The Wisconsin engineer. Vol. 29, No. 8 May 1925

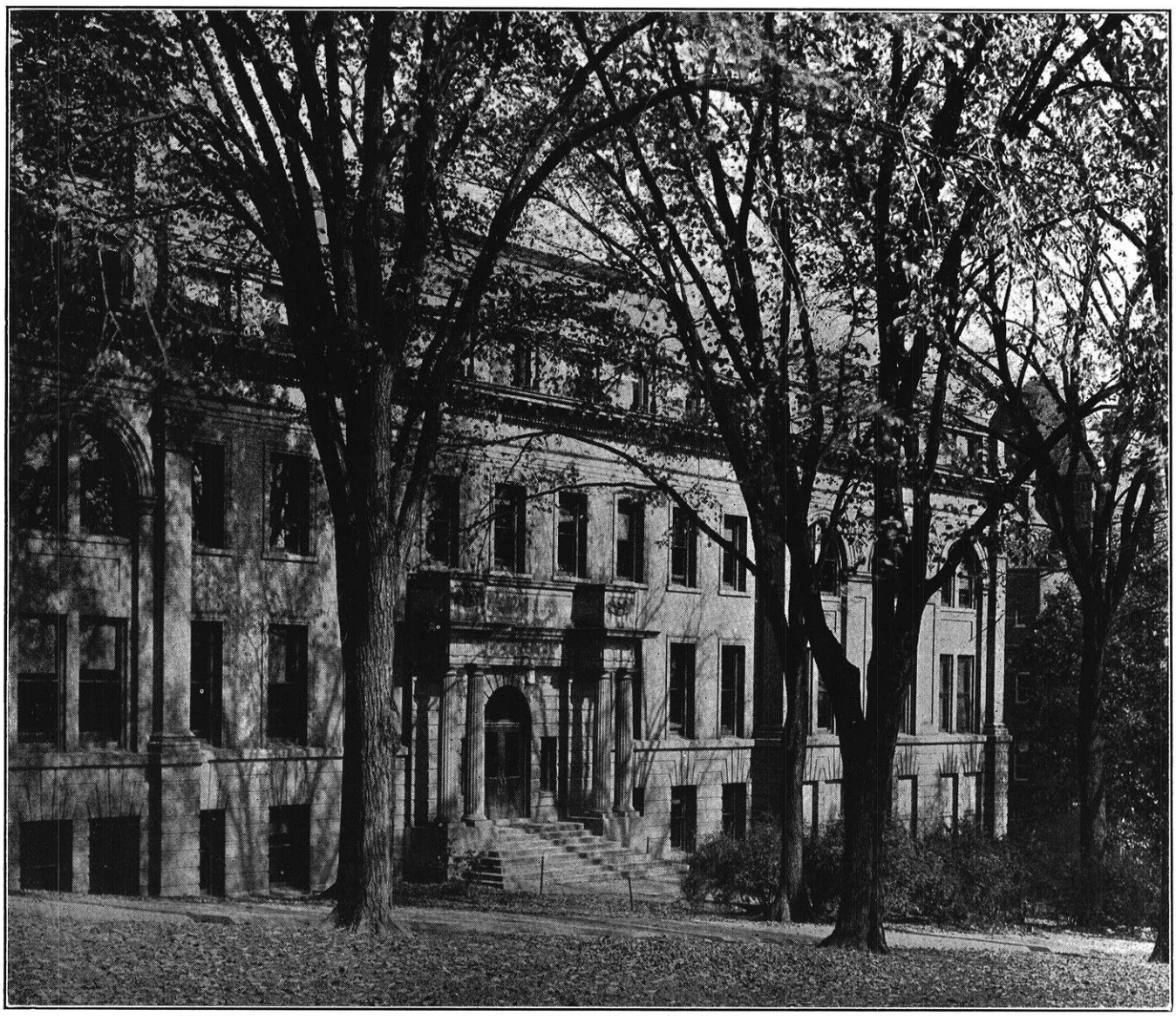
Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

The WISCONSIN ENGINEER

Published by the Engineering Students of
THE UNIVERSITY OF WISCONSIN

VOL. XXIX MADISON, WISCONSIN, MAY, 1925 NO. 8

Member Engineering College Magazines, Associated



—Courtesy of Photoart.

The

WISCONSIN ENGINEER

Founded 1896

25c A Copy

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

$1.50 A Year

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VOL. 29 MAY, 1925 NO. 8

 Entered as second class matter Sept. 26, 1910, at the Post office at Madison, Wis., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized October 21, 1918.

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VOL. XXIX, No. 8 MADISON, WIS. MAY, 1925

THE ELECTRIFICATION OF CANE SUGAR MILLS

By A. S. Rufsvold, e '23

General Engineering Department, Westinghouse Elec. & Mfg. Co.

THE application of electric drive to cane sugar mills is a comparatively recent mark of progress in the sugar industry. The first complete electrically driven cane mill or "Central" in Cuba was placed in operation not more than ten years ago, and since that time rapid strides have been made until now about sixty percent of the cane sugar output of Cuba comes from mills using electric drive.

In cane mills the situation differs from that in most industrial plants in that the source of power is a by-product. The crushed cane or "bagasse" furnishes all or most of the fuel required for the boilers. Therefore, economy is not the determining factor which is responsible for the adoption of electric drive in this industry. In cane mills, reliability is of utmost importance, and this factor, together with the greater flexibility and lower cost of maintenance of electric drive as compared with steam, is responsible for the use of electricity.

In order to appreciate what is involved in the electrification of a mill it is important that one should have some conception of the method used in extracting the sugar from the cane. So before discussing the electrical equipment we will first review briefly the process of manufacture which consists of first, the extraction of the juice; second, the clarification and evaporation; and finally, the separation of the crystals from the molasses.

The cane is transported to the "Central" by steam, gasoline, or electric locomotives in special cars. At the mill the cane is dumped on a conveyor and then transferred to the main cane carrier which takes the cane into the mill.

The milling machinery consists of one or more "tandems", each comprising a single or double "crusher" and three to six "mill stands." A crusher consists of two large corrugated rolls, and a mill stand is made up of three rolls grooved to facilitate the grinding action.

The cane falls by gravity from the head of the conveyor to the first crusher, then to the second crusher. In passing through the crushers, the hard structure of the cane is broken down, and much of the juice is extracted. The continuous mass of crushed cane then passes through each set of mill rolls in succession, additional juice being extracted at each set of rolls. Pressure is applied on the top rolls and is controlled by means of a hydraulic ram. About 250 tons pressure is used on the crusher rolls, and the pressure on the mill stands ranges from about 350 tons on the first mill to 500 tons on the last mill.

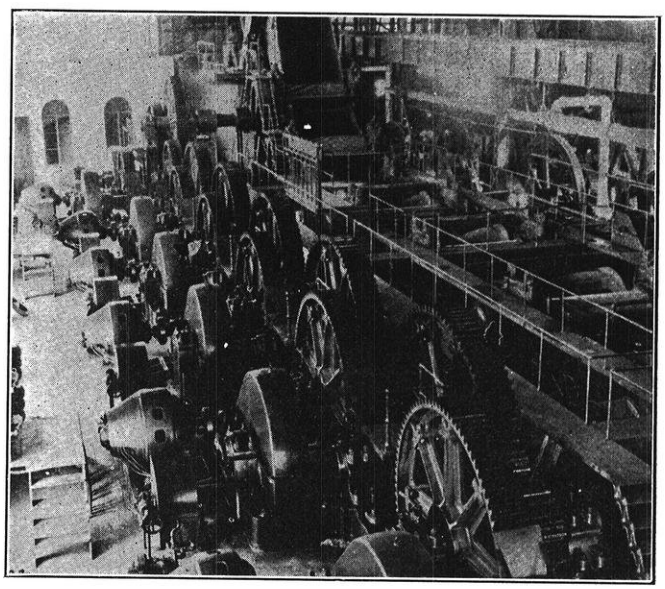


Fig. 1. *Tandem Drive at Central Mercedita, Cuba, Using Liquid Rheostat Control*

In order to increase the amount of juice extracted, "water of maceration" is applied to the cane mass as it passes through the rolls. The water increases the amount of juice extracted from the cane by diluting that which cannot be squeezed out by the roll pressure. However, all water which is added to the juice must be evaporated later in the process. The quantity of maceration water which can be economically added is limited by the cost of the evaporation process which follows the extraction of the juice. When there is an excess of bagasse and steam, the capacity of the evap-

orating equipment rather than the cost of evaporation limits the quantity of maceration water which can be used to advantage.

After passing through the last set of rolls the bagasse is conveyed to the Dutch ovens in the boiler house where it is burned as fuel. For a given percentage extraction, the fuel used in a Central can be taken as a measure of the plant efficiency. In one mill it may be necessary to supplement the bagasse fuel supply with oil, and a second mill may operate with a surplus of bagasse. Obviously, if the same percentage extraction is obtained in both mills, then the one having a surplus of bagasse is operating at a higher overall efficiency.

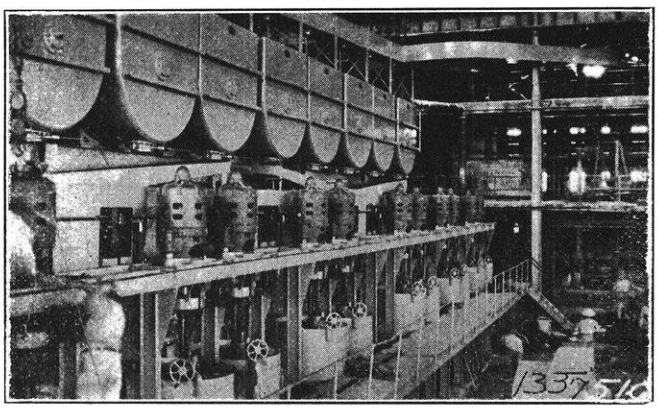


FIG. 2 *A Group of Centrifugal Extractors*

In the clarification process, the extracted juice is first treated with lime to neutralize the acids and cause partial precipitation of the impurities. The limed juice is heated and then discharged into large tanks called "defactors" where live steam raises the juice temperature to the boiling point. The impurities coagulate and settle, and the clear juice is then drawn off and pumped into the evaporators. From the evaporators the thickened juice or syrup is pumped into vacuum pans where the syrup is boiled until the crystals form. The resultant product of the vacuum pans is a dark brown mass of crystals and molasses and is called "massecuite."

The separation of the molasses from the sugar is accomplished by means of machines called "centrifugals". Such a machine consists of a motor driven basket lined with a fine screen. After receiving a charge of massecuite, the basket is accelerated, and the centrifugal action forces the molasses through the screen, leaving the dry crystals of light brown sugar. Bagging and storing completes the process, and the raw sugar is then ready to be shipped to the refineries. We pass now from the process of manufacture to a consideration of the electrical equipment used in a modern "Central."

In the power house, non-condensing turbine generator units of 750 to 1500 KW capacity and low voltage are most common. Two such units are usually operated in parallel, and a third unit is provided for standby service. From the standpoint of flexibility, the use of two or more units is preferred to the use of a single large unit. Approximately one half of the total electrical power is required for driving the tandem rolls, and the remainder is used for driving the conveyors, pumps, centrifugal extractors and other auxiliaries.

The tendency in switchboard equipment is to provide non-automatic oil circuit breakers for the main generators and automatic oil circuit breakers for the feeder circuits. Disconnecting switches are used to isolate the circuit breakers for inspection and repair. The most modern switchboard equipments include auxiliary sectionalized bus system to minimize the possibility of power interruption.

Before describing the motor and control equipment used on the tandem drives, some of the application requirements should be mentioned. The proper extraction of juice requires a roll speed of about 20 feet per minute on the crushers, and increasing to about 30 feet per minute on the last set of rolls. This peripheral speed means an approximate of 2 to 3 RPM. Consequently, in applying individual electric motor drive to the mill stands it is necessary to use comparatively low speed motors (500-600 RPM.) driving the rolls through double reduction gears. It is quite advantageous to use the same gear ratios throughout so that only one spare set of gears and pinions is necessary. Likewise, it is convenient to use identical motors for driving the rolls. But since different relative speeds are required on the various mill stands it is necessary to either make use of a permanent speed adjustment on the motors, or to have all motor speeds identical and use gears of dissimilar ratios. Both methods are in use, but the former is preferred by mill owners. The first requirements of the tandem motors, then, is low rated speed with 30 to 50 per cent permanent speed adjustment available.

Then in order to take care of variations in the quantity and quality of the incoming cane it is also necessary to provide for simultaneous speed adjustment of all the tandem motors, in addition to the initial speed adjustment. The speed of the tandem as a unit should be under the control of one operator who occupies a position from which he can observe the operation of all the machinery. This constitutes the second important requirement of the tandem motors and control equipment.

