pleased, since the day has been changed so that more of them can be present.

Of particular interest to the Alumni of 1908 is the re-union being planned for that class by Prof. Stock of Rose. Several letters have been sent to various members of the class of '08 and many encouraging, enthusiastic replies received. It looks as though the re-union would be a success—well, we know it will. It's going to happen on the 8th.-9th.-10th. of June and the class of '08 hopes that its fellow classes of '07 and '09 will consider themselves counted in to help celebrate its twentieth birthday as alumni.

Rose Show will be held on the 19th.-20th.-21st. A sort of open-house to let the friends of Rose see what has been going on out here recently. There'll be lots of things you never thought engineers had anything to do with!

P. S. There will be several alumni here, too.

## *Price Regulations of Public Utilities*

(Continued from Page 13)

not entered into the property. In this report of structural overhead and amount equal to fifteen per cent on the total of all items exclusive of material and supplies is submitted. The item of structural overhead cost as it is used in the appraisal included such costs as engineering, superintendence interest during construction, taxes during construction, fire and liability insurance, small omissions of the inventory, and contingencies. In making up the unit prices applied to the units of inventory in the appraisal, no allowances have been made for the items of structural overhead, and in order to arrive at an appraisal made on the "Basis of Reproduction" theory, it is necessary that an allowance be made to cover these items.

From all of this the total valuation of the plant is computed. The number of customers that this utility serves is known and from these two items a fair rate is set for the customer to be charged.

If a change in rates is wanted by one of the public utilities, they make out an appraisal of their plant. This is submitted to the commission. The commission sends their engineer to check the appraisal. If the Commission finds that the company will be getting no more than a fair rate with a change of price they will allow them to change. If they think that a change in price is not necessary but the company does, a public hearing is held to decide whether the price should be changed or not. The expense of manking an appraisal by the commission is paid by the utility into the state treasury.

## *The Tragedy of Waste*

(Continued from Page 6)

the situation. We would rather stand around and complain of the high cost of living.

Not so apparent to the individuals but more wasteful than milk delivery are the cross hauling methods used consistently by railroads. We prove in geometry that the shortest distance between two points is a straight line. Yet a railroad in the East recently shipped goods over three sides of a rectangle before they reached their destination. Likewise Chicago uses West Virginia coal while Indiana and Illinois coal is shipped out of the state. In summary of the waste in distribution it can be safely said that the energy of two million individuals is lost under the present system.

A somewhat hurried survey of the system has brought out many huge wastes, yet all of these are like a drop of water in a bucket when placed beside the waste in natural resources. In an increasing amount yearly we are destroying that which can never be replaced, or, at least, we are making no attempt to replace it. The situation would be acute enough without any wasting involved; but when we see coal, oil, and gas deliberately wasted, then the situation is very grave. Accurate statistics have shown that for every ton of coal mined one ton remains in the ground never to be used by civilization. With a 50% loss involved merely through mining, the coal is used to fire a boiler. Due to the crude methods used, and the lack of efficiency of the boiler, only 5% of the total heat is turned into useful energy. With water power and coal used together we can increase the efficiency greatly.

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# ATHLETICS

## *Baseball Prospects*

THE baseball prospects are very bright this year due to the fact that there are several letter men left from last year. If experience is anything Rose should be one of the most feared teams in the state.

At the catcher's position Bob Thompson is back and he can hold this position down without a bit of trouble. Marsh is also trying for a position on the receiving end.

Rose has two veterans on its pitching staff Babillis and Peters. Babillis has had two years of college experience and is able to hold his own. For first base Rose is well fixed with Wayne Kehoe and Allen. Kehoe is a letter man and a heavy striker. Allen is a tall athlete and can take his turn at the plate.

Bob Dowen, a letter man can take care of the keystone sack. Taggart, captain, will take up the duties of shortstop.

Leake, another letter man is at the hot corner but Carl Dowen a freshman also looks good.

Rose has three letter men back for the outfield, Alexander, Houston and Goddard. Also, Rose has two good men in Wills and Gibbons. Wills is a very good utility man.

With the material Rose has and the weather remains good, Rose should go great and have a successful team.

