Mr. Markham

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THE DUKE ENGINEER

Volume 2 Number 2 March 1941

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of Duke University

TO OUR NEW PRESIDENT –

It was with genuine pleasure that the engineers of Duke University learned of the action of the Board of Trustees in appointing Dr. Robert Lee Flowers to the presidency of the University.

We are proud to state that this is the first time that a man with engineering training has been appointed to the guiding post of a school of such size and renown as Duke University.

When Dr. Flowers came to Duke in 1891 from the Naval Academy at Annapolis where he received his training, he was assigned the position of Instructor of Mathematics, but found he also had to teach courses in electrical engineering. He took a position with Westinghouse during the summer to obtain practical experience in this field and later took an active part in the electrical wiring of various parts of Duke University.

This practical contact with engineering and his previous training brought out his everlasting and sympathetic interest in all happenings on the engineering campus. Dr. Flowers is always well informed on all our doings and never is too busy to visit our assemblies or shows. He is perhaps the only University official who fully realizes the engineers place and problems

The engineers join with the writer in wishing Dr. Flowers many pleasant years of sucess in guiding the destiny of Duke University. May he always know that the Engineers are with him 100 per cent!!!!

The Editor.

E.S.G.A.

As a result of the joint action taken by the undergraduate men of both colleges, an Engineering Student Government Association (E.S.G.A.) was formed to replace the unwieldy and dated Engineers' Club and Council. This new organization has full jurisdiction over all students of the College of Engineering and is answerable to no other student organization. The fact that we are no longer under the S.G.A. of Trinity College should not tend to push the two student bodies apart; rather, the severing of that link should urge us to form other and stronger connections in other ways. We are not merely one of a number of colleges; <u>we are a part</u> of Duke University.

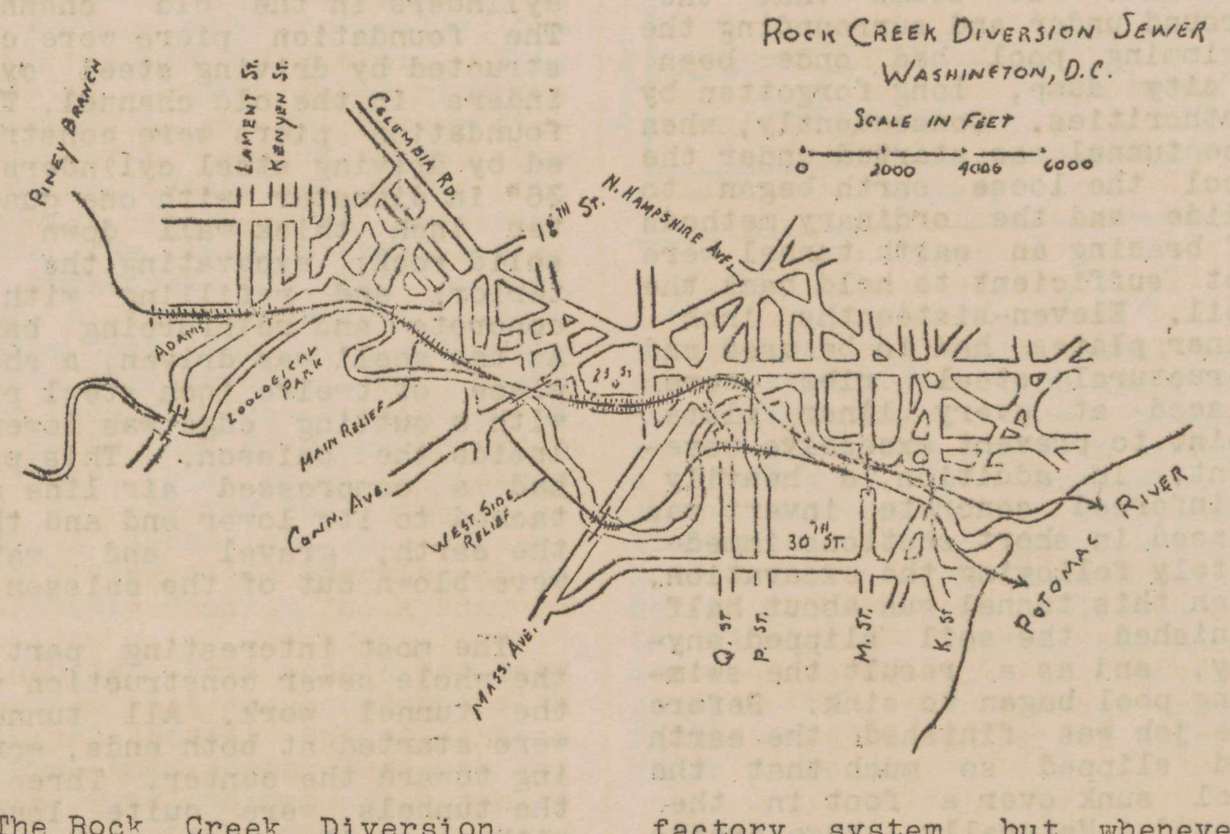
The formation of the E.S.G.A. brought about a number of important changes which will affect the engineering students. In the main, an attempt was made to enlarge the field of activities of the Organization and to enable more students to participate in its functions. The Engineers' Club was done away with, and voting privileges were extended to all engineering students independant of payment of dues. Restrictions formerly existing on non-residents of Southgate were removed, and those boys are now given more of an opportunity to take an active part in all engineering affairs. This new organization is no longer a <u>Southgate</u> Council but an <u>Engineering</u> Association.

R.E.Perinovich

SEWER CONSTRUCTION

C. NEAL FLEMING JUNIOR C.E. OUTLINES DIVERSION SEWER PROJECT

For the past two summers I have been working in a sewer. Let me state, however, in order to not liken me to a common "sewer rat," that this sewer was in the process of construction and had not yet been used for its primary purpose.



The Rock Creek Diversion Sewers, as the name implies, were designed to keep sewage from flowing directly into Rock Creek and thus polluting the water.

Let me give you a brief picture of the set-up as it stands. The natural wooded valley of about 75 square miles in area in the District of Columbia, through which the creek runs, is occupied by Rock Creek Parks and the Zoological Gardens. The area immediately adjoining this is densely populated. About 160,000 people living in Rock Creek basin are served by combined sewers, that is, sewers which carry both house sewage and storm water run-off. During dry weather this is a satisfactory system, but whenever rainfall occurs these intercepting sewers become supercharged, and the combined flow of sewage and storm water is emptied directly into Rock Creek. This happens about 40 times during the average year. Thus a great necessity arose for a new system of sewers for the purpose of eliminating the pollution of Rock Creek. A huge relief sewer was designed for this purpose and the plans were turned over to the P.W.A. for construction. This relief sewer was to be about 8½ miles long, beginning at the first Rock Creek outlet and continuing on down to the Potomac River. In this 8½ miles lf length, the plans called for over two miles of tunneling through solid rock.

The first section of the project extended from the Potomac River north to "N" St., a distance of about 4,400 feet. This section was built by excavating an open cut all the way with the exception of a short earth tunnel under the Francis Swimming Pool It was in this short tunnel that the first difficulty was met. It seems that the ground under and surrounding the swimming pool had once been a city dump, long forgotten by authorities. Consequently, when the tunnel was started under the pool the loose earth began to slide and the ordinary methods of bracing an earth tunnel were not sufficient to hold back the soil. Eleven-sisteenths inch liner plates had to be used and structural steel ribs were placed at every liner plate :oint to prevent excessive movement. In addition, a heavily reinforced concrete invert was placed in short sections immediately following the excavation. When this tunnel was about half finished the soil slipped anyway, and as a result the swimming pool began to sink. Before the job was finished the earth had slipped so much that the pool sunk over a foot in the ground. Naturally, huge cracks and crevices appeared in the bottom of the pool and on the sides of the bath house. It cost the contractor a good bit to repair the damage done by that 200 ft. earth tunnel. The remainder of Section 1, above the swimming pool was built in an open cut. In this part the contractor sheeted and braced the trench with H columns, two inch horizontal timber sheeting and 12" x 12" lateral bracking. The H columns were driven prior to excavation. This made a very satisfactory method of holding the trench. However, many columns could not be pulled up on completion of the construction and most of the sheeting timber was lost. The contractor soon abandoned this method as too costly.