Up to the present time induction motors have been used for the tandem drives. Speed adjustment is obtained by the use of resistance in the rotor circuit. Magnetic controllers with grid resistors permit the control of all motors from one drum master switch. This type of control is used to some extent, but has the disadvantage of providing only a limited number of operating speeds. In some installations, magnetic primary controllers are used with liquid rheostats. In this scheme the motor speed is controlled from push button stations which operate a pilot motor on the rheostat. This scheme of control provides any number of operating speeds but has the disadvantage of requir-

(Concluded on page 152)

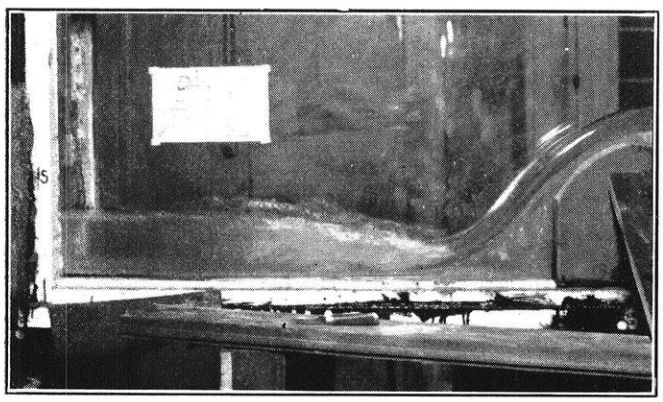
1924-25 THESIS WORK IN THE HYRDAULIC LABORATORY

By CHARLES I. CORP

Professor of Hydraulics

TWENTY-SIX seniors have been doing thesis work this year in the Hydraulic Laboratory of the University on 12 different projects. The problems are of unusual interest and cover, for the most part, fields in which very insufficient experimental data is at present available.

H. W. Jensen and J. S. Saks are experimenting on a model dam to determine the effect of the standing wave formed below the dam in undermining the structure. They are developing the relations between discharge over the dam and tail water level, which will assure the disturbance of the standing wave coming onto the concrete apron at the dam toe.



Model dam used in Jensen and Saks' experiment. Note standing wave at toe of dam.

G. N. Growt and G. T. McCormick have tested out very thoroughly a 2½ inch Viking Rotary Pump that has been donated to the laboratory for experimental and exhibition purposes. There is very little published data on the efficiency and other characteristics of rotary pumps and practically no information on their deterioration with time. It is expected that from time to time similar tests will be made on this pump to determine the effect of wear on its efficiency and capacity.

G. S. Woodward, L. C. Bennett, and E. B. Rundell are making a series of experiments to determine the loss of head due to flow of oil through pipes of different diameters. By heating the oil they are enabled to make determinations for fluids of different viscosities. Another interesting phase of their experiments is an attempt to reduce the amount of heat necessary to make a heavy oil more fluid for pumping by heating the pipe directly instead of the oil itself. Comparisons are being made as to the relative efficiency of both plans.

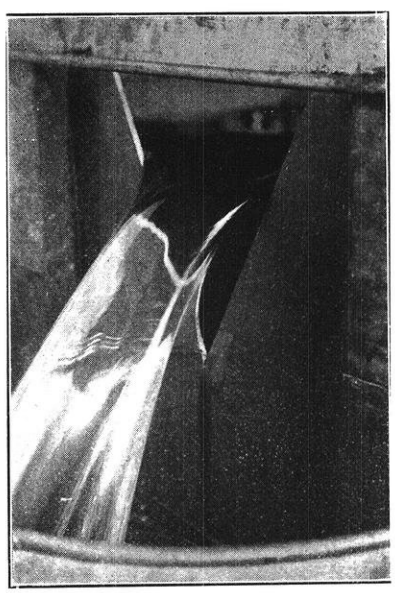
R. H. Brumm and W. H. Cartwright have conducted a series of experiments on a new type of water hydrants to determine the loss in the valve, barrel, and other parts of the hydrant body. Three different sizes were tested,—all being furnished for this purpose by the Darling Valve and Hydrant Company.

D. E. Bloodgood is developing a method of collecting and transporting sewage samples for bio-chemical analysis, where it is necessary to collect these samples in the field and send them to the state laboratory for analysis. The present procedure has always been to erect a field laboratory at the plants being investigated.

H. V. Ballam and E. G. Plautz are determining the loss in 3 inch diameter pipe bends of different radii. This is a part of a series of experiments on pipe bends of different diameters to be published as a university bulletin.

Glenn S. Bartleson is comparing the loss in 2 inch bends of different radii with the losses occasioned by two 45° standard fittings connected with a straight length of pipe, the purpose being to see if, by the use of standard 45° ells and straight pipe, a right angle turn can be made in which the loss is not greatly different from that in a formed bend, which is expensive to construct.

G. H. Abendroth and W. G. Flueck are making a very interesting study to determine how accurately water consumption can be estimated from the floor area of buildings of different types. They are measuring up rooming, business, industrial, and residential buildings and obtaining the actual water consumption from the Superintendent of Water Works from which to construct their tables. Their results indicate that this may be a more accurate means of estimating water needs than the ordinary schemes based on population alone.



Stream flow over triangular weir. R. N. Norris' studies.

R. N. Morris is determining a coefficient of discharge for triangular weirs of various angles. It has been demonstrated that the coefficient is much more constant for some angles than others, and he is endeavoring to determine a desirable angle, or angles, that the sides should make with each other in order that the coefficient may be as constant as possible for different heads.

(Concluded on page 149)

AERIAL PHOTOGRAPHY IN ENGINEERING

By RICHARD V. RHODE, *Senior Mechanical.*

MAN'S early attempts to fly were inspired largely by the desire to view his earthly domains from the air, and it is natural that, having succeeded, he should continue to develop his opportunity to its utmost possibilities. This is being done at the present time in the form of aerial photography and map-making, and altho the development of this new science has not yet reached perfection, it has passed the pioneer stage and photographic maps are now being constructed which compare favorably in accuracy with the best that are made from the old method of ground surveying.

The questions which naturally arise in the mind of the engineer at the suggestion of aerial photographic maps are questions of utility and expense. Are these picture maps better to use than the old line maps? Does it cost more to make them? Neither of these questions can be answered directly without knowing the specific case, but it is safe to say that for many uses the photographic map is incomparably superior to the ordinary map and that for these uses its cost is comparatively low. In city planning and municipal development the aerial map is becoming almost a necessity. It shows a wealth of detail, every feature of the town's physical makeup, from the largest buildings and the parks to Mrs. Jones' washing hanging out on the line, becoming plainly apparent in the picture. The value of such a map for the study of traffic and other municipal problems is too obvious for discussion.

To the hydraulic engineer the aerial "mosaic" map opens up a new field of possibilities. With the aid of a specially devised stereoscope, the relief of the terrain can be studied and the approximate flood lines determined. To do this by the old methods of surveying would take months of effort. A further advantage of aerial surveying in this sort of work is found in the possibility of mapping the territory and locating property lines without letting anyone know it is being done. Most of the photography is done at altitudes of between 10,000 and 15,000 feet, and at this height the airplane can neither be seen nor heard. Thus the farmer or property owner can be approached after the survey has been completed and before he has had an opportunity to prepare himself against an offer. In the location and planning of transmission lines and railroads, aerial surveying has already proved to be of practical value and in other fields of less interest to the engineer, such as timber cruising, tax assessment, and so forth, aerial mosaic maps have been found valuable.

Aerial photography is divided generally into two divisions depending upon the use for which the photograph is intended. The first of these, and the one of lesser importance from an engineer's standpoint, is the oblique view. This view is valuable chiefly as an accurate bird's eye picture for illustrative purposes. The engineer finds it of use to picture to his clients the general physical aspects of territory under consideration, and because it is easily understood by the layman, its utility is greatly increased. The vertical view, on the other hand, is not so easily understood because of the angle at which the objects are seen, but it is a true scalable representation of the earth's surface and fulfills the function of a map, with the distinctive feature that every detail on the ground is pictured as it actually exists and hence does not require the signs and symbols which are so mysterious to the average person. It is in this type of aerial photograph that the engineer is chiefly interested.

The making of an aerial mosaic map is a comparatively difficult task and presents problems of flying and photography that were, until recently, almost insurmountable. Only four or five pilots out of a hundred are sufficiently skilled to be of use in this work. If the photos are being made from an altitude of ten thousand feet or over, the pilot must maintain this altitude within one hundred feet to keep the error within one per cent. At the lower altitudes this limit of flight is decreased proportionately. The pilot must also be able to fly his ship on an even keel, without rolling or pitching, as the focal plane of the camera must be parallel to the earth's surface in order to prevent distortion. Devices such as gyroscopes and gimbal ring mounts have been used with some success to keep the camera in its proper position, but still much depends on the skill of the pilot. Winds further complicate the problem, and the aviator is called upon to fly a straight course in spite of them. All in all the pilot's job is a hard one, and without skilled men the mosaic map would be impossible.

Much depends, also, upon the airplane itself. It must have a "ceiling" or maximum of at least ten thousand feet, and a speed range of from forty to one hundred and ten miles an hour. A great deal of time is consumed in climbing to the required altitude and in returning to the flying field after the useful flight is finished, and for this reason high speed and climbing capacity is necessary to cut this time to a minimum. Flying at present is expensive, costing approximately a dollar a minute, and any time that can be saved is obviously worth saving. Endurance is another primary consideration. Only from two to four hours a day are available for this photographic work, and if the airplane consumes most of its fuel attaining the required altitude and returning to the field it can be seen that it would be very costly for photographic purposes.

Altho good airplanes and pilots are indispensable for aerial map-making, the paramount instrument is the camera. The history of aerial photography dates back to the early nineties, but it is only until recently that more than indifferent results have been obtained. This is due to the advent of a new and highly developed camera specially adapted to aerial work. The Fairchild camera, as it is known, with its "between-the-lens"

Upper: Oblique view of Columbus Circle, New York City. Compare this view with the vertical picture accompanying.

Lower: Columbus Circle and a corner of Central Park, looking down vertically.

shutter and automatic film spacer is one of the most marvelous pieces of automatic precision machinery in existence. It consists of over a thousand parts, and yet its weight is only fifty pounds complete. In practice the camera is mounted on gimbal rings in the center of the photographer's cockpit while nearby is strapped an extra magazine for re-loading in mid-air. An automatic timing device is installed to cause periodic exposures at the proper time intervals. Sometimes "ray filters" are used to eliminate the effects of atmospheric haze. Unusually clear pictures can be taken from altitudes as great as thirty thousand feet, which, with the ordinary type of equipment, would be impossible to obtain.

When a photographic map is to be made, the first step is to obtain an existing map of the territory and lay out the course of the flights. The desired scale being known, the altitude at which the airplane must fly is automatically determined, and it is necessary to plan the course of the ship and the intervals of exposure so that sufficient "end lap" and "side lap" will be obtained. The center portions only of each photograph are true representations of the earth's surface, due to the distortion near the edges, and it is necessary to have the pictures overlap from 30 to 65 per cent to allow for this feature.

Oblique view of Market Square, Kenosha, Wisconsin, taken by the author with a graflex camera. Simmons Bed Factory and the harbor in the background.

The 'plane will not follow exactly the predetermined path of flight, and to make enough allowance for any deviation from it, this overlap becomes indispensable. It would not do to fly the course, take all photographs, and the piece them together only to find that gaps were left uncovered. This sometimes occurs in practice, however, in spite of the best efforts of the pilot to keep his ship in the proper line of flight. Sometimes the camera is not truly vertical at the instant of exposure, and the distortion thus caused may be so great as to make the photographs useless. In cases such as these, extra flights must be made and the missing links obtained. Distortion is caused also by any great variations in the relief of the terrain, and this difficulty has not as yet been overcome satisfactorily. It must be emphasized at this point, however, that slight variations in relief are entirely negligible and that most of the ordinary ups and downs can be corrected in the photographer's laboratory. Very great distortions, however, cannot be corrected and usually greatly distorted pictures are thrown out.