April 4—E. I. S. N.—At Charleston.
April 12—Wabash—At Crawfordsville.
April 18—Depauw—at Greencastle.
April 28—Indiana Central—Indianapolis.
May 1—Wabash—Here.
May 9—Indiana Central—Here.
May 11—Depauw—Here.
May 16—E. I. S. N.—Here.

## *Track Prospects*

IN previous years Rose has been known for its good track teams. In dual and triangular meets Rose has usually been victorious. Rose has also made a good showing in the Little State Meet and the Big State Meet. With the material Rose has it should have another good year.

Injuries have hurt Rose to some extent this year, Rose has lost Derry, star hurdler and Dean may also be lost due to sickness.

Davy and Hill have been lost due to ineligibility.

In the dashes Rose has Wade, Weddle, and Loving. Wade is from Wiley High Sshool, and Loving is a former Garfield Star. Weddle is also said to be a "whiz" in the dashes.

In the 440 yd. dash Rose has Muntz, who tied Paul Turk's record last year. In the half mile Rose has Muntz, also Beem and Scharf. Beem is a letter man from last year. Scharf is a former Brazil athlete.

In the mile and the two mile Fitch and Baker look good with Scharf and Reeves giving them a good race. Fitch broke the two mile record last year and Baker was a close second.

In the hurdles Rose has Spangenberg former Wiley star who ought to be able to take care of the hurdles.

In the field events Rose has Barret and Ellis for the shot put. Barret is one of the best weight men Rose has ever had. In the discus and javelin Rose has Barret, Hauer and Ellis.

Captain Max White will take care of the broad jump. White, Barret, and Keller will take care of the high jump.

In the pole vault White, Nicholson and Cripe look the best.

With this material and some good weather, Rose should again win honors in track.

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### Creature of Curcumstance

Fond Mamma—"My little man at the foot of the whole class? Why Howard, I am so disappointed.

"Fuzzy"—Well, it ain't my fault mamma, the boy who is always at the bottom is sick this week.

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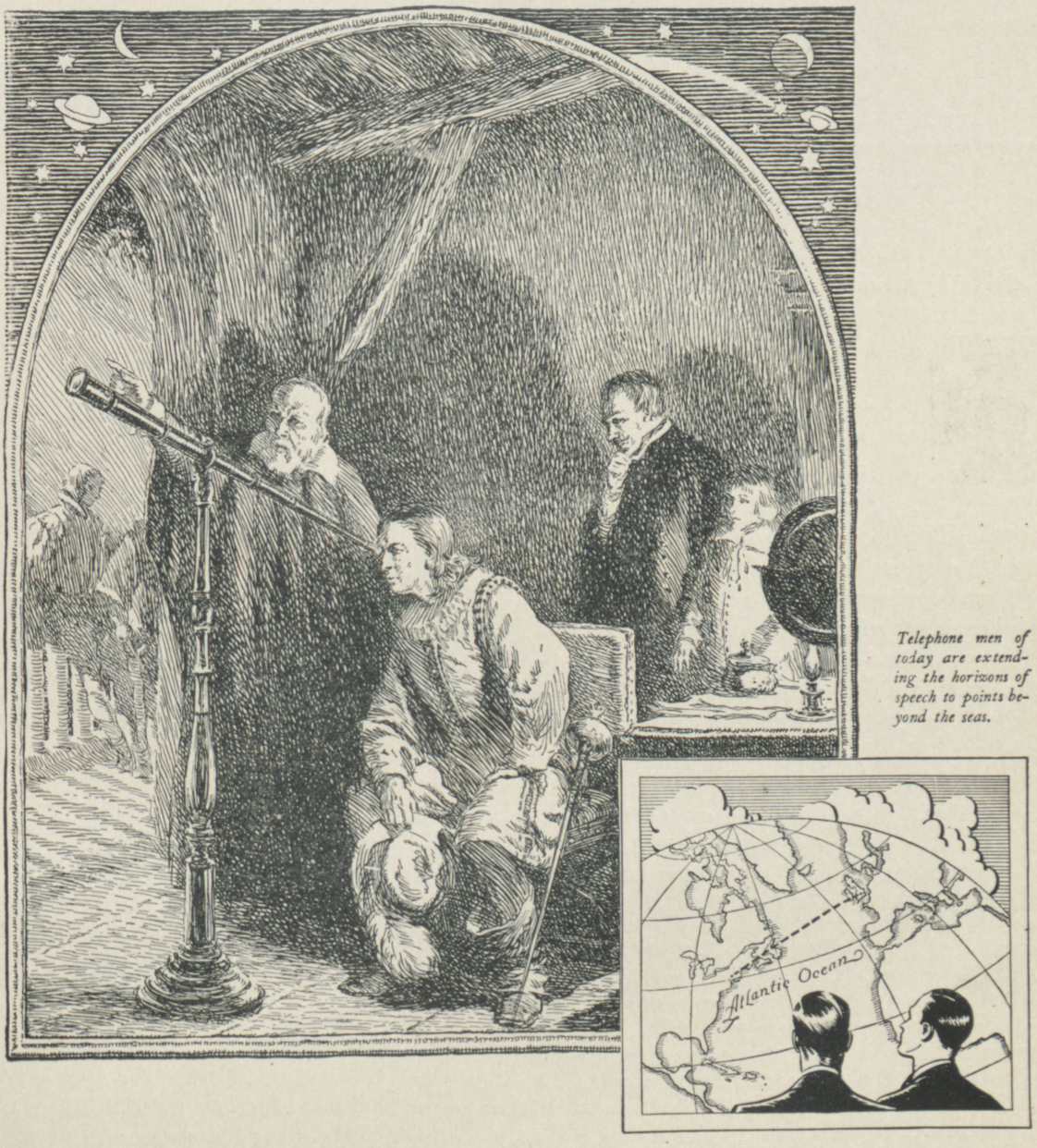