One of the interesting features of the layout of this sewer was the diversion of the channel of Rock Creek for a distance of about 800 feet. The creek was diverted to the west and the sewer was built on steel cylinders in the old channel. The foundation piers were constructed by driving steel cylinders in the old channel. The foundation piers were constructed by driving steel cylinders 36" in diameter with one quarter inch thick wall down to solid rock: excavating the interior: and refilling with concrete and reinforcing bars. As the shell was driven, a short piece of twelve inch steel pipe with a cutting edge was lowered inside the caisson. This pipe had a compressed air line attached to its lower end and thus the earth, gravel and water were blown out of the caisson.

The most interesting part of the whole sewer construction was the tunnel work. All tunnels were started at both ends, working toward the center. Three of the tunnels were quite long, with several curves in them. The tunnels were built on a slight slope with a drop of about two feet every thousand feet. It was entirely up to the surveying crew (of which I was a member) to make these tunnels meet in the middle, on line and on grade. When the first tunnel broke through it was off line by an eighth of an inch and two thousandths of a foot off grade, which was considered quite accurate. All of the tunnels came out about this close, one of them being perfect in line.

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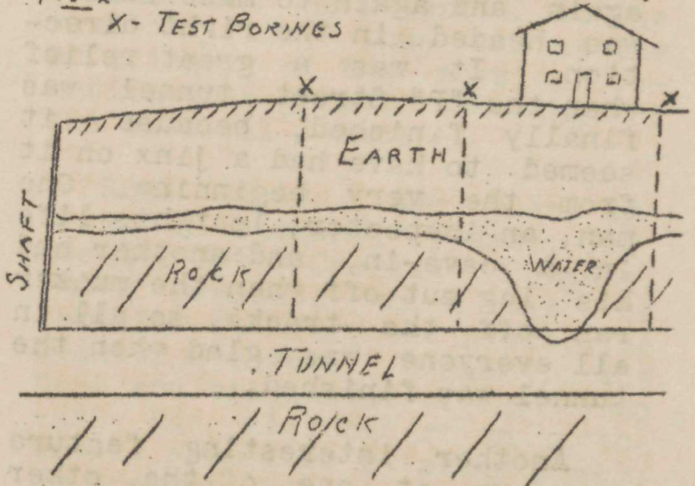
"Providence helps the man who TRIES"

The tunnel known as the "P" Street tunnel, so-called because its shaft and beginning were at "P" Street, was the most troublesome part of the project. In the first place, the original test borings did not reveal the true identity of the subsoil conditions, and a huge water pocket was not discovered until after the tunnel had been started. (Refer to figure 2). As a result the tunnel struck the bottom of the water pocket and consequently all the water flooded into the tunnel and had to be pumped out. As soon as this water was gone, however, there was a large cavern left in the earth, and, naturally, the earth settled quite a bit. This settling played havoc with the foundations of the houses directly above the settlement. One house in particular (Refer to figure), which was directly above the water pocket, had to be abandoned. It had settled over a foot and a half in some places and was also slightly tipped over on edge. This was a very peculiar case, because no one party was to blame for this accident, but still, somebody had to pay for the house. The last I heard of this affair, they were still arguing as to who should replace the house.

However, this wasn't the only trouble that was connected with the "P" Street tunnel. Even before the shaft was sunk to begin work, there was a job of relocation to be done. It seems that there was already a smaller sewer existing under "P" Street, and no one knew just exactly where it was located, so the surveying crew came in for a little dirty work. We had to go down in this existing sewer with a transit and tape and measure the angles and distances (we did this at four o'clock in the morning, thinking there would be the least "traffic" in the sewer at that time). Anyhow, the sewer was finally relocated and work was started on the new one.

The entire tunnel had to be driven by blasting, with rigid requirements placed on the method of using the dynamite. The rock was a hard mica schist, very seamy. The seams ran in all directions and considerable overbreakage occurred, but nothing that could not be handled by

FIG. 2



timber bracing. This tunnel was about twenty feet high and fifteen feet wide. The actual sewer that was built in it had a 14'-6" x 11'-7¼" horseshoe cross section. The concrete lining was placed by pneumatic methods, the arch and sidewalls being placed first, followed by the vitrified brick-lined concrete invert. All the voids caused by overbreakage were filled with cement grout placed under pressure.

It might be interesting to know how we transferred the tunnel line from the ground elevation down into the tunnel itself. This was done by means of fifty pound plumb-bobs, hung on thin steel wire. Two points on the center line were located directly over the shaft, and from these two points the 50 lb. plumb-bobs were lowered 75 feet down into the tunnel by means of small winches and then locked into place. On the floor of the tunnel the plumb-bobs were set in buckets of heavy oil to prevent any swaying that might occur. Once these two bobs were lowered it was a simple matter to take the transit down into the tunnel and set up on the same line. In this way the tunnel line could be checked again and again to make sure it was headed in the right direction. It was a great relief when the "P" Street tunnel was finally finished, because it seemed to have had a jinx on it from the very beginning. One man, an inspector, lost his life in a cave-in, and another had his leg cut off when the mucker ran off the tracks, so all in all everyone was glad when the tunnel was finished.

Another interesting feature came up at one of the other tunnels. It happened that the Calvert Street tunnel portal was fairly close to the last abutment of the Calvert Street Bridge, and when blasting operations were started complaints were received from nearby residents. Investigation of these complaints disclosed that air concussion was caused by the closeness of the portal to the arch of the bridge, which acted as a sounding board. Very little vibration had been noticed through the ground. Tests were then made in all the houses from which the complaints came, using a pin test device developed by Professor E. H. Rockwell, now Dean of Engineering at Lafayetts. This device consists of 14 steel pins one quarter inch of lengths varying from four to seventeen inches, balanced on a carefully leveled steel plate. Vibration from blasting may tip over certain pins, the taller ones falling more easily than the shorter ones. If all the pins fall, there is little doubt that the vibration is excessive, in terms of possible structural damage to buildings. If, on the other hand, no pins fall, it is evidence that no structural damage will be caused. If only two or three of the taller pins fall, it is improbable that damage will occur, but indicates that the safe limit is near. In no case where the pin device was used was there sufficient jar from blasting to tip over a single pin.

The reaction of an explosion upon the human nervous system is the combined result of noise, air concussion (evidenced by rattling windows), and the actual jar due to movement of the ground. The last may be small and yet a nervous person may honestly believe his house is about to be destroyed.

This whole project I have very briefly outlined required a period of about 3 years. In fact it isn't completed yet, lacking a few finishing touches and general clean up work. It will probably be put into use about next June. The total project involved the construction of about 40,000 feet of sewer, of which 11,000 was constructed in tunnel. The cost of the whole thing, including engineering, was approximately $3,500,000.