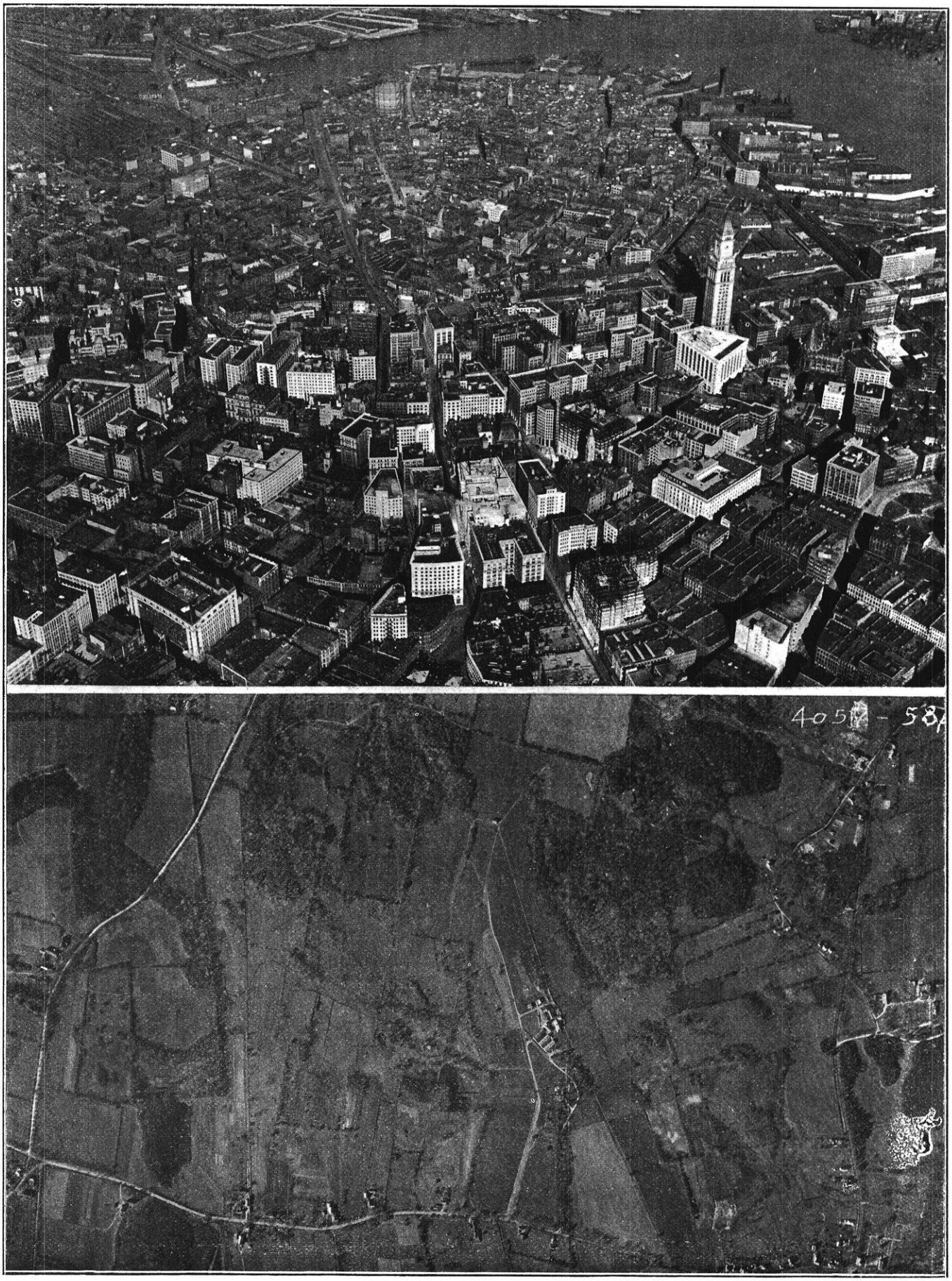
After the photographs have all been taken they must be thoroughly examined, the distortions must be corrected and the pictures brought to the proper scale either by reducing or enlarging slightly by the usual methods or by stretching the dampened negative. Then they are cut carefully so that no overlap will show and pieced together to form the finished mosaic. In this piecing together process some form of control is necessary so that the map will check the actual territory. Three methods of control are used ordinarily, depending upon the accurracy desired and the use for which the map is intended. If existing maps or surveys are found to be sufficiently accurate, a network of control can be obtained with the aid of the pantograph. If such aid is not obtainable or is not accurate, it is necessary to go into the field and establish control by means of triangulation. The amount of this control depends upon the accuracy desired. If extreme accuracy is necessary, as for mapping municipalities where land values are high, one point must be located in each individual photograph, for other purposes where accuracy is not so essential, sufficient control may be obtained from known distances as great as from twenty to fifty miles. A third method which is used when no maps are available and field work is not feasible, is a method known as photographic control. In brief, this consists of bringing all photographs to the same scale by locating two identical points on two overlapping photographs, finding the ratio of one to the other, and reducing or enlarging as necessary. After they have all been brought to the same scale a line is plotted covering the distance between the two known control points *at the scale of the photographs.* The ratio of this distance to the actual distance between the known points furnishes a clue by which the whole map may be brought to scale.

The cost of aerial map-making varies considerably, depending on the scale desired, the relief of the terrain, and the amount of control obtainable. Further elements which affect cost are location, that is, distance from an operating base and flying field, and the size and shape of the area to be mapped. It has been estimated that the expense of producing aerial mosaic maps is distributed as follows:

Lineal Strip Mosaic Maps.		*City Maps to Scale.*	
Flying	37%	Flying	31%
Dark Room	24%	Dark Room	19%
Engineering	39%	Engineering	50%

Thus it can be seen that the cost is greatly increased if there is little control available and if a large scale is desired, as the necessary engineering and flying are thereby increased. In mapping Kansas City, Mo., the Fairchild Aerial Camera Co. operated from New York

(Concluded on page 158)



Upper: Downtown Boston and its maze of crooked streets. —Courtesy of Fairchild Aerial Corp.
Lower: This picture was taken in the fall when the leaves were coming off the trees. Note the fence lines inclosing farms and the detailed information about the farms themselves.

ACCIDENTS IN INDUSTRY

By G. J. TJOFLAT, e '24.

Engineer, Westinghouse Electric and Manufacturing Company.

ACCIDENTS have been and still remain a very vital problem with which industry must struggle. They are a burden upon both the employer and the employee. The employer is the loser in the reduction of efficiency and in the disruption of the esprit de corps of the worker, and the employee is the loser in wages.

Safety First had been practiced by several manufacturers before any of the states had adopted Workmen's Compensation Acts, because they realized that accidents were an economic loss; but after these acts were adopted, industry as a whole was forced to protect the employer, with the result that accidents have been made a direct charge upon it.

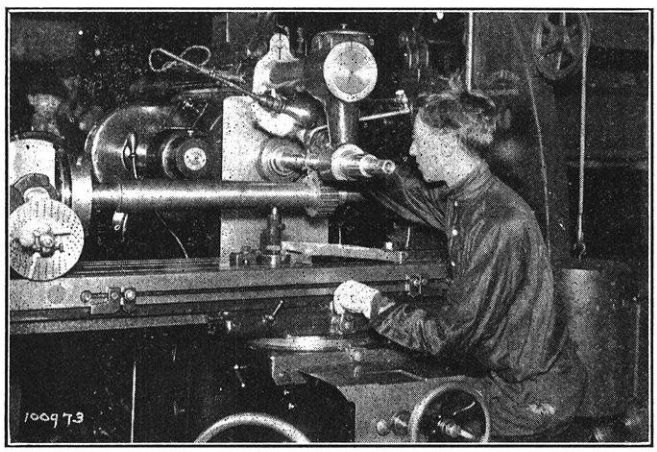


FIG. 1.—*The Unsafe Way to Operate*

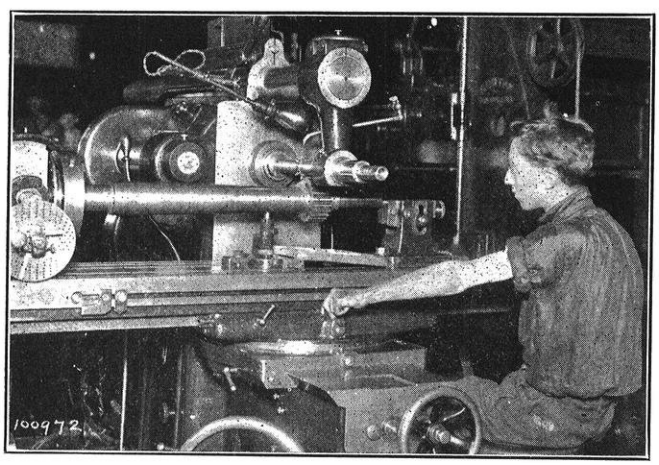


FIG. 2.—*The Safe Way to Operate*

The Safety Department of one large industrial concern, formed some years ago, first thought that the accident hazard could be eliminated if all dangerous tools were properly guarded. This was done, but accidents were not reduced very much, because an important problem involving the human element, which had been considered to a certain extent, had not been solved. It is very doubtful if any safety organization will ever function at its maximum efficiency until this element has been reduced by educational or other means to a minimum. This organization accordingly proceeded to eliminate accidents by teaching "safety first" to the employees in conjunction with the practice of guarding all dangerous tools. Special efforts were also made to prevent unsafe practices in machine operation as is shown by photograph No. 1. Photograph No. 2 shows the safe operation of the same machine.

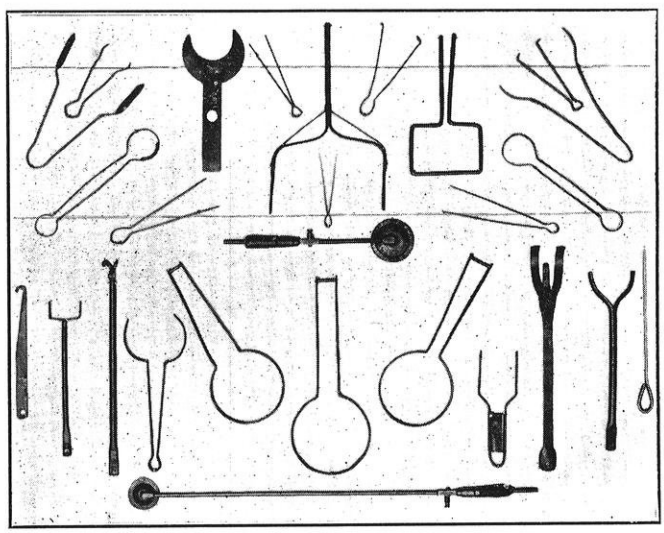


FIG. 3.—*Various Safety Devices used by W. E. & M. Co. Tweezers, Magnets, Suction Devices, etc.*

The results of safety education in connection with the practice of guarding dangerous tools has been most pronounced in the sections of this Company's shops where heavy tools such as punch presses, milling machines, and squaring shears are used. Before the Safety Department had begun to function, these sections were known to the employees as the "slaughter house", because so many fingers and hands were amputated on the machines

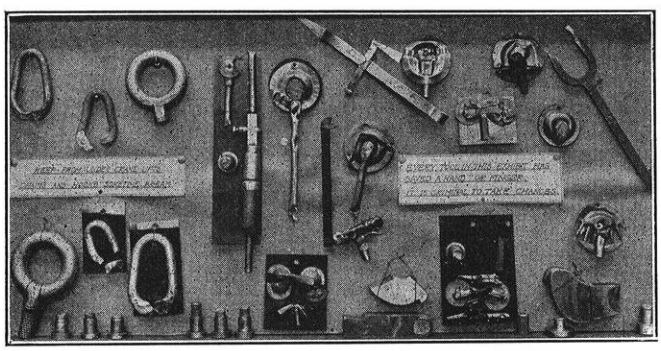


FIG. 4.—*Damaged Safety Devices*

located within them. For this reason, the man-hours lost per accident, in this part of the industry, were very high.

Safety devices, such as vacuum cups, tweezers and magnets are used for feeding sheet steel to and from

the presses and other machines of this type, and have substantially reduced the severity rate of accidents caused by them. Photographs Nos. 3 and 4 show these safety devices and also serve to give an idea as to what would have happened to a hand or finger had they been in the same position that these damaged devices were. Accidents caused by falling bodies have also been materially reduced in these sections because heavy dies and materials are no longer handled by hand. Anything that is too heavy to be handled by hand is taken care of by traveling cranes and electric trucks, and in this way accidents which usually result in crushed fingers and toes have been minimized.