*Telephone men of today are extending the horizons of speech to points beyond the seas.*

# New Worlds for Old

LIKE Galileo, every pioneer seeks new worlds. In the telephone industry this has led to discoveries of ways and means to better service.

Telephone pioneers of yesterday hewed a way through intricacies of science, finance and business management to establish the era of "distance speech."

Telephone pioneers of our own day *imagined* a 'cross-ocean service—and then made it.

Telephone pioneers of tomorrow will face the challenge of new and greater problems sure to arise.

## BELL SYSTEM

*A nation-wide system of* 18,500,000 *inter-connecting telephones*

"OUR PIONEERING WORK HAS JUST BEGUN"

# FRATERNITIES

## *Alpha Tau Omega*

THE annual A. T. O. pledge dance was given at the Edgewood Log Cabin on Saturday nite March 31. The dance started at 8:30 P. M. and the hilarity increased as the time advanced. George Pat's orchestra furnished the music and such music! The time was perfect! and the harmony was equally as good as the time! The floor was as smooth as glass and—well what else could be desired for a good dance? The sport continued until the clock began to toll the highest hour of the nite, when the dance broke up. Everyone had a joyous time—the pledges making the most of their last free dance. Those present were the active chapter, the pledge chapter, and the visitors, Mr. Mendenhall and the chaperones Brother and Mrs. Wischmeyer and Professor and Mrs. Hutchins.

Brother "Tommy" Crutcher and Brother Mac Intosh were back to visit the past month and they looked just as good as ever. "Mac" is working as associate professor of civil engineering at the University of Louisville and is getting along fine.

Max White and "Cy" Fitch are rounding into shape for this years track season and are expected to add many points to the squads score in the various meets. Max is the captain of the squad and hopes to make '28 a very successful year.

"Bob" Alexander is serving his last year on the baseball team in the left field position and will help the team to bring home the bacon. Pledge Brother Herndon Witt is also out for baseball and is expected to develop into a good player.

## *Theta Kappa Nu*

ST. Pats Day was celebrated by the members of Theta Kappa Nu by having a house party Saturday night March 17. Everybody had a good time dancing and playing cards. Refreshments were served and everybody departed saying they had a very enjoyable evening.