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My love has flew
He did me dirt
I did not knew
He were a flirt

To those in love
Let I forbid
Lest they be do'ed
Like I been did

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YE STANLEYE STEAMER—1941

DONALD RUSSELL SENIOR E.E. REVEALS ITS POSSIBILITIES

While daydreaming, haven't you ever imagined yourself behind the wheel of a super automobile ----an automobile capable of smooth, steady speeds up to 150 or even 200 miles per hour; capable of rocket- like accelerations from dead stops; a reserve of immense power which might be called on for sudden, fast, ac celerations; an instantaneous flow of power to the wheels at a feather-like touch to the accelerator; no bothersome gear-shift or clutch pedal? Why do I ask this? Because this is no fantastic midsummer's dream, but a reality of as today. There is an automobile ---a miracle of man's ingenuity and cunning--an automobile that has proved its abilities in practical tests.

It is not entirely like the automobiles with which we are now familiar. It is impossible to build an internal combustion engine which would fufill the requirements of this "dream" car. The reason that this is impossible is that the capacity of the internal- combustion engine is proportional to its size and displacements. For a set size engine, the capacity is restricted by stresses and other characteristics of the materials of which it is possible to fabricate the engine. For these reasons we must then turn to some other means of locomotion for our "dream."

The machine of chemical reactions has been eliminated, and we must turn to physical reactions. If we must use physical reactions, what reaction would give us ideal results for which we are seeking? Why not use the great internal energies stored in steam?

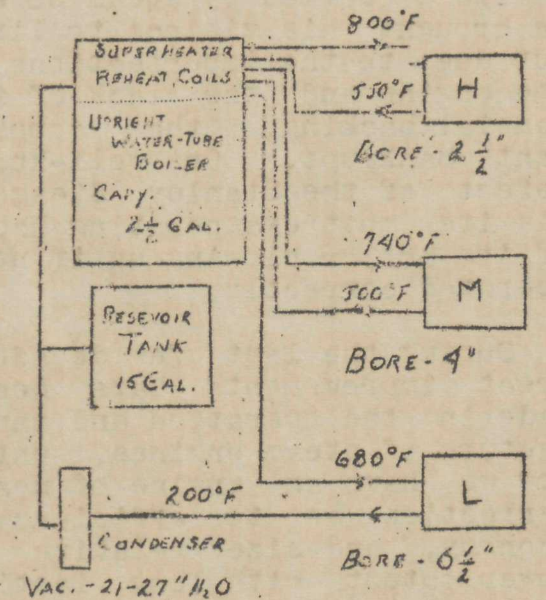
Steam as a source of power is very flexible. Its effects can be controlled more fully than can chemical combustions. Also more useful energy may be converted from the potential to the kinetic form, thus making the efficiency of the physical reaction much greater than that of the chemical reaction.

Some decades ago there existed a company; by name, The Stanley Motor Carriage Company, Thier product, which may be familiar to many, was named, The Stanley Steamer. Stanley, the head and originator of this company, had visions of an automobile propelled by steam power. He brought his visions to life, but due to the imperfections of the engine and the lack of financial backing, the company went bankrupt. One well-known defect of the Stanley Steamer was its most exasperating habit of its boiler blowing up if not operated correctly.

During the last few decades, great improvements have been made in the operation and manufacture of steam engines, until now we have an engine of near-perfection as to efficiency, economy, and size relative to power output with long lasting qualities. During this same time, an engine operating on steam and intended for the operation of vehicles has been designed. The product which has been conceived is now being placed on the market by the Stanley Steam Motors Corporation. The company feels that they are placing in the hands of the public a product vastly superior to the internal-conbustion engine now in common useage.

Some of these advantages are: its lack of vibration; its lack of bothersome noise; its flexibility of the power unit, which supplies full power at any speed of operation; its smoothness of energy changing from the physical form to that of mechanical motion; its greater tractive power; its simplicity of operation and manufacture; and its longer trouble free operation and economy.

And now to get technical about the matter, we go into detail concerning the engine. The new steam unit is a one-hundred and fifty horsepower, triple-expansion (reheat cycle), three cylinder, double V-type engine with a four-inch stroke, and with 2½", 4", and 6½" bores having an inlet steam temperature of 800, 740, and 680 degrees Fahrenheit respectively.



Schematic Diagram of Boiler & Cylinders.

The boiler and engine are composed of a single unit; the boiler being an upright, water-tube, flash type, with a capacity of two and one-half gallons, together with a reservoir tank capable of holding fifteen gallons of water. The size of the unit is small and compact with a weight of approximately 1300 pounds and can be installed under the hood of any automobile, replacing the present engine and transmission. It should be noted here that this weight is of the entire unit, in which the triple expansion engine is bolted directly to the boiler. The three cylinders are set at angles of 60 degrees with respect to each other and deliver power to a simple counter-balanced crank which receives as many power impulses per revolution as a twelve-cylinder gasoline engine. A small two cylinder auxiliary unit with automatically regulated speeds supplies power to the water pump, which automatically feeds the boiler with water; to the blower, which forces air through the burner; and to the condensor fan and generator. The complete power unit requires only the turning of the ignition switch to start it in operation.

The thermal efficiency of the engine is approximately 22% of best load and speed. The volumetric efficiency of the engine ranges from 104% to 86% at different speeds. The overall efficiency of boiler, engine, and auxiliaries, from fuel to delivered horsepower is approximately 17%. This overall efficiency can be compared to that of the gasoline engine which has an overall efficiency of approximately 11% to 12%. This high efficiency was made possible by the use of the reheat cycle and a complete temperature drop through the pistons. Note from the diagram that the exhaust temperature to the condensor from the low pressure piston is 200 degrees F. and each pound of steam contains less heat to be dissipated. This makes possible the use of a standard radiator in an automobile.

The greatest improvement in

design of this unit in comparison to the old unit is in the boiler and burner construction. The old Stanley boiler had the most exasperating habit of blowing up if not carefully watched for pressure and feed water, and this occured while operating under conditions of pressure up to 900 lbs. per sq. in. The new boiler is designed to operate at a pressure of 1200 lbs. per sq. in. under a factor of safety of five. To insure absolute safety, several safety valves are placed in proper positions on the unit. Years of research along with the development of alloys account for the superb design of this boiler. Patent rights prevent the discussion of test data and dimensions but its serviceability proves its worthiness. The burner is the main secret of the company in that only the engineers know the design. On test it has shown itself to be the most efficient small burner yet built with practically no fume whatsoever.

Some of the general questions that are asked about the new unit will be answered as fully as possible in the following:
(1) Weight: The weight of the entire unit is less than 1500 lbs. and develops 150 horsepower. This unit is especially suitable for use in tractors, buses, trucks, and military tanks: but it still is adaptable for automobile use even though there is no decrease in weight over the present internal combustion engine, the advantage being in the increased horsepower per pound of weight.
(2) Torque: The normal internal combustion engine will average a maximum torque of 390 lb-ft. and 2000 rpm. compared to a torque of 12· lb-ft. exerted by the steam unit from a standstill. This torque is instantaneous and will not drop off but a small fraction until the engine has passed a speed of 1000 rpm.
(3) Engine speed: A steam engine will operate slower than the internal combustion engine and this unit has a speed of approximately 1/3 the speed of the gasoline motor. Higher speeds are obtained by the use of differential gears.
(4) Shifting Gears: There is no gear shifting on the steam engine. This eliminates the intricate transmission and clutch. Stalling is practically impossible.
(5) Moving parts: The steam unit has only 16 moving parts compared to the hundreds of moving parts of the gasoline engine. This removes lubrication difficulties as the steam unit requires only a small amount of lubrication.
(6) Fuel: The steam unit uses crude oil for fuel which is a tremendous advantage inasmuch as the price of refined gasoline is five times that of oil.
(7) Ignition system: The only ignition needed in the steam unit is the spark across the burner to set it into operation when the pressure of the boiler becomes below a set value. This operation is entirely automatic in that the boiler must at all times maintain a pressure of 1260 lbs. per sq. in., the burner cutting on and off as needed.
(8) Speed: This point is one of the greatest attributes of the steam engine for use in automotive locomotion in that the maximum speed has never been found. No one person has ever dared to attempt this test as the speed would be too great for the ordinary automobile body. It may be said, however, that the engine will not even be straining at a speed of 100 miles per hour.
(9) Ease of Operation: No shifting, merely brake, accelerator, and reverse lever. A peculiarity of the steam engine is that it will travel just as fast in reverse as it will forward.
(10) Repair: All of the parts of the steam unit are within reach

for repair, and entails no complete tearing down of the unit for special replacements.
(11) Vibration and Noise: Steam powered units are notably free from vibration and noise. In a large measure riding qualities of automotive vehicles are determined by these factors. Absence of noise makes the steam unit desirable for military use.
(12) Economy: The price of crude oil at the present time is fairly low, but as the demand increases for this product, the price will naturally increase. Including the probable increased oil cost, the steam car will operate for 2/5 the cost of gasoline vehicle operation.
(13) Length of Life: The length of life of a steam engine is by far greater than that of the internal combustion engine and since the engine is geared directly to the drive shaft the steam unit will not idle when the motion of the car is stopped. The distance travelled by the steam engine is the same as travelled by the wheels (in proper proportions) while the gasoline engine travels many more miles than the wheels due to its idling characteristics.

Question has been raised as to heating of the boiler after the car has been standing over a long period of time. The present boiler is so insulated that it will maintain steam over a period of 48 hours, and have enough steam left in the boiler for a drive of five miles or more. This amount of time is more than ample for heating the boiler up to rated pressure. The reason for this boiler being able to raise steam at such rate is due to the small water capacity of the boiler and the design characteristics of Flash Steam. This boiler is capable of raising enough steam pressure for operation in less than two minutes, the efficiency being due to the excellent burner construction.

In looking ahead to the very near future, I see that nearly all vehicles shall be powered by steam. It is self-evident that, since the steam engine has so many advantages over that of the internal-combustion engine, that eventually the internal-combustion engine shall be partially, or perhaps, totally replaced by steam engines. In your own mind, since reading this, do you not think that this may come to pass? Farseeing engineers have often said that if 10 per cent of the attention paid to the gasoline engine had been paid to that of the steam engine developments, steam would be the dominant automotive power today. The highly efficient steam engine is not expensive to manufacture, and its lubrication is easily and thoroughly accomplished, since there is not the excessive heat in its cylinders that is generated in the internal-combustion engine. The primary reason that steam has not, until the present time, been used for locomotive power in vehicles is directly due to poor boilers and burners. The present desigh has overcome these drawbacks and the engine as it stands today has tremendous potentialities.

Convention is another obstacle to overcome in that the general public feels dubious in purchasing new products without first seeing their capabilities over a period of years. This being so, ti will take time to convince the public of the overwhelming advantages of this car.

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Congratulations to Cecil Lucas for winning prize for best student paper. He will represent Duke at the A.S.M.E. convention in Atlanta, Ga. on April 2, 1941.

MOSQUITO BOATS

HUGO PHILLIPS SENIOR M.E. DESCRIBES CONSTRUCTION & USE.

At a time when all the resources and capacities of the nation are being marshalled into one coordinate defense program, it is appropriate to consider the part which the motor boat plays in this program. If any concrete evidence of the value of the motor boat in war time is required,n we need only to turn to the remarkable achievements of the 110 foot sub-chasers in the last war. They constituted a formidable auxiliary unit of our naval forces and their sucess is now a matter of history.

Broadly speaking the motor boat, a relatively small unit in comparison to those commonly associated with actual naval service, has certain specific characteristics that fit her for duty where larger craft are hampered by their own limitations of size. Wherever a surface craft of high speed, manuverability, shallow draft, low visibility and small cost- both initial and maintenance- is required then the boat is indispensible.

Motor boats have amply demonstrated their effectiveness not only as sub-chasers, but as torpedo boats, mine layers, coastal patrol craft, dispatch boats, rescue craft in conjunction with aircraft, and even as plane carriers. On the inland waterways they manuver with ease and speed a versitile, mobile craft for a variety of purposes.

American boat builders have been at work on orders for a variety of motor boats for naval use. Much interest has been centered lately on the wasp-like torpedo boat which carries, at a speed of 50 knots, a deadly sting in the form of four torpedoes. In America the development of these craft was stimulated by the appropriation of $15000000 by Congress for experimental and test purposes. Earlier tests had been conducted on the 40 and 55 foot British Thornycroft models. The fund, however, made possible a general competition in this country in which civilian naval architects submitted more than 40 designs for torpedo boats and sub-chasers. These were divided into four classes or groups with a first prize of $15000 in each class.

Among the M.T.B.'s,Motor Torpedo Boats, resulting from this contest, a group of eight, called the P.T. series, are being built. Numbers 1 and 2 are 59 footers, built by the Fogal Boat Yard in Miama; numbers 3 and 4, also 59 footers, at the Fisher Boat works in Detroit; numbers 5and 6 are the big 81 footers built by Higgins Industries at New Orleans; and P.T. 7 and 8 are also 81 footers, built at League Island, Philadelphia.

The exceptional speed capacity of these seagoing "hornets" is a product of the development of high powered, lightweight engines, conversions of aviation motors which have a tremendous power output in proportion to their weight. P.T.6, for example has a power plant consisting of three 1500 hp. supercharged Packard engines, a total of 4500 hp. which is reported to have driven her at a speed of 45 knots over a measured mile. Her armament is claimed to be capable of sinking a battleship.

The construction is rather

conventional, following along the lines used for large pleasure yacht of wooden construction, since most of the torpedo boats to date are of wood for several reasons; primarily because of the ease of handling wood, because of the lightness of wood, and third, because most private boat builders are not equipped to build boats of this type in metal.

A heavy timber is laid on built up stations following the angle it will assume when the finished boat is riding in the water. To this timber is attached the keelson, which forms a backing for the planking which will come later. On top of the keelson the ribs, or frames are built up to form the required contour of the boat. In some cases these ribs must be steam bent to produce the required curve. In no case is the curve cut out of a solid piece of wood for this would produce a discontinuous grain in the rib, materially weakening it. Once the ribs are in place the general form of the boat can be seen. On the fore end of the keel piece the bow stem is attached by means of heavy knees. On the after end there is likewise a heavy knee to recieve the transom. To keep these ribs in line and to act as strengtheners, two long stringers running the length of the boat are knotched into the ribs, one at the approximate water line called the chine, and one at the deck line called the shear.

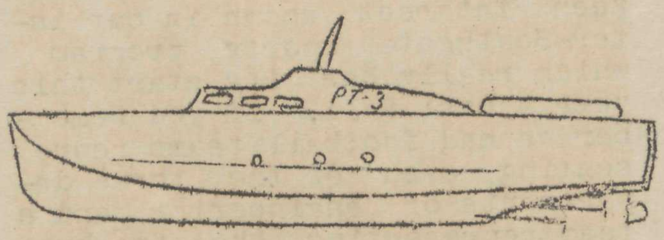
With all this in place the deck beams are cut and fastened to form a rigid skeleton for the planking Here begins one of the toughest jobs of boat building. Each plank must first be accurately fitted fir shape, then steamed to make it more pliable and suitable for bending without splitting. The first plank, the garboard strake, is the first one fitted. After it is in place next to the keel, each successive plank is fitted to conform to the shape taken by the garboard strake. A boat is planked from the keel out to the chine, and from the deck or shear down to the chine. Behind each seam, or crack, in the planking is placed a small strip of wood, or batten, to act as a backing for the chalking that is to come later. The planks are fastened by copper rivets using copper washers under the heads on the inside. The outside head is countersunk and plugged.

While the outside is being finished off, work progresses on the interior and topsides, the decks are first planked with some light wood and then covered with a light armor plate to give some protection from aerial machine guns. The bridge, or conning tower which it may more aptly be called, is also of the same construction with wide bullet proof glass windows and windshields. In most construction the inside of the conning tower is a half level lower than the flying bridge. Each torpedo boat of all classes carries two machine gun turrets mounting two guns each. Forward of the bridge and below the fore deck are the crews' quarters. There is no mess, each man catches a cup of coffee and a sandwich on the run and eats standing up.

And then the engine room. Mounting 4500 hp. in a space one hundredth as small as the average cargo ship is a feat of the machine age. The three engines being forward of the center engine, each driving a single propeller. Along with the engines must go the auxiliary equipment such as light plants, cooling water pumps, gear boxes, air vent ducts, and fuel tanks. One serious problem that had to be met was the complete remote control of the engines. It is needless to say that no man could stay within the close confines of a roaring engine room while the ship was dancing around like a bouncing rubber ball. This meant that all instruments, gages, and controls had to be brought up to the conning tower.

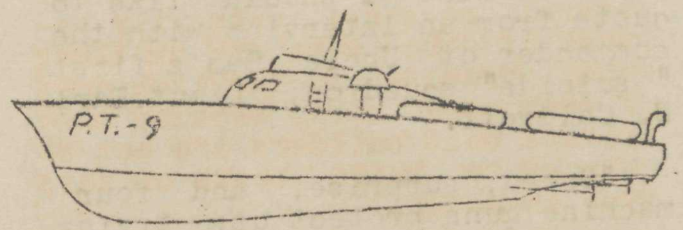
To complete the equipment, radio and direction finders had to be installed, keeping in mind the requirement of low visibility.

It was interesting to note at some of the trials of the large 81-footers just what the different characteristics of each of the designs were. Below are sketched some of these various designs.



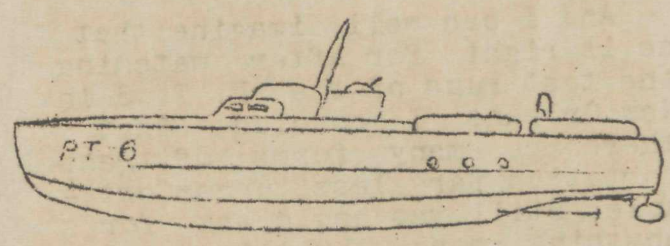
59' PT-3

Sketch 1., where the curved chine runs forward and up to meet the deck line at the bow, the P.T. 3 and 4 seemed to sink their sterns deep into the water and ride with the water breaking almost amidships. This type of wave formation produces a tremendous rooster tail in the wake of the boat. Yet these smaller boats when viewed from a distance looked very much like a small hydroplane skimming the water. An advantage in this wave formation is that in rough water the spray kicked up is well aft of the bridge.



81' PT-9

Sketch 2. shows the larger 81 footer lines. The rakish clipper bow along with the more conventional bottom make her ride more like a larger ship. Her bow does not ride clear of the water but splits the waves. While tending to ride on a more level keel the spray thrown back hits like bullets on the bridge. This means wet, slippery decks.



81' PT-6

Sketch 3. shows the lines of the P.T. 6 and 7. These seem to be a modification of the other two. She has neither the rakish bow nor the rounded up-swept chine. When running she is sluggish at low speeds, pushing a lot of water around. But as her speed increases she seems to plane much as a step speed boat would do. The spray is shot directly sideways and out, keeping it away from the decks.

In closing I should like to quote from an interview with the commander of Uncle Sam's first " suicide" squadron, Lieut.Earl S. Caldwell.

"Speed, surprise, and four machine guns protect us; trying to hit us with the ordinary naval guns is like shooting at a gnat with an elephant rifle.

Such dangerous, body-racking duty makes the 'suicide fleet' more than a fancy nickname.--- The crew, shaken like popcorn in a popper, takes a terrific beating. To ease the blows we stand with knees bent, as if in skiing, digging heels into the sponge-rubber flooring and hanging on to hand rails.

The crews (eight men, one officer) are the cream of the Navy, specially picked for superb eyesight, rich gun and torpedo experience, and god- like dispositions. The last is vital, for PT duty at sea is like sharing a telephone booth with eight other men.---"

And I can well imagine that he is right for after watching the test runs of the P. T. 6 in New Orleans I conclude that there are many forms of transportation far less uncomfortable. Still who could ask for anything more thrilling and of greater adventure.

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God made a machine, the machine
made men
Doctors, lawyers, priests and
then,
The devil got in and stripped its
gears
And turned out the first batch of
ENGINEERS.

SPORTS

During the 1939-1940 Intramural season, Southgate set a record for itself by ending up in fifth place in the highpoint trophy standings, with 478 points. To accomplish this, they won division championships in touch football, basketball, and playground ball; the University Championship in basketball; and had two finalists, Brandon and Murphy, in the boxing events. This year Southgate should come very close to beating last years record. Even though we have not won any championships as yet, we have had more teams and men entered in sports than ever before. In fact, we still have a chance to win cups in volleyball and again in playground ball.

Even more important than our intramural play has been the keen interest shown in our inter-Southgate sports program which really has its start this year. Last fall, if you remember we had football teams representing each of the three departments of engineering and a team representing the freshman class. This winter, a similiar league was organized for the basketball season. As this basketball season is now completed, an all-Southgate basketball team has been selected with the following members:

Lynch	C. E.
McCann	Frosh
Bradley	M. E.
Johnston	E. E.
Donohue	M. E.

We believe that "Chuck " Holley deserves much additional praise for his fine work in the recent Southern Conference Basketball Tournament. This praise is perhaps best expressed in a column in the Durham Sun: "Lanky Chuck Holley, Duke center, was the individual hero of the tournament, if one could be named."

DUKE UNIVERSITY
COLLEGE OF ENGINEERING

PRESENTS ITS

FIFTEENTH ANNUAL
ENGINEERS' SHOW

FRIDAY–SATURDAY
MARCH 7-8, 1941

AUSPICES OF

DELTA EPSILON SIGMA

AMERICAN SOCIETY OF CIVIL ENGINEERS
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
AMERICAN SOCIETY OF MECHANICAL ENGINEERS

As another year rolls around, that annual affair known to the people connected with the College of Engineering of Duke University as the "Engineer's Show" makes its fifteenth appearance. It is open to the students of Duke University and the people of Durham who might be interested in finding out exactly what is dome in an Engineering College as well as to determine just what makes certain mechanical, civil, and electrical apparatus "tick".

To give the student body and folks of Durham a slight insight as to just what to expect and what to look for at this great event we will attempt to take you on a tour of our three Engineering departments, namely electrical, mechanical, and civil.

E.E. DEPT.

We will begin our inspection of the College of Engineering by meeting our guide in Asbury, the building in which the Electrical Department and Administrative offices share three floors of classrooms and laboratories. Now that we are assembled we will start the tour of the Electrical department by entering the first room on our left which contains the 100-watt amateur radio station W-4AHY operated by those students who have amateur radio licenses. As one enters the room he will notice on his right the receiving and sending equipment of the station itself while on his left will be a display of the various parts that make up any radio broadcasting and receiving station From our radio station, the visitor will next step across the hall into the Standards Laboratory where equipment for the standardization and calibration of electrical measuring instruments such as voltmeters, wattmeters, and ammeters may be found and looked over carefully. After visiting the Standards Laboratory, we will find ourselves ushered into a room, the Projects Laboratory, where a demonstration of fluorescent lighting is displayed along with other individual projects. To verify some of the alternating and direct current circuit theories we are now taken to the Electrical Circuits Laboratory where actual experiments which are carried on by the students in every day work are set up and run as they would be in a regular laboratory period. Our next step on the tour is the Communication Laboratory which contains the apparatus used in the study of the transmission of speech and music by wire and radio. Some of the instruments found here, for example, are high frequency measuring and radio signal recording instruments as well as a sample of what local telephone exchange apparatus looks like. In the room connecting the Communications Laboratory is the Electronics Laboratory, where study of vacuum tubes and vacuum tube circuit characteristics are undertaken. Having covered the main floor of Asbury building our guide now leads us to the basement where we find that we are in the Electrical Machinery Laboratory; the equipment is used for the purpose of studying the technique of testing and analysis of the performance of direct current and alternating current machinery as used in actual practice. This labor may interest quite a number of the visitors who use these machines in their own work. After a close inspection of the machinery laboratory, the guide now takes us out to the Annex behind Asbury building for a spectacular performance of man-made lightning in the High Vol-age Laboratory. Although on a smaller scale, this man-made lightning as the visitors are told is the same as that found at the World's Fair last summer. Before leaving this laboratory a demonstration of the effects of lightning on model transmission lines are also shown to us.

At this point, most of the visitors have seen so much, they think that they have covered the complete college and are greatly suprised to hear that we have the Mechanical Department in Branson building and the Civil Department in Bivins building to look over as yet.

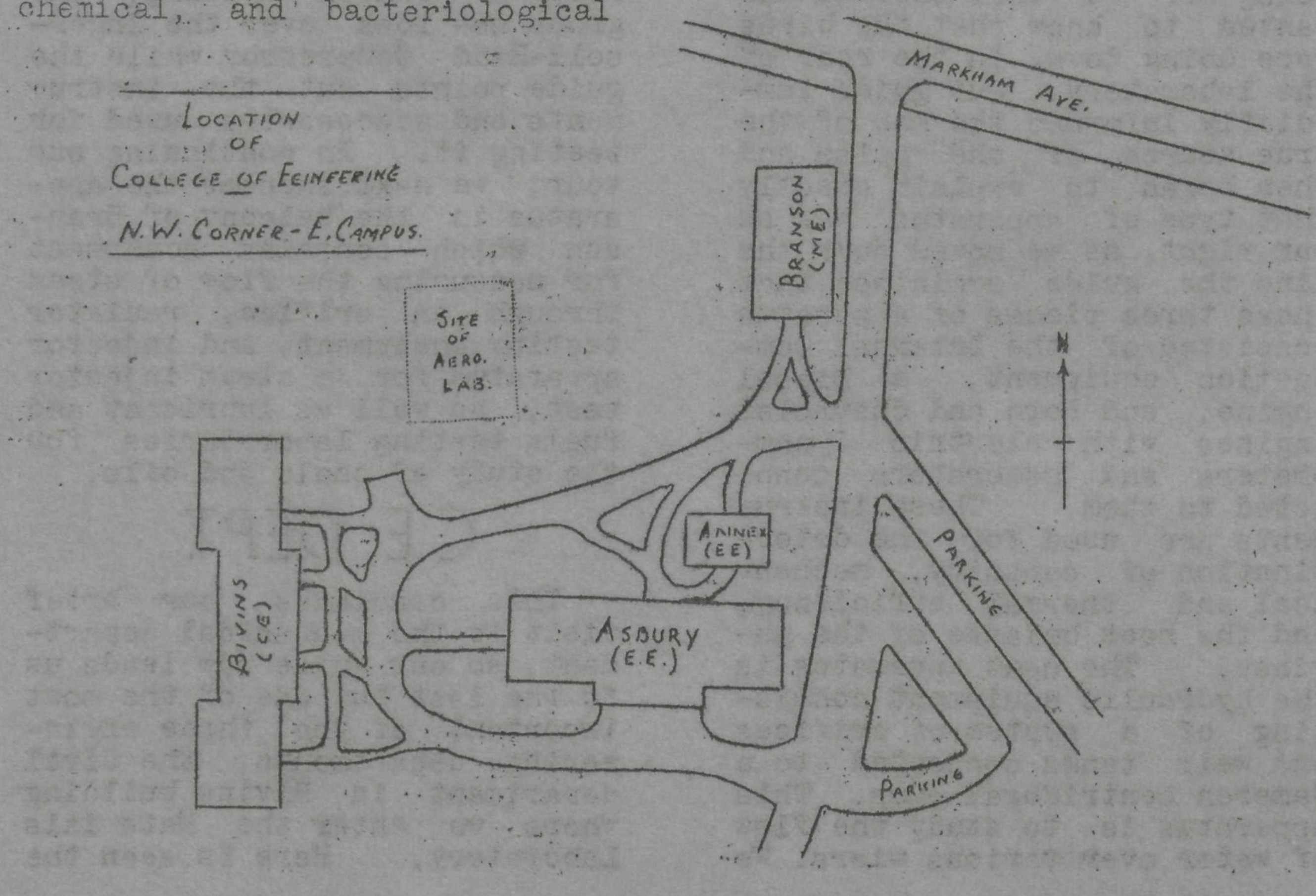
M.E. DEPT.

So next we tramp down a path from the Annex to Branson building where all sorts of queer sounds and noises meet our ears. One visitor in particular commented on the whistle of the safety valve of the boiler which happened to be going off at that instant and wanted to know what the birds were doing down in the rear of the laboratory. Our guide immediatly informed the man of the true source of the noise and then began to explain exactly what type of apparatus was on our right. As we moved down the line the guide explained that these three pieces of apparatus consisted of the Internal Combustion equipment, a Diesel engine, and Ford and Chevrolet engines with electric dynamometers and generators connected to them. These instruments are used for the determination of capacity, mechanical and thermal efficiency, and the heat balance of the engines. The next apparatus is the hydraulic equipment consisting of a system of orifices and weir tanks connected to a Cameron centrifugal pump. This apparatus is to study the flow of water over various wiers. We next find a model refrigerating plant which was a project of a student and is capable of a capacity of two hundred pounds of ice per day. At our guide's signal we next approach what may be called the shop of the laboratory since it contains a lathe, shaper, and universal milling machine, drill press, and wood joiner. The person who was bothered with the whistling noise when he entered the building is now having his curiosity satisfied as we go into the boiler room of the laboratory and inspect the 100-H.P. oil fired Keeler cross-drum boiler with its deaerating feedwater heater, pump, injector, and all other necessary controls. From the boiler room itself we next follow the line of accessories which use the steam from the boiler plant; namely the Troy horizontal automatic and the Troy vertical steam engines, Strutevant steam turbine, and the Brown Electric steam flow-meter. To complete the inspection of the main floor of Branson building, the group now look over the Ingersoll-Rand Compressor while the guide points out the instruments and accessories used for testing it. In continuing our tour, we next inspect the apparatus in the balcony of Branson which contains equipment for measuring the flow of steam through an orifice, radiator testing equipment, and injector apraratus for a steam injector test, as well as lubricant and fuels testing laboratories for the study of coals and oils.

C.E. DEPT.

This concludes our brief visit to the mechanical department, so our guide now leads us to the last but one of the most important of the three engineering departments, the Civil department in Bivins building where we enter the Materials Laboratory. Here is seen the equipment used for the testing of wood, steel, and concrete as to their strength in tension and compression. The various machines found in the room, include Universal Testing Machines, tension machines, Charpy-Izod impact machine, a fatigue machine, hardness testing machines for Scleroscope, Brinell, and Rockwell numbers, and Huggenberger strain equipment. Having made a complete survey of this apparatus, we are next ushered into the Soils Laboratory, a classroom where the study of mechanical properties of soils takes place with practical reference to its use in highway work. Our guide after completing his explanation of the apparatus next passes us through the Surveying Laboratory in which the various equipment used in surveying is displayed and its uses explained. The Sanitary-Analysis Laboratory is next. This is an important laboratory as far as we humans are concerned. Its importance lies in the fact that here is where physical, chemical, and bacteriological and microscopic tests on public water supply and sewage take place. From the first floor, we find the Stress Analysis Laboratory where an exhibit of advanced work in stresses in concrete arches and rigid frames shown by means of the Begg's deformer and photo-elastic polariscope is shown along with other various general exhibits of structural design and surveying problems including plate girders, roof trusses, highway and railroad location. With a constructive view of this lab. in our minds, the guide now takes us back to the entrance of Asbury building, where our party is dispersed.

As I leave the engineering campus, I feel that it was time well spent looking over the various problems presented to the engineer when he is working on a job. It helped me to appreciate the importance of the engineer in the world today. I hope that it offered an opportunity to show how the engineer spends his time in this modern world of machines.



DEAN HALL'S PAGE

PREPARING FOR THE WORKING WORLD

Two articles which appeared in the May 1939 issue of "Electrical Engineering" so impressed me with their direct application to your problems that I am taking the liberty of summarizing them for your consideration.

The young engineer is facing life in an exciting period when change is the only certainty that can be counted on! The prevailing social scheme is not the product of design, but rather the residue of millions of trial and error experiments, and yet, as engineers we cannot remain satisfied with progress through trial and error. Our job calls on us to replace guesswork with rational planning wherever possible. In facing tomorrow you are facing the risks of decision which here-to-fore have been taken mostly for you by parent, school, or teacher. If you are tempted, as you quite probably will be, to prefer security to adventure, think twice before you shun all risks and therefore settle into a definite mediocrity. If you take risks prudently however, choosing a field which challenges you, but one in which you can succeed by reasonable application and effort, success will likely be yours. President Compton of M.I.T., reporting on a study of 54000 officers of 500 corporations, has stated that the college man is seven times more likely than a non-college man to achieve positions of responsibility, and that an engineer is thirty times more likely than a non-engineer. The odds are with you, but they will not save you from the relentless sifting of the first five years out of college. For one who is held back during this period by lack of knowledge, ten are stalled through inability to surmount routine. When you find that you will have to go on with work after you think that you have exhausted your learning possibilities, feeling that you are stuck on a routine job, you will discover that you must now fight your own battle for development. In fighting this battle, though, don't be too much of a lone worker- you will have to judge others and be judged yourself, perform and get others to perform. Your engineering training will be invaluable to you. Educators of all sorts are observing that young engineers stand the shock of adjustment to the world of work better than college men in general. They have a clearer sense of direction, fewer of them flounder, and they know the worth of discipline. Their opportunities are boundless, but they set their own limitations of achievement.

The young engineering graduate may profit by some practical suggestions upon becoming situated in this "world of work." The problem of finding employment can be solved by various methods of attack. Use all the "pull" you can master, but remember that you will have to rise on your own merits. If your pull fails to materialize, there are four best avenues of approach, namely: (1) college interviews, (2) your father's associates, (3) technical employment agencies, (4) personal interviews. Any of these methods that works is the correct one. Important points to be remembered are (1) references: ask men who know you and think enough of you to write letters on your be-

(please turn to page 24)

TAU BETA PI

ITS RELATIONSHIP TO DELTA EPSILON SIGMA

Frequently during the past several weeks, the Greek letters Tau Beta Pi and Delta Epsilon Sigma have been mentioned in conjunction with one another in the conversations of the Engineering student leaders. This fact might raise a question as to just what Tau Beta Pi is and what is the relationship suggested between Delta Epsilon Sigma and Tau Beta Pi.

In the first place, Tau Beta Pi is a national honorary engineering fraternity. It was established in 1885 at Lehigh University to supply the need for an honorary society for engineering students. Its purpose is, as expressed in the constitution "to mark in a fitting manner, those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as under-graduates in the field of engineering or by their attainments as alumni in the field of engineering; and to foster a spirit of liberal culture in the engineering colleges of America."

Tau Beta Pi's creator, Edward Williams, Head of themining department of Lehigh University at that time, was determined to incorporate enough secrecy into the society to prevent its losing its charm and yet to keep the ritual free from meaningless ceremonies. As a result, the strength of the organization is more fully recognized by the members after graduation.

There are now 73 active student chapters, 21 active alumni chapters, and a total of more than 31,000 engineering students have been initiated into the society.

Tau Beta Pi also sponsers a Fellowship plan by which eight engineering graduates may pursue graduate work of their own choice with financial aid of from $650 to $750 per year.

And so we wonder just what the relationship is between Tau Beta Pi and Delta Epsilon Sigma. In the constitution of Delta Epsilon Sigma under purposes is the phrase "to petition Tau Beta Pi". Only recently has the numerical strength of the graduating classes of the Engineering College been sufficient to warrant an investigation of the posibility of making a petition. With the help of Prof. Meier of the E.E. department the investigation was conducted. The net result is that Delta Epsilon Sigma must defer its petitioning for the sole reason that the College of Engineering is graduating only 25 seniors per year as an average. The constitution of Tau Beta Pi specifically recommends that at least 40 engineering degrees per year be granted by the petitioning college.

This fact is not so depressing as it might seem at first. There is much work to be done on the local affairs and activities of Delta Epsilon Sigma in order to satisfy the requirements for Tau Beta Pi. We are going through the transition period and it is not rationalizing when we think that it is a good thing that we have time to handle the problem of transition thoroughly

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Congratulations to William Marshall on his stellar performance in winning the 100 yard free style at the Southern Conference Swimming meet at V. P. I.

OUR FACULTY

SECOND IN SERIES OF BIOGRAPHIES

PROF. J.W. WILLIAMS

Listed in the catalog as "Instructor in Civil Engineering," Mr. Williams conducts courses which are difficult enough to do credit to any department head. In the surveying course, for instance, it is not an uncommon sight to see Mr. Williams "walking" leisurely along with his two-yard stride, followed by a motley group of C.E.'s loaded down with an assortment of transits, rods, hammers, and plumb bobs, half walking, half running in an effort to keep up with him. His examinations are comparatively easy, four-hour affairs, but his homework assignments may lead one anywhere from the depths of a book of logarithms to the old magazine stacks of the Woman's College Library or the Durham County Court-House.

For the greater part of his life, Mr. Williams has been engaged in school work, either as a student or teacher. Born in western North Carolina, he learned early the "ins" and "outs" of various public schools, for his father was a Methodist minister. He graduated from Duke in 1930 with an A.B. degree and from Georgia Tech with a B.S in C.E. degree two years later. After teaching math at Weaver Junior College and Brevard College, he came to Duke in 1936 to do graduate work. One year later he took up his present position. In addition to this he has attended the Universities of North Carolina and Michigan and is now working toward a Master's degree.

Mr. Williams has been a wrestling enthusiast and, while at Duke, played football to keep in shape for that sport. Now he enjoys a good game of tennis whenever he can break away from his teaching duties. Photographic work also claims an important part of his spare time. Most of all, however, he is an outdoor man and enjoys few things as much as a good hiking trip---- a fact to which his surveying class will readily testify.

Mr. Williams seems to pick the middle of winter for all his red-letter days. Last winter the big event was his marriage to Lola Marler Rogers, a Durham girl and a graduate of Duke. This year it was a visit of the stork to his home, resulting in none other than James Marler Williams and accounting for the so beautiful, pink be-ribboned 10¢ stogies his faculty mates have been displaying proudly.

PROF. O. MEIER JR.

If one should go over to the Electrical Engineering lab. some afternoon, he would probably notice a square built man of medium height with an athletic snap to his carriage. That person would be Professor Otto J. Meier, Jr. He is still in his thirties, and seems to be young for all his accomplishments. It may be mentioned that he is married and has a two year old son.

In 1929 he graduated from the University of Pennsylvania with a Bachelor of Science degree in Electrical Engineering. Upon graduation he received the Atwater Kent prize given annually to the outstanding senior of the graduating class. Immediately after this, he secured a position with the Geophysical Research Corporation of New York in the capacity of technical observer. In 1933 he received a graduate fellowship at the University of Pennsylvania. Graduate work under this fellowship was interrupted to accept a position as teacher in Electrical Engineering at Duke in March 1934, where he has remained ever since. He received the degree of Electrical Engineer from the University of Pennsylvania in 1937. He resumed graduate work during summers and received his Master of Science degree from Michigan in 1938. Since he was a member of the R.O.T.C. while in college, he received and held a reserve officer's commission in the U.S.Army. His commision expired at the end of eight years because he did not have the time to devote to it.

He is the faculty advisor of the Duke chapter of the A.I.E.E. and also a member of the Scabbard and Blade, Eta Kappa Nu, Tau Beta Pi, Sigma Xi, A.E.E.E., and the Illuminating Engineering Society.

In class Professor Meier combines his knowledge with an extraordinary gift for talking. He very capable intersperses humor in his discussions.

PROFESSOR F.J. REED

Professor Reed was born in Omaha, Nebraska, but traveled to the East for his education. Graduating from Stevens Institute of Technology in 1926, he secured a position with the Westinghouse Company at Sharon, Pa., and later with the Bryant Heater Company in Cleveland, Ohio. After receiving his Master's degree from the University of Pittsburgh, he began his teaching career at Vanderbilt University in the capacity of instructor of Mechanical Engineering Laboratory; once there he also taught Electrical Engineering Laboratory.

In 1935, Professor Reed accepted a position as instructor or Mechanical Engineering at Duke. Soon after, he was made Assistant Professor of that department. He teaches many subjects, but his main interest is Heating and Air Conditioning and Refrigeration. Opinions vary as to whether or not he is a hard teacher, but everyone agrees that he is a good one. His rapid rise in the field of teaching is ample proof of that. He is very considerate and will always give the student a chance. Renowned for his difficult assignments, he makes his pupils learn the subject, which, in the final analysis, is their purpose in coming to college.

His pride and joy is the student branch of the A.S.M.E. at Duke. For several years he has served as Honorary Chairman, and the success of this chapter has been greatly dependent on his leadership. Last year he took a group of student members to the A. S. M. E. convention at Birmingham; this year the students are looking forward with keen anticipation to another trip of the same kind, this time to Atlanta.

Being keenly interested in sports, he divides his time between basketball, volleyball and golf. Of these last two, he is an active participant, being a member of the faculty volleyball team. His time for golf is somewhat limited by his teaching duties, but whenever he has a free afternoon he can usually be found at the local golf course. His interest in basketball is in the capacity of a spectator, but he follows the sport very closely and is usually seen at all of the Duke contests.

NATIONAL DEFENSE COURSE

On January 15, the Engineering College inaugurated a new course in General Communications. This course open to all men with one year of college or its equivalent in Math. and Physics provides intensive training for students with technical backgrounds and its purpose is to provide, in increased numbers, men better prepared by specialized training to meet the future needs of both government and industry.

All instruction is of a college grade and is equivalent to that given regular students for a degree, but the course concentrates on the training of immediate practical application to specific jobs. This course which comes under the supervision of the U. S. Commissioner of Education, is primarily a part of the National Defense Program and is an outgrowth of the present National Draft. It will fill the increased demand for more men, and it will supply men to replace those called for duty in the Army.

At present there are 25 men from all branches of life who are enrolled in the course. The men are on the average 35 years old and some of them are already employed in this field. These men were selected from those who have some practical experience, or who have had some technical training. They could not be enrolled in college but they could be employed or unemployed at the time of registration. Each applicant was selected on the basis of his record, and this record was very carefully inspected before being approved. This course was planned and taught by Professor Walter J. Seeley, chairman of the Electrical Engineering Department.

AERONAUTICAL ENGINEERING

Inclusion of aeronautical engineering courses in the curriculum of the Duke University College of Engineering beginning next Fall was announced March 1 by Dean William H. Hall of the college.

To provide quarters for the courses, construction will begin immediately on an aeronautical engineering laboratory building, to be situated in the engineering college group on the East Campus. It will be a 42 by 101-foot structure of brick, steel, and concrete, about the size of Branson, the mechanical engineering laboratory building near which it will be placed. It will be completed next Summer and suitably equipped before the 1941-42 session. The aeronautical courses to be offered next Fall will be optional in the Mechanical Engineering Department. Details concerning the courses will be announced later. They will be open to juniors and seniors.

The new aeronautical engineering laboratory will provide facilities not only for regularly enrolled engineering students but those participating in the civil aeronautical authority program.

All necessary equipment for aeronautical instruction of undergraduates will be provided in the new laboratory, including planes and plane engines, parts, wind tunnels, instruments, and machine tools.

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People's minds are changed through observations and not through arguments.---

Will Rogers.

DATA SHEET

Well here we are again writin' up the dirt. Your correspondent doesn't know where all this stuff came from but here it is and it's supposed to be authentic. Correct me boys if I'm wrong.

Question of the week..... Has Serrell any love life??????-----Price might not eat in the Woman's Union but he does spend most of his evenings there.-----What's this about Red Williams?? Doesn't he know the difference between a boy and a girl?-------Bean's old flame got married----before Patterson came back to school.-----According to Wagner, he rates number 1 with Dunky. The Pansy-Villagers better get on the job if they want to keep up with the great FUZZY.------If an Ensign's salary were enough to get married on and the Navy put you where you wanted to go, Andy would be first in line..... I wonder where he wants to go.--They say Tuten was riding HIGH at the Backwards Dance-----Tyson seems to punctuate everything with a Coma....----"Woman Hater" Morrison seems to be hating a town girl pretty regularly lately.------Batten seems to do all right by himself when he does date.------Bill Ticktin probably rates first-----His wedding date has already been set-------Isn't this right Bill?---Absence during the Christmas season must have made the heart grow fonder.

We understand that Sanky Blanton and Lindeberg are on the lookout for an entirely new girl ---Kernie wants a girl with more life---Can anybody help him find her????---

"Buzz" Chapman still thinks that variety is the spice of life.-----Newcomb and M. Johnson say that they love all the girls but we hear that both of them have some local talent on the string......................CAR

lisle, and Meuche still rate the "gal back home" number one -----

Kay-Up wonders when those seniors will start in her direction...Don't you know that no date, no sheepskin?----Everybody would like a birthday present like Rugo's------Hege still goes around with a camera hanging from one arm and a woman from the other.-------"The Return of Snapper Butts".....Just like the old days, huh fellows??----- The doctors who examined the fellows for the Naval Reserve wondered what it was about Engineers that made their blood pressures go up.

DEAN HALL'S PAGE

(continued from page 19)

half, but do not ask the same man to write too many letters, or he will become impatient and his letters boring; (2) application blanks: prepare a personal file so that applications can be filled out accurately, neatly, and if necessary quickly; (3) personal appearance: you have passed the college boy stage, and your present position called for a neat business-like appearance; (4) selecting an employee. You will have to decide between a prosperous large company, a prosperous small company, a company in financial trouble, or the Government, each of which has advantages and disadvantages and the merits of each in your individual case should be studied well before a decision is made.

If the "engineering approach" is applied in seeking employment as intelligently as in solving engineering problems, a suitable position in engineering should be the reward.

The above article is based upon "The Young Engineer Facing Tomorrow", by William E. Wickeden, and "Suggestions on Seeking Employment", by Charles F. Dalziel, in the May 1939 issue of "Electrical Engineering".

Mr C. B. Markham

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