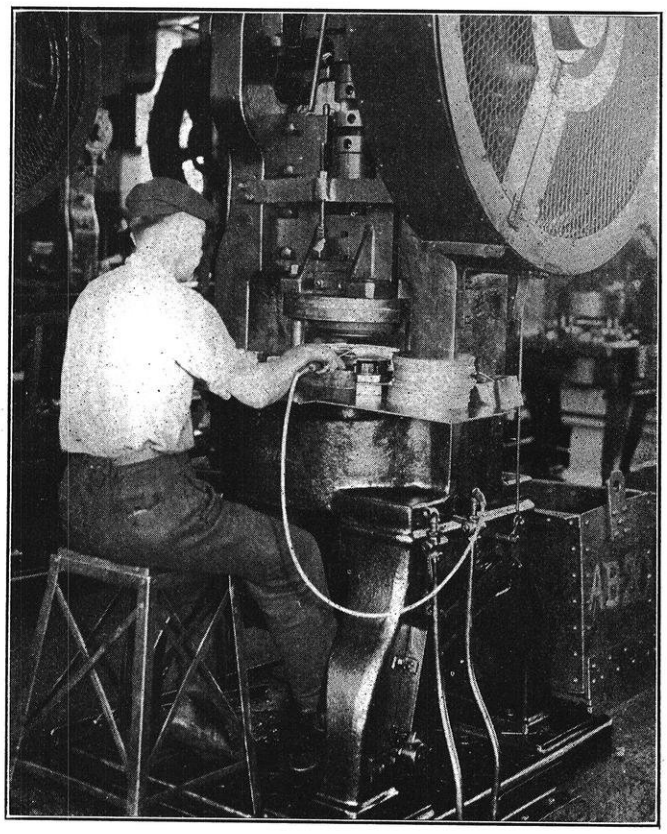


FIG. 5.—*The Suction Safety Device in Operation*

At the present time the following information is recorded for all accidents that contribute to the man-hours lost:

1. The employee's name, age, and nationality.
2. The time of day that accident occurred.
3. The type of machine.
4. The hours lost by the employee.
5. The hours worked by the employee.
6. The anatomy of injury.
7. The cause of the injury.
8. If the employee was injured at his regular occupation.

From this information together with the total hours worked by all employees, the frequency and severity rates for the entire industry are computed. These rates, as adopted by the National Safety Council and others are defined briefly as follows:

1. The severity rate is equal to the man-hours lost per 1,000 man-hours worked.

2. The frequency rate is equal to the number of accidents per 1,000,000 man-hours worked.

The severity rate does not vary directly with the frequency rate. Where an effort is made to reduce the number of accidents it is much easier to reduce the frequency rate of minor accidents, which do not cause a large loss of time, than it is to reduce the frequency rate of very severe accidents which result in a heavy loss of available working man-hours, or available working time. In plants where little effort is made to reduce the number of accidents the severity rate will vary more closely with the frequency rate.

It is of interest to note that accidents vary approximately inversely with the man-hours worked. When the man-hours increase over a long period of time, the accidents decrease, but approach a constant value; but when the man-hours decrease there is a tendency for the accidents to increase. If this phenomena were to be studied very thoroughly, factors such as worry, carelessness, inexperience and prevailing economic conditions may be found to have an important influence.

The Safety Department of the Company under discussion has been quite successful in reducing the severity and frequency rates for their reduction by eliminating the human element as far as possible, which contributes heavily to the occurance of accidents, by teaching the employees to think safety at all times.

HYDRAULIC THESIS WORK

(Concluded from page 143)

E. H. Thwaits and Omar White have been testing the present Madison Sewage Disposal Plant throughout the year to determine the efficiency of the sedimentation and colloidal tanks of this plant.

C. P. Lindner and James Smallshaw are experimenting on a problem in channel flow. Their experiments are intended to show that the ordinary method used in calculating river flow can be improved in accuracy by certain changes.

R. J. Piltz and K. C. MacLeish are experimenting to determine the coefficient of discharge for weirs whose crests are not horizontal. Little data is at present available on this type of weir, which is not infrequently met in practice.

C. J. Francis and I. A. Phelps are experimenting to determine the effect of temperature on the loss due to flow of water through pipes of various sizes.

D. N. Cooley and J. C. Zufelt have been testing the sewage disposal plant of the Mendota State Hospital getting comparisons of its efficiency in operating in several ways.

The Hydraulic Department exhibit at the University Exposition was planned, erected, and demonstrated by the thesis students.

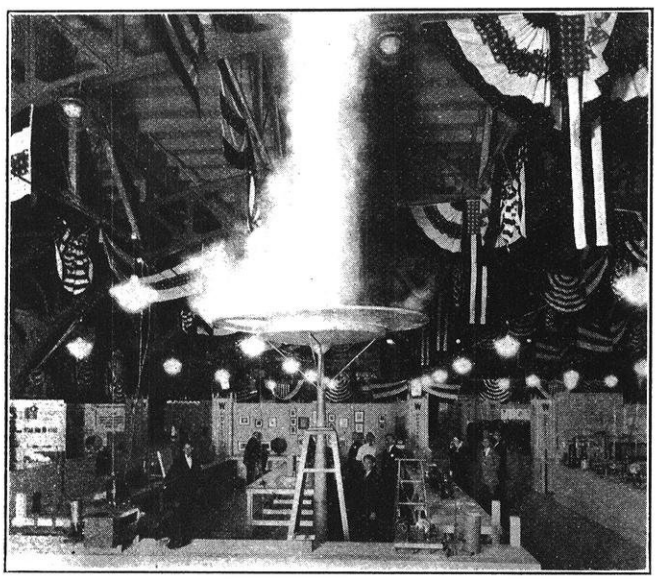
THE UNIVERSITY EXPOSITION

By R .T. Homewood, *Sophomore Civil*

THE 1925 All-University Exposition was held in the Armory and Annex on April 16, 17, and 18. The well made plans of those in charge and the untiring efforts of their assistants made the exposition a real cross-section of university work, and a source of unending interest to the students and many visitors. Everything was exhibited — everything from materials used in ancient history to the modern hydro-electric plant and automatic voting machine.

Letters and Science departments had their booths on the second floor of the armory. To attempt to cover, or in fact to even mention all the interesting things seen in these booths would take a volume resembling a Law School text book.

The work of the Extension Division was graphically portrayed by a large map of the state so arranged with lights as to show the principal divisions of the department thruout the state. An interesting study of university attendance and building conditions was shown by



— Courtesy of Photoart.

The Physics Exhibit on the Main Floor Showing "Old Faithful" in Eruption

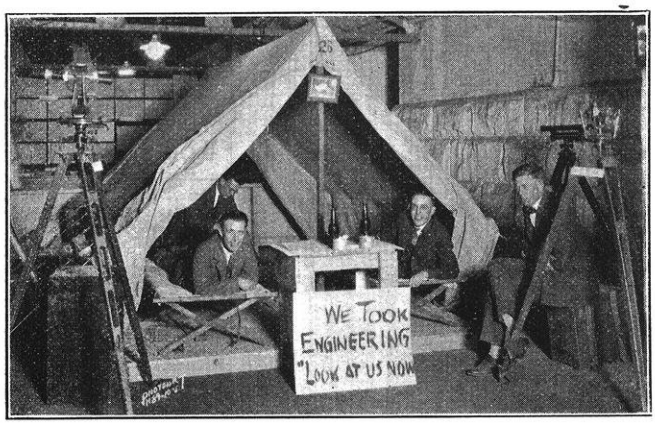
a colored chart in the administration booth. As well as showing in a striking manner the need for more class-room space, the chart made evident the fact that the College of Engineering has increased more rapidly than any other except Letters and Science. The foreign students offered an unique novelty in the display of native costumes and habits.

To get near the Psychology exhibit was an art in itself, and to get away took strong will-power. Everyone was interested in trying the mentality tests and various instructive amusements offered. Prof. C. L. Hull's machine for determining vocations was on display, and attracted much attention.

The physics and chemistry booths showed work with liquid air, molecule machines, electrical discharges thru gases, color photography, factory dust explosions and the periodical eruption of "Old Faithful".

Expert Wisconsin swimmers were on exhibition in the swimming tank; fish of all varieties found in Wisconsin waters, from the small minows of Lake Mendota to gold-fish, trout, and sturgeons swam around in the water, and showed off to advantage under lights of various colors.

"New Lands for Old" the exhibit of the Geology department was a most complete piece of work. A miniature volcano, smouldering continually, would erupt



— Courtesy of Photoart.

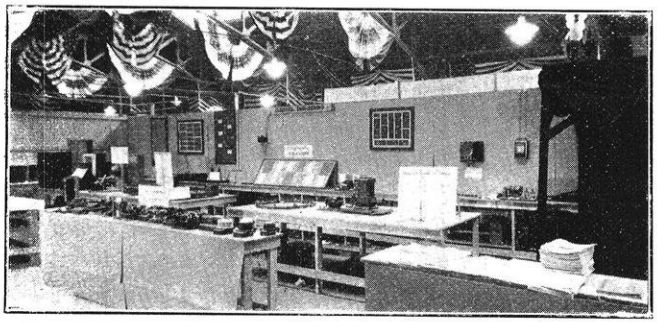
One corner of the Civil's exhibit

"every once in a while", spouting lava which ran down the sides of the crater, building up a mountain. On the side of the mountain and in the valley below, rain fell continuously, eroding away the newly formed land, and washing it down a river which was building up a large delta. A visible cross-section of the delta showed the strata being laid down, and an intrusion of volcanic origin which tipped the strata and formed an oil well.

The engineers' exhibit was in the annex. The topographical department, under the direction of Prof. Owen, offered a sample of the survey camp at Devil's Lake. A complete camp for one party was set up (not forgetting the swimming suit drying on top of the tent). Levels, transits, sextants, theodolites were on display, and a Price Electric Current Meter for measuring stream flow was in operation.

Prof. L. S. Smith had the highways and city planning exhibits. Samples of concrete, made both with Portland cement and the new Lumnite cement were broken to show their relative strengths. Paving blocks and bricks, both new and used, and difference in design of paving blocks to be used with modern motor traffic were shown. The old used blocks were either beveled on one edge or had a corrugated surface to be used for horse traffic. Charts and maps showed the modern methods of city planning, with specimens of both good and bad arrangements of streets.

The electricals aroused wonder and appetites by frying eggs and pancakes on a griddle surrounded with ice, and by making an arc chase itself around a race track and up to the ceiling. An oscillograph showing

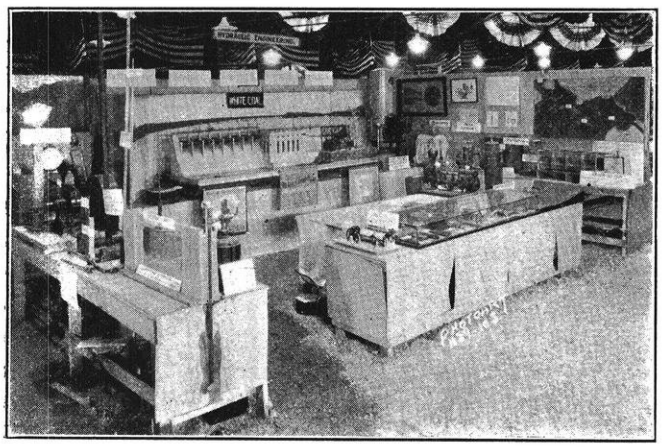


— Courtesy of Photoart.

Exhibit of Electrical Engineering Department

waveforms produced by different sounds was partitioned off with dark curtains in one corner. The effects of various lights on color were shown, demonstrating the difference between the various bulbs used for modern house lighting. The advance in types of meters was shown by a display ranging from the earliest to the most modern meters now in use.

A complete dam and power house was set up in the hydraulic exhibit, under the direction of Prof. C. I. Corp. Water flowed over the dam, and the power house was rigged up just as a real power house, with its generators, switch boards, and transmission lines. Small electric bulbs lighted the top of the dam and the interior of the power house. A glass model of the type of compressed-air-lift pumps used in Madison's water supply was in operation. A model of the standing wave, the type of spillway used at Muscle Shoals was shown. The visitors wondered at a faucet suspensed in mid-air and running continuously. An interesting historical ex-

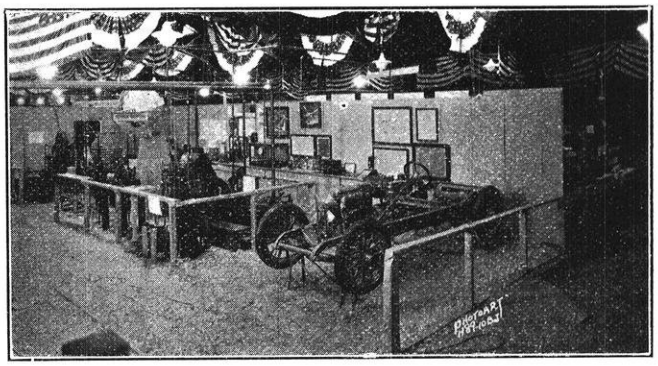


— Courtesy of Photoart.

The Hydraulics exhibit

hibit of ancient hydraulic methods was arranged, showing models of the type of water wheels and pumps used even now in China.

The mechanicals were operating a Lipman Refrigerating machine, covering coils with a thick beard of frosty whiskers. A cross-section of a Nash chassis showed every moving part. A ten cylinder airplane motor designed by a man who was not an engineer was shown. It has never run, and never can; one explosion would wreck the whole motor. Steam compressor models, vacuum heating pumps and hot air engines were in operation. Sh! — a secret — a large globe labeled



— Courtesy of Photoart.