The first week of April was set aside as rough-week during which the Pleges were given a thorough test of their character. The formal initiation services will be held Sunday April 15.

The Pledges entertained the Brothers of Theta Kappa Nu and their girl friends with a dance and house party Thursday night, April 5. The chapter house was gaily decorated in the colors of the fraternity. A red-hot orchestra furnished the music for the dancers. Card playing was also enjoyed by some of the guests. All of the guests expressed themselves as having a very delightful evening.

Brother Lawyer has been appointed to represent the chapter at the Fourth National Convention of Theta Kappa Nu to be held at Cleveland, Ohio, Aug. 28-30, 1928 and hopes to bring back many new ideas which will be of aid to us.

Brother Hillis and Fenner were recent visitors at the house.

## *Sigma Nu*

THE past month has seen much activity around the house of Sigma Nu, the greatest of all, to the notion of the freshmen, being that relic of the inquistion, "Rough Week". Within the past month there has also been written into the pages of history another state formal which was a howling success, both figuratively and literally. The Marrott Hotel, which was the scene of the affair this year, lent itself very readily to the success of the gay dance, the Crystal ball room making the splendor and brilliancy even more attractive. Previous to the dance the brothers and their girl friends dined in the Main Dining Hall at the Marott with inspectors from the fourth division and the General Secretary, Ernest Lee Williams.

Brother Jack McDargh who is now with Portland Cement Association was at the Institute on St. Pat's day to deliver a lecture on the strength of concrete before the civil engineering students. He made a pleasant visit to the chapter house and stayed over for the festivities throughout the day.

Brother Nathan A. Bowers had an interesting article on the failure of the St. Francis dam in a recent issue of the Engineering News Record of which he is the Pacific Coast Editor.

Brother Russell Staggs, who is now located with the Westinghouse Electric and Manufacturing Company, was recently a visitor to the Institute when he interviewed prospective electrical engineers in the senior class.

The Mothers Club met at the chapter house Thursday aftternoon April 5, when an enjoyable afternoon was spent. Refreshments consisted of tea and wafers which were served by those members of the active chapter who were able to get away from school for the afternoon.

# IN THE MIXING HOUSE

THE men in the dynamite mixing house work together with the smoothness of an eight-oared crew. Without hurry and yet without a wasted motion each does his appointed tasks with the precision and alertness of the trained powder worker.

These men must not only work smoothly, but they must think correctly. Nothing must go amiss without their instantly detecting and correcting it. They must know the weights and proportions of dope* and nitroglycerin used to produce the many different grades of dynamite mixed under the great mixer wheels, which are shod with rubber for safety. Any slip of theirs here will quickly be brought to light by the chemists' analysis.

It has taken years of patient work and careful experimenting to bring this seemingly simple mixing process to its present perfection. But no matter how perfectly the machine does its work it would be of little avail without the skill and practical knowledge of the mixing house crew.

To the men of the mixing house is due, in no small measure, the credit for the important work done by Hercules Dynamite as it fights on the side of man in his battle with nature—leveling mountains, altering the courses of rivers, changing the farmers' arid land into fruitful fields, in fact performing for man tremendous tasks which he could never accomplish unaided.

*"Dope"—the powder makers' term for an absorbent containing proper proportions of nitrate of soda, nitrate of ammonia, wood pulp, flour, starch, sulphur, chalk, and other ingredients and which by their own combustion furnish explosive energy.

## HERCULES POWDER COMPANY

(INCORPORATED)

Wilmington, Delaware

HERCULES POWER COMPANY, Inc., 941 King Street, Wilmington, Delaware

Sign and mail this coupon for a free sample copy of The Explosives Engineer—the only magazine devoted to promoting safe and efficient methods of blasting about which every engineer should know something.

Name _____ College _____

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1411

## *Henry Ford--A Pioneer in Aerial Transportation*

(Continued from Page 7)

From this room one can reach overhead to the baggage hold, situated out in the wings. From here also the gasoline tanks can be inspected and every part of the gasoline system, up to the dash board, inspected and repaired while in the air.

