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VOL. XXXIV. MAY, 1925 No. 8

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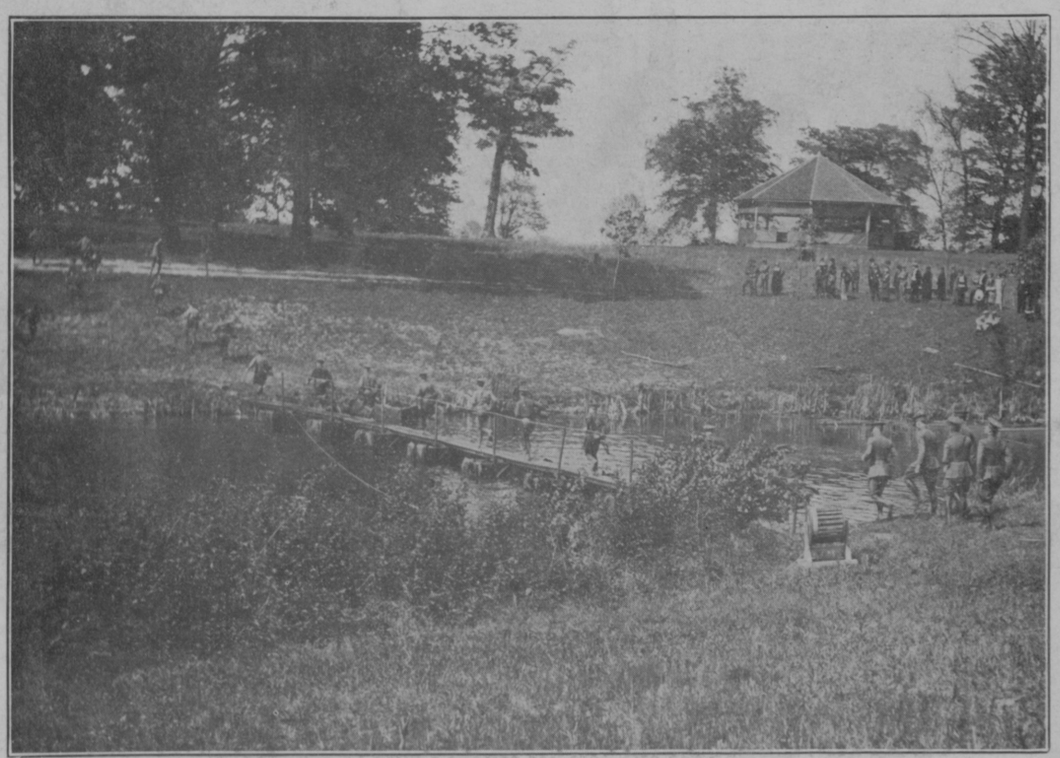

R. O. T. C. Engineers Build Pontoon Bridge

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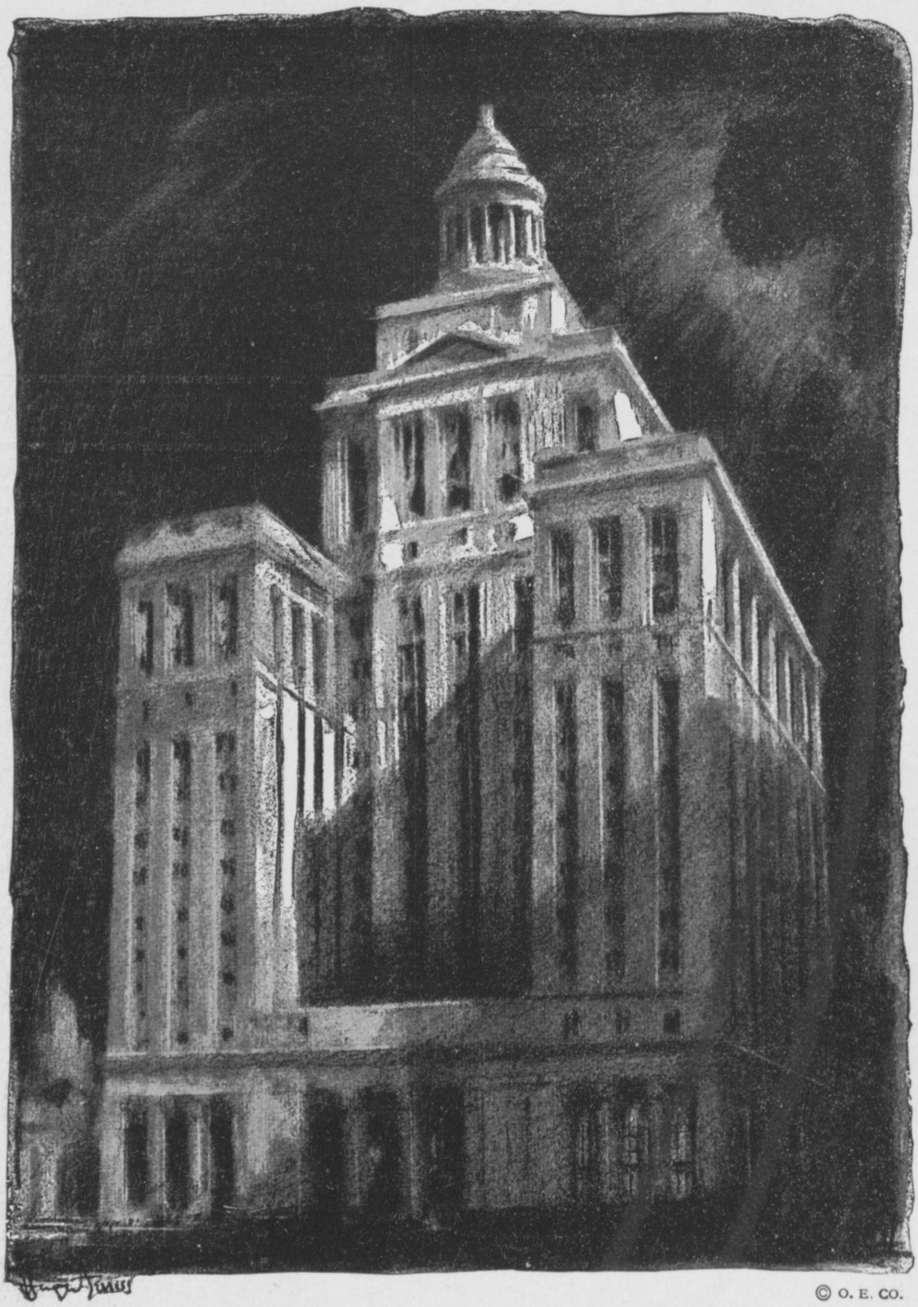

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THE TECHNIC

Member of Engineering College Magazines Associated

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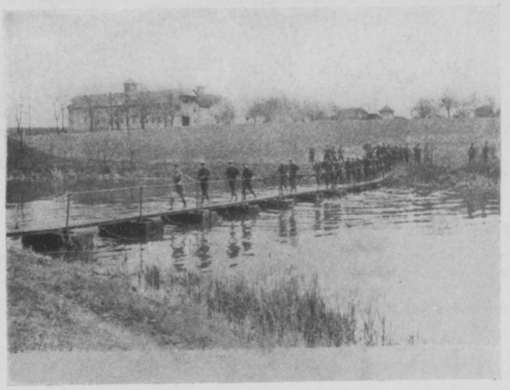

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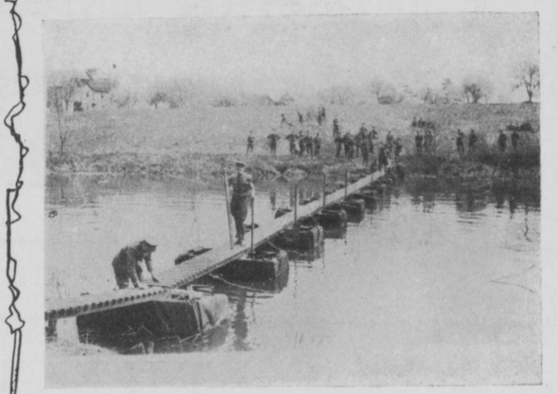

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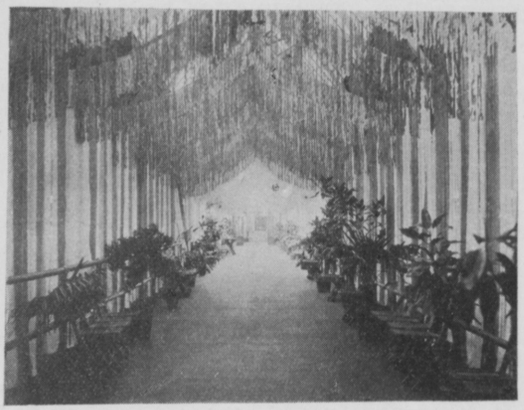

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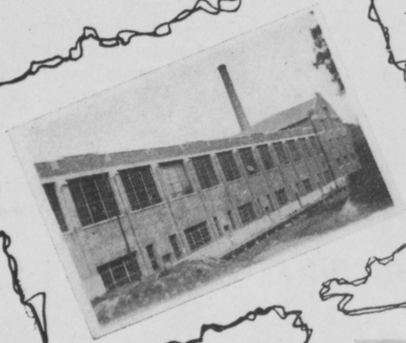

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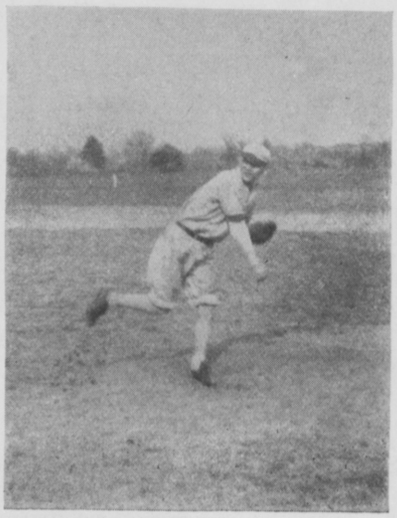


Engineering Extension and Engineering Education

Ben G. Elliot, '10

Professor of Mechanical Engineering, University of Wisconsin

A discussion of the part which Engineering Extension can play in the general program of Engineering Education

ONE of the outstanding events in the field of engineering education is the investigation now being made by the Society for the Promotion of Engineering Education, under a special grant from The Carnegie Corporation, to determine the objects of engineering education and the fitness of the present day curricula. The results of this investigation are looked forward to by engineering educators in the hope that they may receive some light on the perplexing problems which they encounter. Without doubt, the facts discovered and the conclusions reached will have a widespread influence on practically all phases of our program of engineering education.

There are, today, two well recognized functions of a school or college of engineering. The first is the teaching in residence or the educating of our engineering students so that they may enter their life work with a good foundation upon which to build an engineering career. This function is perhaps the most important one in a large majority of our schools and colleges. The other recognized function is that of **research** from which new truths, new facts, and new principles are brought to light for the guidance and the use of scientists, engineers, and technologists.

In addition, a new function in engineering education is being recognized and is being given a place with residence teaching and research. This function at present is designated by the general term **extension teaching** or more specifically **engineering extension**. Extension teaching is not yet recognized by engineering educators because its methods have not been generally adopted, except in a few cases, as a part of a definite educational scheme, and also for the reason that many of our engineering educators are uninformed and unfamiliar with the general principles and objectives of extension teaching. The writer will endeavor to point out some of the principles and objectives of extension teaching and will try to indicate its possibilities as a part of a general program of engineering education.

The main idea behind Extension teaching is that the effective educational work of a college, university or institute should not be limited by the confines of the campus, for outside of these confines is a vast field for educational activity which should be served in just as effective a way as the residence teaching and research serve within the institution itself. This broad conception of educational responsibility is the basis of extension teaching which in practice may take the form of correspondence or home-study instruction, extension class instruction, or the more informal type of instruction as is afforded by the package library or home reading course. In any discussion of extension teaching, however, the mistake must not be made of assuming that it replaces or interferes in any way with the generally recognized residence work. Extension teaching has a distinct field of its own and acts as a valuable adjunct to established residence work.

Let us see just how a plan of extension teaching fits into the general program of engineering education. There are three periods in the educational plan of an engineering student when the methods of extension teaching fill a valuable and useful function. These are: the period before the prospective engineer enters the engineering school; the period between his entrance to the engineering course and his graduation; and the period immediately following his graduation.

Many high school graduates find that they are unable for financial reasons or otherwise to enter a college of engineering immediately. Circumstances force them to wait a year or two before they are in a position to enter school. A plan whereby these prospective engineering students take some of the work in English, mathematics, drawing, etc., by correspondence permits them to enter college with advanced standing, saving both time and money. One large University is also using this plan for the benefit of those high school graduates who intend to enter college immediately but who are deficient in some required subject of the freshman year. Mathematics is the stumbling block of many a prospective freshman engineer. Many of them also find themselves weak in English. During the summer period between graduation from high school and entrance to college, the student is able to complete his solid geometry, take special preparatory work in algebra and English, and is able to enter the freshman year, not only with his deficiencies cleared, but in many cases with some advantage. The working out of such a plan is not an idle dream. Several leading colleges and universities have had such a plan in actual operation for many years, and the results obtained prove its great value and worth.

Many engineering students find it impossible to complete their course without interruptions. In many cases these students go to work to accumulate enough funds to continue their course in school. The experience gained during their absence from school, if of a practical engineering nature, becomes of considerable value. Why is not a plan which will enable a student to continue with a part of his regular school work by correspondence also be advisable? Such a scheme would keep him in touch with his school work and permit him to either take additional work upon his return to school, or perhaps shorten his residence period. The same general plan applies to those students

who are weak in a subject and desire to improve themselves by corespondence-study during the summer vacation; to those who are unable for some reason or other to fit a required subject into their regular schedule and desire to take it by corespondence during the vacation period; and to those who have been conditioned or who have failed in a subject and desire to work it off during the summer so that they may continue with their advanced work in residence or possibly avoid being unable to graduate with the regular class.

One of the studies being made by the Society for the Promotion of Engineering Education pertains to the further training of engineering graduates. Engineering extension may render its most valuable service in filling this need.

