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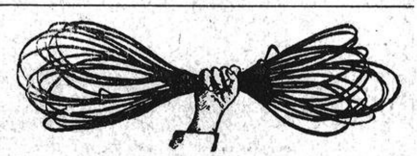

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The Wisconsin Engineer

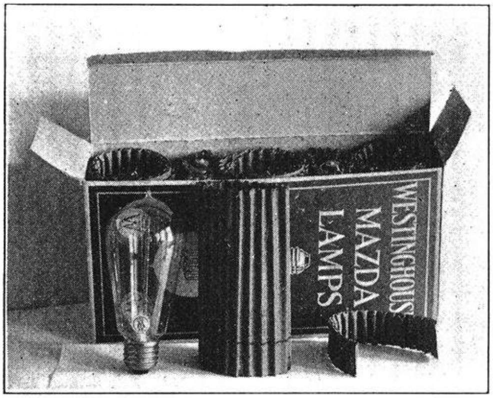
VOL. XXIII DECEMBER, 1918 NO. 3

METHODS OF MANUFACTURING INCANDESCENT LAMPS

H. M. Robins

Superintendent, Westinghouse Lamp Company

The incandescent lamp has become an article of every day use but its manufacture is a series of interesting problems only partially solved. This fact is the joy of the lampmaker's life,—it is the health of the industry,—it is progress.



Whoever has not seen the operation of a lamp factory should think of large numbers of small parts, bits of very fine wire, little pieces of glass and metal which are fused together in the process of making lamps. He should think also of accuracy of measurement in reference to the filament or glowing element of the lamp, and of frequent assorting into sizes of the glass parts.

The Filament

Raw oxide of tungsten is purified by the lamp manufacturer and reduced to metallic tungsten powder,—the particles of which are sintered together in the electric furnace at high temperature. The slug so formed is reheated and worked by repeated hammering, into a long rod, which is then drawn out by passing it through hard dies of successively smaller sizes until, if required, a wire is secured that is only a few ten thousandths of an inch in diameter but many thousand feet long. This wire has a greater tensile strength than steel and is extremely refractory. It is wound on paper spools with its coils overlapping in a manner which prevents tangling, and is carried in stock in this form. When mounted inside a closed bulb from which all active oxygen has been removed, this fine filament of metal will withstand the heat of incandescence, giving off light of excellent quality.

The trade demands a standardization of the quantity of light, the consumption of electrical energy, and the voltage at which lamps will operate. The limits of permissible variation are narrow. It is necessary, therefore, for the manufacturer of lamps to control the sizes of filament very carefully both as to diameter and the length to be mounted in a lamp of required wattage and voltage. A commercially operated micrometer caliper will not record variations of diameter in the small sizes involved, with sufficient accuracy, but by weighing uniform lengths of filament on a sensitive torsion balance, which can be operated rapidly and with precision, the manufacturer does control filament diameter within the narrow limits required by the specifications.

After the filament wire is sized, it is coated with a chemically compounded substance which assists in freeing the bulb of active oxygen in a later operation. As the coat is applied, the wire passes through an oven which dries the filament and permits immediate re-spooling. The torsion balance again plays its part in checking the uniformity of the coat. The chemically treated filament is delivered to the Mount Department, where it is wound on a form which is adjustable and is set so as to define in millimeters the length of filament, to be mounted in each lamp.

The Support

It will be necessary for us to turn from the consideration of the filament which is now in the Mounting Department on forms, and manufacture a support for the filament on which it may be mounted. The materials to be used are cane glass, stem tubing, and a pair of small leading-in wires of an alloy having the same coefficient of expansion as glass. The stem tubing is assorted as to outside diameter and classified into several classes of narrow limits. Each of these classes is then assorted on the basis of thickness of the tubing wall. It is not essential that pieces of glass of the same diameter and wall thickness be made up into lamps of the same wattage or type, but it is essential, when working glass, that the pieces are about the same weight and will be acted upon by the gas fires in manufacture at about the same speed. It is for this reason that the assorting is made carefully. The pieces of tubing so assorted are then cut up into lengths suitable for each type of lamp, ranging from about one

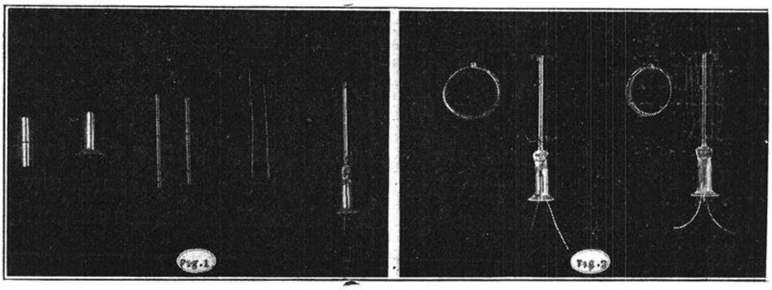


FIG. 1. *Tubing, Flare, Cane, Arbor, Lead Wires, and Stem*
FIG. 2. *Inserted and Mounted Stem; Coil of Hook Wire; Coil of Filament*

inch to two inches long, by being held against a sharp edged carborundum wheel. The combination of the scratch made and the heat generated is sufficient to make a clean smooth cut, the tubing parting at the scratched place.

Cane glass about an eighth of an inch in diameter is assorted in a similar manner and is likewise cut into suitable lengths.

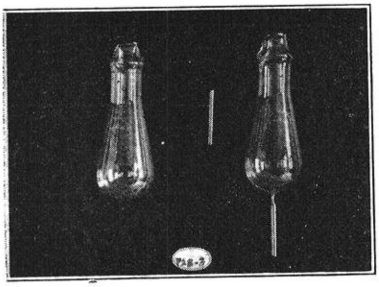
The tubing is flared at one end by means of automatic machinery, little buttons are formed on the cane, and the two together, with a pair of leading-in wires, are fused into a seal. The three parts thus joined are known as a stem. In another automatic machine operation, supporting wires are inserted into the two glass buttons. These wires are in the form of hooks and supply the support for the filament. The inserted stem is mounted on a metal tray having a hundred pegs, and eight of such trays, capable of holding eight hundred inserted stems, become the unit from the standpoint of handling. This unit is delivered to the Mounting Department where eight forms of filament, mounted as described above, are included with the unit and delivered to the mounting operative. The eight forms of filament contain sufficient wire filament for eight hundred mounts.

Mounting the Filament

On receipt of this material, the mount operative unwinds the filament from the form, winding it on the supporting wires on the inserted stem, and clamps the ends, by means of a powerful foot clamp, to the upper ends of the two leading-in wires. The inserted stem is then called a mount and, as wound, is transferred with ninety-nine of its fellows to another tray, replaced in the buss with seven more trays, and delivered to the Sealing Department.

The Bulbs

Before the mount can be sealed into a bulb, it is well to consider briefly the preparation given to the bulb preliminary to this operation. Bulbs are purchased, much the same as bottles,



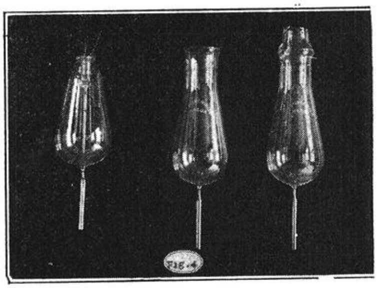


FIG. 3. *Etched Bulb; Top Tube, and Tubulated Bulb*
FIG. 4. *Tubulated, Cracked off, and Sealed in Bulb*

from the glass maker. They are delivered in hampers containing approximately five hundred bulbs, each carefully wrapped and packed in tissue paper. After unwrapping and as a part of the same process, each bulb is passed through a sand blasting machine which mechanically etches the trademark on the side of the bulb. They are then deposited in a tray having twenty-five or fifty holes, depending upon the size of the bulb, and transported on a conveyor to a set of washing tanks where the entire fifty bulbs are locked in a tray and immersed in water. As the water bubbles out of the bulbs, it carries with it any dust or foreign matter which may be inside of the bulbs as a result of shipment. For convenience in transporting, the trays of bulbs are stacked one on top of the other six high and are delivered to another room known as the Tubulating Department.