Forward of the toilet compartment is the pilot's cockpit, which has side by side seats and dual controls and is fully equipped with all navigating instruments and map equipment. It has very high and wide wind screens and is large enough to stand up in. The sides of the cockpit are left entirely open. In some models swinging windows are arranged so that the cockpit can be entirely enclosed, heated, and ventilated.

The plane is constructed entirely of duralumin in corrugated form. The wing unit is divided into three sections. The center past is fastened onto the fuselage by large bolts to the three main spars. The two outer sections are detachable for shipping purposes or for replacement in case of damage.

A wing of thick section is used, the main spar being almost 3 ft. deep by 12 feet wide at the center. The fuselage, which is below the wing is fitted with semi-circular windows which swing on a pivot and give an unusual view in the air. The pilot's vision is such that he can see in every direction, and can see the landing gear and practically every part of the plane from the cockpit. Three Wright Whirlwind motors are now used in the planes.

The chief dimensions and performance of the Ford plane are as follows:

| | |
|---|---|
| Span | 58 ft. 4 in. |
| Length | 45 ft. 8 in. |
| Height (at rest) | 11 ft. 10 in. |
| Power loading | 14.8 lb. per H. P. |
| Rate of climb at ground | 500 ft. per min. |
| Time to clomb to 5,000 ft. | 12 min. |

The type now manufactured are of the multi-engine type with three air-cooled engines. These give the plane sufficient power to continue in flight if one engine should fail and ample power to maneuver into a safe landing even if two of the engines should fail. In this way the hazard of engine trouble is greatly reduced.

A new airplane manufacturing plant and a new hangar having a capacity of housing fifteen or more airplanes, forming one of the largest and most modern aircraft developments in the country has been erected at the Ford Airport at Dearborn, Mich. The new airplane plant has a floor area of 60,000 sq. ft. It is fitted with every modern facility for the manufacture of airplanes laid out in the standard Ford system of progressive production. Materials enter one end of the building and proceed through the various stages of manufacture, emerging from the other end as completed airplanes.

The new plant is a building 120 ft. wide by 500 ft. long and one story in height. An unusual feature of the building is that it has a full 120 ft. span from one side to the other without intervening roof


# Quality

THE trade marks shown above identify products that have won universal recognition as the standard for uniformity of quality and protection. Years of experience in the manufacture of building glass and constant laboratory tests are the reason for Mississippi supremacy.

In 1899 the underwriters based their standard for wire glass on the product of the Mississippi Glass Company. Since then Mississippi has perfected many processes for the manufacture of polished and figured wire-glass and figured sheet glass.

By a new process of manufacture, Mississippi products have a plate-glass finish and a uniformity of quality not found in any sub-standard product on the market.

For strength and beauty—for quality and efficiency—specify "MISSISSIPPI".

MISSISSIPPI GLASS COMPANY
MISSISSIPPI WIRE GLASS COMPANY
220 Fifth Avenue New York
*Chicago St. Louis*

*The Standard is based on*

# MISSISSIPPI

supports, giving clear space for assembly of the airplanes.

The new hangar building is located next to the manufacturing plant, is 123 ft. wide and 300 ft. long. An unusual feature is that each of the 300 ft. sides is inclosed by steel and glass doors. This will permit the entire opening of either or both sides, the doors sliding back and holding into the ends of the building.

February 15, 1926 marked the inauguration of the first contract air mail service. This contract was awarded to Henry Ford. The new air mail service puts Detroit on the Transcontinental Air Mail route, within 8 hours of New York, 3 hours of Cleveland, 4 hours of Chicago and 26 hours of San Francisco. Letters leaving the Detroit postoffice at 9:50 A. M. in the morning will be delivered in Cleveland that afternoon and will reach New York City that evening. Other letters leaving the Detroit postoffice at 2:35 P. M., would reach Chicago that afternoon and San Francisco the following afternoon.

The Commercial airplane reliability tour of 1926 for the Edsel B. Ford Trophy was held Aug. 7 to 21, 1926. The entries were made in two classes. In one class was entered the single motored planes and the other was the multi-motored planes. The reasons being that the multi-engined plane in its present stage, sacrifices a certain amount of operating efficiency in favor of the added factor of reliability, whereas the single engine machine possesses greater economy of operation but perhaps not the same degree of reliability as the multi-engine plane. The planes had to be capable of making a speed of at least 80 miles per hour. All planes had to carry a contest load, in addition to pilot and fuel of at least .6 lb. per cu. in. of engine displacement.