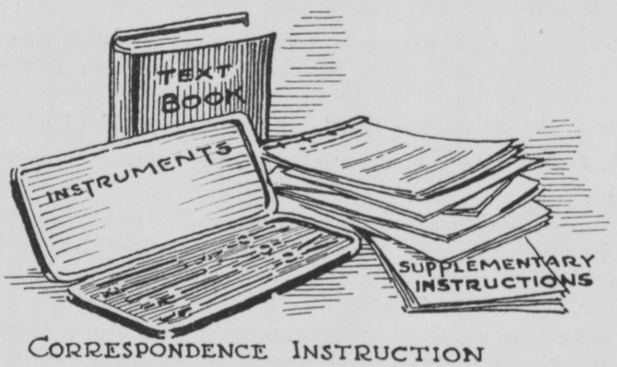
There is strong evidence that a very large number of engineering graduates continue their studies after graduation. Some of them, anxious to receive training which was denied them by the limitation of a four-year engineering course, study business subjects, economics, social sciences, and studies of a cultural nature, while others continue their study of engineering in their own or other fields. Such work could be done in engineering extension classes; by correspondence-study, or by a systematic home-reading course. Why not make the after graduation work a regular and systematic part of our scheme of engineering education. This is being done in a limited way by a very small number of institutions, but nothing in the way of a unified and systematic plan available to all engineering graduates has been attempted.

The question arises as to how a plan of Extension teaching in engineering can be organized and how it will work. Some suggestions may point the way for a workable plan.

The demand and the need for engineering extension as outlined above would not warrant all institutions doing this kind of work. The work had better be done by six or ten institutions with the proper machinery for making it avaiable to the graduates of all institutions. The work might be carried by these institutions in accordance with the lines of work in which each one is particularly strong. One or two institutions might specialize in business subjects; some in cultural subjects; some in the fundamental subjects; and others in special engineering subjects, such as reinforced concrete, water-power engineering, etc. Under such a plan the engineering student and graduate would have available for their plan of study the resources of a vast educational field which would serve not in place of the regular engineering course but as a valuable adjunct to it.

Features of Extension Teaching

The uniformed and the skeptical may think of correspondence instruction in the light of some of the activities of the numerous enterprises of a commercial nature with their glaring and sometimes exaggerated advertising and alluring promises. These, of course, are in many cases merely money making institutions—book selling propositions—and are anything but educational institutions. Some of them are in the hands of educational men who are thoroughly capable and conscientious. Others are merely schemes for making money at the expense of the uninformed. Because this is being done, however, is no reason why the correspondence-study method should be condemned as a useless and an ineffective educational agency. For the benefit of those who are skeptical of correspondence instruction also a feature of extension teaching in engineering, it might be well to point out some of the features of high-grade correspondence instruction as conducted by some of our reputable colleges and universities.



CORRESPONDENCE INSTRUCTION

Let us see how correspondence instruction is conducted by the high grade colleges and universities which hold membership in the National Extension Association. These institutions have developed correspondence-instruction as an effective educational agency and not as a money making scheme. We find, therefore, the real merit of correspondence-instruction in such instititutions.

The organization and conduct of an effective correspondence-study course require unusual ability and technique on the part of the instructor. He must not only be able to teach the student, but he must be able to impress his personality upon him in such a way that he becomes an individual tutor to him. The contact must not be merely between the institution and the student, but between the instructor, as a personality and the student, as a human being. This type of instruction is being carried out every day by many of our reputable colleges and universities.

In the conduct of a correspondence-study course, instructional talent of the highest grade is required. The teaching problems are very different and infinitely more difficult than in residence instruction. The conduct of a course is not a clerical duty which might be carried out by a clerical staff, but a definite educational procedure carried forward by capable and efficient instructors.

The matter of organizing a course for correspondence instruction is not merely one of selecting a book which teach of the subect matter. Few standard texts are entirely suitable for correspondence instruction; consequently, the instructor must prepare such supplementary material as is necessary for the student to do good work. Two important factors in correspondence instruction are the personality and ability of the instructor and the material of the course itself.

Corespondence instruction, however, is but one of the effective methods of extension education. The "package library" and the "home-reading" course are not only exceedingly valuable adjuncts to the more formal method of the correspondence course, but they may also serve a widely different field.

(Continued on Page 22)

Talc: Its Origin, Properties and Uses

J. B. Aikman, '87

Manager and Ass't. Treas., Vermont Talc Co., Chester , Vermont

TALC is one of the most widely used of all non-metalic minerals. Talcum powder for toilet purposes, is the one and only form in which it is familiar to the great majority of people. And yet such is really one of the minor uses of talc, amounting to less than 3 percent of the world's present supply.

Its extensive application to other than complexion purposes is largely a development of the last twenty-five years. Indeed, this is equally true of most non-metallic minerals, for comparatively little-much less scientific research,—was devoted to this class of minerals, before the opening of the twentieth century.

Talc in the form of soapstone has been well known and generally used in a small way for a century or more—largely for domestic utensils such as bowls, pots, footwarmers, linings for fireplaces, etc. Its extraordinary heat-retaining and heat-resisting properties together with the ease with which it may be carved, whittled and fashioned to most any form, because of its peculiar softness—accounts for this, since these characteristics, being the most obvious, were early recognized.

But the real commercial exploitation of Talc, as already suggested, has mainly occurred since 1900.

By far the largest volume in weight and value is used in the form of a finely ground powder, ranging from forty to two hundred mesh.

In addition to its marked capacity to retain and resist heat, talc stubbornly repels the action of practically all acids and alkalies and has such dielectric strength that 30,000 to 40,000 volts are required to pierce a slab one-half inch thick.

Perhaps its most remarkable trait is its unique behavior under heat as shown in the process of making gas tips and fittings for gas stoves, burners for motor truck headlights, fittings for electric switch boards, etc. These are made from a very high grade called lava talc,—fine grained and quite uniform in texture. Despite its softness, such talc is machined, including turning, drilling, and cutting of threads, all to the nicety of iron and steel. After baking where the temperature is raised to red heat—about 1800 degrees—it becomes hard enough to cut glass, but the expansion and contraction from this heating and subsequent cooling is so minute, that the shape and size of the pieces and the accuracy of milling, remain unimpaired.

Its colloidal and absorptive qualities, however, are those which have led to the greatest use of ground talc. So pronounced are these that as a filler in paper making it exceeds by a wide margin all other competing clays in the very important property of retention, while its colloidal nature makes an added appeal to the paper maker, by reason of its capacity to remain longer suspended in water than other fillers.

The same traits form the basis of its valuable application to other industries, such as rubber, to prevent sticking of rubber compounds to hot rolls,—in the manufacture of insulated wire and cables, toilet and foot powders, foundry facings, lubricants, twine, in the making of certain chemicals—as well as many others, in which the consumption though small in volume is no less indispensible.

Talc and soapstone are to be found in most countries, but only in a few is the production of consequence. This is because it is a comparatively low priced material that will not stand high transportation charges and must rely for its consumption on conditions of high industrial development.

Of the world's total production of commercial talc the United States furnishes about 65 percent, France 13.5 percent, Italy 7.5 percent, Germany and Austria 5.4 percent, Canada 4.7 percent, with the remaining small balance from widely scattered coutries.

The production of talc in this country is mostly in the states of Vermont and New York, each contributing from 30 to 40 percent of the total tonnage, with such smaller amounts from California, Washington, Vrginia, Maryland, New Jersey, Pennsylvania, North Carolina, and Georgia. Because of its superior white color, the New York product commands higher prices than that of Vermont, and hence the annual production of the former usually exceeds in value, tho seldom in tonnage, that of the latter. Virginia is the largest producer of soapstone.

The present mining and grinding capacity of this country is considerably greater than consumption except in periods of unusual industrial activity. There are grounds for hope of gradual improvement in this condition, however, as the many valuable and exceptional properties of this mineral become better known to manufacturing industries generally.

While it is used even now in some forty or fifty industries, only a half dozen or so take it in large volume, and such consumption is quite essential to the maintenance and expansion of its productive activity.

Talc is not an original mineral, but rather a secondary geological product being the result of alterations of other magnesium silicates or, in some cases, carbonates. It is found about equally distributed among igneous and sedimentary rocks. The parent rock that originates it varies, but is mostly Tremolite.

Generally speaking, talc deposits are in lenses of pod or cigar shape, differing widely in size, and lie with the longer axis pointing roughly north and south. In Vermont they are found usually, between schists of a chloritic and serpentine character "black wall".

Chemically, talc may be described as a Hydrous Magnesium Silicate—formula $H_2 Mg_2 (SiO_3)_4$. Theoretically pure Talc would contain SiO_2 63.5%, Magnesia MgO 31.7%, chemically combined water H_2O 4.8%. But talc of such purity has never been found in nature. Perhaps the nearest approach to it to be found in this country is from the Death Valley region in southern California near Los Angeles. This

being obviously of very high grade, naturally commands the favor of manufacturer of complexion powders, who are most exacting consumers.

The socalled impurities usually found with crude talc are Alumina (Al_2O_3), Iron Oxide (Fe_2O_3 or Fe_2O_3) and somtimes lime as Calcite ($Ca\ CO_3$). For some uses one or more of these may be objectionable, while in other cases they may be desirable.

The method of preparing ground talc for commercial uses, is entirely mechanical. It is first mined or quarried according to the nature of the deposit—by means of drilling and blasting. It is then roughly sorted for color; that is, different shades of white, and transported to the mill for grinding.

In the plant under the writer's management, the milling process in passing the crude rock first, thro a Climax jaw crusher where it is reduced to about 1 inch to 1½ inches average size. This feed passes through a Sturtevant rotary crusher further reducing the size to ½ to ¾ inch, from which it is carried by the usual endless belt elevator to storage bins located in the upper part of the mill.

From these bins it is fed by gravity to two Raymond, five-roller, high-side grinding mills where the final grinding is done. Operating in connection with these mills, is the cyclone air system of separation. The latter is so adjusted as to carry over into the finished talc bin the portion ground to the desired fineness and permit the balance to drop back by gravity into the mill for further grinding.

These mills each produce from 18 to 25 tons finished talc, pulverized to 180 to 200 mesh, in a nine-hour shift. The finished material is drawn off into bags by means of Howes packers, or where quicker work is desired, Bates Automatic Bagging Machines are used. It is generally packed in 50-pound, kraft paper bags or in close woven burlap bags containing from 150 to 200 pounds.

While the production and consumption of ground talc of commercial grades has developed to considerable proportions in the comparatively short period of two or three decades, with good prospect of further growth in demand for it, the industry suffers from some disadvantages probably the result in part of this very fact.

Of course the chemical and physical properties of any raw material must determine its adaptability for various uses. In the case of talc, its chemical nature cannot very well be modified, and moreover this is not necesary as it undergoes no chemical change in most uses to which it is applied.

Its physical properties however are of the utmost importance to consumers and these are susceptible of modification and control within reasonable limits through the methods of its preparation for the market.

Unfortunately, however, little knowledge exists as to the exact chemical and physical requirements of the various manufacturing processes in which it has thus far been employed. Hence its marketing has depended altogether too much on individual opinion, prejudice and all around rule-of-thumb considerations.

As a result it is often misjudged and made to suffer from unjust competition with other materials with which it is not fairly comparable. On the other hand, this ignorance sometimes leads to attempts to use talc for purposes for which it is unsuited with the ensuing natural damage to its prestige as a raw material.

Standardized methods, acceptable alike to producers and consumers, have yet to be devised and adopted for testing those physical properties which are the foundation of its successful and advantageous sale and use. The most important of these properties are hardness, color, size of grain, shape of grain, "slip", specific gravity, character of grit, absorptive power and behavior under heat.

It is not to be understood that nothing has been done along these lines, but what has been accomplished is wholly inadequate, so it is the hope of talc producers, at least, that the problem may soon make a stronger appeal to those interested in scientific research in the field of non-metallic minerals.

Arthur D. Kidder Named Boundary Commissioner

Terre Haute and Rose Polytechnic have been signally honored in the appointment of Arthur D. Kidder as commissioner in the boundary dispute of New Mexico and Colorado. Mr. Kidder's designation was formally announced in the Supreme Court at Washington by Justice Sanford, being unanimously confirmed by the court following the motion of Chief Justice Taft. Usually in such cases a boundary commission of several members is named and it was, therefore, an especially high compliment to Mr. Kidder that he was solely entrusted with this important task.

Mr. Kidder was born and raised in Terre Haute and is the son of Willard Kidder. He was graduated from Rose Polytechnic Institute in the class of 1899 and married a sister of James Royse of the Terre Haute Trust Company. He has held a responsible position with the General Land Office at Washington for many years.

—Terre Haute Star.

An Adjustable-Speed Alternating Current Motor With Shunt Characteristics

H. C. Uhl, '12

Industrial Engineering Department, General Electric Company

The eyes of the electric world have been opened by the advent of a distinctive member into the ever increasing family of electric motors. Proof of this new motor's practicability is being daily demonstrated. It combines the extreme desirable features of alternating current adjustable speed shunt operation and simplicity of construction. Both design and features of operation are treated in this article.

THE development of satisfactory alterations alternating-current, adjustable-speed motors, and combinations of obtaining adjustable speed, has been given much attention both in Europe and in this country because of the quite general use of alternating-current motors give constant speed or approximate constant speed.

The alternating-current adjustable-speed brush-shifting motor described in this article has shunt characteristics; that is, its change of speed is only moderate as compared to the change in load. It is sometimes known as the Schrage motor from its inventor, K. H. Schrage of Sweden. As developed in this country by the General Electric Company, is is known as the type BTA motor and is built to supply the demand for an alternating-current motor having shunt characteristics, which will also provide adjustable-speed features without unduly complicating the machine. Such a motor may be used for a wide field of applications where its characteristics are desirable or necessary and where alternating current is the only available power supply.

Motors of this type are at present available for use on three-phase 60-cycle circuits for 220, 440, or 550 volts, and are usually built for a three-to-one speed range with a horsepower output rating directly proportional to the speed. They can also be built for other speed ranges and frequencies, as well as for use on two-phase circuits. Ratings from 3 to 50 h. p. are now available and larger sizes have been built. The three-phase 60-cycle motors from 3 to 12½ h. p. inclusive have a full-load speed range from 550 to 1650 r.p.m.; and the motors from 20 to 50 h.p. inclusive have a full-load speed range from 415 to 1250 r. p. m. The horspower given is that at the highest full-load speed. It is possible to obtain more horsepower per pole from the 25-cycle motors for a given speed range than from the 60-cycle motors.