Here a hole is punched in the smooth end of the bulb by directing against this point an extremely sharp, round flame until a small circular section is heated. By blowing low pressure compressed air through the inside of the bulb, a hole is blown outward, leaving a small flared edge at the heated point. To this edge is fused a small tube about two inches in length and perhaps a quarter of an inch in diameter. It is through this opening that the bulb is later exhausted and it is near the point of fusion that the tip of the lamp is made after the air has been exhausted. The bulbs so tubulated are mechanically conveyed to the Sealing Department ready to be sealed over the mounts which are constantly being supplied by the Mounting Department.

Sealing the Bulb

The sealing operation also is automatic. The mount and bulb are placed on a machine in separate holders which, however, revolve about the same axis in synchronism, the mount being properly located inside the bulb. In the operation of the machine, the revolving lamp parts are subjected to small but very hot gas fires which melt down the neck of the bulb until it joins on to the flared end of the mount. The two are sealed together at this point of contact and the portion of the bulb beyond the seal which is superfluous is melted off and removed, after which the operative removes the lamp, and, while it is still hot, straightens the mount in the center of the bulb, by hand.

Exhausting the Bulb

The lamps are then drawn in stacks of three hundred, into the Exhaust Department, where they are subjected to vacuum pumps and mechanically exhausted to a degree requiring a gauge reading in ten thousandths of a millimeter of mercury to indicate it accurately. During the time that the lamps are being exhausted, the bulbs are also being heated to a temperature almost sufficient to melt the glass. This is to insure any small amounts of moisture being changed to superheated steam so that it can be withdrawn from the lamp.

An interesting point in connection with the exhaust is the fact that it is absolutely impossible to exhaust completely a globe of this kind by mechanical means since, on each stroke of the pump, the atmosphere inside of the bulb is rarified but not completely with-drawn. After this process has been repeated for some minutes, the air remaining in the bulb is extremely rarified but there is sufficient oxygen, either in the form of free oxygen in the air, or combined with moisture, to be a source of trouble during the burning life of the lamp. However, since it is impossible to exhaust the lamp completely by mechanical means, the operative, at the end of a predetermined schedule, tests for degree of vacuum, and, if this is satisfactory, heats up the little tube at a point adjacent to the bulb, and seals off the lamp at this point. The tip of the lamp, with which everyone is familiar, is evidence of this operation.

Flashing

The flashing operation, which is really a part of exhaust, is the first operation in which the filament is subjected to electric current. In this operation, the lamp is put in series with a constant resistance. The lamp itself has a varying resistance inasmuch as its resistance cold is probably less than one-tenth of its resistance when heated. The total resistance of this series circuit, whether the lamp is cold or hot, is sufficient to prevent a too excessive rush of current through the lamp which is still incompletely exhausted and which might otherwise burn out. As the current flows through for the first time, certain gases in the filament and in the chemical coating, are set free. The damaging portions of these gases which tend to deteriorate the filament, together with such oxygen as may have been left in the bulb after the mechancial exhaust, are combined with certain elements given off by the chemical with which the filament was coated. The resulting compounds are probably in the form of minute quantities of powder which are invisible to the eye, also some neutralized gases in small quantities which have no oxidizing effect on the filament. After the lamp is flashed and all gases neutralized, it may be safely subjected to the voltage for which it was designed.

Basing and Inspection

The remaining operations in the manufacture of the lamp are basing and final inspection. The basing operation consists of cementing onto the neck of the lamp a base to whose terminals the leading-in wires are soldered. This base makes the lamp convenient for general use. The lamp is then given a rigid inspection for mechanical defects, cleaned, labelled, and packed in cartons, ready for shipment.

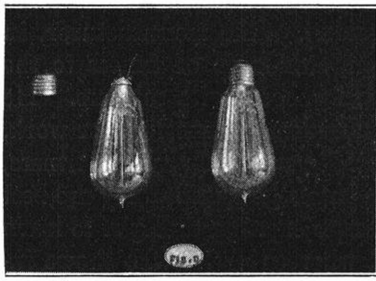
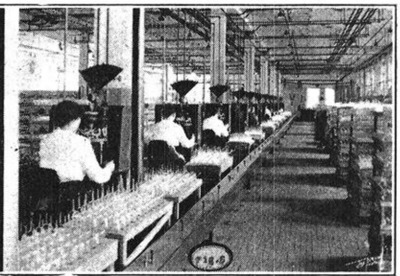



FIG. 5. *Exhausted Lamp, Unbased and Based*
FIG. 6. *Tubulating Department*

Automatic Machinery

The use of automatic machinery in connection with lamp making is increasing every year. Mechanical engineers of high order are constantly working on the problem of developing machinery to combine operations and facilitate handling of material. The nature of the work is such that nearly all of this development has been done by the lamp manufacturers, whose engineers see the possibilities and think them through to completed solutions. With the increased use of automatic machinery, the problem of maintenance has brought about, more clearly than before, the realization that good work cannot be done with poor tools and that machines must be kept in continuous and perfect repair if manufacture is to continue uninterrupted and at a low cost.

Training Operatives

As might be expected with small fragile parts, where the work is light, the operations require skill and dexterity. Women make admirable workers at lamp making where nimble fingers rather than muscular strength is required, and, in America at least, most of the operations in the incandescent lamp factory are done by women.

Not only is the material used in manufacturing lamps of a fragile nature, but it is expensive and the total value handled by each worker during a day, compared with labor, is very high. This is particularly true of the completing operations. It follows that spoilage may become the greatest expense incident to the manufacture of lamps; therefore, all contributing causes are watched with the greatest interest.

Skill is acquired only with training. The manufacturer, in selecting workers, cannot maintain standards of fitness to the extent used by the Government in choosing its soldiers. He must take most of the applicants presenting themselves for work, endeavor to classify them as to intelligence and physical fitness, and place them on work for which, in his judgment, they are best suited. He knows that it is useless to expect a dull girl to learn a particularly difficult operation, whereas a girl who shows interest and intelligence will become an excellent operative on such work. An eye test is made to ascertain whether the applicant has at least eight-tenths normal vision. If the condition is otherwise, this defect is conscientiously brought to her attention in order that she may take care of this most valuable asset. The manufacturer encourages attention to such matters in order that the applicant may be employed to mutual profit.

Working Conditions

During the early days of each worker's training, when she is not accustomed to the handling of fragile material, much of the product which is handled is so injured that it must be rejected as defective. This period is a source of much expense. However, the employer knows that this expense is necessary to the training of the worker and must, therefore, see it through. He is not anxious to repeat the experience at frequent intervals and a low labor turnover becomes particularly desirable from this standpoint. Proper compensation, pleasant surroundings, good sanitation, ventilation, and lighting, orderliness, recreation, local interest, and loyalty are all things which not only are desirable but, in their influence upon labor turnover, are of vital importance to the plant's success.

If compensation were merely payment for so many hours of effort, it would be highly inaccurate as a measure of the worker's worth. In the modern lamp factory it has a broader meaning. Piece rates create interest in productiveness but may foster carelessness in handling material, resulting in increased spoilage. Add a premium feature to the piece rate earnings, increasing substantially for corresponding decreases in spoilage. The worker becomes a partner receiving a share of the value saved. Interest is permanent and properly directed. Compensation more nearly measures worth.

It has been generally accepted that environment has much to do with the development of individuals. The problem of creating suitable working conditions for women has already received careful study by employers. Primarily, the lamp factory is a place for work. However, work should be distinguished from drudgery. Work rooms should foster industry but conserve physical energy. Well lighted, airy rooms, light walls and clean floors, may not be noticed particularly by the workers but there is a mental attitude resulting from such conditions which is decidedly worth while.

Maintenance of aisles and working spaces promote orderliness which is contagious throughout the actual operations. Moreover, such a condition expedites the travel of material through the factory. The customer's order does not wind its way around obstructions in the work rooms and therefore needs less prodding on its journey in order to reach the shipping department on time.

Workers take pride in being connected with a progressive establishment and in many cases are attracted by the exterior appearance of a factory. From this standpoint, lawns, decorative fences, flower beds, and vines become an asset of far more value than the actual money expended.

Much of the work of a lamp factory, as the reader has noticed, is accomplished by means of automatic machinery. The parts to be made up are numerous and individually of small value. Productive efficiency in the handling of expensive machines is of great importance from the standpoint of the investment involved, yet this results in monotony. In itself, monotony is not a disadvantage in connection with such operations as it results in less fatigue than those operations requiring not only continuous physical efforts but continuous thinking as well, nevertheless continuous physical efforts even without mental effort is fatiguing and motion studies are worked out in connection with each type of machine so that the worker will become tired as little as possible during her day's work.

Means of recreation during the noon hour are provided. Competitions as to quality and performance during working hours are devised. Outside socials and athletics are encouraged so that a local interest may be built up about the factory and its activities.

Loyalty cannot be created artificially. It must be real or it does not exist. Its growth in the factory depends upon the justice and squareness of the treatment accorded to all. The fighting spirit is its direct result. It brings enthusiasm such as will overcome all obstacles.

OH BOY! THAT'S THE GIRL

THE SERVICE OF THE AMERICAN RED CROSS

Erecting a 600-bed hospital on the old race track at Auteiul, outside Paris, in a fortnight is the record-breaking bit of engineering accomplished by the American Red Cross. Not long ago there came word to the Red Cross in Paris that such a hospital was needed at once and, knowing that "at once" meant a rush order, Red Cross workers in Paris started under a full head of steam. The great storehouses of the Red Cross were drawn upon and the steel structure of the hospital and the great canvass covering were loaded into more than 100 camions and sent on their way. The steel superstructure was first set up and then covered with the canvass; windows and doors were inserted and plumbing installed. Within the fortnight patients were quartered in the hospital.

The activities of the Red Cross are manifold; it has done many things in service to humanity in the name of the American people. The Red Cross has received more than $325,000,000 in money and materials from the American people. Of this sum, it spent $106,000,000 during the first six months of this year. In France, it spent $34,000,000 up to June 30. It has appropriated another $36,000,000 for the period ending December 31. In Italy, it will have expended some $20,000,000 by the end of the year. In the United States, it spent $12,000,000 in the first half of 1918.

On May 1 of last year, the Red Cross had 486,194 members, working through 562 chapters. On July 31 of this year, it had 22,648,103 members, besides 8,000,000 members of the Junior Red Cross. These members now carry on their activities through 3,854 chapters, which again divide themselves into 30,000 branches and auxiliaries.

Eight million noble American women have given their time to work in canteens and in the making of relief supplies. For the period ending July 1 last, the Red Cross chapters through their workrooms produced 490,120 refugee garments, 7,123,621 hospital supplies, 10,786,489 hospital garments, 10,134,501 knitted articles, and 192,748,107 surgical dressings. This makes a total of 221,748,107 articles with an estimated value of $44,000,000. These articles were largely the product of women's hands and by the same token infinitely more precious than could have been the output of factories or machines. The articles, going into operating rooms, to homeless refugees, and carrying comfort to our men in the field, convey a message of love from the women of this country entirely distinct from the great money value of their handiwork.

The Red Cross must continue its service for humanity as the steward of the American nation. In order to do this it must have the united support of the people, so it has set aside the week of December 16 to 23 for its second annual Christmas Roll Call. It is hoped that then every American will become a member of the Red Cross, as a reconsecration of the whole people, an inspiring reassertion to mankind that, in this hour of world tragedy, America's supreme aim is not to *conquer,* but to *serve.*

AN OBJECT LESSON IN ECONOMICAL DESIGNING

The value of good engineering is shown by the work of the Engineering Division of the Ordnance Department. Carefully designed crating of field guns for shipment to France has already saved railroad space equivalent to 2,558 cars and ship cargo space of 5,671,753 cu. ft. The strategic value of the space was more important, but its cash value was $34,362,923. By redesigning the copper driving bands on the shell, the range of one of our guns was increased 2½ miles and the accuracy so improved that a given number of shells will fall into one-eighth of the space formerly covered. Modifications in the design of star and parachute signalling cartridges saved $1,000,000. Substitution of antimony for tin in the slugs of the 30-caliber cartridge saved $5,000,000. A change in the clips saved another million. Four million two hundred fifty thousand dollars was saved by redesigning small-arms amunition boxes. Increasing the thickness of helmet steel by 0.002-in. enabled the contractor to draw the helmets in one operation instead of two and saved $80,000. Would you like to know more about this Engineering Division; how it is organized and how it works; what obstacles were overcome in adapting the French 75 mm. gun to American production and how we improved the weapon; or why the German 75 mile gun was a failure? If you do, look up, "The Engineering Division of the Ordnance Department" in the American Machinist for Nov. 21, 1918.

SOME PHASES OF MILITARY ROAD WORK

GORDON F. DAGGETT

Engineer of Surveys, Wisconsin State Highway Commission

Among the many problems being developed during the present great world crisis, one of the most interesting is that of the construction and maintenance of battle front and communication highways. A great deal has been written on the subject, but the problem has only been touched, due to the fact that definite information cannot be obtained during the conflict.

One of the great needs of the armies of the Allies has been for technically trained highway engineers,—men who not only know their business from the professional standpoint, but who are capable of assuming administrative charge of affairs. These men must, in general, be university trained engineers. The young civil engineer has been inclined to shy at the profession of Highway Engineering in the past. He has been justified in that attitude in a way, but it is to be hoped that the need of highly specialized, trained, technical engineers will be met to a greater degree in the future by more young men selecting that profession. They must be made to realize that the highway engineer is just as important as the mechanical, electrical or mining engineer.

Developments in military road work are coming so fast that it will be of interest to study briefly the trend of highway construction and maintenance, beginning with the punitive expedition of the United States army in Mexico in 1916.

Road Work in Mexico

The punitive expedition clearly indicated the necessity for the proper training of men and the possibilities of trained men and animals in transportation. Motor trucks were first used in any great number by the U. S. army on this expedition.

In general, the highway problem in Mexico consisted in providing roads for a traffic, the main portion of which required a boulevard, under conditions where even dirt roads were difficult to obtain. This shows precisely the problem confronting the highway engineer, and further emphasizes the need of a special and technical training.

The principal type of road that was constructed was the dirt road, commonly known as the earth road. Dirt roads did very well for the first few trips, but soon became impassable and the need of reconstruction soon became a momentous problem. Chuck-holes developed. These were filled, and the roads kept open for traffic. The light sand encountered made dust from twelve to eighteen inches deep. The highway engineers realized that a new system of roads must be constructed, and secured the necessary machinery consisting of engines, graders, scrapers, rollers, and drags, and proceeded to construct what was termed a "sunken road." The construction virtually consisted of an intensive maintenance program. The roads were graded and crowned by graders pulled by tractors. Tractors of the caterpillar type proved to be the best for all conditions as they could pull without burying themselves into the ground. The ruts were graded out, rather than any attempt being made to fill them. This resulted in a "sunken road," and permitted the use of hardened virgin ground without a continual excavation and clearing out of new roads. These sunken roads with no drainage naturally were unsuitable for wet weather, but with the well graded road, on one side specially prepared for and used only during wet weather, the problem of making passable roads and maintaining traffic under all conditions was considered solved. The "sunken" or "shaved" road was a decided departure from the usual road making principles. These roads were scraped to a depth approximating twenty-four inches with an average depth of one foot, over a width of about sixteen feet. Many other roads were constructed, but they consisted of the ordinary type of crowned earth road with good side ditches, and the necessary culverts to care properly for the side drainage.

One feature that was of considerable assistance in preserving the road, was the control of the traffic. The traffic of the Mexican expedition consisted of one truck train (thirty trucks) a day over each point in the road each way. The average truck was two and one-half tons. This meant that the road was subjected to traffic which produced a wheel pressure of from three-fourths of a ton to probably about two tons.

The lessons that were learned by the engineers and officers of the punitive expedition into Mexico in the year 1916, were in many ways stepping stones to the methods that have developed in the German war.

The French Highway System

France, with a population of 39,000,000, had, when the war started, over 370,000 miles of fine macadam roads. These roads were well drained, graded, and nearly all were covered with a hard surface of either waterbound or bituminous macadam. The main system is called the Route Nationale and Route Departmentale. The width of the national highway is sixty feet, with a metalled roadway twenty-four feet wide and a graded section fifteen foot wide on each side, making the width of traveled way fifty-four feet. The departmental highways are forty-two feet wide and surfaced for a width of eighteen feet with stone macadam. The system of secondary roads consists of about 105,000 miles, which are graded for a width of thirty feet including side ditches. The tertiary roads, comprising approximately 185,000 miles, are graded for a width of twenty-seven feet.

The first German drive for Paris in 1914 was stopped because this fine system of macadam roads, made it possible to keep troops and supplies moving in a steady stream to stem the tide of oncoming Huns, and the battle of Verdun was fought, so far as France was concerned, with soldiers, ammunition, guns, and supplies transported over highways, because the one railroad that could supply the section was cut off by the Germans. These two instances demonstrated the great military importance of good highways.

Difficulties of Maintenance

Military highways receive hard usage. The traffic is both heavy and continuous. Motor trucks that weigh from three to five tons, carry loads of four to five tons, and travel in fleets, do much damage, while the heavy guns drawn by 17-ton caterpillar tractors literally pulverize the surface. We have heard a good deal about the effect of shell fire upon the roads; but, according to the information at hand, the destruction from this cause is much less than one might infer. Shells that, in loose earth, would bury themselves before they exploded, burst almost at the moment of contact with the hard surface of a road and expend their force in the direction of least resistance. Consequently shell holes in the roads are much shallower than in the fields.

The highways must be maintained under severe conditions.

At critical times the roads must be kept in use constantly so that it is difficult to find an opportunity to add material and surface it properly. It is also difficult to get the material to the place where it is needed. If the highway becomes impassable, the army is helpless. In the fall of 1915, certain sections of the British armies had to stop fighting because the roads could not carry the needed materials.

During the battle of Verdun, the main highway carried an average of 5,000 motor trucks every twenty-four hours over a length of about forty miles. The roads were kept in repair by putting on broken stone where obtainable,—in many cases from the foundations of wrecked buildings. When there came a lull in the traffic, the roads were scarified by hand and the road surface was rebuilt with broken stone to a depth of about two inches.

Organization for Military Roadwork

During the early stages of the war, all road work was controlled by the regular military establishment. Later it became imperative that a highway corps should be created and, after some months, this was done in both the English and French armies. When the new department was formed it was found that military prejudice must be overcome. Fortunately the right men were placed at the head of the new organization, and today the armies have come to rely on the highway engineers for all construction, reconstruction, and maintenance of highways. The highway corps had to reorganize the work, and to do this without friction was no mean task. The road gangs at that time were not accomplishing much, but the installation of modern business principles, together with a knowledge of what was needed, trebled the efficiency of the highway gangs in a very short time.

All road building and maintenance in the American territory has been placed under the general control of the Director General of Transportation. He has delegated the responsibility for all highway operations to a Manager of Roads, who has an organization of his own. The relations between the staff of the Road Manager and the technical troops in the field is somewhat similar to those that ordinarily exist between a State Highway Department and a contractor. The office of the Road Manager not only designates where work shall be done, but relieves the field officers of the routine involved in getting shipments of construction plant, materials, and supplies to specific places and at specific times.

Labor

The class of labor used in the British and French road work includes German prisoners, Indian cavalry, West Indians, Chinese, English, French, and Canadian labor battalions.

Road Machinery

It has been found impossible to use steam rollers at the front in any kind of road work. The puffs of steam and smoke disclose their presence and make excellent targets for enemy shell-fire. Therefore the gasoline driven machine is used exclusively.

Materials

Road building in the war zone has many interesting problems, among them that of the utilization of materials at hand. In one instance where stone could not be obtained for repairing a portion of the twenty-four foot road leading out from Acheux, stone from the outer six feet on each side of the road was loosened and thrown onto the middle, making twelve feet of a fairly good road. On other roads, planks have been used to advantage. They are very expensive on account of transportation required, and the fact that they are hard to obtain at the battle fronts. However, millions of railway sleepers and great quantities of three-inch plank were used by the armies in their advance on the western front. Sir Douglas Haig, in his dispatches, has mentioned the value of the plank roads to the British army, in their big drives during the rainy season.

The materials used for construction at the front in the early part of the war were often strange and consisted of those upon which the engineer could conveniently lay his hands. There are village sites, where every available stick and stone has been put to military uses. The brick and stone were taken for the roads, the timbers and plank were used to bridge shell holes, and what was left was used by the armies for camp-fires. A more complete obliteration can hardly be imagined. But all this was changed when the road department became better organized. Stone and plank in quantity have been furnished for roads on the shell-pitted areas.

Type of Construction

The soft French limestone is the principal road material in France. It gives excellent service and forms the basis of the macadam roads. It has been found better, however, to discard the telford construction which the French have used; the roads seem to give better service where the large stones are laid flat. This gives greater bearing power and the road will carry more load than on stone laid on edge. The best sizes of stone to carry the motor traffic at soft spots are the four, five, and six inch.

It appears from the most reliable and first hand information, that the waterbound macadam, terford, V drains, and stone base are the most effective purely military types of construction. Some may wonder at this, but it is to be remembered that the maintenance requirement controls under actual fighting conditions. Repairs must be made easily, rapidly, and without in the least interrupting or diverting traffic.

The records furnished us so far indicate that water-bound or clay-bound macadam has been generally used by the French and English immediately behind the Western Front.

War zone roads must be built quickly and under conditions of traffic hardly to be conceived. Certain war roads are useful for only short periods and for strategic reasons should be easily removed and projected in other directions. Captain J. McLean Jasper, of the Imperial Forces, says regarding macadam roads in the war zone:

"Briefly I should say that for battle arrangements and service conditions, roads within two miles of the front line should be of a temporary nature and easily transported from place to place. From two to eight miles back they should be of a permanent nature. From there back the importance of roads drops off somewhat because the railroads should bear the greater weight of traffic. The condition for quick disembarkation of troops and handling of material must be carefully considered in the whole scheme of things, otherwise a great deal of lost motion and delay will be caused. I am considering the roads necessary for the concentration and movement of troops under battle conditions, which is the thing that concerns us most at present. If battle conditions are designed for, road service for trench warfare will be quite sufficient."

Perhaps the best and most comprehensive presentation of the subject of war highways has been made by Major General Leonard Wood, U. S. A. What he says is much to the point and so practical that we cannot do better than quote him as follows:

"Of course, war demands a nation's entire resources, and the most efficient means of delivering them are needed. Thus a systematic well-planned network of roads which can be regularly used commercially is not only a good investment, but may be of tremendous value to our military forces. While hastily or improperly built roads should not be rushed at this time, on the chance that they might be of some strategic value to our armies, substantial highway construction of economic value should not be curtailed because we are at war. Through routes connecting centers of production, or population, aid in the prosecution of war by providing additional facilities for transportation of men and supplies.

"There are also many roads, more especially along our coasts, the construction of which would probably not be warranted from the commercial standpoint, but which are a very real necessity in coast-defense plans. These, for example, might connect points of supply with selected points of defense, or enable the easy shifting and concentration of defending forces. Present roads are inadequate for such purposes in practically all coast states. It would be well to select the roads to be improved at this time after consultation with the War Department, and build those which have the greatest strategic value. It might frequently happen that a location which would make the highway a military asset would serve the community as well as another location which might be a military liability.

"As a general rule, highways and highway bridges which are capable of sustaining modern commercial traffic will also stand under military loads. A bridge or road designed for the commonly used loading of a 17-ton road roller will be safe for practically all military loads and can be easily strengthened for the heaviest field guns now in use. Military plans are based on existing conditions and, therefore, field guns and their carriages are designed to be transported over the bridges and roads in the theater of operations. If heavier structures were the rule, larger guns would be forthcoming. At present the largest siege guns are transported in sections, the heaviest section weighing about 18 tons, most of which is on one axle, but distributed over a considerable area by means of "caterpillar" wheels.

"Highway bridges to be of military value should, therefore, be designed for the heaviest commercial loading with a clear width of roadway of not less than 24 ft. and preferably 30 ft. From the military standpoint it is desirable that they should be (1) as nearly as possible of standard design, (2) difficult to put out of commission, (3) easy to strengthen, and (4) easy and quick to repair or replace in case of partial or total destruction. Structural steel, reinforced concrete and masonry are the only materials which answer these requirements, and at the same time have the permanence desired for this class of work. Structural steel fulfills the conditions named more completely than the others, but simplicity in design, using standard members and substantial construction, are prime requisites. The heavier the type of construction the more adaptable it is to any given military situation.