The performance of the leaders in this tour set a mark for light commercial plane efficiency that may make it possible for new air lines to be established more quickly because of the very much lower capital expense for planes such as these over most of those now in use, as well as the greately increased pay load per horse power which these new designs can carry at high speed. The use of the air-cooled engine and refined stream lined design are responsible for the transportation of small loads at 4 lbs. per horse power over 2500 miles at an average speed of over 110 miles per hour.

The tour did much to demonstrate to the public the reliability of the new types of aircraft that are being developed. A Ford pane was put in the race not as an entry but to get valuable data on the plane when used on a long trip.

As we have seen Ford has been very active in developing the airplane and can be depended on to do his part in the future.

## *The Tragedy of Waste*

(Continued from Page 15)

Progress up to this time has been very slow, in spite of the great need for development.

At the present time our supply of natural gas has been practically exhausted; our oil supply is good for about twenty years—yet we still waste one million barrels annually; fifty million horsepower is

being wasted annually through lack of waterpower development; fifty billion cubic of lumber are either thrown away or destroyed by fire; and yet we have hardly given a thought to the result of all this waste. We are laughing at Mother Earth now, but the day of reckoning will soon come when someone else will laugh.

In summarizing the book, Mr. Chase shows the fallacy of the statement that we are rich. We think the nation can afford to waste because it has plenty. Yet 95% of the people in the United States existed on thirty-seven billion dollars in 1924. When every one makes a living instead of a dying wage; when every tree that is cut down is replaced by another; when every ton of coal in the ground is mined, then we will begin to see progress. Perhaps no such condition will ever exist, but we can take a great step in that direction by reorganizing our economic system, and as far as possible by eliminating waste.

Who then shall lead us out of the present wilderness; who shall deliver us from our self-destruction we are now headed for; where shall he dive into the wilderness and bring forth those things which will advance civilization? These are the questions which baffle the author and those which he appeals to us to help him answer.

## *The Neon-Electric Stereoscope*

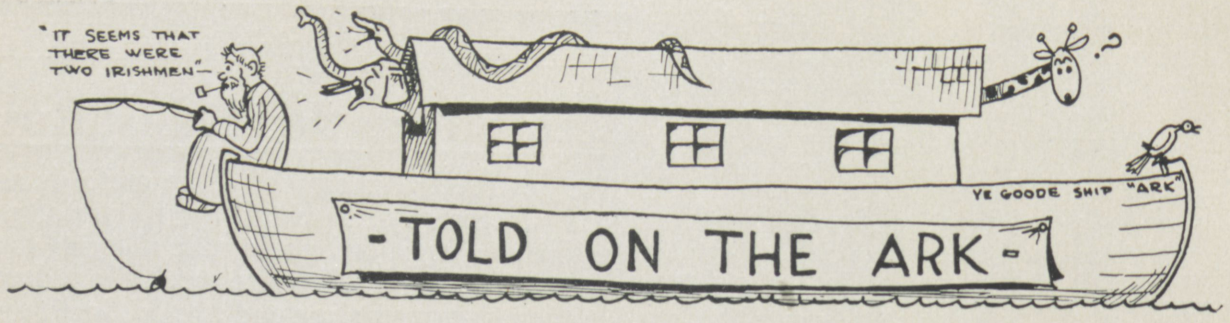
(Continued from Page 11)

velopment has been largely in the substitution of a device which gives an instantaneous flash rather than a continuous variation. A source which meets these requirements is a low-pressure neon tube activated by a suitable transformer.

The particular qualities which make the neon lamp especially suited to this application are its practically instantaneous responsiveness to applied voltage and its low thermal capacity, which prevents it from continuing as a source of light after the voltage has fallen below the extinction point. Several different forms of the neon-lamp stroboscope have been suggested and successfully operated. One form employs a neon lamp placed behind a slotted, rotating disc. Another type uses an electrically-driven tuning fork to interrupt the light. In still another form an electrically-driven tuning fork interrupts the primary current of a spark coil, the secondary of which furnishes the voltage for the neon tube.