General Characteristics

In sizes from 3 to 50 h. p. with a speed range of three-to-one, for use on three-phase 60-cycle low-voltage lines, the motors possess the following general characteristics:

Speed

The motors have a full-load speed range of three-to-one, the slip reducing the top and bottom speeds and all intermediate speeds as with an induction motor. The change in speed from no load to full load, however, is greater than for an induction motor, but is substantially the same in revolutions per minute over the speed range of the developed ratings, except at and near synchronous speed where it is less. At high speed this amounts to 5 or 10 per cent of the speed in question, and at low speeds to 15 or 20 per cent of the speed in question, depending on the rating of the motor.

Starting Torque, Maximum Torque, and Starting Current.

With the brushes in the low-speed position, the motors may be thrown directly on the line and will give from 150 to 250 per cent of normal torque at starting with only 125 to 175 per cent of full-speed line current. The maximum running torque at low speed is 150 to 250 per cent of normal torque, and increases as the speed is increased. For the high-speed position, the maximum running torque is 300 to 400 per cent of normal torque.

With the brushes in the high-speed position the starting torque is approximately 110 to 150 per cent of normal torque, although the static torque may be materially less than these values due to the position curve, and the starting current is approximately 400 to 600 per cent.

Starting Conditions and the Use of Secondary Resistance.

In view of the foregoing differences in starting torque and starting current values for different brush positions, it is desirable that the motor be started with its brushes in the low-speed where the starting current is extremely low and the starting torque very high. By the use of secondary resistance, it is possible to start in any brush position with low starting current and good starting torque. Nevertheless, it is seldom necessary to use secondary resistance for starting as in most applications it is possible to start the motor with the brushes in the low speed position. Where the amount of speed range is small, however, it would be desirable to use secondary resistance even with the brushes in the low-speed position because, as synchronism is approached, the starting current values approach those of an ordinary induction motor.

It is possible to use secondary resistance to obtain lower speeds than the rated speeds as in woundrotor induction motors. In the brush-shifting motor, however, it is necessary to keep each phase of the resistance independent. Secondary resistance is frequently used to obtain a creeping speed of one-half

the otherwise minimum speed, for applications such as textile printing (for pattern adjustment and threading in) where the motor is loaded during this period. The secondary resistance is used in conjunction with contractors, which when closed short circuit the resistance and when open insert the resistance. These contractors are controlled by a push-button station, or a small master switch.

When secondary resistance is used, an amount to give a certain reduction in revolutions per minute with full torque at low speed will give approximately the same decrease in revolutions per minute when used with the same torque at other speeds.

It is also necessary to use secondary resistance when the motor is to be plugged.

Direction of Rotation

The motors will operate continuously in either direction, i.e., clockwise or counterclockwise facing the commutator, with the brush mechanism set for the rotation desired. They may be reversed by interchanging two line leads as on an induction motor. Reverse operation should be permitted only for short periods, as the torque, powerfactor, and heating characteristics of the usual motor in reverse, with brushes set for forward rotation, are not so good as when the brushes are set for the desired rotation. The brushes may readily be set for either direction of rotation.

The motor may be arranged for reversing service without resetting the brushes, by permitting a decrease in the starting torque and in the low-speed power-factor.

Efficiency and Power-factor

For ordinary sizes of motors the high-speed full-load power-factor will be from 95 per cent lagging to unity. The low-speed full-load powerfactor will be approximately 65 to 70 per cent lagging. The low-speed light-load power-factor, however, will be higher than the low-speed full-load power-factor. The power-factor at synchronous speed is determined by the characteristics of the machine when operating as a plain induction motor. It is thus apparent that where the motor draws the most energy from the line, i.e., at high speed, the power-factor is the best.

The efficiency of this shunt-characteristic motor remains nearly constant over the greater part of its speed range, but is somewhat lower at the low speeds. The efficiency at synchronous speed and high speeds will be slightly lower than for an induction motor of the same horsepower at synchronous speed. The average efficiency is high as compared to that of wound-rotor induction motors with secondary resistance, or when compared with direct-current motors operating from alternating-current—direct-current conversion apparatus.

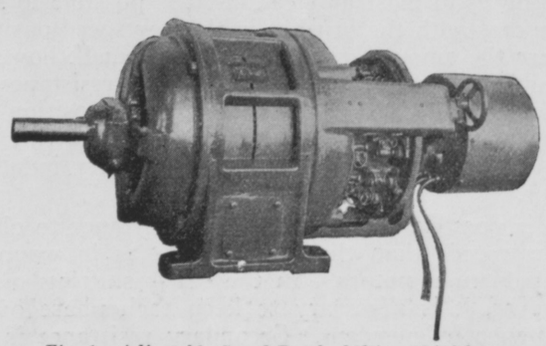


Fig. 1. Adjustable Speed Brush-shifting 30/10-h. p. Motor, Wound for 550 Volts, 1250/415 r.p.m.

General Considerations

The brush-shifting motor has a very low voltage on the commutator which is particularly advantageous for certain applications. This voltage is the same when starting or running.

Variations of line voltage do not materially affect the speed as with direct-current machines, the motor being similar to an induction motor in this respect.

Neither do temperature variations affect the speed as with direct-current shunt motors.

Details and Operation

The motor may in some respects be compared with the wound-rotor induction motor, although it should be borne in mind that the characteristics of this brush-shifting motor are quite different from the characteristics of the wound-rotor induction motor, as is shown later.

The general construction of the motor is shown in Figs. 1 and 2. The schematic diagram in Fig. 3 shows how the windings are arranged. The primary winding is in the rotor instead of in the wound-rotor induction motor, and is connected to the power supply through collector rings. The secondary winding is in the stator, which again differs from its position in the wound-rotor induction motor. The secondary winding has each phase independent. In addition, this shunt-characteristic motor has a second winding in the rotor similar to a direct-current armature winding which, in this case, also connects to a commutor. This winding, known as the adjusting winding, is placed nearest the air gap to obtain the benefit of lower reactance and thereby give better commutation.

The motor is provided with two brush yokes, one located at each end of the commutor, so arranged as to shift in opposite directions. One end of each phase of the secondary winding is connected to brushes on one brush yoke and the corresponding other ends of the secondary winding are connected to brushes on the other yoke. Bus rings on the yokes keep the phases separate and permit the use of several studs per phase. With three-phase power supply for the primary in the larger sizes of motors, it is frequently desirable to use a different and larger number of phases in the secondary, and a corresponding spacing of the brushes on the commutator. This is possible since there is no electrical connection between the primary and the secondary. Better commutation and better operating characteristics are thereby obtained.

The primary winding in the rotor which connects to the power supply through the collector rings generates the working flux in the machine. This flux is substantially constant since the line voltage and line frequency are substantially winding, which connects to the commutator, is placed in the same slots as the primary flux, by transformer action. The commutator changes the frequency from line frequency to slip frequency, which is the frequency of the secondary of the machine.

Thus the voltage between two brushes properly located on the commutator will depend upon the number of commutator segments between them or, in other words, upon the number of turns of the adjusting winding included between the two positions on the commutator where the brushes are located. Obviously, the minimum value of this voltage will be zero when the two brushes being considered are together on the same commutator segment, thus including no portion of the adjusting winding. Also,

the voltage will have its maximum value when the two brushes are one pole or 180 electrical degrees apart on the commutator. Now assume one of the brushes to be connected to one end of a secondary phase and the other brush to be connected to the other end of the same phase; and likewise for the other brushes or groups of brushes and secondary winding phases. For the condition where the brushes

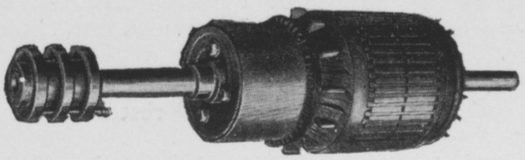


Fig. 2. Armature of Motor Shown in Fig. 1

are together on the same commutator segment, it was noted that no portion of the adjusting winding was included and it is apparent that the secondary winding is short circuited. Thus we have the conditions existing in an ordinary wound-rotor induction motor with short-circuited secondary, and the motor will run as an induction motor with its speed depending upon the frequency of supply and upon the number of poles of the motor.

If the brushes of the motor are now moved apart, some commutator segments and consequently a portion of the adjusting winding will be included in series with the secondary winding, thus impressing a voltage at slip or secondary frequency across the secondary winding. If the brushes are properly located on the commutator, this voltage will cause an increase or decrease in the speed of the motor because the secondary winding must generate a counter voltage with proper phase rotation to balance the voltage impressed upon it by the adjusting winding. The speed of the motor must change until the voltage generated by the secondary winding (generated by its cutting the primary flux) balances the impressed voltage with just enough difference to permit sufficient current to flow to develop the required torque.

When the gear shaft of the brush-shifting mechanism is turned in one direction the speed is raised, and when turned in the opposite direction the speed is lowered. The motor operates both above and below the induction motor synchronous speed.

If the brushes of the motor are shifted approximately 90 electrical degrees around the machine, that is, such that the same brushes are together on a segment 90 electrical degrees from the position referred to, and they then be moved apart as before, the speed would not change, but the power-factor would. Therefore, by compromising between the two positions speed control is obtained, and also control over the power-factor within the capacity of the windings.

It may be well to mention that if the motor is running at 150 per cent of synchronous speed, the slip energy will be 50 per cent of the power developed at synchronous speed with the same torque and the adjusting winding need be made only 50 per cent of the synchronous horsepower capacity of the secondary or stator winding. With such an adjusting winding the machine can be operated either 50 per cent above or 50 per cent below its synchronous no load speed range.

The two brush yokes are connected to the shafting mechanism by means of gears. For hand control of the brush shift, a handwheel is placed on the gear from a remote point, a conveniently located hand-connected bracket with chain and sprocket is connected to a sprocket on the gear shaft of the shifting mechanism. The handwheel bracket is provided with a pointer geared to the mechanism and a dial so that it may be calibrated in any way desired. The brushes may be shifted by means of a pilot motor and gear train mounted on the motor and connected to the brush-shifting mechanism. When using the pilot motor mechanism for brush shift, the speed of the motor may be controlled from a distance by push buttons or by various types of automatic regulators.

Control

Very simple control can be used since it is usually possible to throw the motor directly on the line with the brushes in the low-speed position. The motor is connected to the source of power in the same manner as many induction motors. For hand and remote hand control of the brush shift, an enclosed magnetic switch with thermal overload and undervoltage protection may be used, and may be operated by means of a stopstart push-button station. When using the pilot-motor type of control, a modified magnetic switch(2) with thermal overload protection may be used with a push-button station marked start, stop, fast, and slow, in addition to the pilot motor, gear mechanism, and small pilot-motor transformer. With this arrangement the brushes will automatically return to the low-speed position on stopping or, if power fails, they will move to the low-speed on re-establishment of power.

With pilot motor control a transformer is required for all voltages of the main motor, because a low-voltage pilot motor is used so as to increase the factor of safety in the device. The small pilot motors are built for 70-volt operation and the transformers are supplied with taps. A limit-switch arrangement is mounted on the brush mechanism of the main motor to limit the travel of the brushes in either direction.

When secondary resistance is used with these brush-shifting motors of the smaller sizes (3 to 50 shaft as shown in Fig. 1. If hand control is desired

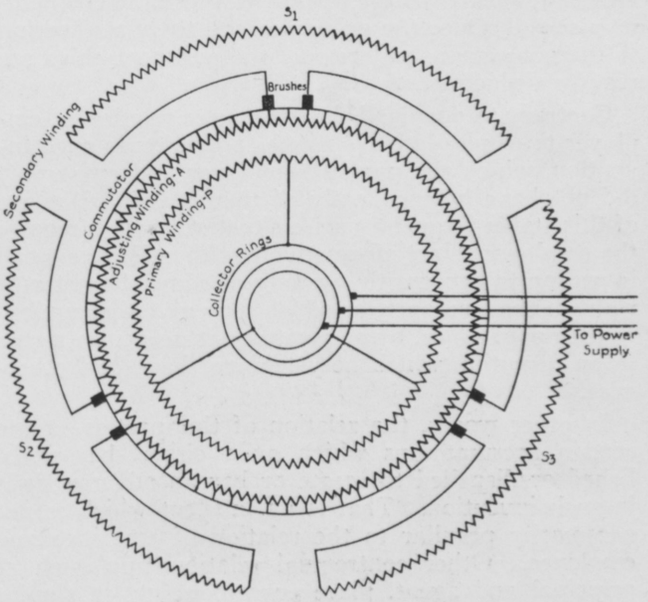


Fig. 3. Schematic Diagram of Adjustable Speed Shunt Motor. The stator contains only the secondary winding, each phase of which is connected independently between two commutator brushes. The rotor has two windings. The primary winding is connected to the collector rings deriving power therefrom. The adjusting winding is placed in the same rotor slots and connects to the commutator.

Employees as Inventors

Roland C. Rehm '12
Member of the Illinois Bar

To what extent does your invention belong to your employer? An authoritative discussion of patent rights of Employees as Inventors.

IF left to himself, the engineer, like his brother, the scientist, would concern himself little with patents and the law relating to patents and inventions, notwithstanding that the solution of problems which daily confront him, frequently require inventive thought of a high order. Perhaps this may be explained by the fact that this inventive skill is seldom exercised with any thought of reward by monopoly and, in fact, requires no stimulous of that character. It becomes so much a part of his daily work in his service to mankind that he is seldom inclined, if indeed he ever thnks about it, to avail himself of any rights which the statutes have created for him.

But in the world of business competition with which nearly all engineers are associated, or in which they live, the engineer is eventually confronted with some phase of the law rlating to patents and invensome phase of the law relating to patents and inventions. In most cases, the subject is first presented to him in connection with his status as an employer or as an employee,—a relation regarding which there is much misunderstanding in its bearing on rights in and to inventions.

The engineering graduate is generally either an employer or an employee. In either position, his mork is usually that of development and improvement;—both of which may, and often do, involve a patentable invention. Whenever either the employer or employee desire to exercise rights created by a patentable invention of the employee, occasions may arise which require a determination of their respective rights.