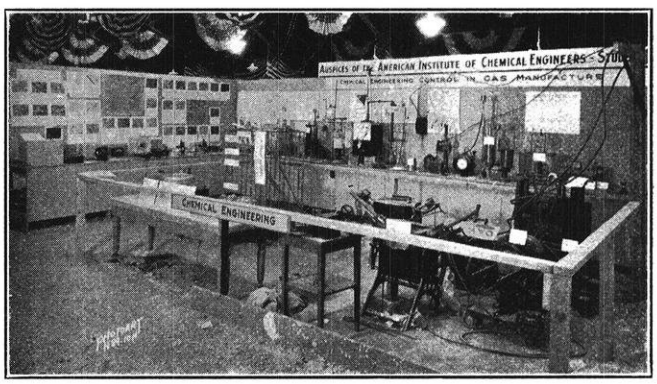
Mechanical's display

"Steam and Gas run the World" was rotating — run by an *electric* motor.

Moulding and finishing castings, from the pattern-making to the completed product, was carried out in the shop exhibit.

The mechanics department carried out tests of strength of materials on samples of concrete, iron and steel.

A model of the modern processes used in supplying city gas was set up and operated in the Chemical's exhibit. Electric furnaces, electro plating, and methods of distribution of heat were on display.



— Courtesy of Photoart.

Chemical Engineer's Booth

A miniature relief of the Devil's Lake region showcity gas was set up and operated in the Chemicals' exexhibit of the railways department.

The exposition was in every way a success. The cooperation of the students and faculty made possible a real cross section of university work. The interest arroused was manifest by the necessity of extending the exposition over Sunday; so that many students and visitors, unable to come during the regular three days might see the exhibits.

ELECTRIFICATION OF SUGAR MILLS

(Concluded from page 142)

ing a running supply of cooling water for the rheostat.

In the more recent installations a method of tandem drive known as the "variable frequency" system has been used. This method employs a variable speed turbine to drive the generator feeding the tandem motors. The speed of the motors is proportional to the frequency of the generator. The variable frequency system has certain advantages but requires increased turbine capacity and does not preclude the use of resistance control. When all gears are alike, secondary resistance must be used with each motor to obtain the necessary initial speed adjustment.

The method of tandem drive which is being considered for new installations is based on the use of direct current motors. In any application where wide speed adjustment is required the D. C. motor is far superior to any A. C. motor. In using D. C. motors for the tandem drive the initial speed adjustment can be readily obtained by field control. Then by using a variable voltage generator the speed of all motors can be varied together by controlling the generator field excitation. Such a scheme of control is much more simple and flexible than the variable frequency system, and has many other advantages.

Now pass from the tandem drive to consider other applications of motor and control equipment in a Central. The tendency in this industry, as in other industries, is to use squirrel cage motors wherever possible because of their ruggedness and simplicity.

The conveyors require low speed motors with some method of gear reduction. Motors fitted with back-gear parts are used quite extensively. Magnetic brakes are used on the motor shafts to hold the load in case of power failure. Since centrifugal pumps require high speed motors, they are preferred to the plunger type. For a given horsepower rating, a high speed motor is smaller and costs considerably less than a low speed motor. Auto-transformer starters are used for the high speed motors. For starting the low speed motors the tendency is to use simply an oil switch for full voltage starting.

For the centrifugal extractors, individual motor drive is the accepted standard. On these machines the cycle of operation is short,—the charging, acceleration to full speed, and discharging all being accomplished in four or five minutes. The problem here is to provide a low speed for the charging and discharging operations. Two speed squirrel cage motors using polar groupings are used to some extent. However, the single speed motor is preferred because of the greater simplicity of both motor and control.

Aside from what has been mentioned, there are no unusual motor applications in the industry. The use of standard motor and control equipment is the prevailing tendency throughout, but the tandem drive must necessarily involve special equipment.

EDITORIALS

S. G. SARGIS

THE ENGINEER

My fathers sleep o'er the sunrise plains,
And each one sleeps alone;
Their trails may dim to the grass and rains,
For I choose to make my own;
I lay proud claim to the blood and name,
But I lean on no dead kin;
The name is mine whe'er for praise or scorn,
But the world began when *I* was born
And the world is mine to win.

They built big towns on their old log sills
Where the great slow rivers gleamed,
But with new live rock from the savage hills
I build as they only dreamed.
The fire scarce dies where the trail camp lies
Till the rails glint down the pass,
And the desert springs into fruit and wheat
And I lay the stones of a solid street
On yesterday's untrod grass.

I take no thought of my neighbor's birth
Or the way he makes his prayer;
I grant him a white man's room on earth
If his game is only square:
While he plays it straight, I call him "mate",
If he cheats, I drop him flat;
All rank but that is a wornout lie,
For all clean men are as good as I
And the King is only that.

I dream no dreams of a nursemaid state
That will spoon me out my food;
The strong heart sings in the fray with Fate
And the shock and sweat are good.
From noon to noon all the earthly boom
That I ask my God to spare,
Is a little daily bread in store,
And the room to fight the strong for more,
And the weak shall get their share.

The sunrise hills are a tender haze
And the sunset seas are grey,
But I stand here where the great skies blaze
Over me and the great TODAY;
What use to me is the vague "maybe"
Or the mournful "might have been"?
For the sun wheels swift from morn to morn
And the world began when *I* was born,
And the world is mine to win.

— CHARLES B. CLARKE, JR.

(The Western — in "Sunlight and Saddleleather")

The engineer who loses his honesty has nothing else to lose.

CAN TARDINESS AFFECT ONE'S FUTURE?

Whenever some one arrives late at one of Prof. D. W. Mead's lectures, the professor ceases to speak until the intruder has seated himself. Recently "Danny", as he is affectionately spoken of by the boys, saw fit to digress from his subject, upon the tardy appearance of one of the students.

"The man who cannot be on time is rarely trusted with work of any importance," said Professor Mead. "When anybody keeps us waiting we are irritated," he continued, "and we come to distrust those who do this habitually. Promptness is a perequisite of success, and promptness in small matters makes it easy to be prompt in the major matters of life."

There are those who scoff at these statements, but they do so merely to justify, in their minds, their own laxity. Might it not be well to follow the advice of one who has had such a wide range of experience, and who has himself been so eminently successful?

The opportunity to do mischief is found a hundred times a day, and that of doing good but once a year.
— Voltaire.

"The man with nothing to do, and all day to do it in, is the one who misses the train. —Elbert Hubbard.

OBSERVATION Observation is a good habit of a trained mind. Most of us observe closely on special occasions but we do not do it as a matter of habit. The ability to observe closely is an asset of inestimable value. Successful people in any line are people who have been close observers in addition to being thinkers. Without observation no one can hope to see original beauty. He gets his ideas second hand. He is an unthinking individual since he cannot have the basis for thought. Neither can he concentrate or reflect. Without these qualities he is a mere sieve, ideas going through him and failing to take root. We should continually observe and look for better ways of doing things, thus making ourselves more valuable to others and developing that security which comes through accurate knowledge.

"Those who would enjoyment gain, must find it in the purpose they pursue." —Hale.

CAMPUS NOTES

J. LEVIN

HIGH SPEED NAME-PLATE IN E. E. LAB.

From the report of a junior electrical we are thus illuminated in regard to rotating name-plates: "The speed of the machine was adjusted by means of the motor field rheostat so that the speed of the generator was at the speed of the name-plate on the machine."

The following fellows and scholars in the College of Engineering were appointed for the year 1925-26:

Roland D. Parks, fellow in mining engineering; Edwin E. Larson, fellow in chemical engineering; William M. Richtman, scholar in mechanical engineering; and Edmund H. Thwaits, scholar in hydraulic engineering.

Chi Epsilon, honorary civil engineering fraternity, announces the initiation of three honorary members and ten students.

F. E. Turneaure, dean of the College of Engineering; C. I. Corp, professor of hydraulic engineering; and L. F. Van Hagan, professor of railway engineering, were initiated as honorary members. The students initiated are W. S. Cottingham '25, E. G. Plautz '25, P. W. Bishop '26, F J. Hebda '26, R. A. Nelson '26, R. J. Piltz '26, B. F. Smith '26, J. P. Smith '26, R. R. Schrader '26, and E. E. Belade '26.

Eta Kappa Nu, honorary electrical engineering fraternity, announces the initiation of the following students:

P. J. Kwasigroch '25, R. R. Brooks '26, C. E. Johnson '26, N. G. Robisch '26, V. E. Lemmer '26, S. W. Roland '26, and C. E. Hockings '26.

The initiation on April 2 was followed by a banquet at the Capitol Cafe, with Prof. J. R. Price as toastmaster. The new members were welcomed by H. C. Wolfe '26, and C. E. Johnson '26, responded on behalf of the initiates. Talks were given by Bert Miller, J. E. Wise and N. E. French, alumni members.

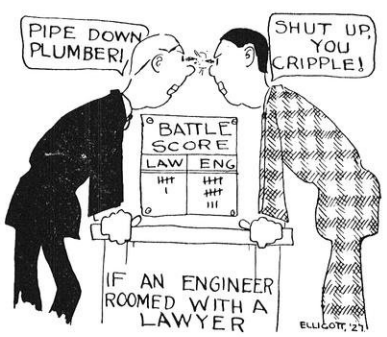
The A. I. E. E. listened to a discussion of Short vs. Long Wave Radio Systems by Prof. Edward Bennett on April 2. Ass't Prof. Leo J. Peters then spoke on the Effect of Static on Radio Receiving Stations.

A new Rotrex vacuum pump, together with an E. H. Wachs vertical centercrank engine to operate same, has found its way into the Steam and Gas Lab. In addition, a Cochrene steam-flow meter has been secured for experimental purposes.

At a meeting of the student chapter of the A. I. E. E. April 22, the following officers were elected:

N. G. Robisch '26, president; S. W. Roland '26, secretary-treasurer; and C. E. Hockings '26, Polygon representative.

Before the election of officers, Prof. J. T. Rood spoke on the Electrification of Railways.



Instructor: "Are you satisfied with your first boxing lesson?"

Battered Shyster: "Y-e-s; but I guess I'd like to take the rest by correspondence."

Gone are the days of male exclusiveness in the College of Engineering, for almost a score of adventuresome co-eds have broken thru its portals. Although only one co-ed, Emilie Hahn, min. '27, is taking a purely engineering course, the sixteen others are enrolled in Prof. Leonard S. Smith's popular classes in City Planning. The L & S College, the Journalism course, and the Home Economics course each boast several feminine representatives in this engineering class.

A KISS

As the chemist describes it

KI plus 2S equals Kiss. The action is reversible. Concentrated reagents should be used whenever possible. The reaction takes most rapidly in the absence of light. It has a sweet taste and ethereal odor that produce a blissful sensation.

The product is entirely soluble in distilled moonlight, and is best precipitated in the absence of humanity. It is entirely reduced and cannot be oxidized. Its highest valence is 2.

The greater the density of the reagents, the more often the reaction takes place. The graphical represention is elliptical.

The reaction is complete when a ring of gold appears surmounted by a small piece of crystalline carbon.

The product is anhydrous and should be analyzed qualitatively rather than quanitatively.

—*"Modern Mining."*

An article entitled *A Rapid Means of Plotting Conic Sections* by Earl Raimon Stivers, instructor in railway engineering, which appeared in the March, 1924, issue of the *Wisconsin Engineer*, has been reproduced in the *Ingeniera Internacional* for March, 1925. The *Ingeniera Internacional* is a Spanish-American engineering journal which has a wide circulation among Spanish-speaking engineers and builders in Mexico and South America.

The following advertisement once appeared in a Pittsburg newspaper:

Wanted: Civil engineer for construction work in the Wheeling district. Young man preferred. Must be able to read blue prints. Write C-214, Chronicle Telegraph.

Civil engineers were probably above par when the advertising writer penned the above announcement.

The eleventh national building officials' conference was held in Madison, April 21-24. Over two hundred building trades executives and officials attended this convention. The program consisted of papers and discussions on the various phases of the building industry, and also included a trip to the Forest Products Laboratory.

The electrical laboratory has recently acquired a new G-E 2000-volt, direct current generator with two commutators, each having a capacity of 1000 volts. Three 50-volt storage batteries have also been secured for radio work.

Fourteen Regents' scholarships were awarded to freshman engineers for the year 1924-1925.

Steven H. Polaski, m '26, captain of the 1925 varsity football team, has just become president of the Athletic Board. Besides being active in athletic circles, Steve is also a member of Pi Tau Sigma, honorary mechanical engineering fraternity.

The index for volume 29 of the *Engineer* is now ready. Subscribers may obtain copies of the index by writing to the Circulation Manager of the *Wisconsin Engineer*.

PROFESSOR SMITH ATTENDS INTERNATIONAL CITY PLANNING CONFERENCE

Leonard S. Smith, professor of highway engineering and city planning, represented the city of Madison and the University of Wisconsin, at the International Conference on City Planning held in New York City from April 20 to April 25 inclusive. Mayor Milo I. Kittleson of Madison, and E. E. Parker, c '04, city engineer of Madison, also attended this international conclave of city planning executives. Professor Smith reports this Congress the most important and successful he has ever attended.

Among the problems dealt with at the sessions of the convention, the two most important were the Decentralization of Industry into Garden Cities and City Planning as a Solution of Traffic Congestion. The words of Dr. Raymond Unwin, Chief Architect to the British Ministry of Health, admirably express the keynote of the convention: ". . . . . and in the main we agree on a general policy, aiming at a better distribution of population and a carefully planned and regulated development of our lands, which will check excessive concentration, and promote the localization of life around more numerous centers."

Professor Smith, who is a member of the Madison city planning commission, has been asked by Mayor Kittleson to give an illustrated lecture before the Common Council and interested citizens on the application to the city of Madison of the lessons learned at the convention.

Drunk: "Shay, is my name Heinz?"
Drunk's friend: "Of course not."
Drunk: "Well, it oughter be, 'cause I'm pickled."

Mr. F. M. Balsley, of the Wisconsin State Highway Commission, was the principal speaker at the A. S. C. E. meeting held April 2. His subject dealt with the progress and development of Concrete Road Building. At this meeting six new members were elected to the society. A committee was appointed to design a flag for next year's St. Pat's parade.

LOVE-LIFE OF AN ENGINEERING STUDENT

Fools may sing of hearts and love
And eyes and cheeks and hair —
Write sonnets to a woman's glove
And swear her wondrous fair.
Bah! She's an artificial thing:
All powder, paint, and lipstick —
But hearken to the song I sing,
And hail *my* love, the slipstick.

Women are babbling all the time
Of dates and drinks and dresses,
Which wouldn't help at all when I'm
Computing torques and stresses.
It conquers without fear or doubt
Whole hosts of sines and surds,
And helps me work in peace without
An avalanche of words.

Slide rules are always accurate,
And women never so;
And while rules are not affectionate,
They never answer "No!"
So hence with women's wanton ways,
With eyebrows, lips, and curls:
My little log-log polyphase
Is worth a dozen girls!

—*Cornell Widow.*

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.

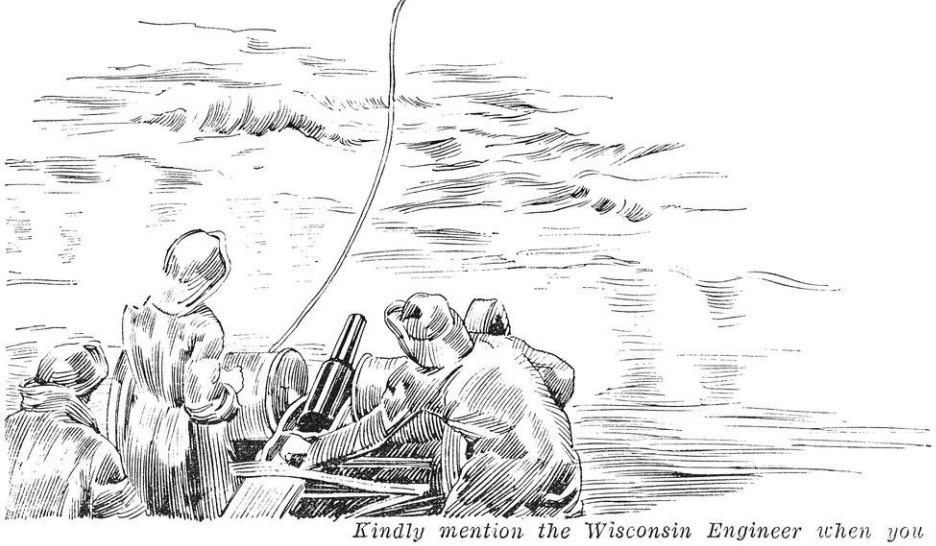
Tendency toward motion in more than one direction, at one time, is very common mechanically. The wheels of a motor car are spinning around and are also pushed from the side, due to the weight of the car, slope of the road, and the force of turning corners. The discs of a plow, forced forward at an angle, 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**



Kindly mention the Wisconsin Engineer when you write.

ALUMNI NOTES

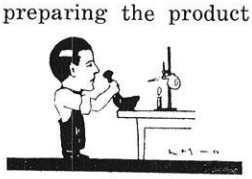
R. T. HOMEWOOD

Some of the alumni have recently complained about the limited space given to this department. It is an easy matter to get such information as changes of address, but what alumnus wants the department to read like a city directory? We recently sent out a letter to two-hundred men of '24, asking for letters telling of their experiences during the year since graduation. Out of the two hundred men, five replied. The department is yours, men, let's make it a live one — send in a letter — if each man does, there will be no room for complaint.

CHEMCIALS

M. T. Bennett, ch '25, has changed his address to 1263 National Ave., Apt. W, Milwaukee, Wis.

Perry Fulkerson, ch '24, is with Proctor & Gamble at the Ivorydale Plant. He is in charge of Chipso production. He writes, "P and G is a good big firm and there are many and varied fields for engineering and the company and employees are largely broken in and friendly to the technical control of processes. The Chemical Division and Engineering departments have the largest personnel of technical men, but there are also a large number in the production work like the work that I am doing, which is preparing the product for market. — I wish every success to the grads of '24." Fulkerson's address is 612 E. Epworth, Winton Place, Cincinnati, Ohio.



Edmund Hoag, ch '11, is chief chemist with Ruberoid Co., 204 Taylor St., Joliet, Ill.

CIVILS

W. C. Buetow, c '08, is living at 2445 Park Ave. N., Indianapolis, Ind.

George Chamberlain, c '10, is mining engineer for Orwell Iron Co., Dunwoody Mine. His address is House No. 40, Dunwoody Location, Chisholm, Minn.

Leon E. Chase, c '22, has resigned from the engineering staff of the City of La Crosse and is resident engineer for Taylor and Woltman, consulting engineers, at Bloomington, Illinois.

Charles Ellsworth, c '14, is engineer with McLennan Const. Co., at Chicago. His address is 1755 North Shore Avenue.

J. E. Gillespie, c '08, is paving contractor in Chicago. His address is Gillespie Construction Co., 111 W. Washington St.

LeRoy F. Harza, c '06, C. E. '08, is consulting hydro-electric engineer at Chicago with offices at 919 Monadnock Bldg., 53 W. Jackson St.

N. M. Isabella, c '14, is Manitenance Engineer of the Wisconsin Highway Commission.

Joseph Kunesh, c '14, gives his present address as Box 151, Villa Grove, Ill. He has recently returned from Haiti where he was chief hydraulic engineer in the Department of Public Works.

Walter F. Nickel, c '13, is a contractor in Oakland, California. His address is 117 E. Sixteenth St., Apt. 1.

Cecil Russell, c '23, is assistant engineer on a river control job in New Zealand. He announces his recent engagement to Miss Alice Day of St. Louis. His address is 162 Heaton St., Christchurch, New Zealand.

Kan Su, c '16, is executive engineer of the Board of Public Works at Wuchow, South China.

L. R. Talbot, c '11, is New York manager of Cement Gun Co., Inc., 30 Church St., N. Y. He is living at 33 Overlook Rd., Port Washington, L. I,. N. Y.

George W. Trayer, c '12, C. E. '22, was married on April 18 to Miss Rebecca Tyson Janney of Fredericksburg, Va. They will reside at 202 N. Lake St., Madison. Trayer is in the Aeronautical Research Department of the Forest Products Laboratory.

Charles E. Wheeler, c '22, was married on May 2 to Mary Lorraine Alexander of Madison. Their future address will be 11144 Esmond St., Chicago, Ill.

Arnold S. Zander, c '23, has changed his address to Ridely and Stuart Aves., Baltimore, Md.

ELECTRICALS

Robert B. Bohman, e '23, has left the Folwell-Ahlskog Company, Chicago, and has formed a connection with Baird & Warner, Inc., Chicago, where he is engaged in general real estate work, specializing in the negotiating of mortgage loans and bond issues. His business address is 134 S. La Salle St., and his residence remains at 6916 Dante Ave.

Richard Brewer, e '21, is electrical engineer with Pennsylvania Power & Light Company. His address is 860 Park Ave., Williamsport, Pa.

Floyd D. Johnson, e '24, has been with the Westinghouse Electric & Mfg. Co., at Pittsburg since last July. He admits he is gradually getting accostomed to Pittsburg and may in the course of time like the city. He writes, "After starting work with the company last July I spent one month in the shop followed by two weeks in an inspection department. I then had the good fortune to be chosen as one of thirty-six men who were put thru a three months engineering school —. At the present time I am in the electrical design school with six other men all planning on design work later." Johnson's address is 7936 Susquehanna St., Pittsburg, Pa.

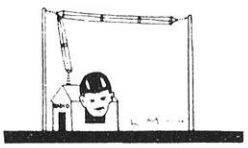
Leon M. Kelhofer, e '24, is with the Commonwealth Power Corp., of Jackson, Mich., working on central station design. His address is 511 Michigan Ave., W., Jackson, Mich.

James Mainland, e '11, sends his adress as 2109 Clear Lake Ave., Springfield, Ill.

Erick N. Nelson, e '24, is still with the Doherty Training school at Denver. He writes, "I have been thru the gas operation division which includes production, distribution, and utilization of gas and have had a taste of everything from digging ditches to selling gas appliances. — Clark Hoover, Heine Gregg, Meritt Giles and myself were down at the station last Wednesday as the track team came in from California — it seemed good to see Wisconsin's colors again as the men worked out a little." Nelson's address is 330 W. Irving Place, Denver, Colo.

Leslie V. Nelson, e '17, has changed his address to Box 322, Crosby, Minn.

Andrew N. Outzen, e '10, is with the Detroit City Gas Co., Detroit, Mich.



John C. Potter, e '04, is transmission engineer with Compania Telefonica National de Espana, a part of International Tel. & Tel. Co., at Madrid, Spain. His office is at Gran Via 5, and he is living at Nunez de Balboa II.

H. H. Scott, e '96, has changed his address to 29 Corliss Ave., Pelham, N. Y.

Frederick Silber, e '94, has changed his address to Room 614, 137 S. La Salle St., Chicago, Ill.

K. A. West, e '24, may be reached at 1919 N. Fifth St., Sheboygan, Wis.

M. A. Whiting, e '04, was one of the 43 out of approximately 7,000 employees of General Electric Company to receive the awards made this year by the Charles A. Coffin Foundation. Whiting's award was for inventing and developing an effective system of direct current motor control for high speed elevators. He is living at 650 Rugby Road, Schenectady.

MECHANICALS

Walter Alexander, m '97, M. E. '98, was recently elected to the Milwaukee Board of Education.

Earl Leroy Caldwell, m '24, writes, "I started my career last summer with the Illinois Bell Telephone Company in Chicago where I remained but three weeks. I was then sent to Alton, Ill., where I worked until September. Between September and Washington's Birthday this year I had all the ailments the devil could devise, but I shook them off to take my present position with the U. S. Lighthouse Service, Staten Island, N. Y. My official title is "Aid". At present I am engaged in redesigning some towers and lights on the Jersey coast, and when the contracts are let I shall have the inspection of the jobs." Caldwell's address is Evelyn Lodge, 71 Central Ave., Staten Island, N. Y.

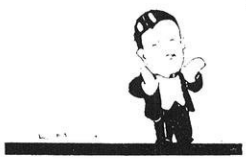
Charles J. Chambers, m '24, writes, "We just finished a large job, the new Hibbard, Spencer Bartlett warehouse, in which I figured and located all the radiation. Heating is about all I have done to any extent, although I have laid out several sets of sprinklers, some plumbing, and also some ventilation. — I am rooming with Bill Greeley, and Walt Kuenzli and Fritz Wandschneider live down on the second floor; Purvis lives about a mile from here." Chambers' address is 311 N. Central Ave., Chicago.

Charles Edmunds, m '07, has been placed in charge of the die, forge, and heat treating departments of the new Ajax Motors Co., at Racine. His address is 1406 College Ave.

Geo. H. Gross, m '23, can be reached at 2060 N. Clark St., Chicago, Ill.

Burton Hawkins, m '12, is mechanical engineer for Universal Oil Products Co., 321 S. Michigan Ave., Chicago. His home address is 3205 Kenilworth Ave., Berwyn, Ill.

Arthur King, m '01, has changed his address to 35 S. Dearborn St., Chicago, Ill.



Fred J. Mollerus, m '24, is in the testing department of General Electric at Schenectady. He writes, "The present time finds me as second low wop on what I believe is the best test in the works—60 turbines nights. Got quite a kick out of it two nights ago starting up a 30,000 KW machine for the Bethlehem Steel Co. — Hayward left three weeks ago for Pittsfield test. Kellogg left as head of 60 turbines nights for the American Gas and Electric Co., at Wheeling, W. Va. Zamzow and Quammen are working days, and I nights, so that one of us is around all of the time."

Harry W. Cole, m '02, has changed his address to 190 Ampthell Rd., Bedford, Eng.

Courtney Douglas, m '03, is with the General Electric Co., at Chicago. His new business address is 230 S. Clark St.

Walter Porth, m '23, is still on his journey around the world. He had reached Tunis by March 24, and expects to sail for the states about May 1.

E. F. Week, m '12, is manufacturing radio receiving sets at Oakland, California. His address is 3463 Champion Street.

MINERS

M. H. Hawkins, min '25, is employed as mining engineer with the Oliver Iron Mining Co., at Ironwood, Mich.

M. W. Link, min '21, is employed as mining engineer with the Lafayette Fluorspar Co., (a U. S. Steel Subsidiary) at Mexico, Ky.

H. G. Lynch, min '24, is employed as mining engineer with the Great National Smelting and Mining Co., at Estacion, Coahuila, Mexico.

R. J. Stengl, min '13, sends his address as Box 1106, Picher, Okla.

If anyone can give us the present address of any of the following men we will greatly appreciate the information.

V. R. Bacon, e '14, J. P. Bendt, c '12, Frank A. Buese, m '22, C. B. Christianson, c '22, M. K. Drewry, m '22, Alden C. Feusel, c '23, P. A. Foote, ch '22, R. W. Groot, e '23, Felix Guenther, e '23, C. E. Huntzicker, m '23, E. D. Johnson, e '21, Stuart C. Lawson, min '17, J. E. Mackie, c '23, Everett C. Meyers, c '23, M. Mitchell, ch '21, A. T. Newell, min '15, G. R. Olson, e '22, Paul W. Romig, m '21, F. E. Wertheim, m '17, B. F. Wupper, m '23, W. P. Zabell, e '09.

AERIAL PHOTOGRAPHY

(Concluded from page 146)

and furnished a map covering 60 square miles at a scale of 600 feet to the inch. The price was between $95 and $100 per square mile. In an eastern town of the same size mapped to the same scale, the price was only $73 per square mile. Neither of these figures, however, are generally representative. Where control is available and the scale 800 feet to the inch, the work can be done for about $80 or $90 per square mile. On the other hand, if the area is small and the scale large, say 200 feet to the inch, the cost may run as high as $700 or $800 per square mile. It is difficult to compare the cost of aerial surveying with the cost of ordinary ground surveying, as costs which cover conditions on the ground such as interruption by pedestrians and automobiles, cutting of brush, topography of the country, and so forth, are not obtainable. However, it is evident that in most cases, aerial maps are cheaper, and are exceedingly more useful and valuable because of the wealth of detail and information which they contain, and because of their accuracy.

ATHLETICS

B. R. TEARE

BASEBALL

After an otherwise disappointing southern trip, the baseball team opened its conference season brightly by winning from Northwestern, 8 to 5. However, the score sheets for the trip do not begin to show its value to the squad, for in each game and practice the men added much to their useful store of knowledge and experience. Until the game before Northwestern, Wisconsin came out on the small end of the scores with the exception of the game with Union University. The trip furnished the men with much needed practice and on the whole they played much better ball than the score sheets indicated.

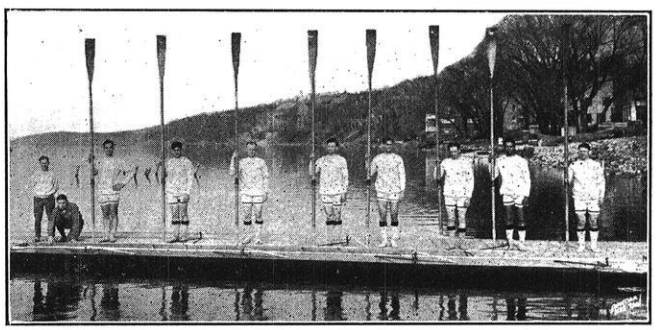
Following the victory from Northwestern the baseball squad prepared for the contest with the Michigan Aggies, the first home game of the season. Last year at Lansing the Aggies ran rough shod over the Cardinal squad. Wisconsin, therefore, had a strong motive in their game this year and were out to avenge that defeat, and were successful to the tune of 18 to 4. Their pitcher of no-hit, no-run fame in the preceeding game with Armour Tech was hit out of the box. Clausen and Stoll did fine work pitching for Wisconsin, and Wieland, shortstop, contributed not a little to the score by a home run in the third inning when the bases were full. The next Saturday the Illini invaded Wisconsin with the dope in their favor by virtue of a run of easy conference victories and, unfortunately, the dope proved correct. Fighting hard every minute, but never close to victory, the Badgers were downed, 10 to 4. Kinderman starred for the visitors, Larson played a good game at bat for Wisconsin, and Steen did well in the field.

Following the Illinois game Coach Lowman shifted the lineup and began strenuous daily practice for the game with Ohio state at Columbus on May 2. Ohio was tied with Michigan for the championship last year and had a goodly number of veterans back from that team. Their experience proved too much for the Badgers, and they won 4 to 1. However, with the exception of a disastrous first inning in which a walk, a hit and two errors gave Ohio its runs, Wisconsin played good baseball. Their inability to hit in pinches was the chief cause for their failure to annex more runs, as they had several good opportunities to do so. Stoll pitched for the Badgers and with the exception of the first inning did very well. Barnum, behind the bat, played an exceptionally strong game.

Ohio, Michigan, and Illinois appear to be the class of the conference due to their large number of veterans. At this writing Ohio is leading and seems to be holding down first place securely. Wisconsin has exhibited great possibilities and with a little more improvement in hitting should place in the first division.

CREW

For somewhat over a month now the rowing squad has been working out on the lake, improving its form and increasing its endurance. Even during the spring vacation, while most of the students were taking life easy, the varsity and frosh crews were practicing twice daily, and this practice has had its fine effect on the



—Courtesy of Photoart.

One of the Varsity Crews

men. It is still too early to make predictions, but Coach Vail has worked his squad into presentable shape. This has not been easy sliding, however. Handicaps, such as strong winds and rough water, sometimes prevented workouts in the shells, and until its new engine was installed about the middle of April, the coaching launch, Isabell, was out of commission. Without it, Coach Vail was unable to give his men the proper training instructions.

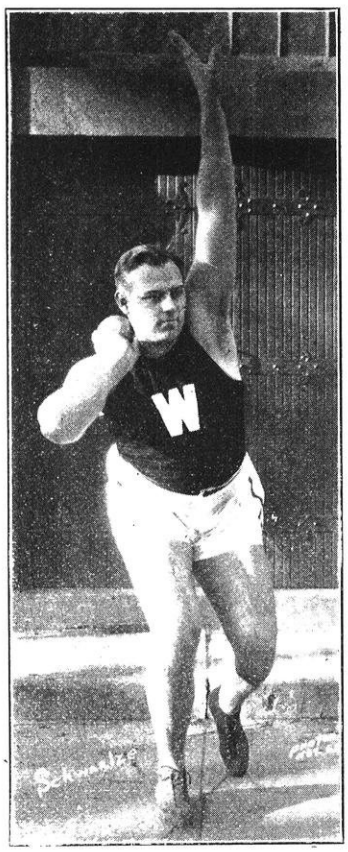
As yet no varsity crew has been picked, but the coach has been trying different combinations in an endeavor to find the best eight. Bentson, however, as stroke has shown his capability. Though not in school last year, he was stroke on the crew the year before. Last year Johnson filled that position exceptionally well although it is the hardest, for the stroke oar must regulate the power and stroke of all the men in the shell. The personnel of the crew changes from time to time, and as yet nothing definite can be said about it. One of the good combinations that has been working together is Bentson, Captain Teckemeyer, Grunetz, Houdek, Treichel, Sly, Gerhardt, Porter, and Coxwain Coulter. Not long ago Dad Vail cut the number of men on the

squad down to twenty-four. Generally there are from three to six shells out daily, including those of the freshmen, who have some promising material. Some schools, however, such as Harvard and Pennsylvania, send out many times that number and have a small flotilla of coaching launches to carry the coaches about.

Notwithstanding the lack of men and shorter season on the lake, last year the Wisconsin crew showed its power, and compared very favorably with others; and it is now rounding into the same pink of condition for this year. Gradually each move becomes more certain and positive as the men become more accustomed to their tasks. Lung power and endurance are also picking up with practice, and as the regatta season approaches the crew should again place Wisconsin's name with the best.

TRACK

After a two and a half week's trip across the continent and back, the track team arrived on the Sunday following spring vacation. Well may Wisconsin be proud of its tracksters, for on their journey they showed both skill and sportsmanship, and made Wisconsin's name greater wherever they went.



SCHWARTZE

Much to the disappointment of Badger fans, California's Golden Bears were victorious in the big meet held there, scoring 65 points. Wisconsin was second with 39½, and the All-Stars third with 29½. As luck would have it, on the night before the meet there was a heavy rain which made the field anything but suitable for real speed. The effect of this seemed to be greatest upon the Badgers.

In spite of the slow field, Pat McAndrews starred brilliantly for Wisconsin, winning a first and two seconds. Track fans were surprised to see him lead Barber, the fast dash man from California, in the century with a time of 9 9/100 seconds. He garnered the seconds in the 220 and the broad jump. Schutte added three points to the total by running second in the mile, and Kennedy unexpectedly came out first in the 440. Schwartze, the giant weight man and football player, in one of his best heaves of the season took first in the shot put, and had a second cinched in discus until one of his throws was declared illegal, and he was forced into third. The relay team, running in fine form, also added a third to the Wisconsin score. Chuck McGinnis, still handicapped as he was from a sprained ankle, won second in the high jump.

Leaving a fine impression at California, the team journeyed on to the Kansas Relays, where they fared somewhat better. The trip was less hurried and a few light workouts were taken on the way. On arrival, the team was in better shape than when at California, and it showed it in results, for the Badgers appeared as one of the strongest teams there. The most outstanding performance of the meet was made by Herb Schwartze, when he easily won first in the shot put, establishing a new intercollegiate record of 49 feet 10½ inches. His nearest competitor came more than three feet behind this. The sprained ankle kept McGinnis from more than a tie for third in the high jump. Only by a very small distance did Locke, of Nebraska, lead McAndrews in the century. Other results, such as second by the relay team and a tie for third in the pole vault, were equally good and helped place the Badgers among the foremost.

After a rest of hardly a week at home the track team was off to the Drake Relays at Des Moines, where Schwartze again starred for Wisconsin. Seeming to grow better in each succeeding meet, he not only broke the Drake records in the shot put and discus throw, but also set up a mark that comes within ten feet of the national record for the former. Other points came from a tie for fourth in the high jump, and third and fourth in the two relays, the mile and two mile. Altogether Coach Jones' men in two of the three great national relays, Kansas, Drake, and Penn, made an excellent showing.

Of the season's best records in the conference to date, Wisconsin holds second in the 100 yard dash, first in the 220, third in the 440, first in the mile, second in the two mile, first in the shot put, first in the discus, second in the high jump and fourth in the pole vault.

EFFICIENCY IN UTILIZATION OF FUEL BY PUBLIC-UTILITY POWER PLANTS CONTINUES TO INCREASE

The Department of the Interior has just issued a report prepared by the Geological Survey on the production of electricity by public-utility power plants for 1924, which shows that the average amount of coal used to generate a kilowatt-hour of electricity has decreased 1 pound in the five-year period since 1919. In 1919 3.2 pounds of coal were consumed in generating a kilowatt-hour of electricity. In 1924 2.2 pounds were required. In 1919 a ton of coal when utilized in a public-utility power plant to generate electricity produced 625 kilowatt-hours. In 1924 a ton of coal produced 909 kilowatt-hours. These figures represent an increase of 45 per cent in efficiency in the utilization of fuel. These results are based on the operation of all plants. Some plants are producing nearly 2,000 kilowatt-hours to the ton of coal.

EXTENSION NOTES

NOTES FROM MILWAUKEE DISTRICT

The Engineering students of the Extension Division in Milwaukee held a dance in the Gold Room of the Wisconsin Hotel on Friday, April 17. The Committee in charge of arrangements was: Kurt Wendt, chairman, Leona Fleischer, Marguerite Kneip, George Thill, George Mueller, and Malcolm Anderson.

H. A. Frommelt, instructor in Metallurgy in the evening classes in Milwaukee, is conducting a series of articles in the Milwaukee Journal on *Picking A Job.* These articles are creating very favorable comment from all parts of the state.