In the new form of neon-electric stroboscope developed by C. A. Nickle of the General Electric Company the advantages of the older types of the instrument have been combined to produce an instrument as portable as an ordinary voltmeter—and as simple to operate. The apparatus consists of an especially constructed transformer, designed with a magnetic shunt and air gap and built of a special grade of iron which is readily saturated. In addition to this, a portion of the core of the transformer is of reduced cross-sectional area, the purpose being to produce a rectangular flux wave, which causes the secondary voltage wave to take on a shape represented by a series of straight vertical lines alter-

(Continued on Page 25)




### Fair Warning

Teacher—Johnny, if you continue being naughty, I'll send a note to your father.

Johnny—You'd better not. Mother's jealous as a cat.

---

The height of class: The society lady who bought a cow into the dining room to show her guests that they were getting fresh milk.

---

### Hark, Engineers!

The man who uses bad English often uses good Scotch.

---

Some guys think they are doing their bit when they bring a corkscrew to a party.

---

Bill H. Have you heard the latest about John?

"Duke": No.

Bill H.: He put his wet umbrella to bed and stood up in the corner all night.

---

Proud Parent (who served)—What I told you is the story of the World war.

His Son: But, Pappa, what did they need the rest of the army for?

---

Lady of the House: You say you always feel fatigued. I can't understand that.

Hobo: I's hereditary, mum. Me father was the original tired business man.

---

He: Are you down on petting?

She: No—are you up on it?

---

He—Say, boys, I read in the paper that more than 200,000 pilgrims visit Mecca each year.

Him—Yeh? What's her address? Gosh, she must be a knock-out.

---

First Collegian to Second Rose Soph—Slow down, Joe, You're going too fast. The crowd can't read the jokes.

### Programme of Music

1. Jazz Melody: "I call my boy friend "Feet" 'cause he's always under the table."

2. Romantic Ditty: She thought he was a sausage king but he was only a fat baloney.

3. Song of Youth: He called her his treasure because all her teeth were gold.

---

James—Did you dig any gold out of that college boy?

Big and Bad Blonde: Well, not exactly but when I kissed the top of his head I struck oil.

---

He—Blast those flies. I've never seen such things. They're the biggest damned pests.

Visiting Mother-in-Law: Henry, you forgot that I'm here!

---

She: It's wonderful what they can do with fruit trees now—change one kind into another.

He: I didn't know they could do that.

She: Oh, yes; I heard the farmer say he was going to prune his pear trees this year.

---

Spec: Bet you can't guess why my pa ain't on speaking terms with his customers?

Tech: What is he? Deaf and dumb?

Spec: Naw, He's an undertaker.

---

Jimmie: My roommate invented a labor-saving device.

Ann: Yeh? What is it?

Jimmie: Oh, he's got the best method of borrowing money you ever heard of.

---

The Hero: You're a bright boy, all right. Is your sister apt, too?

Little Brother: Sure. If she gets a chance, she's apt too.

## *The Neon-Electric Stereoscope*

(Continued from Page 23)

nately positive and negative and separated 1-120 of a second. In order to further accentuate this peaked wave form the secondary of the transformer is tuned to reasonance by means of a fixed condenser connected across the secondary. In thus tuning the secondary, however, a series of harmonics is produced in the voltage wave and so a series of secondary images appears on the disc of the stroboscope. The fundamental image, however is much brighter than any of those produced by the harmonics and so is readily distinguishable.

With this type of stroboscope remarkably accurate measurements can be secured, even with a relatively small disc. With white lines only .02 inch wide, on a black disc one foot in diameter, measurements of the position of the line are accurate to within .02 inch at the periphery of the disc. This indicates that the duration of the illumination of the disc during each flash of the neon lamp is about 1-50,000 of a second. It is this extreme rapidity of the flash which produces the very sharply defined image.