The law on the subject compromises no special or intricate rules but is simply that developed from a logical application of general principles based on common sense. Once the principles and their application to the subject are understood, the pertinent rules are readily deducible.

Contrary to popular belief, the mere relation of employer to employee itself creates no rights in such invention, which the parties (employer and employee) did not have independently of their status. But out of this status frequently arise situations which require the employee to act affirmatively with reference to an invention to prevent the vesting of some character of right in the employer, or which may give the employer the opportunity, by affirmative act, to secure rights in an invention which he would not have had otherwise.

In other words, the relation of the parties create certain presumptions which must either be established or dispelled to create or bar an adverse right in such invention. That is an incident which is not necessarily peculiar to the relation of employer and employee. Other contractual relationships, such as principal and agent, place corresponding or similar burdens on the parties.

Rights in addition to the foregoing conditional or potential rights must be created by special agreement beyond that creating simply the contractual status of employer and employee.

For the purpose of a convenient treatment of the subject, employees may be divided into two classes:

1. General employees.
2. "Research" employees,—being those whose duties involve primarily research, development and improvement.

The foregoing classification has been selected, not because the two classes of employees differ legally respecting inventions, but because the first is not, and the second is, expected to develop and improve process, machines, products, etc. Obviously all employees do not fall in one or the other of these classes. Many may have both general and research duties.

The expressions "employer" and "employee' are not used, in this connection, in any narrow or technical sense. The distinction between the two turns more on their respective responsibilities, their duties, and the relations they have with the business. For example, the president or general manager of a corporation, and others in similar authority, while technically employees of the corporation, are really to be considered employers for present purposes, because of their responsibilities and relations to the business. They occupy places of trust toward the corporation (their actual employer), and owe to it duties not required of ordinary employees. As a practical matter, there is no one superior to them, to act for the corporation to safeguard its rights where such rights conflict with their rights. Because of their positions of trust, the duties they owe to the corporation are superior to their private rights as employees. They cannot assert their own rights, in conflict with the duties they owe to the corporation, to deprive it of something to which, except for their positions of trust, they might be entitled. And if they do violate their positions of trust, they can be adjudged to hold what they have taken as trustees for the benefit of the corporation.

But the ordinary employee is not thus responsible and owes to his employer no such extraordinary duties being on the shoulders of his superiors.

Because the duties of the general employee only infrequently carry him into the realm of invention, he is seldom confronted with the need to discover what are his rights. Being ignorant or misinformed of his rights, he seldom attempts to assert any, and generally yields to the desires of his employer. The fear of discharge or disfavor if he does not yield, or the hope of some preferment or advancement, generally induces him to waive any rights which he may have.

Because it is not the general practice to place general employees under contract with reference to inventions, rights in certain classes of inventions of the employee (in the absence of any contract) must be determined by the conduct of the employer and employee. Moreover, in some cases, even where there is a contract with a general employee, such a contract has been held invalid for want of consideration on the theory that the usual wages or salary paid the employee were paid for ordinary services and that the

employee received, in fact, no consideration for his invention. However, this rule is not general and, moreover, in many cases, it is difficult or impossible for the employee, on whom rests the burden, to prove that he did not in fact receive some slight additional consideration for his invention.

In the absence of an agreement, under what circumstances may an employer obtain rights in an invention of an employee?

At the outset we eliminate from the need for detailed consideration, inventions in no way connected with the business of the employer. As a rule all rights in these belong to the employee who made the invention. Cases, of course, may arise in which special circumstances give the employer a right, but he secures such right by special arrangement or understanding and not because of the relationship.

Inventions relating to the employer's business may be divided into two general classes:

1. Those made by the employee, using the time, tools, and other property of the employer, and which are applied in the employer's business.
2. Those made by the employee on his own time and at his own expense and with his own resources.

In the first class, any present or prospective patent of the employee is subject to an implied license or "shop right" in favor of his employer. Such a license is personal and is not transferable. Its duration depends upon the character of the invention and its relation to the employer's business. For example, if it be a process employed in the business, the employer may use the proceeds during the entire term of the patent.

Except for this implied license, all other rights in and to the present or prospective patent, belong to the employee.

In the second class, all rights in and to the invention belong to the employee unless he apply the invention to the employer's business and permit the latter to use it in his business without, at the same time, demanding any present or prospective compensation therefor. Where the employee stands silently by and thus permits his employer to use the invention, he is deemed to have waived certain rights, and the employer then acquires what has been called an implied license or "shop right" commensurate with the extent to which he was tacitly permitted to use the invention.

While this "right" has been called a license, it is not so much an affirmative right as an estoppel against the patentee to assert the patent against the employer. It is a fiction by means of which an employer, having proceeded in good faith and without notice, is protected from molestation by the patentee.

The fairness of such a rule is apparent. An em-employer who proceeds to use an improvement of the employe without opposition or notice that the employee proposes to exercise any right or perhaps even without notice that the improvement is a patentable invention, should be permitted to continue such use; and the employee who remained silent when he should have spoken, should not be permitted to terminate the employer's use of the invention. A plain case of estoppel.

There are some apparent exceptions to these rules, but in most cases some express or implied understanding between the employer and employee, with reference to the particular invention, lies at the bottom, to reduce or enlarge the rights of the employer.

A discussion of the situation presented by an understanding or agreement between employer and employee relative to a particular invention or inventions in general, may conveniently be deferred until we come to a consideration of agreements with research employees.

The situation of the research employee is of more concern to the engineer because more frequently he is either in charge of development work or is employed as a research employee.

The research employee is generally employed for the express purpose of devising specific improvements or developing and improving generally the employer's business. His contract of employment may go no farther, or, on the other hand, it may expressly provide what rights the employer is to have in the fruits of the employee's labors.

The situation of the research employee, as we have defined him, differs from that of the general employee at least in this respect: The mere fact of employment, regardless of the scope of any contract of employment clearly contemplates that the employer shall, at least, receive some benefit from the employee's improvements and developments, otherwise there would be no object in employing him. Hence the right to such benefit will be implied. What rights the employer receives depends on the circumstances and the relation of the invention to the employer's business.

Unfortunately, agreements made for the express purpose of defining the respective rights of employer and employee often fall far short of accomplishing this purpose,—either through carelessness or ignorance regarding the various rights which may raise when the employee makes a patentable invention.

To assist in a further analysis of the subject, it will be helpful to state briefly what rights an benefits may accrue from a particular development or improvement:

First, there is the benefit to the employer's business arising from a development or improvement. Quite aside from the question whether such development amount to a patentable invention, it may be advantageously employed in the business to increase efficiency or production, reduce costs, or provide a better product. All of these advantages and benefits exist and may be utilized whether or not the development be a patentable invention, and if so, whether a patent be taken out by the inventor.

Second, if the development be a patentable invention, and a patent be taken out, other benefits and advantages arise from the monopoly granted by the patent. It is important in this connection, to bear in mind that the monopoly granted is not the **right** to to make, use or sell the patented invention, but the right to **exclude** others from making, using or selling the patented invention. In other words, the patentee's right, if he have such right, to make, use or sell a patented invention, is independent of the patent. The patent confers no such right. It is a natural right which may be freely exercised by the patentee, except where his invention utilizes some other patented invention and is dominated thereby.

In contemplating a line of development, the employer may have one or both of the foregoing cl sses

of benefits in mind. And his contract with his employee may cover one or both.

The employer may desire simply to utilize certain developments in his business, without regard to the possibility of excluding other from employing such developments. Again, he may desire, in addition, to monopolize the development by means of a patent On the other hand, however, the employer may contemplate developments simply to monopolize them, without any intention of employing them immediately in his business. This is particularly true in large enterprises where developments may be made not with any intention of commercializing them immediately, but for the purpose, thereby to minimize successful competition against their own commercial practices and products.

Since these classes of benefits are entirely independent, an agreement with an employee covering simply improvements and developments for use in the business, cannot be logically extended, in the absence of special circumstances indicating a contrary intention, to include the monopoly granted by a patent for an invention. Attempts so to enlarge the employer's rights generally arise when the employer perceives in the invention other unthought-of advantages and an opportunity to exploit them in a manner which he did not originally contemplate nor bargain for with the employee when the development was undertaken.

And for the same reasons, it does not follow that because the employer did not specifically contract with his employee for every character or right or benefit arising from a patentable invention of the employee, that the employer gets nothing.

For example, an employer, realizing the need for improvement in certain processes to induce costs or increase production, may contract with an employee to develop such processes solely for use in his business (a benefit not conferred by a patent), and with no thought of exploitation by patent monopoly. If the contract go no farther, the employee cannot be held, in the absence of special circumstances indicating a contrary intention, to have surrendered all his rights in a present or prospective patent. In such a case the patent belongs to the employee, subject only to a license to the employer to use the patented invention in his business according to the nature of the invention and its relation to the business.

If the development be a new or improved product intended to be manufactured and sold by the trade, then with a similar agreement, the employee's patent is subject only to a license to the employer to make the product and sell it to the trade.

Therefore, in the absence of special circumstances indicating a contrary intention, an employer does not obtain all right in and to a patentable invention unless his agreement with his employee specifically so provide.

For the foregoing reasons, it cannot be assumed that an employer contemplated the asignment to him of all rights in an invention when his agreement requires the employee simply to devote his time to certain development. The purposes of the agreement may be fully satisfied by a development which is not patentable. In other words, the employee may accomplish the desired end without making a patentable invention.

But there are circumstances, as sugested above, from which may be implied an intention that he employer should acquir all rights in an invention. A special case would be one where there was no inducement to undertake the development except that of exploitation by patent monopoly. Again, a line of development may be undertaken not for immediate use in the employer's business but for possible future use or to anticipate possible lines of competition—which development would be of no value to the employer unless it were monopolized by patent to exclude competitors. In fact, the object of most parallel development is to increase the protection against competition,—and that can only be accomplished by patenting the development.

In this connection, it may be said, in general, that an agreement to assign a present or prospective patent to the employer will be implied because of special circumstances: (1) where the employee was hired to devote his time to development work and where it appears that the resulting benefit, if any, to the employer resided substantially entirely in the opportunity to monopolize it by patent, or (2) where the benefit to him of the development would be only temporary or theoretical, if not monopolized; or (3) where any other benefit to him would be so slight compared with the cost of the development, that it must be presumed that the employer would not have undertaken it except for the opportunity of monopolizing it, or (4) where the only purpose of the development is ever undertaken except for the sole purpose of exploitation by patent monopoly or that all benefits and advantages of an invention reside in a patent monopoly. The very facts that a patent is not always obtainable, and that in most cases the employer does receive a substantial benefit from the invention in addition to that which would be conferred by a patent, are sufficient to dispose of this hypothesis.

Therefore, except for the foregoing special circumstances, unless he contracted expressly for the entire right to the invention, the employer receives only the "right" to use it without molestation by the patentee.

The authorities are by no means uniform on this point. In fact, a recent case has served, if anything, to increase the confusion.* The logical rule seems, however, to be that the employer gets only what he contracts for or what necessarily follows by implication from the surrounding circumstances. That rule works no hardship on anyone because it requires simply, what it obviously just, that the employer be explicit in his agreements with his employee.

The special circumstances of that case probably contributed to that result. Peck was also a practicing patent attorney and was probably understood by his employer to be acting for it also in that capacity. In that event, he occupied a position of trust with respect to his employer in connection with any patent he might secure. The facts indicate that the court might well have decided the case in favor of the employer on that ground alone. Moreover, the court apparently considered that the monopolizing of the development was what induced the employer to undertake it.

*In that case (Standard Parts Co. v. Peck 44 Sup. Ct. 230) Peck, an engineer and a patent attorney, was hired "to devote his time to the development of a process and machinery for the production of the front spring now used on the product of the Ford Motor Company," at a stated compensation. Peck applied for and obtained a patent (acting also as the patent attorney) which he declined to assign to his employer. The Supreme Court held that the patent belonged to the employee.

(Continued on Page 26)

Alumni Notes

'89

Victor K. Hendricks, who has resigned his position with the Illinois Appraisal Co., motored from Chicago to spend Easter with Mrs. Hendricks' parents at Terre Haute. Mr. Hendricks has not announced his future plans.

'97

W. G. Arn has just undergone a serious operation in a Chicago hospital, and has been ordered South for recuperation.

'99

Arthur D. Kidder is now Supervisor of Surveys, General Land Office, Washington.

'01

G. Henry Clay, who is working out details for production of Glazed Concrete under the Burke patent, is residing at 27 East 55 Street Terrace, Kansas City, Mo.

'03

E. C. Metzger now lives at 1947 D Street, Granite City, Ill.

'04

R. D. Landrum is now General Manager of the Ceramic Materials of the Titanium Alloy Manufacturing Company, Niagara Falls, New York. He was formerly Vice President of both the Vitreous Enameling Co., and the Vitreous Steel Products Co., of the same city.

'08

F. H. Reiss has moved to 9397 Clifton Boulevard, Cleveland, Ohio.

'11

E. C. Bradford's new address is 1105 Locust Street St. Louis, Mo.

'12

Joseph A. Hepp was recently elected director of the Utility Employees Savings and Loan Association, a $4,000,000.00 corporation composed of the employees of the Union Electric Light and Power Company and its subsidiaries.

'17

E. N. Goldstine now resides at Blackstone Apartments, 203 Juneau Avenue, Milwaukee, Wis.

C. A. Wente is in New Orleans with the Richards-Wilcox Manufacturing Co. Address 616 Hibernia Bank Building.

'20

James S. King, who has been at his home in Terre Haute for several months on account of illness, has again taken up his work with the Youngstown Sheet and Tube Co.

'21

Robert R. Gilkison has taken a position with the St. Louis Structural Steel Co.

'23

Fred B. Tetzel has been made Advertising Manager for the Marion Steam Shovel Co. He has been Assistant Manager.

Reserve Officers Training Corps, Advanced Course

Wm. W. Bessell, Jr., 1st Lieut., D. E. [D. O. L.]

THE R. O. T. C. Advanced Course Camp will be held at Camp Custer, Michigan from June 19, 1925 to July 30, 1925.

The camp has been held at Camp Custer, Michigan for the past two years. Camp Custer is six miles west of Battle Creek, on the road to Kalamazoo. The War Department will have buses at all stations in Battle Creek to meet students and take them to camp. and in addition jitneys run betwen Battle Creek and Camp. The War Department allows students 5c per mile for the travel to Camp Custer and return. This allowance will cover the actual cost, although many students "bum" their way, saving the transportation money. Many students fortunate enough to own cars. drive up and find the automobile quite a convenience in camp.

Camp Custer is a "tent" camp. Regular army organizations will be present in camp to furnish troops for demonstrations, etc. The students are arranged in companies, Rose students being assigned the Engineer Company, which also consists of students of engineering from the Universities of Illinois, West Virginia, and Cincinnati. The tents for each company are on one tent street, with the Regular Army Officer instructors in tents at the head of each street. So far as is possible the students from each school are tented together. Last year we had four Rose tents. Student Officers, including a company commander, are selected from among the students. Last year Illinois beat us and succeeded in securing most of these honorary positions.

All uniforms, rifles, bayonets and bedding are issued upon arrival at camp. These uniforms must be worn during duty hours. Advanced course students having tailor made uniforms, however, should take them with them, as they may be worn in town, etc. Last year Rose did not have "tailor mades" and the disadvantage with the fair sex in Battle Creek and vicinity was evident but this year the other extreme is feared.

Students should take any athletic equipment that they may have, with them—especially, tennis racquets, tennis shoes, swimming suits, track suits, football shoes, etc. There are four courts in camp, two of them concrete. Golf may be played in Battle Creek. There are usually two or three baseball teams and football teams. There are two lakes in camp. One of these, Eagle Lake is fitted up with bath houses, spring boards, diving platform, etc. Last year buses left camp at 4:00 PM daily to take any students who cared to go, to Eagle Lake.

Ten days of the schedule are usually devoted to Rifle Markmanship. Men fire the record course and get an opportunity to qualify as Marksman, Sharpshooter, or Expert Rifleman. Badges for qualification are awarded. In addition, Battle Creek merchants usually present medals and cups to the highest men.

Each company has its own mess hall at the end of the company street. Meals last year were very good. The Officer Instructors eat with the company.

(Continued on page 14)

ATHLETICS

Ticks from the Season's Clock

On April 16, the Rose nine played the Wabash baseball team and lost by a score of 12-1. As it was only the third game of the season for the Engineers, the playing was a bit ragged. However, the team is rapidly rounding into form and should make a creditable showing before the season is over.

The Engineers' baseball team journeyed to Bloomington on April 18, and lost to the strong Indiana University nine by a score of 13-3.

Rose Poly came very near lifting the jinx at De Pauw on the twenty-third but a few bad breaks cost us the game. Both teams played good baseball; the game ending with a score of 3-7.

Freshman Athletics

The Freshman baseball team has been having a successful season. They have won both of their games played so far, beating Garfield High School by a score of 9-1, and Wiley High 18-3.

Looking Ahead

"Hez" Clark

Eight football games are included in the Rose Poly 1925 football schedule. The building of a football team for the Engineers is sure to prove a real problem because of the men lost by graduation and by being dropped from school at the close of last term. Three of these gridiron men who failed in studies have entered Purdue and Indiana. Captain John Moorhead, left tackle; Rickelman, guard and tackle; Anderson, end; Glenn, half back; and Fischer, half back, all will be lost by graduation. Four first string men were dropped from Rose because of failure the second time in one subject. Although they were doing good work in other subjects. The loss of nine letter men in a school with the enrollment of less than 250 is a stinging blow from which it is hard to recover.

The hope of the Rose followers rests on the Freshmen team of 1924. While this team successfully defeated Wabash College freshmen 6 to 0, and won from Linton high school 27 to 0, still it must be remembered that three of these athletics are no longer in school. That is; an end, tackle and center of the 1924 Freshmen eleven will not be eligible for the 1925 varsity.

At present the varsity letter men who should prove to be the ones around whom the team will be built in 1925, are: Kunz, center; Kelly, and White, guards; Aitken, Tackle, Reinking, half back: Brown, end; Piper, full back; and if Harry Davis returns to school he will prove a good man in the line.

Kepler and Crawford, of last year's freshman squad should make good in the line on the varsity. Carroll is another possibility. Alexander appears to be the best bet of the ends. The former Wiley high school athlete played end on the freshman football team, and forward on the basket ball team, second on the base ball team, and was a point winner on the freshman track team this spring. Taggart, the man who scored the winning touch down against Wabash freshmen, should make good at half back. Curl is another back field man. Browder, a first class defensive player, is also one of the most valuable offensive half backs being able to give plenty of interference to his team mates, and he carries the ball well. Houck, former Brazil high school track star was the fastest runner on the freshman team last year and plays half.

Those close in on the athletic situation at Rose are expecting much of Billy Leake, former Louisville high school star. He is a real quarterback who knows how to run a team on the field. He can pass the ball in great style, and should prove one of the best field generals who ever wore a Rose football suit. He was a star on the Rose Freshmen in 1924.

Success in athletics is due to a great extent to school spirit and rivalry for positions on the varsity teams. With the Freshman rule in force at Rose there are so few men eligible for varsity teams because of the limited enrollment that there is little rivalry for positions and it is difficult to get regular attendance at practice. The Freshman rule is the real cause of Rose Poly's lack of success in basket ball and base ball this year, and should the Freshman rule have been set aside the Engineers would have a far stronger track team. Without the Freshman rule Rose can win a reasonable share of its games, Contracts with Indiana and Purdue in 1925 in football prevent the setting aside of the Freshman rule until December, but then Rose must get away from the freshman rule or expect to continue to take the short end of scores in various branches of athletics. Schedule follows:

Sept. 26: Vincennes University at Terre Haute.
Oct. 3: Franklin College at Terre Haute.
Oct. 10: Eastern Illinois Normal at Charleston, Ill.
Oct. 17: Purdue University at Lafayette.
Oct. 24: Evansville College at Terre Haute.
Oct. 31: Butler College at Indianapolis.
Nov. 7: University of Louisville at Louisville, Ky.
Nov. 14: Indiana University at Bloomington.

Reserve Officers Training Corps Advanced Course

(Continued from page 13)

Each year the camp publication "The Torch", getting its name from the R. O. T. C. insignia, is edited and gotten out by the students. In form it is much similar to "The Modulus", showing camp activities, etc., with numerous pictures.

Illinois is our big rival, our rival in shooting, in athletics, in everything. Illinois has about as many students in the Engineer Company as does Rose, and the rivalry is keen. Then, too, the Engineer Company and the Cavalry Company have quite a time. They are usually tented in streets next to each other and are not very complimentary to one another.

Students are allowed to leave camp, visit town or other parts of Michigan in the vicinity, in the evenings. Gull Lake, about six miles from camp, is quite a noted summer resort. Dances are held at the hotel there every evening, students are welcome. Battle Creek is the home of Kellogg's Corn Flakes, and Post's Bran Flakes. Group visits to these two plants are usually conducted.

But the whole team doesn't play first base

To suppose that a baseball nine will all cover just one position is as far from the truth as to think that everyone in the electrical industry is an engineer.

This field will always need trained engineers. But with its great manufacturing, construction and commercial activities, the industry must have non-technical men too.

Since the industry is manned by many types, the result of your work will depend a good deal on the success with which you team up. The qualities that win are not only efficiency attained by the light of a study lamp, but that all-pull-together spirit of the athletic field.

This point of view may be useful to the man who has wondered whether campus activities, with all their striving and stern testing, their setbacks and their triumphs, have any counterpart in after life.

Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the Industry.

Western Electric Company

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Number 49 of a series

Adieu, Class of '25

As we go to press, the thought of commencement begins to enliven us and yet to sadden us a little. To you of 1925 we are glad that your efforts have been cuminative. You have thus far nobly carried on, and the real beginning is not far ahead. To those who have already tasted of practice, commencement is as a vantage point, viewing an ever-widening horizon where a man looks toward his goal, and makes for its realization. To the men who have not yet encountered engineering life problems, the step from Rose means not only the grappling with professional problems, but the change to a position in the maze of humanity that goes about, earning its daily bread.

We are glad that Rose men are not stereo-typed, and that each meets the world in his characteristic way. There is that individuality of purpose and character that is not conformed to a straight-jacket while in school.

Through the years of college life we have watched the progress of these men. We shall continue to look to them as exponents of ideals of industry and integrity which motivated the founders of the Institute. They will go out to factory and office; to distant countries and strange peoples; to communities and suburban hamlets. In all places they will be called upon to lead those about them. Upon their shoulders, as American students, rests the future of the world of tomorrow.

Why is a Vacation?

"Where are you going this summer?' seems to be a quite prevalent question on the campus. To the average student this may not appear to be a matter of much importance. Let us see. Granting that the engineering student does not feel inclined or interested in text book study and class-room lecture for three months following the June exodus, we believe that there are many fields open to him where he may improve his time with opportunities along practical lines.

The man who has never tried the commercial world may seem at a loss to know just how to begin, and along what lines he should direct his efforts. To this type of student the best course should be to direct a few letters of inquiry or application to large industrial plants, engineering concerns, state highway commissions, and the like. From these organizations will come responses which should be studied to note several things: employment policy; possibilities of employment in that city or town; and whether such a concern can use the services for the summer months of a student possessing your qualifications.

The matter of hunting and finding a suitable position for a few months is a most interesting and absorbing study for our embryo engineers. Now we have mentioned three points to observe in the replies to letters of inquiry or application. The "why" behind such an investigation can be explained. In noting the **employment policy** of a company a student is able to learn much about the method of applying for a position, even though he is not successful the first time. The knowledge of how to approach an employment man comes from the thorough understanding of a concern's employment practice. Many times such an understanding can be gained by carefully studying their letters.

A second point to look for in replies to applications is whether that particular section (town or city) is needing men who possess more than a high school education. If one firm replies in the negative and gives the general or implied impression that they have ready access to men in their vicinity, it is evident that such a section has its quota of men for such lines, and any more inquiries would be useless there.

Lastly, an industry, such as you have selected as favorable, may not be able to use a man of your calibre for only three months. This often happens when an undergraduate aspires to a position in a research laboratory or engineering department of some corporation. Such organizations, even though they may take a few undergraduates, will not generally accept any man who intends to be in their employ but three months.

But to return to a general view of this matter of getting a position. Press on—do not be daunted—study the employment system of each organization—and lastly, tell the truth. Then, and only then, can you believe yourself.

Your summer's experience, whether in laboratory or working side by side with the laboring man in factory, no matter where it may be, will be invaluable. It will give you a greater appreciation of what you have learned. It will be an excellent appetizer for your engineering education digest.

From W. A. Lawman, '92, president of the Wagner Electric Company, and one of the founders of our Technic comes the most stimulating and constructive letter that we have ever had the privilege of reading. It is simply an appeal for news of the true Rose, of her progress, her students, building program,—all; but written with a sincere, unselfish desire to see true ideals and purposes maintained in Alma Mater. To completely answer all in one issue is an evident impossibility. To the end of touching each point, and indicating some of our needs, this discussion is submitted.

Progress

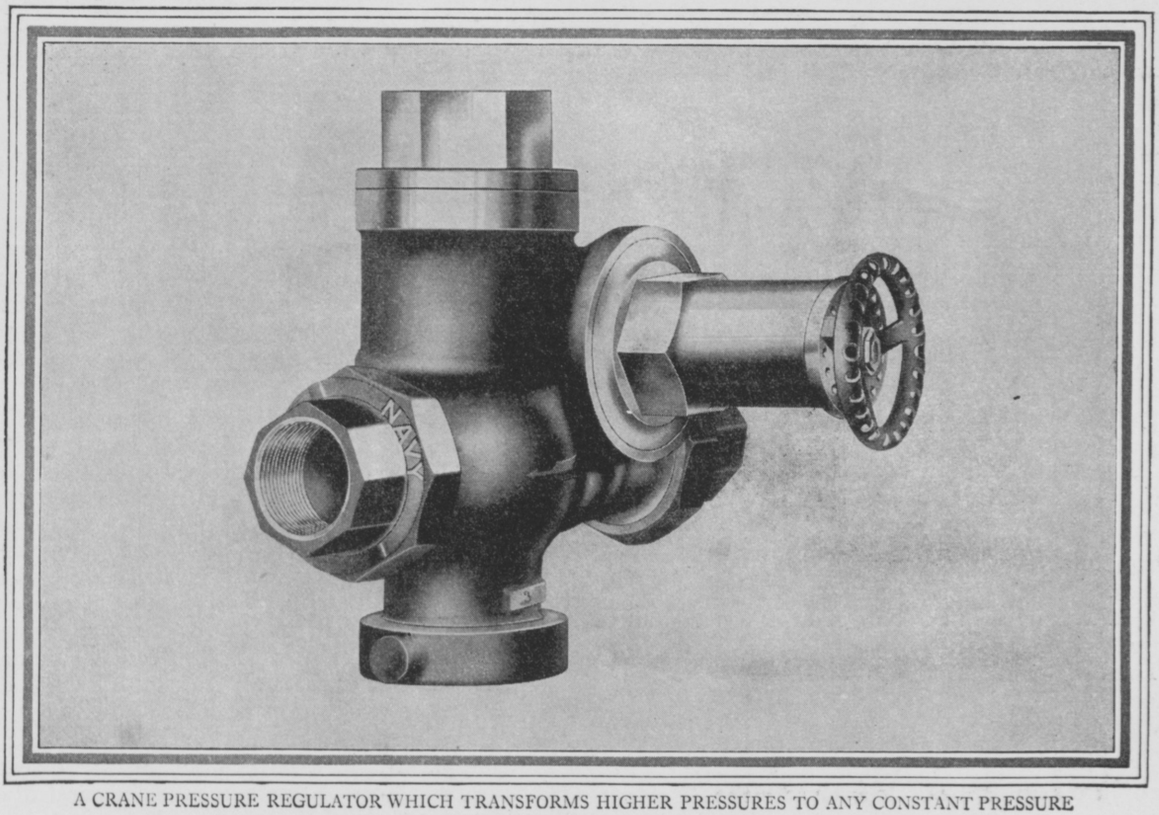
Another school year has passed! For some it means the passing from the portals of the Institute to the commercial world. To others it means just one more year of directed scholastic endeavor. To the sophomores and freshmen the coming years should mean a revivifying of the question, "What are we here for," Rose Polytechnic is just beginning her fourth year in the new location.