"To be of value to armies in campaign, roads should be paved for a width of not less than 18 ft. and preferably 20 ft. and the total width between inside edges of ditches should be at least 30 ft. This will provide for two lines of motor trucks and allow a space on either side for the emergency repairs of broken-down vehicles, or the movement of troops. A shoulder width of 12 ft. either side of the pavement, would be very desirable, as this would give room for infantry marching without interfering with the use of the pavement for loaded vehicles. Low grades are, of course, very desirable. A grade of 3½ per cent, if not too continuous is without objection, and occasional short stretches of 5 to 6 per cent grades can be negotiated without serious difficulty. Any steeper grade has a marked tendency to bunch and slow up traffic, requires lighter loading or more animals, and consequently reduces the capacity of the road.

"The foundation for the paved road should be capable of carrying the loads mentioned above, and its depth of course depends on the material used, character of subsoil and climate. It is apparently the tendency in this country to slight this part of the work in order to reduce costs. The speed as well as the weight of motor trucks demands the most painstaking and substantial construction. The foundation and substructures should receive the most careful attention, as they are liable to fail in bad weather or when needed in an emergency. Heavier foundations than are customary would not only be good military insurance, but also lengthen the life of the wearing surface under peace-time traffic.

"The requirements of the wearing surface for military purposes may be stated as, (1) absolute dependence in all kinds of weather, in all seasons of the year, under the most severe usage, (2) wear resistent, so that extensive or frequent repairs or maintenance will not be necessary, (3) easy and quick to repair without interrupting traffic and with simple tools and materials, (4) low in tractive resistance, and (5) offering a good foothold for horses and a good grip for rubber tires, and at the same time smooth enough to allow a good rate of speed for motor trucks. Here again it is seen that military requirements coincide closely with industrial considerations. Only the highest types of standard pavement surfaces answer these requirements completely. Wearing surfaces which are not suitable for use in our cities will not stand up under concentrated highway traffic. The block pavements such as stone or vitrified brick are probably the best types, but in localities where these materials are not available carefully prepared sheet pavements of proven worth can be used satisfactorily. Methods of construction or types of surfacing which are used to cheapen the first cost at the expense of the requirements state above should not be used. They are also proving uneconomical under modern commercial traffic.

"The shoulders of a road paved for a width of 20 ft. being little used for traffic, may be lightly surfaced for a width of from 2 to 5 ft. on either side. The tractive resistance of this shouldering material should not be much greater than the pavement in order to avoid accidents when motors going at a high speed turn off the paved portion. In many localities oiled, rolled earth will answer; in others crushed rock must be used.

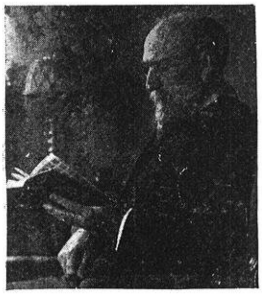
"The construction of highways and highway bridges built by an army in the field would necessarily be governed by other considerations than those discussed. Timber would, for example, be used to a considerable extent in bridge building. The European armies, however, are giving dependability and permanence greater weight than formerly. Under war conditions only the highest type of construction can long withstand the strain.

"In conclusion, I would urge consideration of road construction paralleling our eastern seaboard, particularly in those localities where important fortifications exist with no first-class connecting road. No one can foresee the outcome of the present crisis nor those crises which will follow. These matters of preparedness which cannot be handled over night should be considered well beforehand and provided for while we still have time and allies to defend us."

FISHING THROUGH THE ICE.
Great Sport if You Don't Weaken

IN MEMORIUM—CHARLES RICHARD VAN HISE

F. E. Turneaure
Dean, College of Engineering



President Van Hise

In the death of President Van Hise, the University has lost a great president. As he was the first alumnus to hold this position, and was, furthermore, a graduate of the College of Engineering, his career should be of particular interest to engineering students and alumni. His career is a fine example of what this nation can produce in the way of a country boy of brains rising step by step by native ability and sheer hard work to a position of great influence in the state and nation. What he accomplished through persistent and untiring energy, coupled with a continual widening of intellectual activities, should be a great inspiration to the graduates of the institution over which he presided for so many years.

President Van Hise was a Wisconsin man,—Wisconsin born and bred,—and his life work has been given to the interests of the people of his state. From the catalogs of the University, it appears that he entered the University in 1877 and graduated from the Metallurgical Engineering course in 1879. Just why he selected an engineering course is not known, as he never followed the engineering profession as a career. It is quite likely, however, that a taste for mineralogy and geology, combined with a practical turn of mind, had much to do with his selection. It has often been admitted by President Van Hise that he was no great "shark" in mathematics and mechanics, finding such studies difficult and not very attractive, and it is interesting to note that the Metallurgical course of that time differed from the Mining course only in the fact that chemistry was substituted for mechanics. Whatever may have been his intention, it seems certain that his future work was very largely determined by his contact with Professor Roland Irving, under whom he had a large amount of work in geology, metallurgy, and mining. Professor Irving was above all a teacher and a scientist, rather than an engineer, and inspired his students with the scientific spirit as few teachers of that time or of any later period have done. There being but few students at that time (two engineering students in Van Hise's class) the opportunities for the young scientist or engineer to come into intimate contact with the work of inspiring teachers were unusually good, and it is little wonder that under these conditions a geologist like Irving should produce another geologist like Van Hise. Immediately after graduation, we find the young scientist employed as assistant in metallurgy at the University, and from that time on his work was continuously connected with the University as instructor, professor, and president.

It is easy to picture Van Hise as a very serious-minded student, not over-fond of sport; we know, on the contrary, that he was not a grind, but a very vigorous and full-blooded youngster, joining in the fun as heartily as in the work. He greatly enjoyed the dormitory life then in existence, and always spoke of it with a great deal of interest and enthusiasm, frequently telling of the pranks of the boys at that time. He greatly appreciated this life with other boys, and his experience then undoubtedly had much to do with his strong efforts to secure appropriations for dormitories and commons for the students of the present generation.

As a scientist, President Van Hise did not confine himself to the library and laboratory. He was a practical man, and was constantly at work on problems of applied geology. Whether or not his engineering training had anything to do with this tendency, it is nevertheless true that he became one of the greatest applied geologists of this or any other country. He was not satisfied with deducing a possible theory to account for geological changes, but proceeded to test his theory by quantitative calculations. It was not merely a question whether a certain chemical or physical process could, theoretically, produce certain transformations, but also whether such process could operate to a sufficient degree to produce these results. Calculations of quantities and amounts entered strongly into his studies, and in such analyses he made use of precisely the same methods which the engineer must employ in the solution of large problems. He brought to bear on his problems all of the sciences involved,—mathematics and mechanics, as well as physics and chemistry,—and secured much help from experts in these departments in the solution of his problems. His ability in handling such problems made his studies of Lake Superior geology of immense practical value to the mining industries of the country. He was a master mind in his specialty.

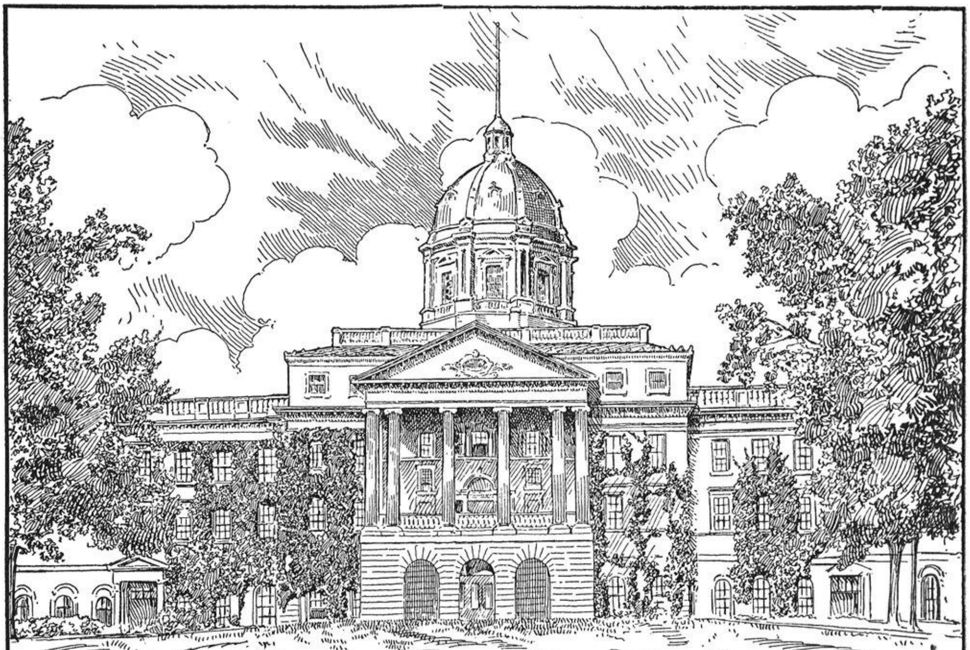
But as a member of the faculty, President Van Hise's interests were not confined to his own department. He always took a very active part in all matters pertaining to the general work of the University, and was particularly interested in athletics. He was for a number of years member of the Athletic Council, and frequently, in faculty meetings, supported very strongly the side of the students in questions pertaining to athletics. He was then, as always, a strong debater, persistent in securing what he thought to be the correct action.

As a university president, Charles R. Van Hise was one of the greatest presidents of a state university of recent years. He believed that a state university should be as strong as any endowed institution, and that the public would support this policy. He further believed that a state-supported university had obligations to the public and to the state beyond those of a private institution. These obligations he considered to be far-reaching and outside the ordinary scope of universities. The work of the Extension Division, developed under his administration, is an example of such public service. And in extending the University in these ways, President Van Hise had no fear that such activities would injure the standing of the University in its higher fields of work. He firmly believed that such work well done would strengthen rather than weaken the institution, and in this belief the experience of the past ten years has proven him to be right. He had the highest ideals of what a university professor should be, and it was the high quality of the faculty above all things that he insisted upon. He wanted as many first-class men in every department as the University could afford. As president, he endeavored to develop all departments equally. While naturally having more special knowledge of scientific departments than of others, he was absolutely impartial in his attitude toward all of the departments of the University. He was quite as anxious to have a strong literary course as a strong scientific one, and the discovery of a virile, inspiring teacher in any department was his greatest delight.

President Van Hise's ability in debate and his unusual energy and persistence led to his being very successful in his promotion of the interests of the University in the legislature. Due to its rapidly increasing growth and cost, the University was sometimes strongly attacked in committee hearings, and at times the President would be severely attacked in a personal way. Such personal attacks never seemed to trouble him in the least,—they were simply ignored; but he kept right on arguing for University appropriations and persisted in his fight to the very end, with the result that he usually secured what was needed and ended the campaign with a very much better public understanding of the position of the University and of his personal efforts in its behalf. Under his direction, the University has grown from an attendance of less than 3,000 to more than 8,000 students; the Medical College was founded; the Extension Division was established and developed; and a large proportion of the buildings now in existence have been constructed. For many years he has fought for student dormitories and commons, firm in the belief that these institutions are of great value as a common meeting ground for young men of student age. It is hoped that his death will not prevent the consummation of his desires in this direction.

President Van Hise was not a man to be content with confining all his activities to his daily work. His mind was constantly on the alert, and he was a close student of general economic and political problems of the day. His intimate knowledge of mineral resources led him promptly to take up the subject of conservation, and he was quick to perceive the significance of this movement. Again on the great question of industrial regulation, his accumulated knowledge regarding certain great fundamental industries led him to take a vital and immediate interest in this problem, and a large amount of his time for the past two or three years has been devoted to a study of this subject. He gave his support whole-heartedly and vigorously to the prosecution of the war. He was at the same time a warm exponent of a league to enforce peace, and his last public address, based largely on information secured during a recent visit to Europe, was an earnest plea for public support of such an organization.

President Van Hise had thus for many years devoted his whole strength to public service,—to the University, State, and Nation. His unselfish and devoted work may well be an example to the students and alumni of the institution which he so greatly cherished.



MAIN HALL

EDITORIAL

The Call of Humanity is "Join the Red Cross"

The Great War is ended, but the work of the RED CROSS goes on. Relieving the sufferings of a war mad world is only one of its many duties. Wherever large numbers of our fellow beings are in pain or need,—in the wake of famine, tornado, and pestilence,—there is the RED CROSS extending material aid. It is the embodiment of the sympathy that the more fortunate of us feel for those who are out 'a luck. There will be dreadful suffering this winter in many parts of the world. Do something more than shudder about it. Help the RED CROSS to carry such relief as may be possible to the stricken people. America has been fortunate among nations. Let us justify her fortune by our deeds. JOIN THE RED CROSS. L. F. V.

THE S. A. T. C.

We were glad to see the S. A. T. C. come. It was a fine idea and in time the rough spots probably would have ironed out so that something useful could be accomplished. To use the great educational plants of the country for the preliminary training of officers instead of letting them lie idle, seemed the logical thing to do. To close the universities of the country in war times was to class them as non-essential, and in the United States education has not been considered non-essential. The S. A. T. C. was welcomed. The desire to help in the national emergency carried the faculty and the students over the rough spots. But there were rough spots. Army methods, developed in military posts where the time and energy of a soldier have little value, were brought into the educational field where the time and energy of the student must be utilized to the utmost. As a result, little has been accomplished in the way of education; we will not presume to speak for the military side. But now the war is ended. The emergency is past and we need to get back to our engineering studies. We are not sorry to see the S. A. T. C. go. L. F. V.

WHAT ARE YOU GOING TO DO?

You men who are being discharged from the S. A. T. C., stop and think just a moment what a college education will mean to you. The University, and university life, such as you have seen it, is not as it is in normal times. Do not be discouraged. You have had a start. The government has aided you thus far. From now on every effort will be made by the faculty to see to it that in the next two quarters your year's work shall be rounded out, and that next year you will be able to start in with a clean slate, and with a full year's work behind you. Pull up another notch in your belt; beg, borrow or earn as you go along the money which will be necessary and come back on January first, determined to see the thing through. Many men before you have come to college without a red cent in their pockets, and four years later have graduated with honors. Why not you?

G. B. W.

THE OUTLOOK

For the past year and a half we have had but one aim—to win the war—and every effort has been directed toward that end. With the signing of the armistice on November 11th our objective was practically attained. The world is now turning its attention from war to peace and we are face to face with the great problems of readjustment and reconstruction.

The return of millions of fighting men and more millions of munition makers to peace time pursuits is a tremendous economic problem, and in its solution the engineer will have a large part. He will both plan and direct many of the works to which these men will turn their energies. At home we have not only the vast accumulation of constructive works which have been held in abeyance during the war, but many new projects such as that of reclaiming millions of acres of both swamp and arid lands to provide homes for our returning soldiers.

In the countries where the fighting occurred there is not only the problem of readjustment but also that of reconstruction. To restore the battle-field of Belgium, Northern France and the other devastated territories to their original condition will require a vast amount of work, and these regions must call upon the rest of the world for much of the equipment and material needed for this reconstruction. This will necessitate great fleets for transportation; but, thanks to submarine piracy, the world's tonnage of ships is far below normal, and with the added requirements of after the war it will be a long time before the supply is equal to the demand. All of these things mean more work for the engineer.

When a stable government is established in Russia, that vast empire of almost untouched natural resources will be opened for development. With an area nearly three times that of continental United States, and a population of one hundred and seventy millions, with its mines, oil fields, forests, and agricultural areas, it has great possibilities. Railroads, factories, and all the other concomitants of civilization are needed. The numbing hand of despotism has held back these things in the past, but with the coming of freedom we may expect also great material progress.

With all these fields of endeavor opening before him, at home and abroad, with a comparative shortage of engineers due to the fact that the technical schools of the world have graduated an unusually small number of men during the war, the prospects of the engineer have a rosy tint. He will have a larger field of usefulness in which to exercise his abilities and a better chance than heretofore of reaping a just reward for his services.

F. E. V.

THE NEW INDUSTRIAL ERA.

On December 4th, 5th, and 6th, twenty-five hundred men, each a representative of some American industrial concern, met to consider the industrial problems of the future. The great social, economic, and industrial problems resulting from the termination of the war were discussed, and a harmonious, uniform plan of action evolved. The big purpose back of this meeting was so to coordinate the industries of the United States that greater efficiency might be had, and the maximum service rendered.

This meeting is but the outward mark of the dawning of a new era in the industrial life of this nation. In the past the dominent note in industry, and in business, has been competition. Each industry has tried to secure monopoly rights upon something, and with that as a club, has tried to force its competitor out of business. The result of this competition has been, in many instances, actually to hold back industrial development, instead of furthering it as so many people believed.

With the coming of the great war, however, it was realized that the struggle could be won only thrü the unified effort of all the industrial concerns in the country. Raw materials were alloted to each industry according to its needs. Designs, plans, patents, and trade secrets were pooled, and all industries alike could use them. Thru governmental intervention, the age long competition of Capital and Labor has been somewhat lessened, and they are cooperating for the common good of the nation more than they have ever done since the Industrial Revolution. The railroads have been unified and consolidated under one management, and are operating together as one great amalgamated transportation system. An effort is being made to make Cooperation, and not Competition, the dominent note in industry.

G. B. W.

LIBERTY FUEL

The War Department has announced the development of a new fuel for use in gas engines. Kerosene is said to be the base, and the fuel is described as: "Odorless, tasteless, and non-corrosive. It leaves less residue of carbon than any gasoline, requires less air or oxygen for combustion, and developes greater horsepower. The force of the explosion of Liberty Fuel has been found to be 30 per cent greater than gasoline." The fuel is said to be decidedly cheaper than gasoline and is now being produced in quantity. The new "gas" is the result of more than 500 experiments conducted by Maj. O. B. Zimmerman and Capt. E. C. Weingerber. This College can bask in reflected glory for Maj. Zimmerman is a graduate of our mechanical course, class of '96. He received his M. E. degree in '00. Before going into war work, Maj. Zimmerman was advisory engineer for the International Harvester Co. He is now in full charge of the selection and purchase of engineering equipment for the mobile army. L. F. V.

ON EARTH PEACE, GOOD WILL TOWARD MEN

The Christmas that the world has waited four long weary years to see has arrived. Victorious Peace has come to the Allied Nations, and Liberty has once more been triumphant. Let us hope that the time of which the angels sang, nearly two thousand years ago, is here at last.

Go home and enjoy your Christmas as best you know how, but remember those that are not so fortunate as you, and do what you can to make their Christmas as happy as your own. Then when you return, and under new, more favorable conditions, plunge into your work with a vim, and prepare yourself for greater service to humanity.

With the coming of peace, will come many changes and readjustments. We must start the new year on an entirely new basis. No longer do we feel the stirring call to arms, but just as strongly we should feel the stirring call to service. The world needs true men, men who are ready to give their all in service to humanity, just as much now, as in 1914. G. B. W.

PROPOSED AUTO-MECHANICS COURSE

The auto-mechanics course that was given to the soldier students of the vocational detachment, proved so successful that an effort will be made to continue it as a civilian course. Besides making the course open for election by engineering students, it is proposed to throw it open to students of other colleges who can show that they would be benefited by such a course. It is further proposed to permit men over 18 years of age, who for various reasons have not completed high school, to take the course. For this latter group, it is proposed to arrange elementary courses in English and shop mathematics.

Merry Christmas and Happy New Year

WITH THE COLORS

BY WILLARD A. KATES

GREGOR S. AFFLECK, ch '18, has been commissioned as an Ensign in the Engineering Bureau. He has just returned from service at sea where he had some experience with submarines.

ROBERT A. BAXTER, ch '18, a former member of the staff of THE WISCONSIN ENGINEER, is at the deck officers school at Pelham Bay.

LT. GEORGE E. BOOTH, e '16, is with H. Q. Co., 60th C. A. C., A. E. F. He recently had a motorcycle spill that spoiled his uniform and loosened his teeth but failed to damage his sense of humor.

FRANK H. CIRVES, soph. Chemical 1917–18, is at Great Lakes. He was a member of last year's Engineer staff.

BROOKS L. CONLEY, e '18, HAROLD W. GOFF, e '17, W. C. MACKEY, ch '17, A. C. NIELSEN, e '18, H. C. POLLAK, e '16, and GILBERT RODDEWIG, m '17, are in training for the Navy at Stevens Institute.

CAPT. ROBERT C. DISQUE is director of the radio branch of the military aero service with headquarters in Washington.

ROLAND I. DRAKE, junior Chemical 1916–17, returned to Madison on a furlough. He has served as Second Class Electrician on the U. S. S. Agamemnon engaged in transport service.

WILLIAM E. ERICKSEN, soph Chemical 1917–18 and member of the ENGINEER, is seaman, second class, in training at Camp Schick No. 2, at Northwestern University. This is a branch of the deck officers school at Municipal Pier. Another branch, Camp Schick No. 1 is at the U. of Chicago. Ericksen was a visitor on Nov. 30th.

T. A. GILL, ch '17, is serving in the 158th Company, Signal Marine Barracks, Navy Yard, Philadelphia.

LT. J. F. GROSS, m '16, is with the 7th Engineers at Camp Humphreys, Va.

C. F. HAYDEN, ch '18, is a sergeant in the Ordnance Department, stationed at Rosslyn, Va.

PRESLEY D. HOLMES, senior chemical, left shortly before the signing of the armistice for the O. T. C. for heavy artillery at Fort Monroe. Recent advices indicate that he will complete the training.

LT. PATON McGILVARY has received the Italian Cross of War for bravery in action. He is reported to have been recently engaged in bombing work.

K. S. McHUGH, ch '17, is a captain in the Ordnance Department in charge of the machine gun school at Camp Hancock, Ga.

WILLIAM H. NEGLEY, junior chemical 1917–18, is stationed at New London where he is acting as an instructor in the Listeners School for submarine detectors.

PAUL T. NORTON, e '17, after being attached to the British air forces in London on special detail for four months, is now with the American army.

VICTOR A. OLSON, ch '18, is now at sea serving his time in the School for Ensigns in the Navy.

RALPH E. RAMSEY, ch '17, is captain in the 339th Infantry with the A. E. F. in Russia.

C. W. SCHMIDT, e '18, HOWARD FULLER, e '18, JOHNSON, ch '17, KENNETH SHIELS, m '18, and H. N. SHAW, m '18, are now at sea.

L. F. SEYBOLD, e '18, is now an Ensign in the U. S. Naval Reserve Force. He was back at the University for a few days during the latter part of October, having received his commission Oct. 23, after returning from a trip "across." He tells of meeting many of the old boys under unusual conditions. "KEN" WHITCOMB was found one day hovering over his ship in an observation balloon. RAYMOND MILLER, m '18, and KURT L. SEELBACH, m '18, also received their commissions on Oct. 23, GEORGE T. MOORE, m '18, received his commission as Ensign on Oct. 28th, and W. S. NATHAN, c '18, will receive his commission soon.

WILLIAM F. SLOAN, e '04, has been commissioned captain in air service production.

HOWARD E. SWEET, ch '18, and C. T. FLECKENSTEIN, ch '18, are at Camp Alfred Vail, N. J., in training for commissions in the Signal Corps.

LT. H. D. VALENTINE, a former instructor in the Chemical Engineering Department, is convalescing in a hospital in France.

CAMPUS NOTES

By WILLARD B. BELLACK

BALLAD OF THE GOOD SHIP MAHONEY

William G. Mantonya

We joined de Navy way last May
    It wasn't time ter fool,
Dey didn't give us gob suits den,
    But sent us back ter school.

We wrote and wired and telephoned,
    And tried to get a job,
As Admiral, er Commandant,
    Er C. P. O. er Gob.

But when October finally come,
    We goes back to de "U,"
We didn't want ter do it
    But dats all dey'd let us do.

Dey put us in de barracks
    And dey made us eat der chow,
We ain't civilians any more,
    We're in de Navy now.

Dey blow de horn at half-past five
    And gits us out of bed,
We dassent go ter sleep again
    But gits right up instead.

Fer fifteen minutes after dat
    We're busy, dis is how,
We make de bunk, swab up de deck
    And den fall in fer chow.

De chows been Jerry up ter date,
    We hope de luck will last,
But if we want enuf ter eat,
    We got ter eat damfast.

When chow is done we go back home,
    And push a broom until
Dey toot de horn at seven bells,
    Den we falls in fer drill.

"Squads right, squads left, squads right about,
Attention; wipe dat smile,"
We do dose tings an hour or so,
Den go ter class a while.

At noon we gits our chow again,
And den till half-past four
We climb de hill ter classes
Where we try ter learn some more.

At half-past four battalion drill
Comes off a while each day,
Dey also takes de roll again,
So we don't stay away.

When dis is done we eats again
And den we gits in line,
Dey march us up fer study hours
From seven until nine.

At nine o'clock our time's our own,
Until nine forty-five,
We sure do hate to waste dis time.
Oh, goodness sakes alive!

When all dis idle time has passed
De guy he blows "Tattoo,"
We makes our bunks and goes ter bed,
Dats what dey make us do.

At ten o'clock de guy blows "taps,"
De lights go out and stay,
De guys pipes down and goes ter sleep.
So ends de perfect day.

Its hard at first ter foller rules,
Before you gits der drift.
But dey has means of teaching you
Dats most uncommon swift.

Its a great life when you learn it
And you likes it more and more,
But de first eight years is hardest
Den its every other four.

And I wouldn't leave dis Navy
With its drillin' in de ranks,
And I wouldn't trade me gob suit
Fer de nicest pair of banks.

PROF. L. S. SMITH gave an illustrated lecture, November 26, on the Survey of the Boundry between the United States and Mexico.

PROF. R. S. McCAFFERY spoke at the November meeting of the Wisconsin Section of the American Chemical Society on Some Recent Experiments on the Acid Bessemer Converter. The paper was illustrated with motion pictures.

PROF. G. L. LARSON has been appointed a member of the State Conservation Board in the Fuel Administration.

On November 16, the football team journeyed to Minneapolis and lost a 6 to 0 game to its ancient rival. A week later another journey was made to Columbus where the boys pulled a 14 to 3 victory out of a hardfought game. On Thanksgiving Day the Michigan Aggies visited us. The score was 7 to 6 in our favor. On the whole the season has been satisfactory. We have had better, but then,—c'est la guerre.

As the young lady remarked: "The marines look nice in those uniforms, but I don't like their trousers without leggings." Oh well! Anything to be obliging. Just take 'em off, Hank.

PROF. L. S. SMITH, who has made quite a reputation by his work for the Liberty Loans, headed the joint committee of faculty and students that handled the United War Work drive for the University. Over $38,000 was raised, or about $8,000 over the minimum apportionment for the University. The details were roughly as follows:

1700	women students	$11,000
3000	men students	15,000
400	faculty members	11,000
	University employees	1,000

This efficiency thing is great stuff. You kill half an hour from 11:30 to 12 and then have to bolt your dinner in order to make the 12:30. That looks bad, but note how nicely things arranged. The Clinic stands between the mess hall and the College. Drop in and have a dyspepsia tablet.

Major Case, who established the ARCHIBALD CASE LOAN FUND for engineering students in memory of his son who was killed during the construction of the Hell Gate bridge, has written to the Dean, stating that he desired to increase the fund if it were still needed. It has been the custom to confine loans to seniors, but the funds now on hand permit help to be extended to worthy students in the lower classes.

Take a squint through the periscope and see what we see. Right you are, Rollo, that's Prof. McCaffrey,—your easily understood uncertainty is due to the military haircut. And there, about two o'clock, red steeple, eight o'clock, three fingers, you note two men on foot. Do not fire; they are friends,—Berggren and Jesse Kommers, both with smooth and hairless mugs. Berggren failed in his attempt because of lack of fecundity in the soil and Kommers sacrificed his wistaria on the altar of friendship. Hey! Let go that eyepiece. You'll wreck the machine. Oh ho ho, Yea bo! I see her too! Some sight! Some sight! Say Cristobal, have you taken note of the great variations in the tout ensemble,—Huh? Oh, that's French for 'architectural effect.' I say, have you noted the great variations in tout ensemble that are caused by variations in the height of different co-eds, in spite of a standard distance from the concrete to the hem of the skirt? A height that exposes one girl's ankle, exposes another girl's—Quick, pull in the periscope. There's a destroyer in the offing.

Brother Townsend will now rise and lead us in song. All together, one, two, three:

"There was a class called Steam and Gas.
Not much steam but lots of Gas."

Society is preparing to climb out of the mothballs as soon as the S. A. T. C. is in the hic jacet class. Dame Rumor has it that several tasty little Lake Parties are in the planning.

Essential Military Command: "Wipe that smile."

ALUMNI NOTES

FRANK J. BACHELDER, c '15, is in charge of appraisals for the Bureau of Aircraft Production. He is trying to get into touch with mechanical, electrical, and civil engineers with construction experience.

MAJOR FRANK CASE, c '90, Assistant to the President of the American International Corporation, will be chairman of the delegation which the American Society of Civil Engineers will send to a Congress that will be held in Paris early in December. The delegation is being sent at the invitation of the French Society of Civil Engineers. The Congress will concern itself with the problems involved in the rehabilitation of France and the restoration of French industry.

WILLIAM D. FOWLER, C. E. '16, who was injured in an auto accident as recorded in our April number last spring, has been able to resume his duties with the Dravo Contracting Co. He has not recovered entirely from his lameness.

C. F. GRAFF, c '04, is president and general manager of the American Nitrogen Products Company of Seattle. The company has recently opened eastern offices in the Woolworth Building at New York City.

VICTOR C. HAMEISTER, ch '16, was married last July.

LEANDER M. HOSKINS, c '83, C. E. '87, professor of applied mathematics at Leland Stanford, Jr., University, received the honorary degree of doctor of science from Wisconsin last June. In conferring the degree, President Van Hise said:

"Immediately after graduating at this university thirty-five years ago you began here your teaching career. Both at Wisconsin and Stanford you have made yourself eminent as teacher of mechanics and applied mathematics. You have been a reliable and successful investigator in hydraulics and problems of elasticity. Your students and your colleagues alike have learned to appreciate your rare personal qualities and sound judgment."

G. C. McNAUGHTON, ch '09, is Chemical Engineer for the Bathurst Lumber Co., Ltd., Bathurst, N. B.

NIC A. SAIGH, c '15, is on the engineering force for the extension of Camp Grant.

PAUL H. SCHMIDT, ch '18, is employed as chemical engineer with the Federal Rubber Co., Cudahy, Wis.

KAN SU, c '16, may be addressed at 3910 Prairie Avenue, Chicago, for the next few months. He is with the C., B. & Q. R. R.

W. R. McCANN, E. E. '15, is now with the Stenotype Company of Indianapolis.

HAROLD K. WELD, g '05, is second assistant to the vice-president and assistant general manager of the Standard Underground Cable Co., 600 Westinghouse Bldg., Pittsburgh.

J. WESLEY WILLIAMS, ch '18, is in the government nitrate plant at Sheffield, Ala.

C. B. WILLMORE, ch '16, is chief chemist for the Massena Plant of the Aluminum Co. of America, Massena, N. Y.

CARL ZAPFFE, g '07, M. S. '08, Geologist, Northern Pacific Railway Company, kicks through with a subscription for five years which puts him in a class with such "old timers" as Hinrichs, Lachmund, Salsich, and Shea. Apparently, however, he has not complete confidence in the business ability of the engineering students. He writes: Your idea of "PERMANENT SUBSCRIBER" is endorsed. If you can keep your books straight and promise not to bill me again for 5 years, you may keep the attached check for $5.00. Please do not send me 5 copies; remember it is five years that I want. (Sounds like a jail sentence.) Best of luck to you. Your magazine is interesting, and surely better than in my days." By golley! as old man Jiggs would say, if it wasn't for the sugar coating, Carl, we wouldn't swallow your darned old pill. How could you? Oh, how could you impugn our book-keeping? Just for that we'll keep your check.

STATE STREET IN WINTER
As the Old Grad. knew it

"What are you thinking about, Tommy?"

"I'm just wondering how I'm going to get my coat on over my wings when I die."

"You'd better wonder how you're going to get your pants on over your tail."—*Harvard Lampoon.*

They had been making hay while the sun shone, and when they had finished a high haystack the farmer's boy shouted from the top: "Say, mister, how am I goin' to get down?"

"Oh, jest shet yer eyes an' walk round a bit!"—*Exchange.*

A newspaper philosopher describes a gentleman as "a man that's clean inside and outside, who neither looks up to the rich nor down on the poor, who can lose without squealing, and win without bragging, who is considerate to women, children, and old people; who is too brave to lie, too generous to cheat, and who takes his share of the world, and lets other people have theirs."

HER LITTLE PLAN.—"I see you a good deal with young Freighly Spenditt."

"Yes, auntie."

"I hope you are not going to marry the young spendthrift."

"On, no. I wouldn't think of marrying a spendthrift. But, auntie,—"

"Yes, dear."

"Its awfully nice going 'round with one." *Louisville Courier-Journal.*