Thus the outstanding advantages of the neon-electric stroboscope are its remarkable accuracy, its portability, its ruggedness, its compactness, and the absence of any moving parts whatever, with the exception of the disc.

Abstracted from the General Electric Review.

### HUMOR NOTES

Father (to youngster, just put to bed): "Now, what are you crying for?"

Son: "I wanna drink."

Father: "So do I; go to sleep."

---

Sweet Young Thing (to battered foot-ball player): "How'd you get hurt?"

Him: "I was swimming in the pool and a battleship ran over me."

---

El Masulino: "What is there so enticing about you tonight?"

La Feminiana: "Your arm, Don Juan."

---

Cy: "Say, pard, I see you have a bad leg? Pray tell me, what may you be doing for it?"

Clone: "Limping, Cy, me boy, limping."

---

She was only A math prof's daughter but she had DeVoivre's figure.

---

Rumble: "Does your girl know much about automobiles?"

Seat: "Gosh no; she asked me if I cooled the motor by stripping the gears."

---

"You know, there's something dove-like about you?"

"No, really?"

"Yes, you're pigeon-toed."




**True Blood**

Attorney—Why do you say they are through-and-through gamblers?

Sheriff—While we were chasing them they were betting on which one of us would capture them.

---

**So Handy**

Bride-to-be—What do you use to clean the carpets?

Hostess—I've tried lots of things, but I've found my husbands the best.

---

Drop me a line soon, sez he as he fell overboard.

---

Dumb Guy: "What's the matter with him?"
Second Student of Math: "I dunno, why?"
Dumb Guy: "He rubs out his board work with the chalk and re-writes it with the eraser."

---

First Engineer: "I'm going to make my mark in this world."
Second Rose Hopeful: "How's that?"
First Engineer: "I've almost succeeded in grafting Weed chains on banana skins."

---

He: "If I had known that tunnel was so long I would have kissed you."
She: "Good heaven, wasn't that you?"

---

A complicated traffic tangle was caused recently by a lady motorist who signalled that she was about to turn to the right and did so.

---

**Know Your Webster**

Professor Settles: "Richardson, define a zebra."
"Rich." "A zebra is a sport model jackass sowing his oats."

---

"What size school do you attend?"
"Well, it takes a good story two weeks to get from a professor back to the professor."

---

V. J. Mitch: (Having forgotten her name; but not willing to admit it) "Is your name spelled with "i" or "e"?"
Sweet Young thing:—Sir, my name is Hill.

---

—A girl has hardly passed the spanking age nowadays before she reaches the sparking age.

---

Most of us take our fun where we find "it."

---

"How did your husband come to get all those splinters in his tongue?"
"He dropped a pint on the floor."

---

Customer: "Can you give me change for a dime?"
Druggist—"Sure and I hope you enjoy the summer."

---

We suggest that Congress pass a law compelling bigger and better apartments for sardines.

---

# MAN EATING SHARKS AND FLYING FISH

On your first trip abroad, you are doubtless prepared to see lots of interesting things—icebergs, perhaps—exclusive French restaurants serving corned beef and cabbage—cultured Englishmen who do not wear monocles, or say "Old Bean". Probably you would not even register surprise if you found high speed Otis elevators apparently as much at home on the Leviathan and other trans-atlantic liners, as in the finest buildings in all parts of the world.

OTIS ELEVATOR COMPANY

*Offices in All Principal Cities of the World*

# SKILL

THE twist of the wrist, the "throw" of the arm, the shifting of the weight—these are among the many little points which make the skill that you admire in the javelin thrower as he hurls the shaft two hundred feet or more.

As on the track or the football field, in the gymnasium or on the water, so in industry progress is the result of fine improvements—a thousandth of an inch here—a minute variation in a curve there—slight changes foreseen by engineers and carried out by skilled workmen.

It is this attention to detail that is constantly improving General Electric apparatus and contributing to the electrical industry, which, though still young, is already a dominant force, increasing profit and promoting success in every walk of life.

*Whether you find this monogram on an electric refrigerator for the home or on a 200,000-horsepower turbine-generator for a power station, you can be sure that it stands for skilled engineering and high manufacturing quality.*

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GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK