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# ST. PATRICK'S DAY ENGINEER MAG IS ON SALE TODAY

## Illustrated History of Annual Celebration in This Issue

The March number of the Wisconsin Engineer, fittingly issued on St. Patrick's day, will be on sale in the hall of the Engineering building today and tomorrow.

The feature article is entitled, "Commercial Aviation and the Engineer," and it contains an excellent survey of the problems of airplaine design which must be solved before the airplane can become as common as the automobile. At the same time the opportunity for the young engineer in attacking these problems is pointed out.

The second article by Prof. Max Mason on his submarine detector goes more into the refinements of the invention and the obstacles encountered in the attempts to perfect the device. Another article on concrete ships takes up in detail the side-launching method of getting the completed ship into the water.

In keeping with the date of issue is a history of St. Patrick's day celebrations at Wisconsin and other schools, illustrated with a few typical scenes from St. Patrick's day parades. A large list of alumni notes, and campus notes, together with interesting material in the Engineering review, complete the contents of this issue.

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# The WISCONSIN ENGINEER

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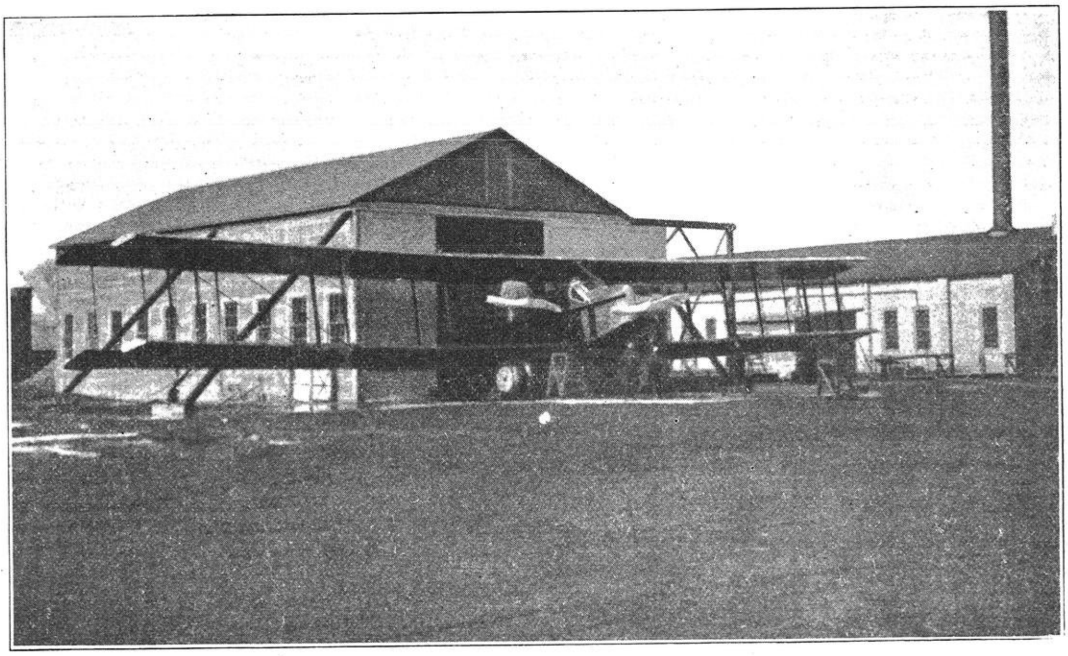

THE LAWSON AIR LINER NO. 2.

The WORLD'S WORD for ELEVATOR SAFETY

Volume 25 Founded 1896 Number 6

# The Wisconsin Engineer

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# The Wisconsin Engineer

UNIVERSITY OF WISCONSIN

VOL. XXV, NO. 6. MADISON, WIS. MARCH, 1921.

## COMMERCIAL AVIATION AND THE ENGINEER

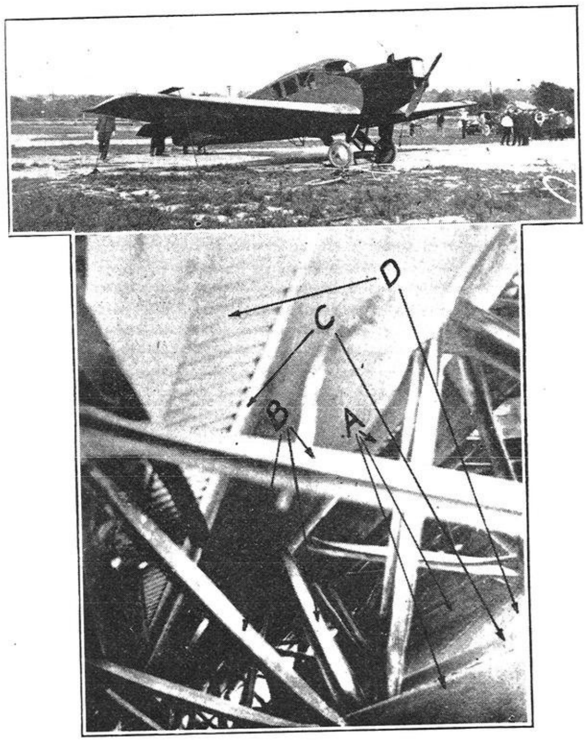
By Harry A. Phillips
*Junior Mechanical*

That it would be difficult to adopt war planes to commercial use was realized by many people even before the armistice. Economy is not given much consideration during a war. Fighting power, speed, and manoeuvering ability are the requisites of a scout plane; other specifications are paramount for bombing and reconnaissance planes, but expense means little or nothing. Nevertheless, a vast amount of new information concerning airplanes was available as a result of war-time development, and engineers built some very creditable passenger and cargo carriers. These were usually adaptions of bombing planes. The Martin twelve passenger carrier, the Curtiss Eagle, the L. W. F., and the Lawson planes in this country, and the Caproni, Handley-Page, Airco, Vickers, Bleriot, and other machines in Europe, were all the results of attempts to incorporate into peace-time planes the valuable lessons of war-time experience. All are highly creditable and represent progress, but they are not solutions of the problems of commercial aviation. We do not expect solutions overnight, however, and it is encouraging to watch the rapid strides being made in this new branch of the engineering profession.

When the man of commerce places the matter before the engineer, he says that flying must be made less expensive. There are, of course, certain purposes to which the airplane may be adapted profitably at the present time. But the differences in cost found in transportation by rail, water, and air, still prohibit the common use of the airplane. With this in mind, the aeronautical engineer has been striving to lessen the cost of air travel, primarily by building airplanes sufficiently economical in operation to warrant establishing aerial lines of transportation.

Confining ourselves to the plane itself, there are apparently three lines upon which reduction of expense may take place. We may produce the plane at less initial cost, we may run it at less expense, or we may make it last longer. All of these are important, but the second is most interesting because the problem of running the plane at less expense is concerned very largely with aerodynamics, a branch of physics comparatively new to us.

The bugbear of the aeronautical engineer, striving for high efficiency of his plane, is parasite resistance, that is, resistance to the passage through the air of members of the machine which, though necessary to its structure, do not contribute a lift to the plane during flight. Interplane struts, exposed bracing and control wires, landing chassis, the fuselage, in short, everything except the wing itself are generally considered in this classification. To draw wings through the air at great speed, requires a force which will overcome not only the resistance of the wings, but the resistance of the parasite members as well; consequently, if we can reduce this parasite resistance in any way, we may use a lower-powered motor, and hence less fuel. The resistance of a member may be lessened by reducing its size, by shaping it so as to create less disturbance in passing through the air (called "streamlining"); or, if it may be contained within some other member, it naturally will have no resistance whatsoever.




German All Metal Junker Plane and the Interior Bracing of the Wings. *The bracing should be viewed from the lower right hand corner. Leading edge is to the left. A-tubular spars; B-inter-tube struts; C-lateral strips; D-corrugated duralumin wing covering. Note absence of external struts and wires in the Junker plane, and the wing form of the fuselage. All parasite resistance except the radiator and landing gear has been eliminated.*

For many years the Pratt truss was universally considered the proper structure for the wings of an airplane. Largely due to the Pratt truss system of bracing, the biplane, with its interplane struts and wires, seemed destined always to predominate over the monoplane, though the superimposed wings are not so efficient aerodynamically as the wings of the latter. The exposed struts and wire contributed a large amount of resistance, and though this resistance was reduced by streamlining, accomplished recently in the case of the wires by the substitution of flattened solid steel wire for the old aviator stranded wire, the desire has always been to brace the wing internally, and use no external struts or wires whatsoever.

The airplane popularly known as the "Christmas Bullet," which appeared in the fall of 1918, was probably the first machine with interbraced wings to be flown in this country. The designed depended upon combination wood and veneer beams to give the requisite strength to the wing, and, though the construction was not immediately successful, it was a good start. Other internally braced wings that have been built in this country are the wings designed by Mr. Stout, and those designed by the Dayton-Wright Co. Descriptions of the Stout monoplane state that six spars, formed of veneer sections, are made up of spruce combined with plywood gussets into the form of a double Pratt truss, the spars tapering with the wing to the tip to keep similar wing curves. These spars are reinforced by the ribs and plywood covering of the wing itself in taking the lift and drift stresses, as the vertical and horizontal components of the air pressure are commonly known. The Dayton-Wright wing is also of wood and plywood. However, the most successful internally braced wing in this country is found on the German all-metal Junker plane. The wings, as well as the rest of the plane, with the exception of the steel couples which attach the wing to the body of the machine are constructed of duralumin. Nine duralumin tubes run laterally through the wing, which tapers evenly toward the tip, the tubes drawing closer to preserve similarly formed wing sections. The tubes are braced by z-sectioned struts and by the wing covering itself. The covering has corrugations parallel with the airflow. Additional lateral strips run the length of the wing midway between the tubes. Parts are connected with rivets. The system of bracing was devised by Dr. Hugo Junker several years ago.

Internally braced wings naturally weigh considerably more than the old type, and must be of much deeper section. The thin wing section is rapidly losing ground anyway, and there is no doubt that the resulting slight increase in drift is more than balanced by the decrease in resistance due to removal of external struts and wires. The successful design of any internally braced wing apparently depends upon the success with which the covering material is used to assist in resisting the external lift and drift forces acting on the wing. Mr. Stout's wing shows that he has worked on this basis, and the Junker duralumin wing is an excellent example of construction based on that reasoning. We may look for big improvements on these, however, as they are only beginnings. It is certain that the internally braced wing will be a feature of the future successful airplane.

Apparently the only solution to the problem of eliminating the resistance of the landing gear is to withdraw it into the fuselage after the plane takes to the air. Since there are some serious difficulties, the majority of engineers have satisfied themselves with simplifying and streamlining the parts of the chassis as fully as possible. A retractable chassis for small planes has been patented by J. V. Martin, but is not in wide use. Despite these facts, the designers of large planes are bound to recognize the advantage of withdrawing the chassis, and there is little doubt that the scheme is to become more popular.

In designing the fuselage, the effort to date has been mainly to shape it properly, and to decrease the size and number of irregularities. Since the fuselage of a plane must exist, and consequently resist, one comes soon to the conclusion that the utmost in design has been reached, but, o nthe contrary, we have only begun. A close scrutiny of the Junker plane will show that a longitudinal section of the fuselage has the curve of an aerofoil, and, according to Mr. Larsen who holds the Junker patent rights in this country, the fuselage lends a lift at high speeds. The possibilities of taking advantage of the resistance of the fuselage by so shaping it as to secure a lift are immense, and it remains the special task of the wind-tunnel expert to guide us in this development.

Power-plant is another problem which is very important aerodynamically and is still causing expert designers a great deal of trouble. Previous to the war there were few airplane motors of more than a hundred horsepower. The demand for larger airplanes carried with it the necessity of using more than one motor, and the usual result was a bi-motored airplane whose motors were placed in seperate units outside the fuselage and on either wing, usually in nacelles placed midway between the planes. With the design of higher powered motors came the demand for still larger planes, and it became common practice to power a plane with two or more motors, each operating its own propeller, and otherwise acting as an individual unit. Moreover, many designers claimed that this practice made for greater reliability since the plane could maintain flight on only a single motor. Experience has proved, however, that this is true only in exceptional cases; almost invariably a plane must land when one motor goes dead, firstly, because half power is not sufficient to maintain flight if full load is being carried, and, secondly, because the location of the propeller pull, at one side, usually makes it impossible to fly the plane in a straight line. The other big objection to the practice is that no matter how clean the nacelle installation may be, it is simply a further parasite resistance in flight.

With the advent of the thick wing, it has become possible almost entirely to enclose a motor in the wing itself, and this system has been practiced by certain German designers. From the purely aerodynamical standpoint, this would be an excellent arrangement, but there are certain mechanical disadvantages, which will be mentioned later. The next, and of course most desirable location of the power plant, is in the fuselage itself. With more than one motor in the fuselage, we may then deliver the power either to a single tractor propeller, or to propellers placed out on the wings. The later scheme is accomplished by delivering the power by means of shafting, and has been attempted by at least one German firm. It is generally thought that the propeller is more efficient if operated in comparatively free air than in front of the fuselage, but there is room for argument over this, as well as over most other phases of the subject.

The English and Italians have succeeded in designing suitable methods of delivering the power of several motors to one tractor propeller, usually thorugh a cycloidal gear which allows withdrawal of any motor during flight to facilitate repairs or adjustments. This installation has the advantages of being compact and so arranged as to allow a mechanic to attend to the operation, and of possessing considerable reliability where three or more motors are used in the unit, and we shall doubtless see the practice become very popular. The method of installing the motors as separate units in the wing has the disadvantages of inaccessibility to the mechanic, and of complicated apparatus for control, gas feed, etc. It lacks the general air of simplicity that is so desirable in any mechanism.

Turning now to the airplane motor itself, let us note that from the very nature of its use it must be light, efficient, reliable, and have a reasonably long life. Necessity for lightness is paramount. Where an automobile motor may weigh fifteen pounds per horsepower, the weight of the air motor has been reduced to two or three pounds per horsepower. Of course we might fly a plane powered by a very heavy motor, but in this case we should have to abandon the useful load which is the source of profit. Efficiency is important in commercial planes not only because the economical motor requires less fuel, but also because the decrease in the fuel carried means an increase in the useful load. On the other hand, lightness means shorter life, and since the operating expense varies inversely as the life of the motor, it is quite apparent that we have two opposing factors that must be balanced.

Like war planes, war airplane motors are not adapted to commercial use. They are surprisingly reliable, but not sufficiently so for commercial purposes and their life is short, due principally to their light weight. We must increase their reliability, but by means other than increasing their weight.

Faulty carburetion, or ignition, is often the cause of engine failure, and ignition trouble is usually the result of faulty carburetion. Those interested in internal combustion motors have wished many times for the perfect carburetor. One device which shows possibilities is the Packard vaporizer, a device developed at the Packard experimental laboratories under the direction of Mr. Vincent, the purpose of which is to vaporize the fuel more thoroughly. Less carbon in the cylinder, and accompanying increased efficiency, reliability, and longer life of the motor are the results of this invention. An added difficulty in airplane motor carburetion is the fact that the motor must operate at a wide range of altitudes and air pressures. This has caused the development of the supercharger, a device for supplying air to the carburetor at increased pressures when at high altitudes. The most successful supercharger which has been developed is the product of the General Electric Laboratories under Dr. Moss. Both the vaporizer and the supercharger have been brought out since the war—they are still in infant stages of development. Why not look for perfection in carburetion in the near future?

Another important cause of motor failure is overheating, due to faults in, or accidents to the cooling system. It will be recalled that Hawker, in his attempt to fly across the Atlantic, was forced down, not by carburetion or ignition trouble, but by a defect in the water line from the radiator. The air-cooled motor is the solution to this problem; it is more simple, and is lighter in weight. With a plentiful supply of air due to the high velocity of the plane, there is no doubt but that a satisfactory air-cooled motor which will be not only light and simple, but reliable, will soon appear. This is indicated by the considerable use of radial motors in Europe. An air-cooled motor enclosed in the fuselage is not at all beyond us, and we may look forward to the day when that dream will be a reality.

Another feature which it would be most desirable to incorporate in an airplane motor is elimination or great reduction of vibration. If vibration could be eliminated or greatly reduced, one of the principal reasons for the short life of the plane itself would disappear. This will be mentioned later in the discussion of materials.

The development of airplane motors suitable for commercial use is a task in which the aeronautical engineer must co-operate fully with the expert motor designer, since the actual design and construction of engines is in itself a most distinct sphere of engineering. What is wanted is a motor practically free from vibration, light enough for air use and simple and sturdy enough to give long life. The motor is the very heart of the airplane, and we must regard it accordingly.

We may therefore, expect to reduce the expense of flying, by reducing the amount of power required to operate the machine, and second, by minimizing the cost of this power through more suitable motor design. The Glenn L. Martin twelve passenger carrier expended about sixty-five horsepower per person to fly at one hundred miles per hour. The first Lawson airliner expended about fifty horsepower per person to fly at seventy-five miles per hour. The Lawson Airliner No. 2, shown on the cover of this magazine, is expected to better this performance. Powered by three Liberty motors, it represents a high state of development of the Pratt truss type of machine. These planes which are believed leaders in their class in this country, are to be as efficient as similar European models. Turning to the aerodynamically more efficient plane, we find the Junker monoplane, the only machine of the new type common in this country, expending only twenty-five horsepower per person to travel at one hundred miles per hour! Such performance speaks for itself.

Research work on the airplane, other than aerodynamical, may be fairly closely confined to the proper use of materials. Briefly, such research is for the purpose of making the plane as light and as strong as possible, and for lengthening its life. The first requires the selection of materials having the highest ratio of strength to weight, and we must then consider means of reducing to a minimum the effects of the two principal destructive influences, namely, weather and vibration. If a material is not naturally immune to weather conditions, it must be protected. It is seldom that the vibration to which it is subject may be reduced. Without going into details, the common practice at present is to build the machine of wooden members supported by metal fittings, and cover the wings, and sometimes the fuselage, with linen. Plywood and metal cowling is used quite commonly in fuselage construction. Wood and metal parts are varnished, and the linen is saturated with a "dope" which shrinks it and acts as a filler, and it is then varnished. The result is a machine which withstands vibration in good shape, but which deteriorates rapidly under the action of the weather. Two to three hundred hours flying time is the life of such a plane. A metal ship, on the other hand, is very susceptible to vibration, and deteriorates more from this cause than from the elements. This is particularly true of duralumin, the new aluminum alloy used in the construction of many German planes, and probably the only metal known at present sufficiently light, tough, and strong to be used for the entire plane. The principal disadvantage, other than deterioration from weather, in the use of wood is the varying qualities of strength and texture, and the difficulty in obtaining suitable airplane wood. A happy solution would be the development of a motor free of vibration. This would allow the use of metal, with its immunity to humidity changes, and its even texture and quality. Such a motor is as yet nothing but a dream.

The use of plywood in airplane construction presents many possibilities. Considerable investigation has been done at the Forest Products Laboratory at Madison, under the direction of Mr. Markwardt, and commercial companies will doubtless do their share in this development. Plywood combines some of the qualities of metal and some of wood and fabric. It is possible that a combination of wood, plywood, and metal, will prove the most satisfactory construction. That is simply another one of the lessons whch experience and investigation will teach us.

Ten years ago airplane manufacture was hardly thought of as an industry. Then came the war. Expensive tools and jigs necessary in the manufacture of metal fittings, the expense of training labor, and the enormous overhead due to the large designing and experimental forces so essential to rapid development, all boosted the cost of manufacture. Progress in design was so rapid that an airplane designed one month and produced three months later would be out of date by the time it got into the air. A new set of jigs and tools for a new design, more experimental work, and perhaps only a few planes produced! The same conditions still apply. But if the industry receives sufficient support during the coming years to carry on its experimental work, we shall soon view an airplane which will fly cheaper, will in time be more or less standardized, and hence be cheaper, and then, in a sort of chain, be made cheaper still by reason of its production in some considerable quantity. Such support must, for the next few years, come largely through the government, for the simple reason that the airplane is still too expensive to attract the individual "entrepreneur." Once set firmly on its feet—when the airplane comes to be a more practical commercitl asset—the industry will quite naturally support itself.

The success of the air mail service and like ventures, generally with makeshift equipment, is encouraging to those who look forward to the age of air travel. We have every reason to believe that the air as a highway, three-dimensioned, and requiring no upkeep expenditures, will, in time, form a means of speedy, safe, and comfortable travel not equalled by any of the present means of transportation on land or water. Large landing fields at every city will form the harbors of the air. Carefully charted air routes, which we may accurately follow with the assistance of detailed meteorological reports, the already successful directional radio, and systematic signal lights, will make possible travel to far cities "as the crow flies." And all this, of course, only after the aeronautical engineer has made it a possibility by producing a plane more suitable for the purpose than those we now know.

The problems in airplane development form an inviting field for the young engineering student. They are so varied, complex, and new, that they offer every opportunity to the ingenuity, inventiveness, and energy of any man properly prepared to solve them. The field offers almost unlimited opportunity to the engineer of real constructive ability. Horace Greeley's "Young man, go west!" may well be paraphrased "Young man, get into the air!"

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## METERMEN'S COURSE A GREAT SUCCESS

A short intensive course for electric metermen was given between semesters at the electrical laboratory by the College of Engineering and the Extension Division in cooperation with the Wisconsin Railroad Commission and the Wisconsin Electrical Association. The course was under the direction of Professor C. M. Jansky of the Extension Division and instructors at the electrical laboratory. The aim of the course, as stated in the announcement, was to assist the electric utilities of the state in the training of men.

# SUBMARINE DETECTION BY MULTIPLE UNIT HYDROPHONES*

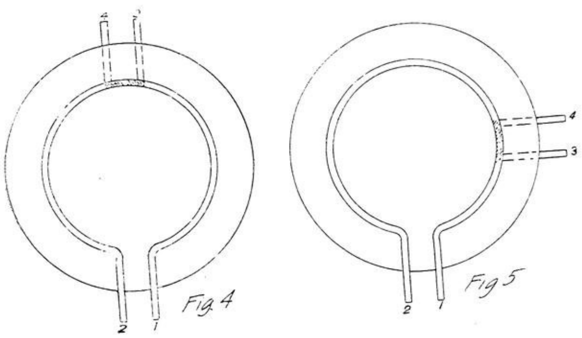
By Max Mason

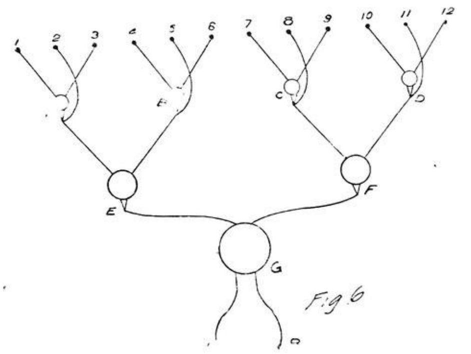
*Research Professor of Mathematical Physics*

*Further experimental installation of M-V Tubes.*

The second M-V installation was made on the *Narada*, a steel yacht some 200 feet long. The individual sound receivers were of the brass diaphragm type, similar to those used on the first M-V tube, but more sturdy in construction. Holes were cut through the ship's plates. the diaphragms being mounted flush with the outside. Two rows of fifteen receivers each were mounted symmetrically on each side just above the keel near the bow. These rows were about four feet apart, approximately parallel to the keel, and were eight feet under the water line. Tubes led from the small air chambers behind the diaphragms to the compensator.

The compensator was a great advance over the trombone slides of the first instrument, the adjustment of length of sound paths being accomplished by the rotation of one horizontal plate on another. The principle of construction of this first rotary compensator may be seen from Figure 4 which gives in diagrammatic form the action of a simple compensator for two sound receivers. The upper flat plate has a groove 1—2 which forms a tunnel-like path for the sound, when closed by the lower plate. The lower plate carries a block which fits the groove, thus dividing the groove into separate sections, while outlet tubes lead through the bottom plate, one on each side of the block. Sound entering the groove at 1 on the upper plates, thus emerges at 3 on the lower plate, and sound entering at 2 emerges at 4. In the figure the paths 1—3 and 2—4 are equal. If the plate carrying the block is rotated clockwise, the block and outlets take the position shown in Figure 5, the path 1—3 being shortened, while the path 2—4 is increased. In practice the grooved plate is rotated. The multiple unit compensator used on the *Narada* carried fourteen such grooves; the mean radii of the grooves being determined so that the proper relative amounts of path change for the leads from the various receivers would be produced by rotation of the top plate. The compensator was practically noiseless in operation so that it was possible to listen continuously while rotating the plate. This continuity greatly increased the range of the instrument and the accuracy of direction determination. A scale on the rotating plate gave the direction, since this was determined by the amount of rotation necessary to bring the sound to its maximum and to center it binaurally.




Figs. 4 and 5. The First Rotary Compensator. *Sound enters the instrument at 1 and 2. Compensation is accomplished by rotating the plate, thus changing the lengths of the paths 1—3 and 2—4.*

Fig. 6. Progressive Compensation. *Sound from the different units are first brought into phase at A, B, C, and D. Sound from these foci are then compensated further at E and F, and finally at G.*

The results obtained with this instrument on the *Narada* were more encouraging than the results of the first M-V tube. The range was much greater and noises originating aboard the ship were much less disturbing. With the ship under way the water noise was negligible at speeds below four knots, increasing in intensity until at about eight knots it became a roar which drowned out the noise of distant ships.

After a time spent in study of the *Narada* installation, the compensator was used for an M-V tube on the *Aylwin,* a destroyer. In this case the sound receivers were rubber tips and were mounted in a water filled tank within the ship. This tank or compartment extended across the ship from side to side. The quarter inch plates of the ship formed its side walls and offered but little resistance to the passage of the sound waves when the compartment was filled with water. Comparative tests were carried out on the *Aylwin*, which was equipped for that purpose with a large number of detection devices. In most of these the use of the compensator for direction determination had been adopted, but for pairs of receivers only. Direction was thus obtained by the binaured effect alone without the aid of the maximum effect produced by focusing a multiplicity of receivers as in the M-V tube. The tests showed the superiority of the multiple unit device. Through the partial elimination of disturbing noises originating within the ship the M-V tube showed greater range. In practice chases, a submarine was detected and located with greater speed and certainty with the M-V tube than with the simple non-focusing detectors. Practice hunts under conditions

*This is the second of a series of four articles by Professor Mason on the submarine detector. The first appeared in the February number of the Wisconsin Engineer.

approximating those of actual services were successfully made.

The next installation was made on the destroyer *Jouett*, which had been assigned to the New London Station for experimental use. The M-V tube was again subjected to comparative test with ten or more detection devices and showed marked superiority. Soon afterward the M-V tube was adopted by the Navy for installation on destroyers.

Lack of space forbids a description of the many experimental forms of the elements of the instrument which were made and tested before the final form was developed. Thousands of tests were made on hundreds of types of individual sound receivers. The spacing of receivers, their position on the ship and the method of

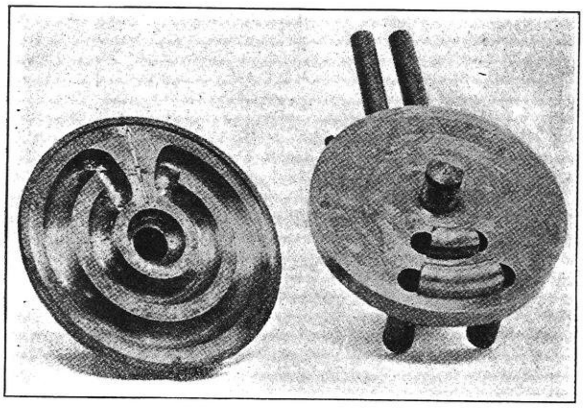


FIG. 7. THE ROTARY COMPENSATOR. *The use of the two grooves permits of a given compensation with half the angular rotation required by the instrument in Figure 4.*

mounting, the size of conducting tubes, the shape of cones and bends, methods of sound insulation, all received detailed study. Compensators of widely different design were tested, before a combination of acoustic excellence with mechanical simplicity was reached.

*Progressive compensation: final form of the compensator.*

The general plan of M-V tube adopted for the *Jouett* remained standard. Twelve sound receivers were used in each of the port and starboard lines. One receiver was mounted in each frame space of the destroyer. Their distance apart was 21 inches, so that the total length of line was about 20 feet. The lines were mounted as near the keel as possible, and far forward under the bow. A plan of compensation called progressive compensation was used, which is indicated in Figure 6. The black dots 1, 2, ---, 12 represent the individual sound receivers. A sound wave advancing through the water in a definite direction is incident on the row of receivers and affects them in turn. The time between the responses of the various receivers is determined by the angle which the wave front makes with the line, and is proportional to the distance of separation of the receivers. These sounds are to be brought into phase at the listener's ears. The responses from receivers 1, 2, 3, are brought into phase by a compensator, indicated in the figure by a circle near the point A. The length of paths from 1 and 3 to A are changed by equal and opposite amounts by this compensator, while the path from 2 is unchanged, 1 and 3 being adjusted to it. Thus, by proper rotation of the compensator plate the sounds from 1, 2, and 3 are all brought to the collection point A in phase. The

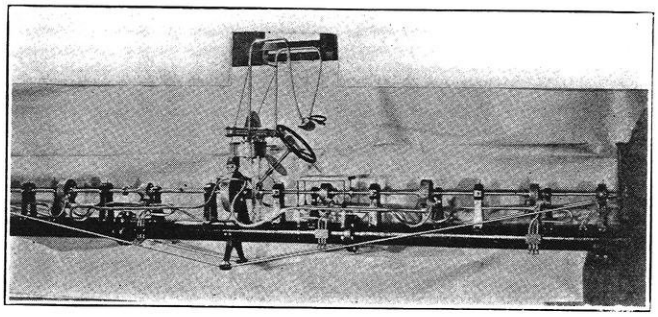


FIG. 8. FIRST INSTALLATION OF THE PROGRESSIVE COMPENSATOR. *The seven compensators are mounted on the same shaft, and are rotated by means of the hand wheel.*

other triplets are treated in the same manner and are thus individually compensated by the first stage of compensation. Their outputs are received at A, B, C and D at different times, the difference in these times corresponding to the differences in times of arrival of the wave in the water at the receivers 2, 5, 8, and 11. A second stage of compensation is then introduced, through which A and B on the one hand, and C and D on the other are brought into unison. Two compensators are required for this stage. As it is desired that the first and second stage of compensation be produced by the same angular displacements of their respective compensators, the second stage compensators must be larger. The ratio of the radii of the grooves of the first stage compensators to those of the second stage compensators must be 2:3, since this is the ratio of the distances 1—3 and 2—5, and hence is also the ratio of the differences in time of the responses of receivers 1 and 3 (which are compensated at A) to the differences in time of arrival of the outputs of the two compensated triplets at A and at C, (which are compensated at E). The effects of receivers 1 to 6 are thus brought into phase at E, and those from receivers 7 to 12 are in phase at F. These effects are finally brought into phase by the last stage of compensation, indicated by the largest circle, and are led separately through stethoscope ear pieces L and R to the listener's ears. The compensation required in the last stage is double that of the second.

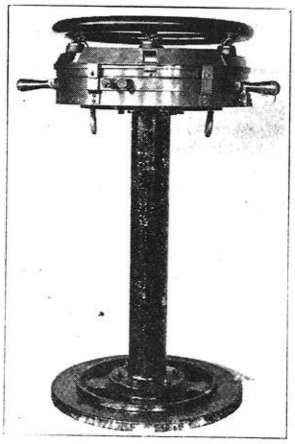


FIG. 9. THE FINAL FORM OF COMPENSATOR. *Compensation of all sound received is accomplished with this one instrument. Compare with Figure 8.*

In the first installation of this type seven separate compensators were used. Each of these was of the type shown in Figure 7, the groove being double, so that both inlet and outlet were on the fixed plate. The seven compensators were mounted on a common horizontal shaft, which was turned by means of a wheel. Figure 8 shows this complicated arrangement, and may serve as a basis of comparison with the final form of the twelve unit compensators. In the final form all seven compensators were combined on a single pair of plates. Figure 9 shows the compensator assembled, and Figure 10 the top side and under side of the grooved plate, and the top side of the lower plate, which carries the blocks, the inlets and the outlets. The seven separate compensators were combined in one by restricting the rotation of the plate to less than 90 degrees, and using the four quadrants for separate groove systems. The course of the sound pulses through the compensator is shown in Figure 11, the lettering corresponding to that of Figure 6. The diagram is drawn for the compensator in neutral position, i. e. the line of receivers would then be compensated for a sound wave whose direction of

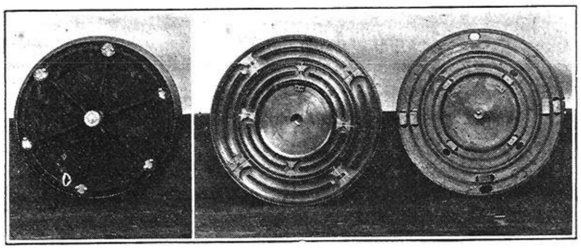


FIG. 10. MECHANISM OF THE COMPENSATOR OF FIGURE 9.

advance is at right angles to the line. The pulses from the several receivers enter the compensator at the points of corresponding number. Those from receivers 1 and 3 for example enter at 1 and 3 and pass through the groove of the top plate. They then unite and pass into the fixed plate at A where they are joined by the inlet from receiver 2. The output of each triplet passes through a groove in the under side of the fixed plate, indicated by the heavy lines from A, B, C, and D. Rising through the fixed plate at the ends of a block, they enter the second stage compensator grooves, and emerge at E and at F, passing again into the lower or fixed plate. These two outputs are then ready for the final stage of compensation, which is double the second stage in amount. This last stage is effected by passing the sound through the groove H—M and the groove K—N in series, the connection M—K being formed as before in the fixed plate. These grooves pass through a cross-over block at O, so that the compensating effect of plate rotation in K—N shall be additive to that of H—M. This gives, as is required, a last stage of compensation double that of the second stage. The proper ratio between the first and second stages is secured by making the mean radii of the groove systems in that ratio. The diameter of the plates was about 19 inches.

By means of this instrument twelve units of an M-V line 20 feet long were focused or compensated by the rotation of a single plate. The compensator was carefully machined from bronze castings, the grooves being machined around the entire circumference and then divided into quadrants by casting of Wood's metal. This alloy of low melting point was used to prevent warping the plates. The blocks of the lower plate were of Wood's metal, cast in the grooves of the upper plate. The flat surfaces were finally finished to high accuracy by hand scraping. The plates were assembled in a dust free room after cleaning and careful lubrication with castor oil. The compensator operated very easily and noiselessly, and gave a sharp focus and binaural center. The short radius bends had been found by previous experimentation to cause no disturbance. Care was taken to avoid abrupt changes in cross section in the sound paths, as such changes reflect sound and tend to set up by resonance a standing wave system of sound within the leads. Gradual coning was produced in the connection grooves of the fixed plate as the channels, through collection, became larger.

The twelve sound tubes from each side of the ship led to the compensator, twenty-four vertical tubes entering a plate which lay below both plates of the compensator proper. The lower plate of the compensator proper rested on this bed plate, and remained stationary and locked in position, while the upper grooved plate was being adjusted, but could be shifted to two positions, so as to connect the compensator to either the port or the starboard line. Even with the lines mounted as near the keel as possible, the ship acted as an efficient sound screen, so that sounds coming from a direction to starboard of the listening ship could be heard but dimly, if at all, in the port line of receivers.

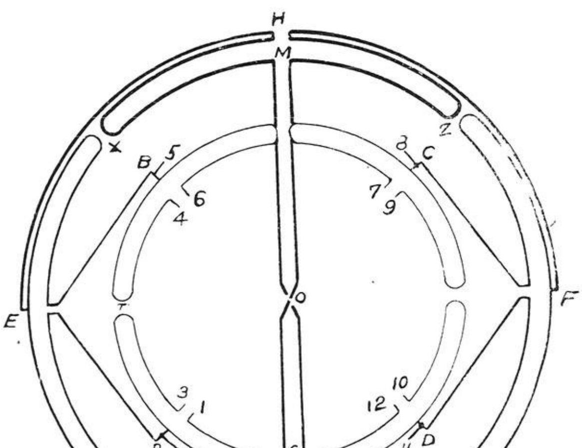



FIG. 11. DIAGRAM SHOWING COMPENSATION IN THE INSTRUMENT OF FIGURE 9.

*The "blister" type of M-V.*

In the final and most efficient form of the M-V tube the receivers were attached to the outside of the ship's skin, and then covered by a streamline shield or "blister" of one-eighth inch steel. The receivers, being in the dead water held by the blister, were very free from water noise caused by the motion of the ship when under way. The disturbance from this cause was not troublesome at speeds up to 15 knots. In some cases surface ships were heard and located from a destroyer making 20 knots, though the sound of a quietly moving submarine would be lost long before such a speed was reached. The deciding factor in limiting the speed of the listening ship was the echo of that ship's own engine and propeller noise, reflected from the bottom of the sea back to the listener near the bow. The fact that the noise of his own ship's engines heard by the listener was reflected from the bottom was not recognized for a long time. It was finally discovered by Dr. H. C. Hayes in operating an electric M-V (to be mentioned later) on a trip across the Atlantic in a transport. When record was kept of the angle at which the ship's own engine noise were received it was found that these checked with the angles to be expected if the noise were reflected from the bottom. The instrument was at once provided with a scale calibrated for depths, and a new use for the M-V line found—that of practically instantaneous depth determination from a ship under way.

The success of this device varied directly with the care taken in its construction and installation. Accuracy of tube length and freedom from any vents from the tubes to the air or cross leakage in the compensator, were necessary for clear cut focusing action. In the first blister installations the problems of mechanical strength were very troublesome. It was necessary to mount the blisters near the bow to secure best listening conditions. In this position they were subjected to terrific pounding in a storm. A seaworthy design was obtained by making the blister sufficiently broad and shallow, so that its lower edge made an acute angle with the skin of the ship. Although installations of the receivers in water or oil tanks within the ship was feasible, the gain in range produced by the outward blister was felt to be sufficient to justify this type of installation for war purposes.

# LAUNCHING A CONCRETE SHIP

By J. P. Schwada, Wisconsin c '11
*Structural Engineer, State Department of Engineering, Wisconsin*

Probably no operation connected with the construction of a ship requires more consideration and care than that of launching. This operation is always fraught with anxiety because of the serious injury to the hull that may result from an unsuccessful launching.

For the launching of the concrete ships constructed by the Emergency Fleet Corporation of the United States Shipping Board, both end and side launchings were used. The latter, which is the more spectacular, was used for the launching of the 7,500-ton concrete oil-carrying ships constructed in the yards at Jacksonville, Fla., Mobile, Ala., and San Diego, Cal., and is the one that will be described here.

The method of side launching has many advantages. With it, restricted or narrow waterways unsuited for end launching may be used. It permits, also, the simultaneous use of several building berths on either side of narrow waterways, where in the case of end launching the upper end only could be used. The reason for this is the short distance travelled by a ship launched sideways as compared to that for a ship launched endways.

An important advantage is obtained also, from the fact that with side launching the ship is on an even keel when building. Everything is plumb from the keel and no "rake" has to be considered. This facilitates the erection of the staging, the forms, and the placing of the reinforcing steel.

Again, it is easier to secure sufficient clearance under the ship to permit changes to made in the blocking, the forms to be removed, and the outside surface of the hull

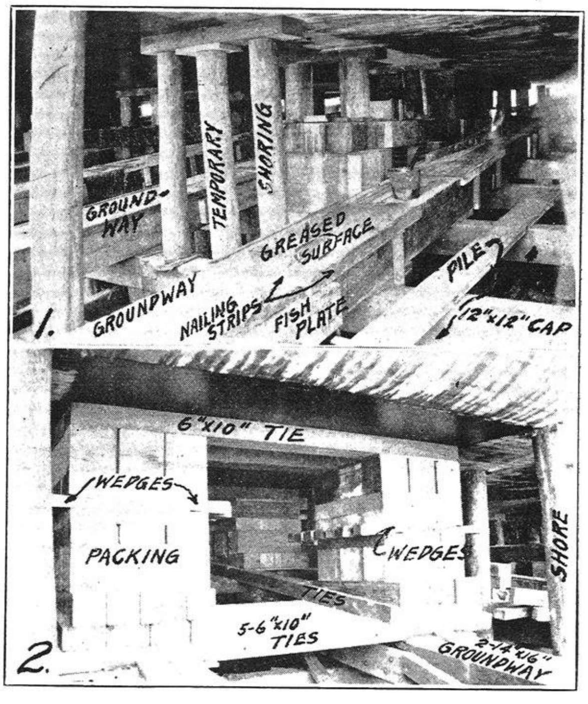



Fig. 1. Grounding and Temporary Shoring. *The ground ways are two 14 inch by 16 inch timbers bolted together and spliced with wooden fish plates. The portion of upper surface marked "greased" is ready to receive the packing. The wooden strips hold the packing free from the ways until launching. The 12 inch square timbers are the longitudinal pile caps.*

Fig. 2. Packing in Place. *The packing on two adjacent ways are tied together longitudinally and transversely. The 6 inch by 10 inch ties in contact with the groundways project beyond the edge of the ways to allow for any turning of the packing if the ship moves faster at one end. The wedges enable the load to be transferred from the shores to the packing on the ways when the ship is launched.*

*This is the fourth of a series of articles on the concrete ship. The first article appeared in the December number.

to be painted. This clearance is, also, uniform over the full length of the ship.

In the matter of stresses in the ways and the ship incident to launching, the extensive calculations involved in end launching are not necessary with side launching. It is necessary, however, to see that the groundways with their supports are securely tied together and that the ship is uniformly supported over its full length. The working stresses in the ship and the ways must not be exceeded.

The building berths in the concrete ship yard at Jacksonville, Fla., are located in what formerly was a shallow bay of St. Johns River. In the main, the berths consist of wooden piling driven below the river bottom to solid rock. The piles are tied together transversely and longitudinally by two wooden sills 12 inches by 4 inches, one on either side of and bolted to the piles. Sand was pumped in around the piles and sheet piling used along the outside row of piles to hold the sand in place. The channel around the building berth was then deepened by dredging.

Each longitudinal row of piles is capped with a 12-inch square timber, the full length of the berth. These timbers carry the wooden bents and staging during the construction of the ship, and also support the groundways for launching.

The operation of launching properly may be divided into the following steps:

of the work at any time to those engaged in it. This signal device is used, also, to signal the men who cut the ropes.

A few weeks before launching, and after the hull is painted, the groundways and packing are placed. Those portions of the upper surface of the ways directly under the packing are greased with linseed oil and launching grease. In order that the effectiveness of the grease may not be reduced, the packing is held clear from the ways until just before launching, by means of wooden strips nailed on top of and on the side of the groundways. The remaining surface of the ways is similarly greased the day of the launching.

A few days before the launching the triggers and daggers, and the patent key-blocks are put in position. There are five sets at each end of the ship. The triggers and daggers hold the ship on the ways after the load has been transferred to the packing. The patent key-blocks relieve the stress on the triggers until the last moment.

These triggers are levers pivoted against chocks secured to the groundways. Daggers or shores extend from a point on the triggers just clear of the chocks to the ship. To the other end of the triggers, cables are attached. These cables extend back and are secured to piles or dead men. Short manila loops are inserted in the cable and rest on chopping blocks. These loops are cut with axes by men at the proper time and triggers and daggers then drop down on the wooden platfrom.

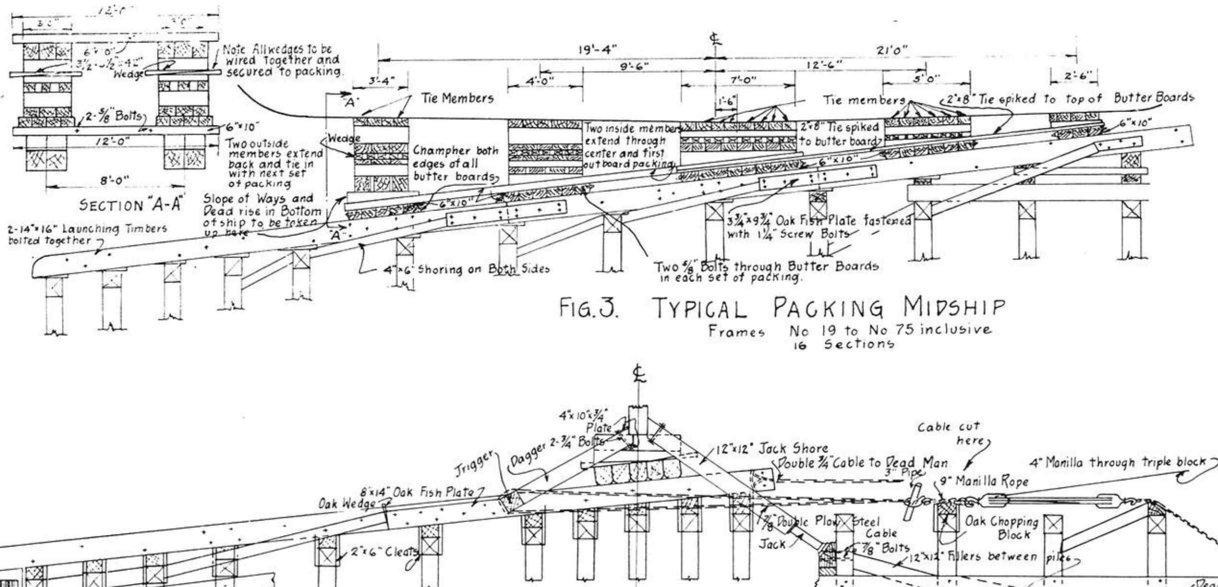



FIG. 3. TYPICAL PACKING MIDSHIP
Frames No 19 to No 75 inclusive
16 Sections

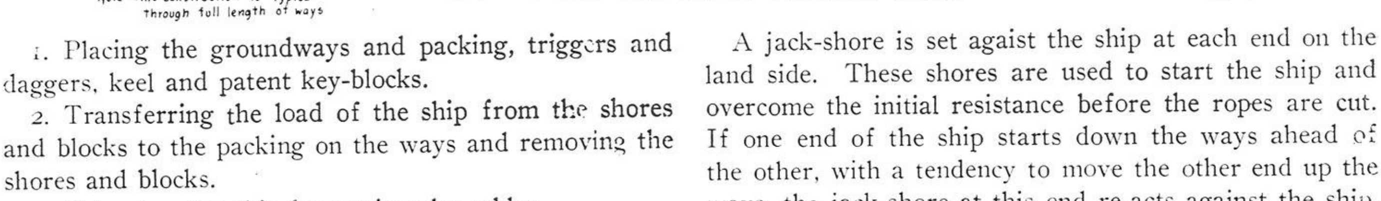



FIG. 4. TYPICAL SECTION AT TRIGGER WAYS

1. Placing the groundways and packing, triggers and daggers, keel and patent key-blocks.

2. Transferring the load of the ship from the shores and blocks to the packing on the ways and removing the shores and blocks.

3. Releasing the ship by cutting the cables.

The entire operation is carried out systematically and in stages, particularly that part included in the last two steps, and a signal device is used to indicate the status

A jack-shore is set agaist the ship at each end on the land side. These shores are used to start the ship and overcome the initial resistance before the ropes are cut. If one end of the ship starts down the ways ahead of the other, with a tendency to move the other end up the ways, the jack-shore at this end re-acts against the ship, prevents it from doing so, and in this way assists in overcoming the resistance at midship.

The signal device generally used consists of three vertical semaphores, pivoted to a platfrom located at each end of the ship, and on the lower or water side of the building berth and clear of the ship way. They are in sight of each other and also in sight of the men who cut the ropes holding the triggers.

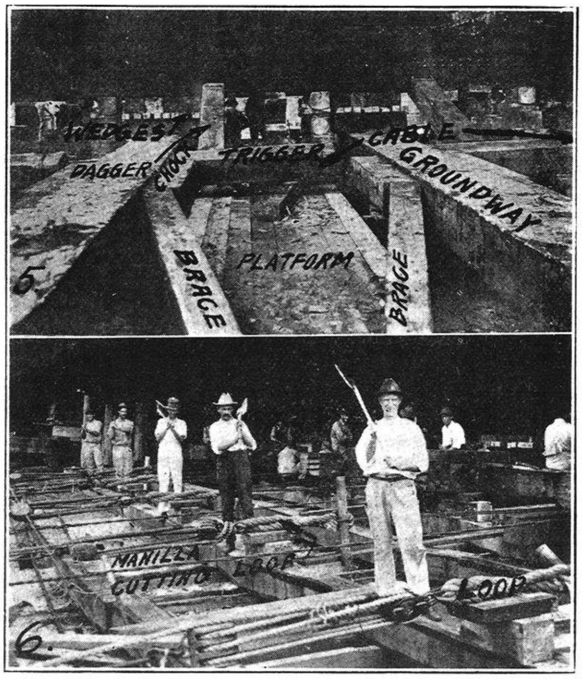



FIG. 5. TRIGGERS AND DAGGERS. *The trigger is pivoted against the chock on way at one end, and is held in place by the cable at the other end, and holds the dagger against the ship. The wooden platform provides a smooth surface for the trigger and dagger to slide on when the cable is cut and the ship moves down the ways.*

FIG. 6. AWAITING SIGNAL TO CUT THE CABLES. *When the load has been transferred from the shores to the packing on the ways, the key blocks removed and the ship is tugging on the cables, the signal to cut loose is given. The cables are cut simultaneously at both ends of the ship and the ship is free to move.*

About a half hour before launching, the load of the ship is transferred from the shores to the packing on the ways by tightening the wedges in the packing. This wedging up is first done on the upper or land side until the shores drop out, then on the lower or water side until the shores on that side drop out. Once more the wedges on the lower side are tightened until the ship is rolled back and the keel blocks can be removed. The patent key-blocks are removed last.

The first of the semaphore signals is dropped when all of the shores and keel blocks are out and the second when the patent key-blocks are removed. At this period of the operation the ship has moved a little and is followed up by the jack-shores fitted at each end of the ship. If necessary, to assist in the moving, these jacks are worked at each end. The ship is now ready to let go and the last signal is dropped. When this is done the men cut the ropes simultaneously at both ends, the daggers and triggers drop down, and the ship with the packing moves down the ways.

The writer wishes to call attention to an article "Side-Launching of Ships on the Great Lakes," by E. Hopkins in Marine Engineering, December 1918. To it he is indebted for some of the information used here, particularly the description of the daggers and semaphore. Side-launching is used extensively on the Great Lakes, and the launching at Jacksonville, Fla., followed in detail the method used there.

## ST. PATRICK, ENGINEER

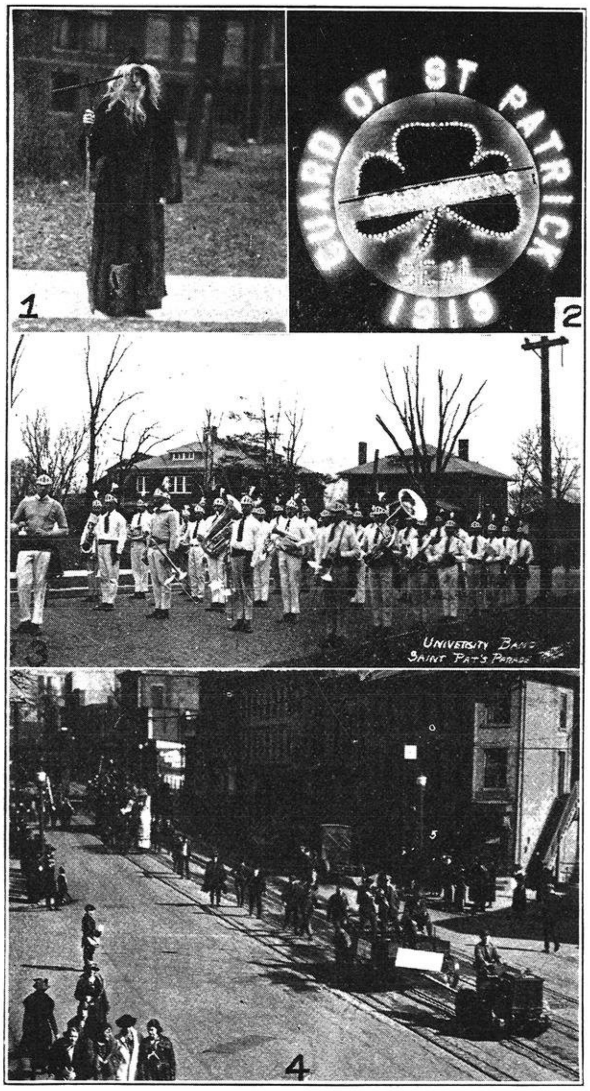
By KENNETH L. SCOTT
*Senior Electrical*

That St. Patrick was an engineer cannot be doubted. His feat of driving the snakes out of Ireland still stands as the greatest triumph of sanitary engineering in any land. His rapid transit work on the road to Hell, and his discovery of the Pearly Gates while sighting through a Dumpy level make him the peer of any instrument man in the government service. And, if more proof is needed, his invention of the monkey wrench is recognized by all but lawyers as sufficient evidence to convict him of his calling. But it was none of these things which won him his high place in the hearts of all engineers. It was his diabolical ingenuity in inventing the calculus which caused all engineers to rise as one man and acknowledge him their patron Saint and master.

Of the actual life of St. Patrick little authentic information is to be had. But his great exploits in the field of engineering have been handed down to us in the forms of songs and ballads like the sagas of the Norsemen, and the singing of these ballads has, in late years, come to form a part of annual celebrations held at various Engineering schools in the country in honor of the founder of the profession. Not all engineering schools do pay homage to St. Pat as we do here, there being probably quite a few places where missionary work is needed to secure for him his full meed of respect and attention, but, largely through the efforts of the "Guard of St. Patrick" which was founded at the University of Missouri in 1903, the number of schools which recognize his professional leadership is being materially increased each year.

It is not known to the writer whether there were St. Patrick's Day celebrations in engineering colleges before 1903 or not. According to the University of Missouri, the idea originated there and spread to other schools as additional chapters of the "Guards of St. Patrick" were established. But these chapters are mainly to be found in the schools of the middle west, an it is known that St. Patrick's Day was celebrated at Boston Tech as early as 1910, although the intense rivalry between colleges there led to the subsequent abolition of the custom. Also, in April, 1918, the Engineers at Washington University, to quote the Washington University Yearbook, "—introduced to the University their newly acquired patron saint, the Beaver, giving in his honor the most stupendous pageant ever staged about the University." Thus it seems that, while Missouri deserves credit for the largest amunt of active work in behalf of St. Patrick's Day celebrations, the idea is probably more or less a sponfor the rapid spread of the organization and the customs, once they were started. Wisconsin has supported the custom for a number of years, although there has never been any official organization here.

The form of the celebrations has varied somewhat at the different schools, but, in general, they have been either in the nature of a pageant or an exposition or a combination of the two. The pageant type has prevailed at Wisconsin, consisting mainly of a parade of appropriate floats and a band, together with some small attendant ceremonies. A great deal of ingenuity has been displayed at different schools in devising striking and original floats for the parade. For instance, at the University of Washington in 1918 there was among other floats "a ship which was propelled by a bellows in the hands




THE ENGINEER AND ST. PATRICK. 1. *St. Patrick, University of Missouri.* 2. *Seal, Guard of St. Patrick.* 3. *University of Missouri, St. Pat's parade.* 4. *St. Pat's parade, University of Wisconsin.*

of two hobos, and which sailed along a brick walk over water laid from sprinkling cans in the hands of two other bums." In this same parade there was also "a locomotive" bearing the mortal remains of Casey Jones, the demi-god whom all Engineers worship. Casey's weeping family and six seniors as pall-bearers followed." One particularly good float of the Ames Engineers was a man sized monkey wrench, calculated to strike terror in the heart of the most intrepid lawyer. Grotesque rabbits and frogs, and double jointed elephants and mules have also featured the parades at Ames. An account of another of their celebrations says, "In 1916 the faculty did not authorize leaving off any of the classes to enable the Engineers to celebrate St. Patrick, so the students took it upon themselves to fail to report to any classes that day. After the salute from the cannon the parade started, to which was added everything movable in sight. Instead of starting straight for town as in other years, it first went though all of the buildings with a general invitation to all to stop work, which everybody did. It was found that it required considerable engineering ability to persuade a Cow which had been discovered nearby, to manipulate the stairways in Central Building." Concerning their celebration in 1915 they say, "At day break on the morining of the celebration a small black house was discovered on the central part of the campus, guarded by four freshmen with rifles. At nine o'clock, after the cannon had been fired, several engineers entered the building and came out carrying a coffin. This was opened and St. Patrick was discovered. He took charge of the parade which marched to town. All of the picture shows in town were rushed later in the same day."

At Nebraska, and Missouri, and Iowa, they have an engineering exposition the week of their St. Patrick's celebrations, at which they stage all of the spectacular and interesting stunts they can manage in the different engineering laboratories. On this occasion they hold open house at the laboratories so the general public may see the work they are doing. Field meets, ball games, speeches, smokers, and dances make up the deek's activities, of which the St. Pat celebration is only a part.

The organization known as the "Guards of St. Patrick," which has been mentioned before in connection with its activity in behalf of St. Patrick's Day celebrations, was founded at the University of Missouri in 1903. Branch chapters were established in the Rolla School of Mines in 1907, at Ames in 1910, Iowa State University in 1910, at Arkansas in 1913, at Oklahoma in 1915, and at Tennessee in 1919. Additional chapters may possibly have been established since then. The membership embraces all o fthe engineering students, who are placed in two classes, Knights of St. Patrick, and St. Patrick's Guards. Any senior who has taken part in all St. Patrick's Day celebrations while in school and who has paid his dues is eligible to be knighted. Any member who has not been knighted is a Guard. To all duly elected Knights of St. Patrick is given a certificate.

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Dr. David White, chief geologist of the U. S. Geological Survey, spoke to the engineering students, March 11, on the subject of "Fuel Reserves."

# EDITORIALS

## FUN

The annual St. Patrick's parade, which is scheduled for Saturday, March 19, offers every engineering student an opportunity to disclose his ingenuity, to show his pep for the school, and—here's the best part—to have unlimited amounts of fun. From making the wrench "that screwed the Law Shop 'nut' off the bench" to storing away the famous Blarney stone after the ceremonies, the parade of last year was one of utmost fun to all participants. It is an activity which no Engineer will want to miss.—M. K. D.

## THE SOPHOMORE HONOR ROLL

In the rotunda of Bascom Hall, in full view of all passersby, there is a plate with the title *Sophomore Honor Roll*. Upon this plate are displayed the names of the students who during the first two years of their Letters and Science course proved themselves leaders in scholastic endeavor.

The Sophomore Honor Roll not only serves as a source of interest and admiration to the thousands who observed it during the year, but also as a stimulus to increased scholastic effort. For, above all, students appreciate recognition of their ability and effort, and will work harder when they know their endeavor is to be rewarded.

In the Engineering College there is need for such an honor roll. Just like the L. & S. student, the Engineer appreciates the acknowledgment of long hours of hard study. True, the seniors and juniors have their Tau Beta Pi, and other honorary societies, but the road to any of these is a long one, unmarked by any encouragement other than the mere sight of grades on an advisor's transcript. Too often, also, men who acquit themselves creditably in the first two years lose interest in scholastic superiority in the latter part of their course and fall to the rear with a cry of 'What's the use?'

In years past several different Engineering honor rolls have been published, but there has been no regularity attached to their issuance nor any particular method used in the selection of the individuals. Why not establish an Engineering Sophomore Honor Roll as a college institution? Select those men who during the first two years have made the highest weighted averages and display their names where even the most casual passers-by will observe them.—W. D. T.

## COLLEGE VS. BUSINESS

Whether or not you believe that high grades are forerunners of success after college, you will be interested in the statistics on this point that are contained in the January issue of the Technograph, which is published by the engineering students of Illinois. Three members of the faculty of Illinois University compiled a list of some three hundred graduates of Illinois from the classes of 1886—1897. The grades of the graduates were taken from the school records, and an estimate was made of the success which each graduate had made since leaving school. This estimate was not based simply on his financial success, but also on the esteem in which a man is held in the community in which he lived, and his standing in his profession. The results of the investigation are given in a table, which is here reprinted. In order that the table maye be clearly understood, a word of explanation is given. Consider the man who had an average of B in college, but who made a great success after graduation. He would be listed in the horizontal row of figures opposite A and in the vertical column under B. Others are listed in a similar manner depending upon their scholarship and success. It seems unnecessary to comment further upon these figures, except to say that they do not confirm the idea that the scholastic scamp is the coming Edison.

| SUCCESS | GRADES | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| A | 29 | 13 | 6 | 4 | 5 |
| B | 10 | 19 | 9 | 11 | 10 |
| C | 7 | 14 | 14 | 5 | 3 |
| D | 6 | 11 | 16 | 17 | 20 |
| E | 1 | 4 | 1 | 5 | 11 |

## A PILGRIMAGE TO PRAIRIE DU SAC

By R. B. Bohman
*Sophomore Electrical*

Tuesday, February 22, furnished an opportunity for a party of our illustrious "plumbers," thirty-one in number, to explore the mysteries and intricacies of hydro-electric power generation at the plant of the Wisconsin River Power Co., at Prairie du Sac,—the largest of its kind in Wisconsin.

Under the leadership of Henry Ford, c '21, our party boarded the Prairie du Sac "Limited," and after a more or less uncertain journey, arrived at Prairie du Sac about noon.

Here we were introduced to real class by dining at the most prominent hotel in town. No expense was spared by its management to insure our complete and entire comfort, as the four lights in the dining room were switched on almost immediately upon our entrance.

A light rain greeted us upon our mile and a half hike to the plant, and managed to stay with us for the remainder of the day.

The plant itself is located at a broad expanse of the Wisconsin River ,and operates under a normal head of 30 feet.

# ALUMNI NOTES

By David W. McLenegan

The Road School drew many Wisconsin engineers back to Madison and gave them the opportunity of renewing acquaintanceships on the campus. Nick Isabella, c '14, Louie Rockett, c '15, Bill Drath, ex-c '15, George Eldred, c '16, and Charlie Holmes, c '17, were among the visitors.

Walter Leland Albers has graduated from the mining engineering course and is residing at his home in Hale Center, Texas.

George W. Axelberg, ex-c '22, has returned to the University after an absence of a year.

Robert W. Bailey, m '07, M. E. '10, a mechanical engineer and steel broker, may be addressed at Apartado 44, Tampico, Mexico.

R. E. Behrens, c '19, who has been with the Aluminum Company of America laying out a mining town near Georgetown, British Guiana, has returned to his home in Milwaukee, as the business depression necessitated stopping work.

J. P. Bendt, c '12, is with the Semet Solway Co. at the Franklin plant of the Cambria Steel Co., Johnstown Penn.

P. A. Bertrand, e '96, is General Manager of the Grays Harbor Railway & Light Co., which has charge of the street railway, electric light, and power utilities in Aberdeen, Hoquium, and Cosmopolis, Wash.

C. A. Betts, C. E. '14, is a civil and hydraulic engineer, residing at 2335 Hudson, Denver, Colo.

Major J. F. Case, c '90, recently added $500 to the loan fund which he established several years ago as a memorial to his son, Archibald W. Case, c '15.

Fred Chamberlain, e '03, is manager in charge of the Doherty properties at Mansfield, Ohio.

Melvin R. Charlson, c '20, is employed in the engineering department of the Wisconsin State Highway Commission.

F. B. Cronk, c '05, M. E. '14, is a mining engineer for the Oliver Mining Co., with offices in the Wolvin Bldg., Duluth, Minn.

The engagement of Robert C. (Bob) Disque, who is at present connected with Drexel Institute, Philadelphia, has been announced.

Jerry Donohue, c '07, was elected vice president of the Engineering Society of Wisconsin at its recent annual meeting held at the college February 21-23.

Joe Dresen, m '20, who is at present with the Fairbanks-Morse Co., of Beloit, Wis., was a visitor on the campus February 23.

Robert E. Egelhoff, m '07, is District Manager of the Turner Construction Co., Buffalo, N. Y. Egelhoff, who was formerly instructor in Drawing and Descriptive Geometry here, visited old friends here last month and informed us that he is married and has two boys, three and five years old. Some boys!

Wilfred Evans, c '17, is living at the Y. M. C. A. in Kansas City.

Tom Fieweger, c '15, is with the Central Engineering Co. of Davenport, Iowa. He is engaged in paving work and highway construction.

R. H. Ford, e '09, is an electrical engineer in Central Hershey, Province of Habana, Cuba.

E. A. Gallun, ex-m '19, who has been in the manufacturing business with his father in Milwaukee, is at present on sick leave at Ojai, Cal. His home address is 620 Newberry Blvd., Milwaukee, Wis.

Clarence Hanson, m '20, writes that he saw the Ohio State-California game, and that he "lost plenty on it." He has just been recommended by the chief engineer of the Standard Oil Co. of El Segundo, Cal., for transfer to the home office and refinery at Richmond, Cal. Although apparently he is enjoying life out west, one can read between the lines that Wisconsin would look good to him again.

W. F. Gettlemann, c '14, is assistant city engineer at Minot, N. D. He is at present in charge of the construction of a $300,000 sewage disposal plant at Minot.

W. G. Hanson, m '20, was around the campus not long ago. He is a testing engineer for the Fairbanks-Morse Co., of Beloit, Wis.

W. Dow Harvey, m '16, formerly located in New York City, is with Montgomery, Ward & Co., as manager of the gas engine factory. He resides at 1340 Dearborn Ave., Chicago, Ill.

L. F. Harza, c '06, is now a Consulting Engineer in Chicago along hydraulic lines. Previously he had been an instructor in Civil Engineering at Wisconsin, an engineer with D. W. Mead, a consulting engineer in Portland, Ore., chief engineer of the new hydro-electric development of the Great Lakes Power Co., Ltd., Sault Ste. Marie, Ont., and an engineer in charge of the Jacksonville Concrete Shipyard.

Burnie O. Henderson, c '17, is with A. Larson & Co., contractors at Eau Claire, Wis.

C. A. W. Henkel, c '16, is in the contracting business at Mason City, Iowa. He was at the University not long ago to receive his degree, after completing his course by correspondence.

William J. Huber, c '20, may be addressed in care of the Dravo Contracting Co., Vanceburg, Ky.

Roland Jens, m '16, is a tool designer with the North East Auto Gear Shift Co., of Eau Claire, Wis.

F. M. Johnson, c '06, is a senior highway engineer in the U. S. Bureau of Public Roads. His address is: Care of State Highway Dept., Austin, Tex.

Robert C. Johnson, c '17, visited Madison on January 31 to attend the Road School. He has recently removed from Chicago to Milwaukee. He is still with the Corrugated Bar Co., as a Sales Engineer. Address, 820 Wells Building.

W. F. Ladwig, c '20, employed by the Wisconsin Telephone Company's Milwaukee office, is in Madison installing cable.

Herman Larson, c '13, 3038 New Jersey St., Indianapolis, Ind., is a partner in the firm of Slattery & Larson, Civil Engineers and Builders.

E. J. McEachron, m '04, chief engineer of the French Battery and Carbon Co., spoke recently at the fireside assembly of the City Y. M. C. A. on the subject of "Handling Men."

H. F. Mielenz, c '17, was in Madison during the session of the Engineering Society. "Mike" is still with the city engineer at Beloit.

J. W. Millspaugh, e '14, is assistant to works manager of the Chain Belt Co., Milwaukee, Wis.

Charles J. Moritz, c '11, lives at Effingham, Ill., where he is completing a contract for paving thirteen miles of road, and for the building of several bridges.

"Ernie Moritz, c '04, project engineer on the Flathead Project of the Reclamation Service, visited old friends and classmates at the college on February 10.

Emmdtt J. Mueller, m '19, is a sales engineer for the Vilter Mfg. Co., Milwaukee, Wis. His address is 627 Frederick Ave.

F. G. Mueller, e '16, resides at Room 402, Y. M. C. A., Milwaukee, Wis.

(*Continued on page* 110.)

# 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.**

No. 1.

# ENGINEERING REVIEW

By M. A. Hirshberg

*Turbine Driven Locomotive*

The Swiss Federal Railways are making exhaustive trials of a locomotive equipped with a turbine. One of their standard type 4-6-0 locomotives has been converted for making the experiments.

The turbine, which is of reversible pattern, is placed in front of the smokebox. Power is transmitted by 30 to 1 gearing to a blind axle placed above the pilot truck and the rods of the six coupled drivers are extended forward, connecting with the crankpin on a disc at each end of the blind axle. The engine is designed for a turbine speed of 8,000 r. p. m. and a tractive speed of 78 km. per hour. Draft for the fire is maintained by a blower. A superheating and condensing apparatus are also included in the equipment.

The tests have shown a fuel saving of 25 per cent over the compound locomotives in service, and there is a marked absence of the vibration of the reciprocating engine.

*Progress in the Foundry*

There has been a great advance toward efficiency and economy in the foundry within the last few years. Probably the automobile industry, more than any other single factor, has been responsible for this change because the automobile manufacturers recognized the value of high grade castings. Whereas the foundryman used to follow rule of thumb methods in mixing his iron, such as determining the composition of the mix from a fracture of the pig iron, he now makes a chemical analysis of the iron and from such analysis determines the exact proportions necessary. He knows the composition of his casting because he knows what he puts into it, and, furthermore, does not have to scrap material because of inaccurate mixing methods. Thus the foundry, which, as some one has said, "is to the machine-shop what the kitchen is to the home," has recently come to operate on a scientific and economic basis.

*New Methods in the Machine-Shop*

Ellsworth Sheldon, associate editor of the *American Machinist*, in the February issue gives a bit of interesting material on the adaptability of special fixtures to grinding machines. Only within the last few years has the grinding of bearing surfaces been looked upon with favor by machinists. At the present time, however, the efficiency of the process is well recognized and up-to-date machine shops are beginning to have as many special appliances for grinding machines as they do for milling machines or planers. The use of these appliances has increased the efficiency of the manufacturing plant wherever they have been installed, and bearing surfaces are now made more rapidly, more accurately, and with greater perfection than ever before.

*Electric Power from the Air*

An amazing discovery that static electricity of the atmosphere can be transformed into regular dynamic current has been made by Gustave Sentner, an Italian inventor, according to *Universal Service*.

By this process electricity is drawn out of the atmosphere by a very simple apparatus. It consists of a pole 36 feet high upon which a collector of aluminum combined with radio-active substance is mounted. The collector is connected to a transformer by means of a special wire. The electricity of the air and that of the atmosphere are attracted by induction, while the radio-active substances cause a reaction which changes the nature of the current. The Italian government has requested the inventor to continue his researches.

*Earth Masonry for Building Construction*

Experiments made by Mr. T. C. Young, a St. Louis architect, have convinced him that earth may be used successfully for the walls of small dwellings, farm buildings, fences, garden walls, and similar purposes. In an article in *Engineering News-Record* of February 10, Mr. Young describes the construction of an oil storage house 10x13 feet in plan, which was built of a mixture of moist clay and loam, tamped into forms made as for concrete. Various forms of waterproofing, such as plaster, coal tar products, and paint, have been applied experimentally to this building, and time will determine the necessity and relative usefulness of these coverings. It is too early to make estimates of the cost of this kind of construction, but it seems probable that earth walls, plastered, can be built at from 35 to 50 per cent of the cost of common brick walls.

*Measurement of Blast Furnace Gas*

An article in *Mining and Metallurgy* gives an interesting account of the use of a Venturi tube for the measurement of blast furnace gas. The experiment was performed at the Federal Furnace Plant, South Chicago, Ill. The Pitot tube could not be used on acocunt of the sludge in the gas which quickly plugged the dynamic and static holes, and spoiled the gage readings. A pipe section with a sharp-edged orifice was therefore used because of the similarity to the Venturi tube, and because of its small size and cheapness of installation. The formulae developed for its use were simple and reliable for the determination of the flow of gas, and they are equally applicable to Venturi or Pitot tubes if the correct constant is substituted.

*Patent Office Bill*

The Patent Office Bill, framed by Doctor Cottrell, the late Director of the Bureau of Mines, which has as its object the reorganization and systematizing of the present Patent Office, is just now in dispute between the Senate and House of Representatives. Three main provisions of the bill in dispute are:

Salaries of Patent Office Employees,

Disbarring of Unscrupulous Attorneys, dealing with the persuasion of ignorant people by unscrupulous attorneys to apply for useless patents,

Administering of Employees Patents, the object of which is to aid in the development and protect patents obtained by employees of the Government.

The first provision has met with favor, the second has received but little attention. But the third has given rise to some heated discussion, especially by the representatives of the manufacturers' associations who declare that they would rather see the bill lost than to have such a provision included. A substitute for this third provision is now being drawn which it is hoped will meet with better favor, and will soon be presented to the Patents Committee.

### $28,000,000 *Bridge*

Bills authorizing the construction of a $28,000,000 international bridge spanning the Detroit river from Detroit to Windsor, Ont., have been introduced into Congress and the Canadian parliament. The bridge, as planned, will consist of two decks, one for railway service and one for vehicles and pedestrian traffic. It will be operated by the two cities, and the expense of constructing will be met by large business interests on both sides of the river. The only means of crossing the river now is by privately operated ferries.

### *Piping Coal from the Mine*

A project to bring coal from the anthracite regions in Pennsylvania into New York City through two fourteen inch pipes by water pressure has been put forward by R. P. Bolton, in the *Scientific American*. Because of a difference in elevation of 2,000 feet between New York and the mines at Scranton, Pa., it is estimated that 7,000,000 tons could be transported. Since 1915 the system has been operating successfully on a small scale in London. The cost of transportation, it has been calculated, would be less than seventy-five cents per ton, and the resulting saving at the mine, due to the adoption of this system, would serve to reduce the price of coal about $1.50 per ton.

The coal to be so delivered must be pulverized and treated in the usual way at the mine concentration plant to remove impurities. The pulverized coal is placed in the pipe line, and forced to the city by means of pumps placed at various points along the way.

The recent car shortages have been responsible for the high prices of coal in all parts of the country. The mine output has not been available in consuming centers at the time of need. Consumers have had no assurance of delivery at any definite time. With this water system of delivery a constant supply would be directly available to consumers at a price somewhat lower than that of today.

(*Continued from page* 108.)

C. H. NICHOLSON, ch '16, is with the Electrical Machinery Sales Co., 832 First National Bank Bldg., Milwaukee, Wis.

C. R. POE, e '17, may be addressed in care of the American Telephone & Telegraph Co., 195 Broadway, New York City.

THOMAS NORBERG, who has been at home in Norway since last June, has returned to school.

LT. A. A. ORT, C. E. '12, has remained in the navy since the conclusion of the war. For some time he was stationed in Philadelphia, assigned to welfare work in the shipyards. He has recently been transferred to Port au Prince, Haiti, where he has charge of the work of the Navy in improving the telegraph and telephone service on the island.

PROFESSOR RAY OWEN, c '04, went down to Louisville, Ky., the latter part of the week of February 21 to direct the subdivision of Camp Zachary Taylor. Ray says that the camp is to be used as a residence district.

H. A. PAIGE, m '12, Manager H. Johns-Manville Co., Milwaukee, was about the University February 22. He spoke before the Engineering Society of Wisconsin on, "The Properties and Efficiencies of Heat and Insulation."

GUY PALMER, e '08, is in charge of an engineering project at New Brunswick, N. J. He has only recently returned from Cuba where he has been doing a similar line of work.

R. H. PARKER, c '16, is an engineer and contractor in McCook, Neb.

ROBERT P. PETERSON, c '16, is with the Henry W. Horst Co., of Moline, Ill., as chief engineer of road construction.

JAMES C. PINNEY, C. E. '10, dean of College of Applied Science & Engineering, Marquette University, was in Madison for the meeting of the Wisconsin Society of Engineers.

BERT PUERNER, m '19, is with the Allis-Chalmers Co., West Allis, Wis., and resides at the Allis-Chalmers University Club, 5031 National Ave.

R. E. ROBERTSON, c '10, is County Highway Engineer at Mason City, owa. GEORGE HENKEL, c '17, is working with Robertson as assistant County Engineer.

L. C. ROGERS, c '15, writes that he is superintending the construction of five miles of concrete Dixie Highway at Milford, Ill.

W. A. ROYCE, e '16, is with the Cerro de Pasco Copper Corporation, and is in charge of the installation of a large electrical unit for that campany at Morococha, Peru, S. A.

K. L. SEELBACH, m '18, is an engineer with the Forest City Foundry & Mfg. Co., Cleveland, Ohio He resides at 1601 Hollyrood Rd.

R. C. SIDGEL, e '20, is with the Wisconsin Telephone Co., Milwaukee.

BOB SVITAVSKY, e-ex '19, has returned to complete his course in electrical engineering.

JOHN R. SMITH, m '05, estimator for the Freeman-Sweet Company of Chicago, a firm of electrical contractors, made a business visit to Madison, and called at the College on February 17. Smith organized the Electrical Estimators Association three years ago and has succeeded in putting estimating on a systematic basis in that industry. His biggest feat has been to make the various competitive firms loosen up on their cost data so that the associated estimators have the benefit of the experience of many contractors in that line of business.

E. J. SPRINGER, g '09, is the New York manager of the Heine Chimney Company, at 30 Church St.

F. STEWART TURNEAURE, who completed his course in mining in February, and John North, a former commerce student, sailed for Colombia, South America, on February 22, in company with Eugene Brossart, a former Wisconsin man. The party headed for the emerald mines of the Carib Syndicate near Bogota. Besides his work in the mines, Turneaure expects to do some oil exploitation for the syndicate.

Mr. Owen Jones recently took up his duties as piano leg designer for the Bangem Piano Company. Yes, we give a Ph. D. in piano leg design, the best course in school. Mr. Jones is finding his work exceedingly interesting, to say the least.

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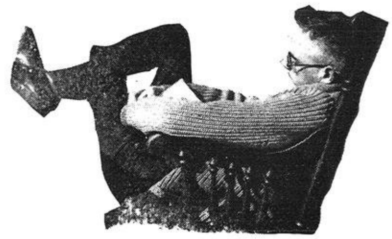
It's bad enough to have the Commerce students come over and use the auditorium occasionally or invade our drawing classes; but when the ag. school sends over a delegation to study hydraulics,—well, it seems to us it's time to draw the line. Yes, it is true; Prof. Corp tells us that he has a class of ags. studying "Water Measurement"—whatever that may be.

# CAMPUS NOTES



By FREDERICK W. NOLTE

St. Pat is with us again. Hooray!

All join hands and sing "The Wearing of the Green."

### "'MOST PERFECT GIRL' MARRIED TO ENGINEER."

In proof of our contention that the engineers always go after and get the best—we offer the above headline taken from a recent newspaper clipping. Say what you will, it takes an engineer to do things right.

### GET YOUR SMOKES?

Pat Hyland is still smiling about those twin daughters, Marguerite and Patricia, who arrived on February 23. Pat lays it all to the efficacy of the office he inhabits. Prof. Keown, his predecessor, had a similar experience not so very long ago. Prof. Kinne, who has charge of the assignment of rooms, says that faculty members are real sports, and that already there are movements under way to dispossess Pat and take his office from him.

The newly installed student chapter of the American Society of Civil Engineers held its first meeting on Friday, February 25th. Dean Anson Marston of Iowa State College at Ames, welcomed the chapter into the organization. Dean Marston, who is a director of the A. S. C. E., reviewed the growth and development of the society and its present policies. Professor L. S. Smith told of the University of Wisconsin Civil Engineering Society as it was in his day at school, while I. I. Rotter gave an account of the present status of the society.

The first unit of the new engineering laboratories, which is located on University Avenue, just west of the Forest Products Laboratory, was the scene of a house warming by the engineering faculty on February 9. Supper was served under the direction of Mesdames Owen and Price. Ray craved the ham, and Jack Price was coffee boy. After supper The Dean conducted an examination of his faculty. Each person wore a card with a number. Each was given a blue book containing numbers and was told to drift around and write in the book the name that corresponded to each number. Then the books were checked against the key list and graded. The great number of new names made it an exciting test of mixibility. Passing grade was 80 names, and only ten per cent of the class was able to pass. There was much complaint of the high standard that is being required of the faculty this year, but the Dean made his standard stick, and the sore head special went out heavily loaded. Professor Kinne was high man with a grade of 94. Prof. Millar was a close second with 93, and Van Hagan came third with 89. Mrs. Corp and Mrs. Van Hagan both received passing grades. Erwin Anderson, instructor in Steam and Gas, had a grade of 87 and received special commendation in view of the fact that he is a new man at Wisconsin.

### NEW SHOP

The pattern and foundry classes started with a rush at the new engineering shops at Camp Randall. The benches for the foundry were designed by Instructor Goude and made by the students. The ¼ ton baby cupola, designed by Mr. Payton, is operating successfully. It was built by Shop 7 men under the supervision of Mr. Hitchcock. Locker facilities will be provided immediately. Mr. Lehman has charge of the new shops. The forge shop will be in operation at the end of this semester.

Dean Anson Marston, of Iowa State College, spoke on Friday, February 25, in the Engineering Auditorium. His talk was on "Our National Highway Engineering Problem," and it was well received. Dean Marston is a member of the Iowa State Highway Commission, the National Research Council, and is a director of the American Society of Civil Engineers.

Old Timer says that once upon a time it was the custom for the senior engineers to play a game of base ball with the engineering faculty sometime in the spring when Commencement Day was near and there was little chance of a senior receiving the prong in case of poor diplomacy. And it fell out that, on one such occasion, Reddy Millar came to bat with Jerry Donohue on the mound for the seniors. As Jerry wound up, some soph in the stands, who had been flunked in descript, bawled out, "Soak him in the ribs, Jerry." And lo, Jerry heard the shout, and became wild and the ball crashed into Professor Millar's ribs with a sickening clank, and the unfortunate sank to the greensward and was carried off in a blanket. Which is the true reason why Jerry Donohue, when he returns to Madison for conventions and such, cannot be induced to wander into the wing where Prof. Millar has his sanctum.

## TRY THIS ON YOUR SLIPSTICK

An L. & S. instructor, in checking a problem for his class of C. C.'s, read the following answer on his 10-inch rule. "3001." Then the C. C.'s marvelled.

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The biggest parade in years is the prediction for the Engineer's St Pat parade on March 19th. The sacred Blarney stone, the snake, and St. Pat himself will be there. Floats typifying the engineer's idea of the colleges across the campus and on the hill will be features of the parade, and prizes will be offered to the entrants of the best exhibits of talent. All engineers not in some group will be expected to march in the cheering section.

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The Engineering Society of Wisconsin, a state organization, held its thirteenth annual meeting at the college on February 21 and 22. It brought many Wisconsin alumni back both to deliver papers and to listen. Prof. C. I. Corp was elected president, and Jerry Donohue, c '07, vice-president for the ensuing year.

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DANNY MEAD was recently re-elected president of the fast-growing and enthusiastic Technical Club of Madison, and in accepting the honor, said that he felt like the young lady of Siam:

There was a young lady of Siam
Who said to her lover, "Oh, Priam,
To kiss me, of course,
You'll have to use force,
But God knows you are stronger than I am."

---

## EXAMS

Exams are just a pipe for me; they cause no grief nor misery, for I've been as busy as a bee the whole semester long. I've ambled gently on my way and cleaned the slate up, day by day, so now I whistle and feel gay for with the profs I'm strong. No lab reports curtail my joys; no cramming makes me lose my poise; I list serenely to the noise made by the loafing throng. They spoofed me in the days gone by when they shot pool and fussed, while I was running the old bean on high; but now they're all in wrong. They're victims of hard hearted profs, who flunk the freshmen and the sophs and greet all bulbul talk with laughs,—if you'll believe their song. Nay, nay, old dear, don't shift the blame; quit bellyaching and be game. The profs treat all of us the same. Don't quit and take the gong. Just buck up, bo, you'll find it's great if every day you'll clean the slate, and profs won't push you through the gate, nor spear you with the prong. MALT BASIN

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## MODERN CONVENIENCES OF EDUCATION

Prof. Andy Anderson in Steam and Gas 3—: "You may see now in our steam work that we need no definition or understanding of entropy, which is a great convenience."

One of the numerous co-eds who infest our no longer sanctum happened to be in the corridor on the third floor near the busy stairway.

Says she in great excitement and haste, "Where's down?"

What should Tau Bete have answered?

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## A PAT STORY WITHOUT THE MIKE

Once there was a Professor of Machine Design and they called him "Pat." On the side he did certain little things such as designing heating and ventilating systems for schools, presumably to add to his professorial income. One day a fellow Prof. in an adjoining office heard a sound like autumn and, going into Pat's office, found him feverishly turning the leaves of an E. E. handbook. Quoth he, "What's the matter, Pat?" And Pat says, "Why is an induction motor?" Upon hearing the explanation he said, "Thats what I thought. But I specified one for a ventilator fan in the Podunk schools and they tell me it won't run." "What kind of juice do they have up there?" asked the fellow Prof. "Why, it's direct current," says Pat.

Pat is right-handed, and he wrote the specifications with a left-handed fountain pen, which probably accounts for the slip of the induction motor.

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The following men completed their work in the mining course last semester and have been recommended for graduation: Warren Walters, Joe Roman, Frederick S. Turneaure, Walter Albers, H. G. Hymer, Marcus Link.

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Professor Van Hagan made a trip to Chicago on February 26, to represent the WISCONSIN ENGINEER at a meeting called for the purpose of organizing technical college magazines into an association.

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Two new men have been added to the staff of the mining school this semester.

Mr. Joseph Oesterle, a former graduate of Wisconsin, is Research Professor of Metallurgy. He comes from the metallurgy division of the Bureau of Standards.

Mr. George J. Barker is an instructor in mining and comes from the research department of the Great Falls plant of the Onaconda Copper Company.

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Do not forget to salute the Blarney Stone in a suitable and fitting manner. Remember your chance comes only once a year.

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Frederick S. Turneaure has gone to Colombia, South America, on geological exploration work for a large eastern syndicate.

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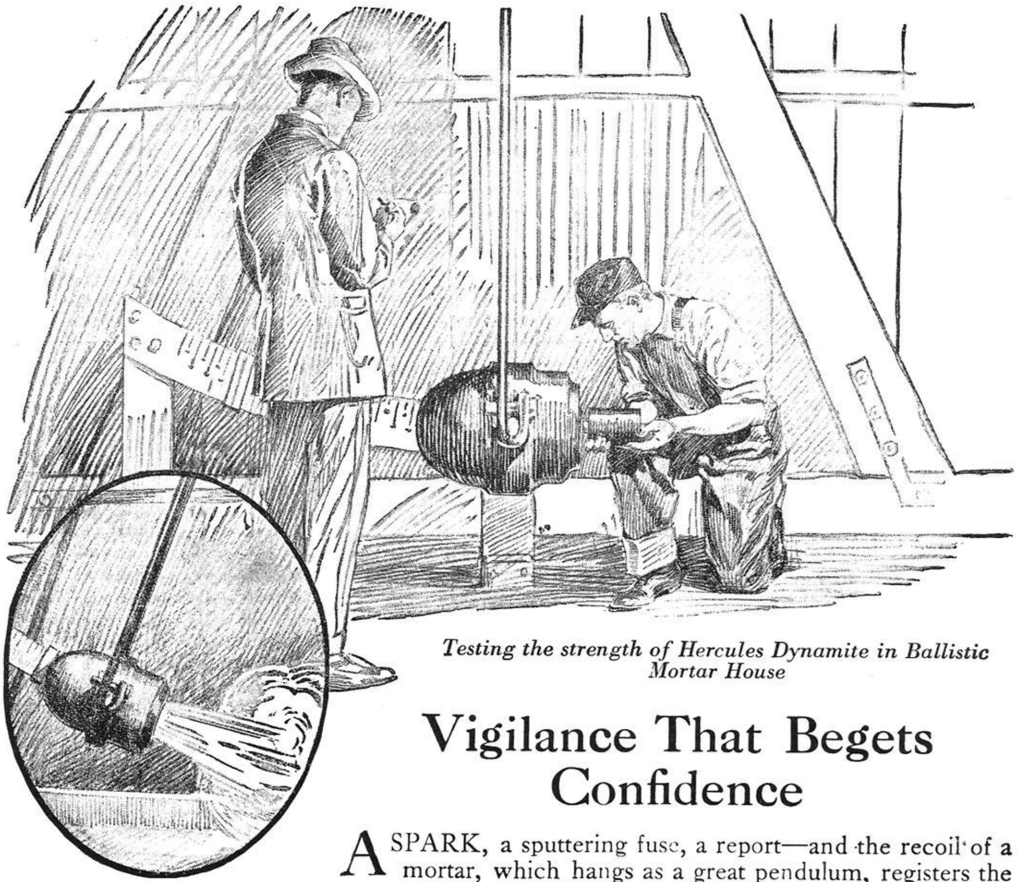
Junior M. E.'s no longer have a fear of high voltages such as they had before starting E. E. 144. At the beginning of the course, their instructor, after a lengthy lecture on the danger of electricity, told of a man who "carried" 4,000 volts,—but lived.

"But," he said, "he was almost entirely killed."



*Testing the strength of Hercules Dynamite in Ballistic Mortar House*

# Vigilance That Begets Confidence

A SPARK, a sputtering fuse, a report—and the recoil of a mortar, which hangs as a great pendulum, registers the energy stored in Hercules Dynamite. This simple but accurate test is only one of many which are employed by the Hercules Powder Co. to maintain the unfailing high and uniform quality of Hercules Explosives.

Before it is finally accepted as ready for commercial use a Hercules Explosive, no matter what its nature, must pass almost as many examinations as a boy about to graduate from high school. It is due to this unflagging vigilance on the part of the men who make them that the products of the Hercules Powder Co. occupy the enviable position they do in the fields of sport and industry.

Among hunters and trap shooters, miners and quarrymen, engineers and contractors, Hercules Explosives enjoy a firmly established reputation for unusually high and uniform quality. This is the reason why they are called upon to perform so much of the work which can only be carried on efficiently and economically by the use of explosives.

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