George A. Spinti III, instructor in Architectural Drawing in the evening classes in Milwaukee, was the designer of the life-size Dutch colonial stone veneer house erected on the stage at the Milwaukee Auditorium as the central attraction of the Home Show held during the week of March 23.

The students of the Extension Division are issuing in mimeographed form each week the *Cardinal, Jr.* The paper is edited by the following board: James Arter, Wilma Klevay, and Leo Promen.

An inspection trip through the Allis-Chalmers plant on the afternoon of April 2, under the direction of H. T. Avey, was made by about fifty students taking the course in Physics at the Extension Division. The young ladies in the class were accompanied by Miss Katherine Lehmann, counsellor of women at the Extension Division.

Prof. A. V. Millar, assistant dean of the College of Engineering, and Professor H. D. Orth of the Drawing Department called at the office of the Extension Division on April 15.

During the Easter Recess a number of freshmen and sophomore engineering students made a transit and stadia survey of the Norris Farm and Camp for Boys. The survey of this property, which is about 20 miles from the city, was started during the Christmas Recess. The field work and map are now completed.

The owner of an East Side property recently requested Extension Division students to survey a large elm tree in the east side residential district, as well as a residence. The object was to demonstrate that the house could be moved past the tree which extended over the street. Simple triangulation was employed and the work done out of class hours. The pleased owner is said to have secured a moving permit which had previously been denied him.

The school for electric metermen, which was held at the University on May 7-11, was a success in every way. Over seventy men attended the course.

Representatives of Wisconsin Electric Utilities in attendance at the Fifth Annual School for Metermen

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In twenty-one high schools of the smaller towns in the state there is a total of 440 seniors who will graduate this spring, writes a District Representative. Of this number 44, or 10 per cent, selected engineering as their life work. Of the number selecting engineering, 19 specified electrical engineering. It is interesting to note that Radio has attracted them to the profession perhaps as much as any one factor. It is also significant that the accomplishments in the field of aviation engineering have also had their attraction.

Mr. E. B. Henley, resident engineer in the Superior district of the Wisconsin Highway Commission, is about to move into his field office. The northern district expects to re-locate the highways in several places, as well as begin construction of the projects known as 406A and B. These projects were surveyed and designed by Mr. Henley during the past year.

Prof. H. P. Hammond, Associate Director of the Board of Investigation and Co-ordination of the Society for the Promotion of Engineering Education, was a visitor at the Extension Division in March. A special faculty committee is making a study of certain phases of Engineering in connection with the investigation being carried on by the Society.

THE SENIOR CHEMICAL INSPECTION TRIP

By HAROLD F. HAASE, *Senior Chemical*

The Senior Chemical Inspection trip to Chicago and vicinity took place on April 6 and 7. The fellows arrived in Chicago at various and sundry hours before dawn. We were just about ready to start at 6:00 a. m. when we discovered the absence of Peterson. After an hour had elapsed, the innocent cause of our delay appeared, and the senior chemical inspection trip was on.

Our first port of arrival was the U. S. Lead Refining Company at Grasseli, Illinois. At this plant 99 99/100 per cent pure lead is made by removing the various impurities — gold, silver, telurium, etc., — electrolytically. Guettler liked the garlic smell of the telurium so well that we had a hard time getting him away. Gerhardt finally persuaded him to leave. Poor Hall's only wish for a silver ingot souvenir is still unfulfilled.

From here we went to the Grasseli Chemical Works across the railroad tracks. Commercial acids, sulphates, insecticides, and other chemicals are manufactured at this plant. On being told by the guide that the plant occupied 320 acres, Andrus asked him if wheel chairs were furnished; whereupon he narrowly escaped being dumped into a vat of H_2SO_4. Brabender wanted to sample some of the Paris green, but Professor Watts interfered Of the walking race between Carlson and Professor Hougen we know nothing, since they were so far ahead of us that we were unable to see the outcome.

After lunch we went to the Standard Oil Refinery, where gasoline is made by the Burton cracking process. Sindt walked himself weary — we found him asleep under one of the stills. Ridgeway was curious about the hairpins in the hairpin tower of a still; he certainly needed some before he was through. We were all impressed by the large number of overhead pipe lines. One of the novel features of this plant is the candle factory, of which there are only four like ones in the U. S. Since the floors were waxed, our sheiks, Giles and Frochlig, received an attack of dancing fever. Ehlers contented himself with collecting vari-colored candles. Six bells, and one day had passed happily.

Tuesday morning we visited the Corn Products Refining Company at Argo. Some of the commodities manufactured here are Argo corn starch, Mazola oil, and corn sugar. This plant is quite new, and has some very fine buildings. Due to the periodic recurrence of dust explosions, the plant is rebuilt rather often. Wheeler's only complaint was that there were too many stairs to climb. Learning that this was a food products factory, Ortega ate himself sick trying to sample everything.

In the afternoon we went to the Illinois Steel plant at South Chicago. The things which interested the boys particularly were the huge 4500 H. P. gas engines, the 200-ton cranes, and the Bessemer converters. Kubista, Kuhe, and Eyer wanted to know what made a rolling mill, and Elfers wanted to know why. Note: the above quartet is still with us.

Esterline enjoyed his meals so much he desires to live in Whiting; we wonder if that is the only reason.

THE JUNIOR CIVIL INSPECTION TRIP

By F. J. HEBDA, *Junior Civil.*

Belonging to the category of events which are experienced once in a civil engineer's lifetime, the inspection trip qualifies to be set down on record as the most elucidating and gratifying journey ever undertaken by the Junior Civils. The party, which consisted of some forty engineers, Parsons, and three members of the faculty, met at the Northwestern Terminal Station in Chicago early in the morning on Monday, April 6, to inspect and make irrelevant comment on the station. Every nook of the station was visited. Rumor has it that the matron of the immigration department was concerned about "Shorty" Stivers' tag.

The first part of the afternoon was spent inspecting the foundation of the new Morrison Hotel forty-five story addition. The addition is of steel skeleton construction, adjacent to the present hotel and facing Clark street. The latter part of the afternoon was spent at the Underwriters' Laboratories where the boys learned of the various ways the insurance associations are combating fire losses. The first day worked havoc with the party, and Hotel Planters, the headquarters, seemed like what it wasn't.

Having stayed in that night, everybody was ready for the middle lap the following day. The morning destination was the Northwestern Terra Cotta Company where, with the exception of Whiteside — who had to report to the central police station, we followed the processes of the manufacture of terra cotta from the drawing room through the shipping yard without a casualty. In the afternoon, the Universal Portland Cement mill at Buffington, Indiana, was the center of interest. Here, again, the successive processes were observed — but with less luck. It was unanimously decided that neat cement is indigestable.

What the boys did that night in the wilds of Chicago has not been recorded; not a solitary engineer could be located. All were on deck for Gary the following morning, however, and the trip would have ended creditably for the engineers had not Spark Plug tried to walk off with an ingot and some rails.

One of the high lights of the last day was the luncheon at the Gary "Y" where the members of the Lions' Club gave vent to their vocal powers in honor of Wisconsin. In appreciation of this welcome the boys responded with "On Wisconsin" and cheers. The other notable event was the disbandment. Chicago is mourning its loss, but the engineers are glad it is over. Much credit is due Professors Withey and Van Hagan, and Mr. Stivers for the efficient manner which characterized their conduction of the trip.

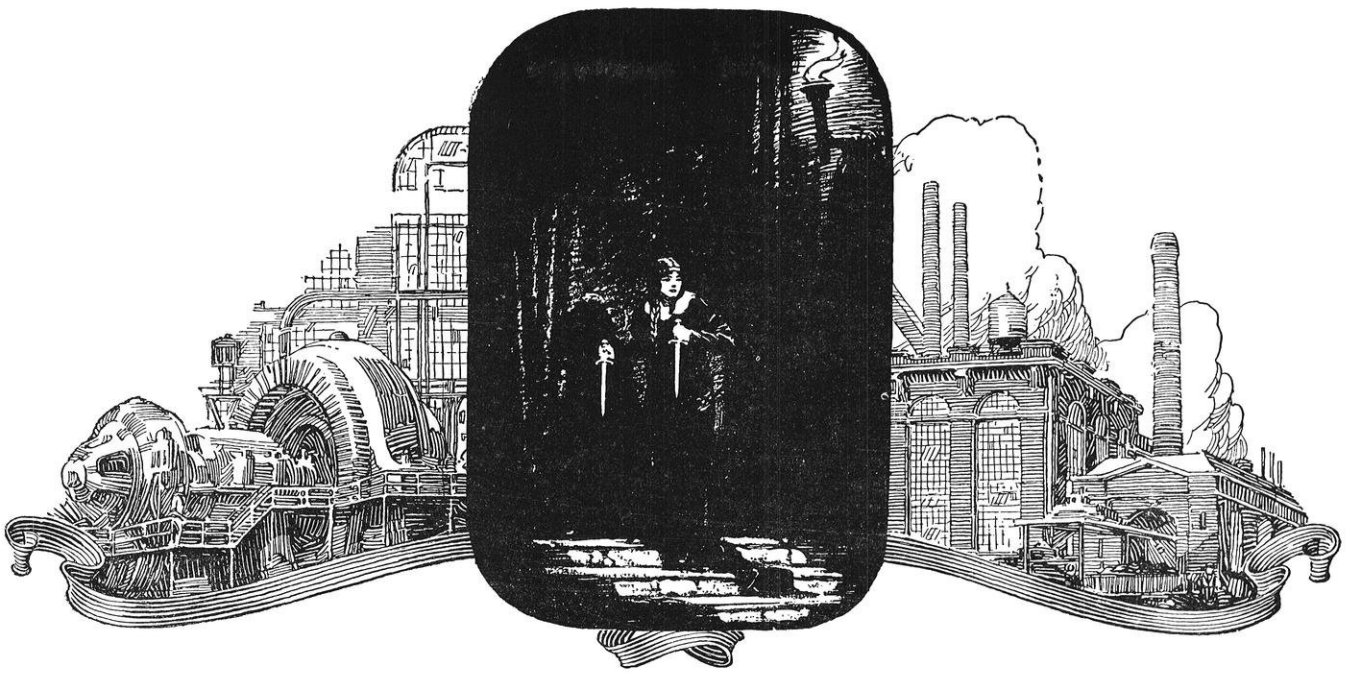
DAYLIGHT ILLUMINATION.

The angle of refraction being equal to the angle of incident, it is a simple matter to determine the correct angles to use in manufacturing glass which will give good illumination. But for proper industrial plant illumination, there is more to be considered than mere deflection of light. The direct beam of light must be eliminated in order to prevent sun glare, which is objectionable on account of its causing heavy shadows and strong contrasts which decrease the efficiency of employees and necessitate the use of shades which in turn reduce the light to such an extent that daylight illumination any distance from the light source is not sufficient. Therefore, in order to produce a glass which when used in the windows of industrial plants will produce as near to ideal illumination as possible, we must first eliminate the direct rays of the sun by deflecting the light to the ceiling and side walls which re-deflect it back to a distance 25 to 50 feet from the window throughout the entire working area. To accomplish this we have scientifically designed a type of glass which is named "Factrolite."

Factrolite consists of 30 ribs to the inch, running at right angles, forming 900 pyramidical prisms or 3,600 light deflecting surfaces which completely disintegrate the direct beam of light from the sun. Furthermore, the depressions in the surface of Factrolite are so slight that the accumulation of dirt and dust is minimized and can be perfectly cleaned with an ordinary dry scrubbing brush. Incidentally, the cleaning of windows is most important for keeping up production and increasing the efficiency of any industrial plant and should be given more consideration in plant management.

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,
St. Louis. New York. Chicago.



"THE PLAY'S THE THING"

JOHN BARRYMORE himself would "get the hook" if he did not know his cues, or read his lines as called for by the action of the play.

Engineers get cues, too—from the industrial drama of which they are a part. Like actors, their performance must fit the action of an economic play.

Thus the reason that the journals, the societies, the schools, colleges, teachers, and well-known public men, are urging engineers to study economics—to learn the nature and effect of economic laws.

To build the largest generator or the smallest meter, for example, is not always in itself a great engineering feat. The feat consists in having it ready at a time, a price, and with such features as the prevailing economic situation calls for.

In this sense engineers—and particularly Westinghouse engineers—must be "practicing economists". They must follow closely the "action of the play"—analyzing fundamental conditions in every field, and calculating their causes and probable effects.

All this, so that when a cue is spoken in factory or home, on farm or railroad, on the sea or in the air, they may be ready.

This advertisement is eighth in a vocational series, outlining the fields for engineering achievement in the Westinghouse organization. A copy of the entire series will be sent to anyone requesting it.

Westinghouse

ACHIEVEMENT & OPPORTUNITY

WESTINGHOUSE ELECTRIC

Kindly mention The Wisconsin Engineer when you write.