The adjustment process has been completed. Incoming freshmen of 1925 will not know the old school except through a recitation and practice of old traditions. It is to other hands that we leave the task of relating the past: we shall pass directly to the present Rose and summarily indicate future considerations.

To evaluate the school at present, we shall divide assets into three coordinate parts: faculty, student body, and the Institute building, grounds and equipment.

True, in the eyes of a freshman a professor looms up as an overpowering giant in mental armour. Such a preclusion may be justified at the beginning of the tetra-annual course, but to maintain such a concept

(Continued on Page 24)



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Rhodes Scholarships

STUDENTS at Rose need to have their attention drawn to the many opportunities offered for advanced work in a number of colleges and universities. Particularly for those who contemplate entering research or teaching there is no better way of preparation than the more concentrated study within one special field. Even for those who plan to follow engineering or technical work, advantages come where these men can show added preparation.

Of course the offered opportunities in the way of Fellowships and Scholarships are, in most cases, open only to those who have already (or are about to) receive the bachelor's degree; there is, however, one exception where scholarships are open to undergraduates who have two or more years of college work. This is the Rhodes Scholarship, admitting students to Oxford University, England, and good for three years.

Selection this year will be made in October, 1925, and is based upon the following requirements:

(1) Qualities of manhood, force of character, and leadership.

(2) Literary and scholastic ability and attainments.

(3) Physical vigor, as shown by interest in outdoor sports or in other ways.

The applicant must be a citizen of the United States and unmarried; he must be between the ages of 19 and 25; and he must have completed his sophomore year in college. The selection is not based upon an examination.

The scholarships pay £350 a year, but the holder is advised to provide himself with at least £50 extra, since the stipend is not sufficient to cover all expenses.

Opportunties are offered at Oxford for special study in a number of lines, including engineering and science.

Appointments will this year be made from 32 states of which Indiana is one; there will be no appointment from Indiana next year.

Rose has never sent a Rhodes Scholar to Oxford; this is not because she has not had a number of available men, but chiefly because the idea has not been brought to their attention. It is time this was corrected.

Information concerning the Rhodes Scholarships can be obtained from Dr. White, who has a supply of application blanks.

Honor System at Cornell

An honor system, installed at Cornell four years ago has been very successful and has the united support of the student body. Although this system has recently been rejected by one of the largest universities of the country, its supporters at Cornell feel that if given a proper trial, it would meet with great success in any institution where the students back it with the proper spirit. Since the time of its adoption at Cornell, not one student has been known to violate the provisions of the system.

Adjustable Speed Shunt Motor

(Continued from Page 9)

h.p.) an enclosed magnetic switch[3] may be used; one three-pole switch for motors with three-phase secondaries and two three-pole switches for motors with six-phase secondaries. A master switch or a push-button station may be used for operating these contactors.

Comparison with Other Types of Motors and Combinations

In many plants much of the work can be accomplished by the use of constant-speed motors and therefore squirrel-cage induction motors are largely employed. For those drives requiring adjustable speed, where alternating current is the major power supply it was formerly necessary to use motor-generator sets or synchronous converters to convert from alternating current to direct current, for the adjustable-speed drives, and then use direct-current motors If it is feasible to use the brush-shifting, shunt-characteristic motor, the alternating-current power supply at low voltage may be used for the adjustable-speed drives also. In this manner the plant wiring is simplified, the overall efficiency is increased in many cases, and the necessity of increasing the capacity of the alternating-current to direct-current converting apparatus when more drives are added is eliminated.

When a large number of adjustable-speed drives are required it may often be more advantageous to install the alternating-current to direct-current converting apparatus in a large unit and use direct-current motors. Cases of this sort must be carefully considered to see which scheme works out the better. The brush-shifting shunt motor is inherently a constant-torque motor and this must also be considered, especially where the application requires constant-horsepower adjustable-speed motors. For constant-horsepower applications this type of motor is at a disadvantage since it is necessary to use a motor which will give the required horsepower at low speeds which thereby gives a large excess capacity at higher speeds.

The double-range Scherbius system, the Kraemer or Rotary Converter System, the Brush-shifting Converter System, and the Frequency Converter System, used in conjunction with large wound-rotor induction motors, give adjustable speed with shunt characteristics in a very satisfactory manner. These schemes are practicable however for comparatively large motors only, since considerable auxiliary apparatus is required and the amount of speed range possible in this manner is rather limited, although sufficient in most cases where these equipments are applicable, as for some steel-mill main-roll drives.

It is possible to use the wound-rotor induction motor with secondary resistance for many applications, but it must be kept in mind that this type of motor with secondary resistance gives a series characteristic, i.e., the speed changes materially with load and at no load with an ordinary amount of resistance in the secondary the motor will operate near synchronous speed. Each controller point will give a definite speed for a given load, the speed varying with the load. The efficiency at low speeds is quite low and it is not usually considered practicable to obtain more than a two-to-one speed range in this manner due to the possibility of instability and stalling at low speeds.

When only a small speed reduction is desired with small size motors, the wound-rotor induction motor

(Continued on Page 26)

What Is Timken Dual Duty?

The twist of the rope tells that the shell spins 'round and 'round even as it thrusts its way forward. There is both revolving motion and forward (endwise) motion.

Tendency toward motion in more than one direction, at one time, is very common mechanically. The wheels of a motor car are spinning around and are also pushed from the side, due to the weight of the car, slope of the road, and the force of turning corners. The discs of a plow, forced forward at an angle, not only revolve, but are thrust sidewise at the earth ahead. And the whirling pulleys in a machine shop are also being whipped from the side by the weaving, swishing belts.

Pure spinning or revolving motion is known as *Radial* motion to engineers. The sidewise or pushing motion is quite naturally called *Thrust*. It stands to reason that *both* the *radial* forces *and* the *thrust* forces, almost invariably combined, must be properly handled by any bearing qualified for most efficient machine design.

The Timken Tapered principle enables Timkens to do Dual Duty, carrying both radial and thrust loads. This is one of the advantages which has made the use of Timkens so nearly universal. All types of machinery, including motor cars, are being Timken-equipped by leading engineers.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

FRATERNITY NOTES

Alpha Chi Sigma

One of the most successful informal parties that Iota chapter has had in recent months was held April 17 at Bro. Phillips' home. All pledges and members with their guests were present and divided their attentions between dancing, music, bunco, and cards. Miss Joy Phillips, who acted as hostess, was in a large measure responsible for both originality and quality in the entertainment. She was voted a complete success in that capacity when refreshments were served.

The evening was so well enjoyed that before the party was over, plans for another social affair following the prom were begun.

Alpha Tau Omega

Gamma Gamma of Alpha Tau Omega is pleased to announce the pledging and initiation of Professor Carl Wischmeyer. The initiation was held at the chapter house on Monday evening, May 11 and was attended by the entire active chapter and a large body of the alumni, including Brothers E. F. Folsom of Indianapolis, Henry Webster of Chicago, David Aten, Jake Maehling, Sam Smith, Joe Fox, John Jakle, Robert Hendrich, B. W. Tyler, H. F. Pflaging, Frank Ranahan, Shaneberger, Wagoner, and others.

Province XVII of Alpha Tau Omega including chapters at DePaw, Indiana, Purdue, and Rose held its fourth annual dance and banquet April 24 and 25 at the Severin Hotel in Indianapolis. This event is growing more popular every year and this last was voted a great success.

The chapter was honored on May 4 by a visit from Brother Thomas Arkle Clark, Dean of Men at the University of Illinois. Brother Clark addressed the Methodist Young Men's Club at the First Methodist Church on "Young People of To-day".

Theta Kappa Nu

Gamma initiated the following men during the week of April 13; Wendell Doeden, W. T. Davidson, Paul Iahn, Howard McKee, James Robinson and Raymond Schauwecker.

On Friday, April 24, the fraternity held a wiener roast on the Rose campus, west of the military firing pit. A large pile of brush was set afire and when nothing but the embers was left, the wieners were roasted. Songs accompanied by ukelele music were diversions until the party adjourned to the house for dancing.

On April 28, Brother Orville Dunning attended the installation of Indiana Delta at Franklin, Indiana. The fraternity was formerly Delta Chi Omicron.

Brothers Sherwood and O. Dunning were guests of the DePauw chapter Friday, May 1, at an informal dinner at the Varsity Tea Rooms.

Among the recent visitors at the house were Brothers Chet. Williams, '16, Leon Maehling, and Aleck Sherwood, '24s.

Theta Xi

Kappa's initiation dance was held at the Edgewood Grove Community House on Saturday, April 11. The Clubhouse was attractively decorated in the fraternity's colors, blue and white. We were very glad to have many of the alumni present.

Practically the entire chapter journeyed to Indianapolis Saturday, April 25, to attend the annual 6294 banquet held at the Hotel Severin.

Recent visitors at the house were Brothers Wharton of Omicron, Junker, Royer, and Armstrong of Kappa. We were also pleased to have Brothers Russel, Harris, Ramming and Romeiser of Theta who attended the Initiation dance.

Sigma Nu

The Beta Upsilon chapter takes this opportunity to announce the initiation of pledges A. L. Kepler, William Houk, Robert Wade, John Mendenhall, and Valentine Mitch.

Bob Cash of the class of '23 was a recent visitor of the chapter. He is superintendent of a copper mine at Kinney, Minnesota. Another visitor of the month was George Lake, ex'27. He is now working in the steel mills at Gary, Indiana.

On the morning of Mother's Day the entire chapter visited the Central Christian Church at Seventh and Mulberry Sts. Rev. H. G. Connelly, who has the pastorate there, was graduated from Bethany College and Yale and is a member of the Sigma Nu fraternity. In the afternoon the mothers were entertained at the chapter house.

A Message to Garcia

It is only a matter of 1600 words or so, and as a whole they are just common words we all use, they have been woven together to form a masterpiece. Elbert Hubbard's "A Message to Garcia" was born February 22, 1899.

The suggestion came from a little argument over the teacups when his boy, Bert, suggested that Rowan was the real hero of the Cuban war. Rowan carried the message to Garcia. Elbert Hubbard arose from the table and wrote "A Message to Garcia". It was run in the Philistine without a heading. The edition went out, and soon orders began to come for extra copies of the March issue—a dozen, fifty, a hundred. When the American News Company ordered a thousand, inquiry was made as to which article had stirred up the cosmic dust. The New York Central railroad obtained permission to reprint the article and issued it in booklet form in editions of half a million. Two or three of these half-million were printed and sold out, and the article reprinted in over two hundred magazines and newspapers. It has been translated into all written languages. A copy was given to every railroad employee in Russia. Other countries took it up, and over forty million copies have been printed.

A wonderful record! And yet there are many who have not read this "preachment" of Hubbard's. If this is true of you, by all means lose no time in removing the defect. Here is the story of Rowan, as Hubbard told it.

"In all this Cuban business there is one man who stands out on the horizon of my memory like Mars at perihelion.

(Continued on Page 25)

The Rollers That Put The Roll In Rolling Stock

WITH the advent of the automobile, Hyatt roller bearings became essential parts in promoting continuous ease of running and freedom from repairs for transportation and farm equipment. The Haynes-Apperson, credited as the first commercial gasoline car, had Hyatt bearings built into it.

The development of the automobile industry and the increase in the use of the automobile has been rapid, and equally rapid has been the multiplication of uses and applications where Hyatt bearings play an important part.

From the humble lawn mower to the haughty motor car, from the finely adjusted motor to the rough and ready logging block and ore conveyor, from the lightly turning windmill to the pounding railroad car, in all fields of activity, Hyatt bearings are vital factors for efficient and economical operation.

The simple, sturdy construction of these bearings gives long life free from worry about breakdowns or replacements. The easy rolling motion and absence of rubbing friction eliminate the danger of overheating and insure longer life to the bearings and enclosing parts. At the most they require oiling only three or four times a year, permitting not only worthwhile savings in oil but also maintenance and inspection costs.

Steady advances are being made in the application of Hyatt bearings to every field where uninterrupted and economical production are important factors. Our engineering and research departments are always ready to cooperate with you in solving your bearing problems. Make a note of our address now for future reference.

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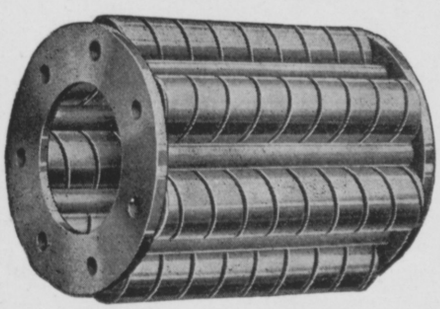
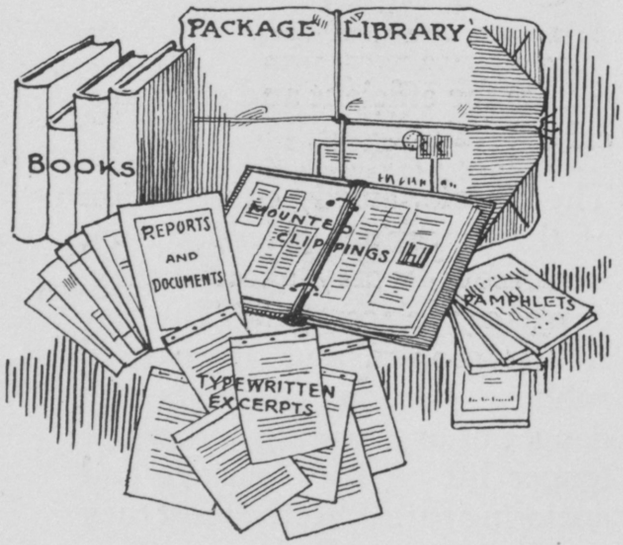


If you will drop us a line, mentioning the name of your college, we will send you a small Hyatt bearing which you may use as a paper weight or a pocket piece. This will give you a clearer idea of the unique construction which makes the Hyatt roller bearing durable and reliable.

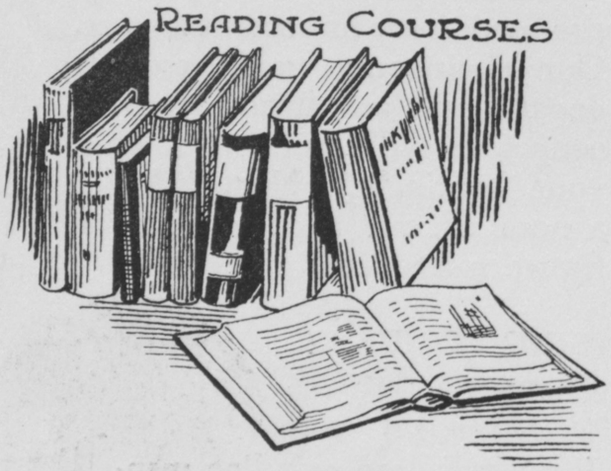
(Continued from Page 4)

A "package library" consists of a carefully selected and up-to-date assortment of pamphlets, books, bulletins, magazines articles, reports, etc., on any particular subject. A student or professional man is thus



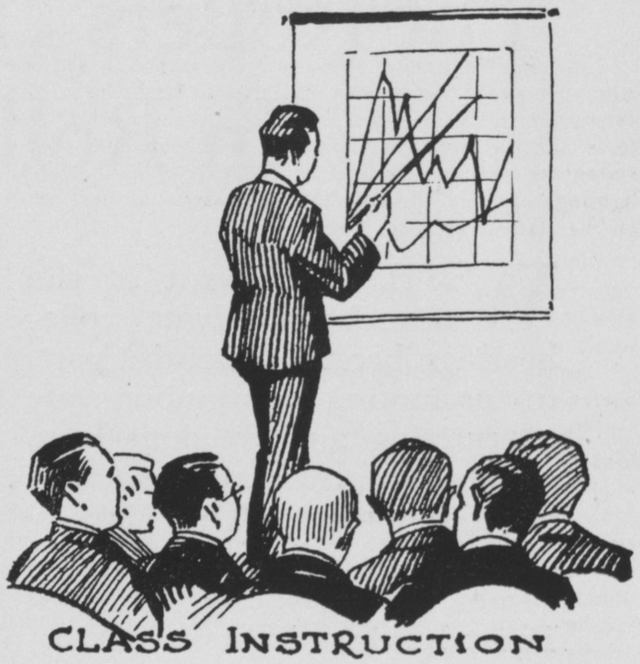
able to obtain the use of a carefully selected library in package form on any subject. Several universities and colleges are now maintaining a package library service, and a similar service is being offered by a few of the large engineering libraries. Such package libraries will no doubt play a large part in a program of engineering extension.

Home-reading courses also serve a valuable function in connection with any plan of extension education which intends to be effective. They are of



especial value to those persons who have completed their formal training or education but still desire to continue their study in their own professional line or in allied or cultural lines. Several such reading courses are now available, but as yet no definite plan is in use whereby a graduate may continue his educational work or training in a systematic or definite way.

Another very effective means of extension teaching is the extension class. These classes are



conducted particularly in the large cities or in the centers of metropolitan areas and afford the student or graduate an extremely practical method of continuing his educational plan. Engineering extension classes are being conducted by several schools as a part of their regular work.

A plan for extension teaching in engineering is not a visionary dream. The elements for the inception of a definite scheme of enginering extension as an adjunct to residence work are now in existence. Without question, extension teaching should have its part in a program of engineering education.

Rose Graduates Receives Honor

One of the proudest claims of Rose Polytechnic is that so great a percent of its graduates attain to important and prominent positions in the engineering field.

One of the latest heard from is Edmund P. Edwards, of Schenectady, N. Y., an employee of the General Electric Company, who was graduated in 1899. Mr. Edwards has just been commissioned and assigned to the war time procurement office of the and asigned to the war time procurement office of the chief signal officer of the second corps area. His commission is the direct result of his work with the General Electric Company, his success with which company had its inception in the training he received at Rose.

Colonel Edwards, after his graduation in 1899, went to work for the Ohio Steel Company at Youngstown, Ohio. He was there but a short time when he was made an offer by the General Electric Company which he accepted. Since that time his rise has been rapid, and he now holds a position of great importance.

—Terre Haute Tribune.

INDUSTRIAL LIGHTING CODES.

In order to protect workers from accidents and eye sight damage, no less than five states, New York, New Jersey, Pennsylvania, Wisconsin and Oregon have now in force lighting codes for industrial establishments. Other states are now considering the adoption of an industrial lighting code, and it seems only a question of time when all the states will adopt such a code.

Proper lighting of work places is not only of great importance to the operators working therein, directly affecting their safety and eyesight, but it is a factor of equal importance to the employer, as quality and quantity of output are deciding factors of profit or loss in the operation of the plant.

The introduction to the Wisconsin code reads as follows: "Insufficient and improperly applied illumination is a prolific cause of industrial accidents. In the past few years numerous investigators, studying the cause of accidents, have found that the accident rate in plants with poor lighting is higher than similar plants which are well illuminated. Factories which have installed approved lighting have experienced reductions in their accidents which are very gratifying.

"Of even greater importance, poor lighting impairs vision. Because diminution of eyesight from this cause is gradual, it may take the individual years to become aware of it.

"This makes it all the more important to guard against the insidious effects of dim illumination, of glaring light sources shining in the eyes, of flickering light, of sharp shadows, of glare reflected from polished parts of work. To conserve the eyesight of the working class is a distinct economic gain to the state, but regardless of that, humanitarian considerations demand it.

"Finally, inadequate illumination decreases the production of the industries of the state, and to that extent, the wealth of its people. Factory managers who have installed improved illumination, are unanimous in the conviction that better lighting increases production and decreases spoilage."

The Wisconsin Commission has adopted a rule to the effect that, "diffusive or refractive window glass shall be used for the purpose of improving day light conditions or for the avoidance of eye strain, wherever the location of the work is such that the worker must face large window areas, through which excessively bright light may at times enter the building."

A glass is now available which meets the above requirements. It properly diffuses the light and prevents sun glare passing into the building and is known as Factrolite.

Engineers of to-day are making a thorough study of illumination, so that they may be able to plan and lay out industrial plants, to scientifically increase their efficiency to as near the maximum as possible. This accomplished the engineer is not only doing something worth while for his employer, but is doing quite as much for himself by coming into prominence with modern ideas.

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

MISSISSIPPI WIRE GLASS CO.,
220 Fifth Avenue,
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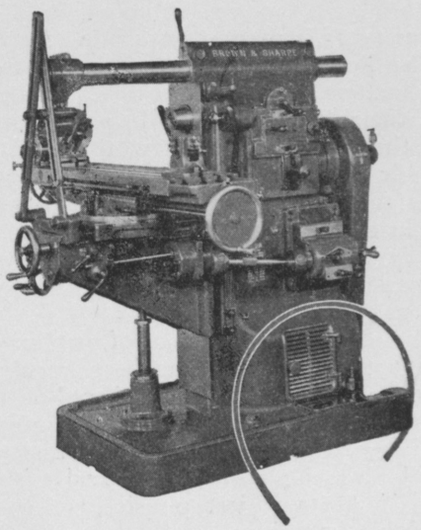

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Compact Design-
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Motor-in-the-Base
Milling Machines

THESE machines offer a very compact and efficient production unit. The motor is completely enclosed in a compartment in the base which protects it from oil, chips, dirt, etc., and in addition saves valuable floor space. Ample provision is made for ventilation as louvres set in the sides of the compartment assure a constant circulation of air.

The design of the motor base affords a ready means of removing the motor whenever desired by merely sliding it out in its adjustable ways.

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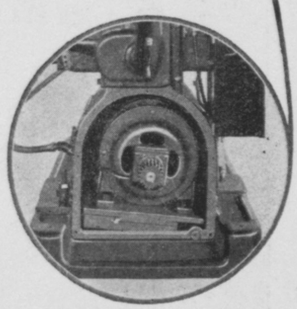

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Progress

(Continued from Page 16)

through all the four years is preposterous in a school such as Rose. The Faculty personnel of our Institute possess that inalterable characteristic of being human. With all their fitness for the dissemination of knowledge of the sciences, we know that after having been in their environment even a year, that every member has the individual students's interest in mind. So our instructors have a different "complex" than those in the schools where Dick Roe "flunks out" because they refuse to take the time to answer his questions.

A typical example of a genuine teacher of men was the late Dr. Johonnott whose loss has been keenly felt in the Rose ranks. He will be remembered as a strong advocate of more cultural subjects for engineering schools. Those men who have come under his instruction will always remember the zeal with which he taught his favorite subject, physics, and endeavored to train logical thinking.

This year has seen the coming of two professors who are new to Rose, Prof. Hutchins and Dr. Howlett. Professor Hutchins is of the Civil Department and Dr. Howlett has charge of Physics. Their reception has not been one of show, and without exception it may be said that Rose men are thoroughly convinced that these men are necessary segments of our circle.

In looking over the student body, we have noted a more progressive change in attitudes from those which existed during the 1922-23 school year. It must be remembered that during that critical adjustment period the sense of unity of faculty and student for school standards was demonstrated. School ideals triumphed, and we who were here bear that inalterable belief that our school will be instrumental in encouraging even a greater scholarship and engineering responsibility in the new location.

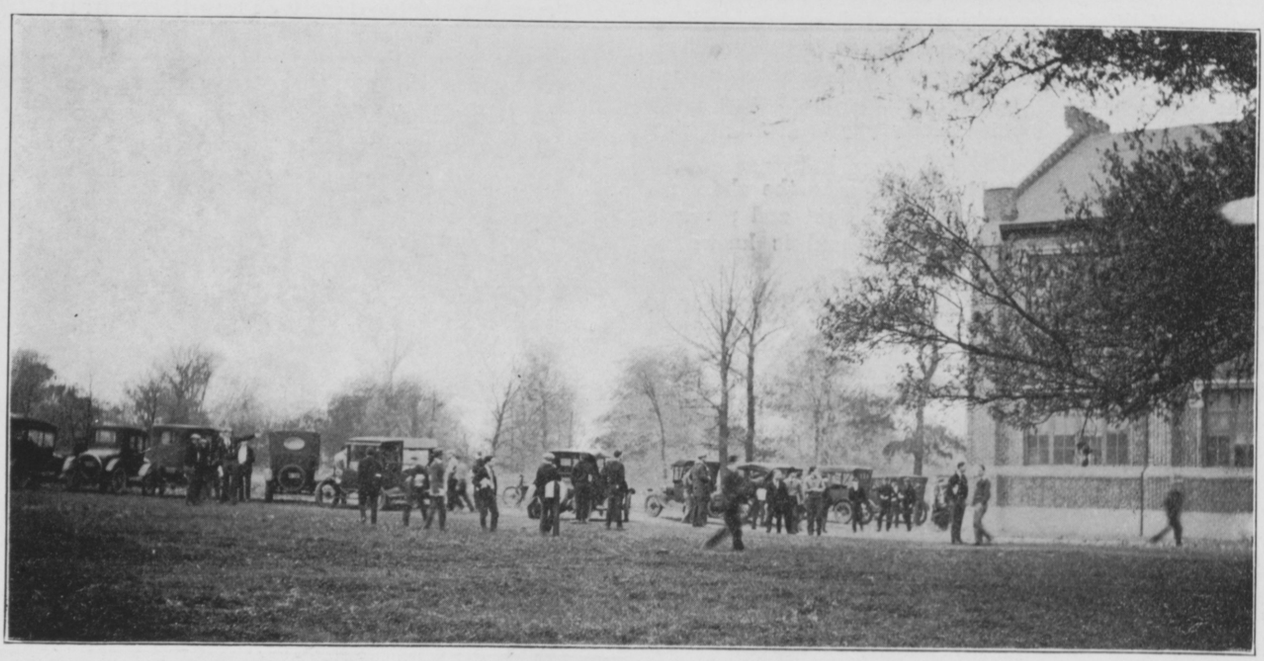
Individual possibilities have not been lost sight of; but in this direction we need more coordination of social interests. We need a few clubs or associations whose object, shall be to allow the exercise of those latent energies of social personality which all students possess. A student forum, as an adjunct to the student council, has been advocated by some to fill the niche of a discussion group where a "spade is a spade" and where equal possibility for expression is afforded. We might ask ourselves the questions. "What of an orchestra? Glee club? Debating club?"

The Rose student **sees** himself in the companionship of fellows" who are consciously asigning themselves to the building of a future. With conditions of student residence as they are, there is a genuine want of social unity. To this end a dormitory has been advocated.

A distinct move toward a dormitory was, recently made when questionaires were sent to all non-residents. The returns, showed most students in favor of such a move; but a more complete survey should be made. The opinions of the resident students of Vigo county were not solicited and definitely considered. These students, also, should perhaps be interviewed, for many of these desire to take advantage of rooms closer to the school.

The board of directors has had the dormitory question of their docket for some time. They are agreed that a student center is necessary and will be built, if an adequate number of students want it. The proposed dormitory will provide a student union where meetings and parties can be held. It will also include reading rooms and dining rooms of adequate size. Yes, a dormitory appears to be one of Rose's most urgent needs.

Since the completion of the athletic track, baseball field, and other campus improvements, the outlook is much better. We feel pride in belonging to an institution which has a reputation out of all proportion to the size of the enrollment. It is good to know that the prospects for the coming year are more secure than at any time since 1922.



Scene following Senior (Shoot-Up)

(Continued from Page 20)

"When the war broke out between Spain and the United States, it was very necessary to communicate quickly with the leader of the Insurgents. Garcia was somewhere in the mountain fastnesses of Cuba—no one knew where. No mail or telegraph message could reach him. The President must secure his co-operation, and quickly. What to do!

"Someone said to the President, 'There is a fellow by the name of Rowan who will find Garcia for you, if anybody can.'

"Rowan was sent for and given a letter to be delivered to Garcia. How the fellow by the name of Rowan' took the letter, sealed it in an oilskin pouch, strapped it over his heart, in four days landed by night off the coast of Cuba from an open boat, disappeared into the jungle, and in three weeks came out on the other side of the island, having traversed a hostile country on foot, and delivered his letter to Garcia—are things I have no special desire now to tell in detail. The point I wish to make is this: McKinley gave Rowan a letter to be delivered to Garcia; Rowan took the letter and did not ask, "Where is he at?"'

Yes, Rowan was the real hero of the Cuban war, but the question we are concerned with is this: How many of us can carry a message to Garcia?

Here in our little universe of mathematics, physics, chemistry, and all, stand our fraternities with a definite duty to perform. They form the nuclei for so many of those delectable morsels of social life which help to break the monotony of recitations, experiments, and quizzes. In the fraternity houses start many of the events which are to spread through the entire student body. In the fraternity it is discovered that a pledge is a second Beethoven, or a Kreisler, and thereupon he is pushed into the orchestra to become one of the mainstays of the organization. The man may be a baseball player, or a tennis champion, but he is there, he must be discovered, and his talents must be directed where they will do the most good for the entire student body and the Alma Mater.

Every fraternity has its own message to carry. Do it, and put "A Message to Garcia" in your library where all may read it.

—Armour Engineer.

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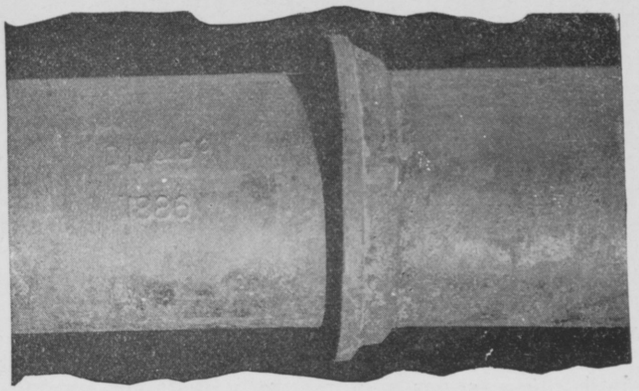
Answer to last month's Cross-word Puzzle. Did you work it?



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(Continued from Page 18)

with secondary resistance may be used to advantage providing the series characteristics acceptable or the load quite steady. This would be cheaper than using the brush-shifting shunt motor. Where it is possible to use wound-rotor motors with secondary resistance, the advantage in efficiency that the brush-shifting motor has at low speeds is of course reduced if operation at low speeds is infrequent, nevertheless the latter motor still has the advantage of a much greater speed range with perfectly stable operation and the advantage of more uniform speed change.

The brush-shifting, three-phase, quarter-phase, and single-phase series motors are adjustable varying-speed motors, also giving speed change by brush shift. But, having a series characteristic, i.e., a large change in speed with change in load, their use is restricted to those applications where the series characteristic is not objectionable. The principal application of the brush-shifting series type of motor with

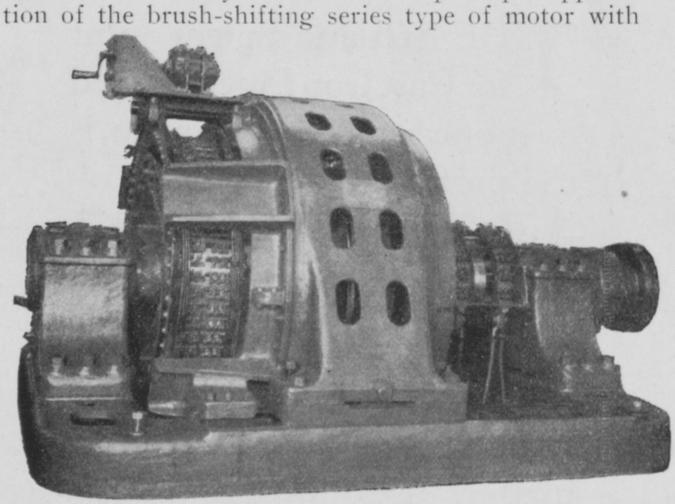

Fig. 4. Brush-shifting Motor for Steel Mill Use

its auxiliary rotor transformer has been and still is for forced and induced draft fans in power plants, for mine ventilating fans, and for centrifugal pumps. In small sizes, these motors were used for various textile applications where adjustable speed was required. Here the motor was applied satisfactorily, in spite of its series characteristics, because no other type of alternating-current adjustable-speed motor of small size was available. For textile applications the brush-shifting shunt type of motor is now being used and will gradually include more applications in the industry due to the better characteristics and greater speed range possible; but for forced and induced draft fans in power plants, mine ventilating fans, and some centrifugal pump applications where the horsepower per pole is high, the series type of brush-shifting motor will still be used as it has proved over many years to be particularly suitable.

It is possible to use multispeed squirrel-cage induction motors in some cases, but this type of motor gives definite speeds corresponding to the poles of the stator winding or windings. With the brush shifting shunt motor a smooth change in speed is obtained throughout the speed range. If several definite speeds are satisfactory, the multispeed motor will be the cheaper.

For certain applications the multispeed, wound-rotor, induction motor may be used satisfactorily. The motor will give definite synchronous speeds corresponding to the poles of the stator winding and will permit a variation from each definite speed by the use of secondary resistance. For any particular speed used, the characteristics in general are the same as for the ordinary wound-motor. Multispeed wound rotor motors are usually built for only two synchronous speeds, due to the number of collector rings required.

Applications

The three-phase adjustable-speed brush-shifting motor having shunt characteristics is suitable for application to a wide range of industries, a few examples of whch are shown in Figs. 4 to 12.

It is well to consider that this type of motor is inherently a constant-torque motor, i.e., the horsepower is directly proportional to the speed, and for a given speed range has a definite possible limit per pole. For a given speed range, more output per pole can be obtained from 25-cycle motors than from the 60-cycle motors.

Motors of this type are particularly suited for the following conditions:

(1) Where adjustable speed with shunt characteristics is necessary and alternating- current power is the only supply.

(2) Where large speed range is required and where uniform speed change is desired rather than speed change in definite steps as furnished by wound-rotor induction motors having secondary resistance or by multispeed in duction motors.

(3) Where it is desirable to operate at low speed much of the time, with the possibility also of operating at higher speeds.

EMPLOYEES AS INVENTORS

(Continued from Page 12)

SUMMARIZING:

A. An employer receives no rights in an invention of his employee except

(1) by an express agreement;

(2) where the intention to receive such rights may be implied from surrounding circumstances; or

(3) under circumstances amounting to estoppel.

However, the court indicated no intention of establishing by its decision any rule in conflict with two of its earlier decisions which have always been understood as confirming the above stated general rules with respect to the right of an employer to patents of his employee.

B. The existence of an express agreement does not necessarily preclude the creation of additional rights arising by implication or estoppel, unless such implication or estoppel be inconsistent, or conflict with the terms of the express agreement.

C. The employer's rights in such invention may consists of (1) a license to make, use, and or sell machines, devices, etc., embodying the invention, or (2) all rights in an invention including any present or prospective patent. The second mentioned rights obviously include the first.

D. The inclusion in an express or implied agreement, of some of the foregoing rights does not carry all of such rights.

The foregoing rules are simply corollaries (drawn from general propositions of law applicable to all species of property) which are distinguishable from general principles only by the peculiar incidents of the kind of property (inventions and patents) to which they relate. We find that they are rules of the laws of property and of contracts and are incidents of the status of employer and employee.

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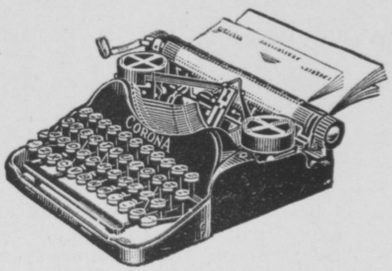

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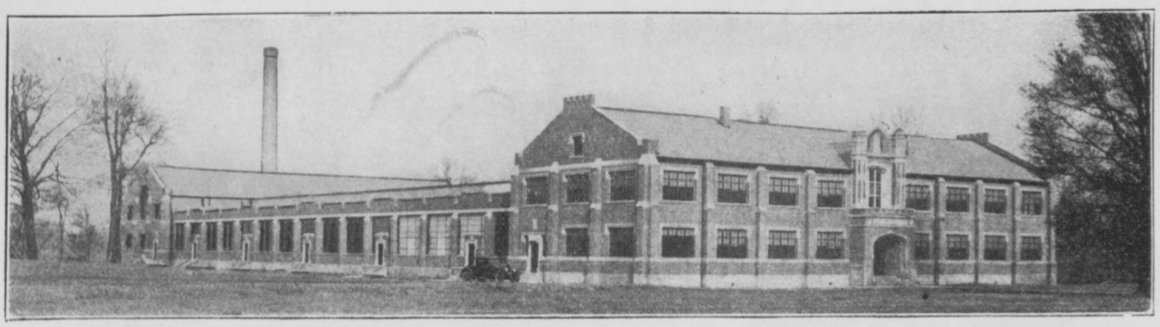

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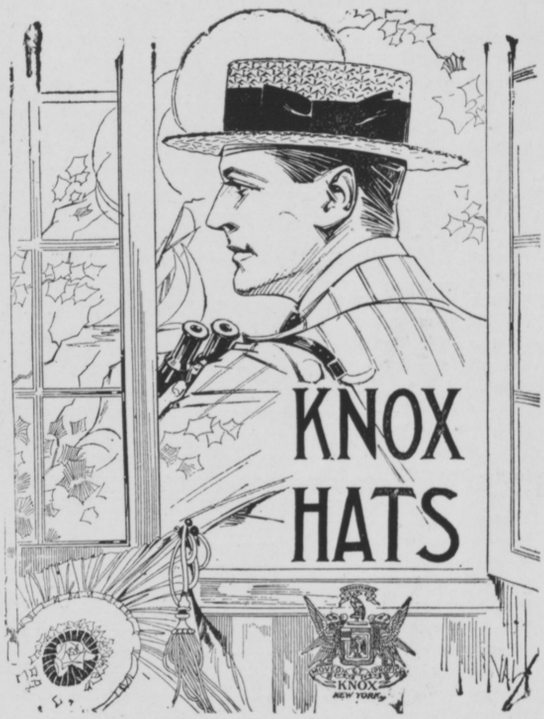

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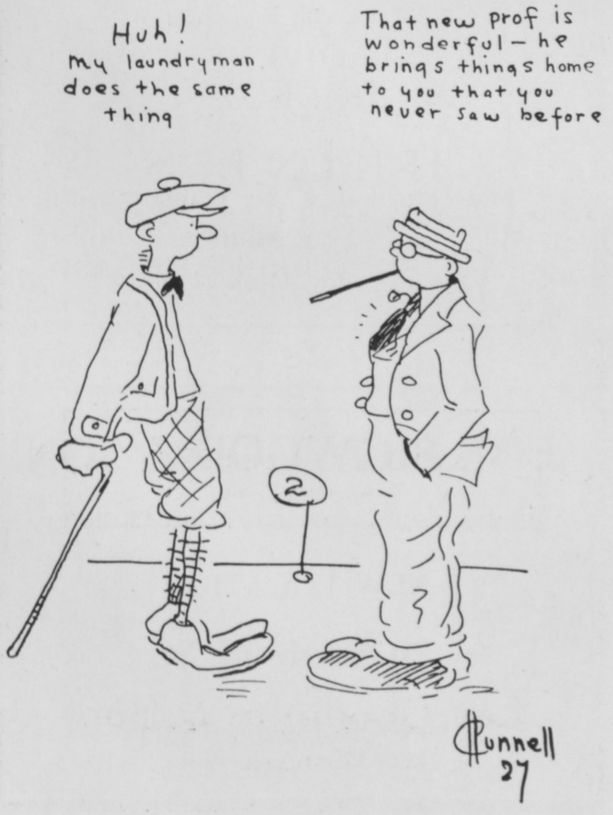

Chucked, By Gosh

"Tough about the piece of wood that got stuck on the engine lathe, wasn't it?"

"Why?"

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—Penn Triangle.

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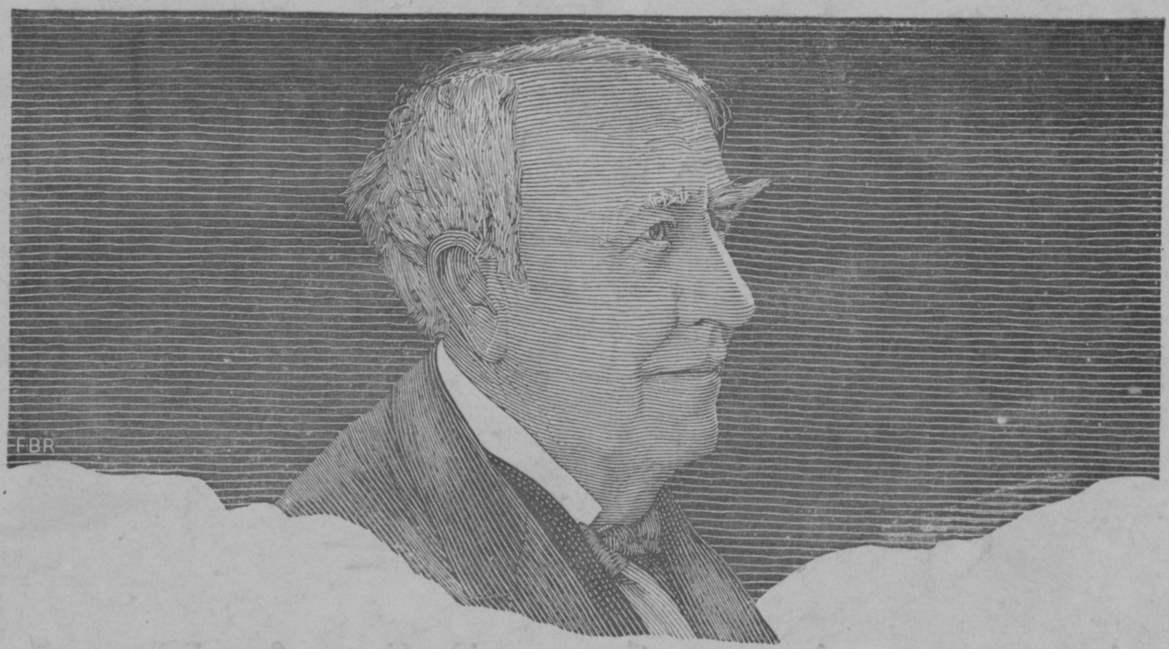

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