

When the Engineers Go to War

THE engineer in time of war, no less than in time of peace, is always in a position to accomplish some valuable work for his country. Unlike the soldier of ordinary attainments, it is possible for the technically trained man to be of inestimable assistance to the general staff of the Army and Navy, who are responsible for the defense of the country at all times. It is only in the past year that due recognition has been given to technical experts in all branches of applied science throughout the country to show what they really can accomplish in a military way.

One of the most important innovations ever made in this direction was that by Secretary Daniels of the Navy, incorporating the new Naval Advisory Board. All of the leading engineering societies in the United States were asked to co-operate in selecting suitable members for this Advisory Board, with the consequence that we now have a unified staff of technicians, capable of giving thoroughly satisfactory and expert opinions on any electrical, civil or mechanical problem that may arise in the development of new war machinery.

There has recently been organized a complete staff of civilian engineers throughout the country who are assigned to the preparation of *purchasing schedules*, to be used in time of military stress. These concern the details of purchasing military supplies, the cost and time of delivery. Thus it is seen that the civilian engineer may be of great value to the country, without being obligated in any way, as far as military connection is concerned.

On the other hand, we have the professional military engineers, which include men who have climbed up to various high positions, particularly those graduated from the government naval and army schools. The naval experts are graduated from the U.S. Naval Academy, at Annapolis, Md., while the army military engineers graduate from the excellent school at West Point, on the Hudson. This school is one of the best in the world, and has received high commendation from the greatest military experts of Europe, who have happened to visit this interesting institution.

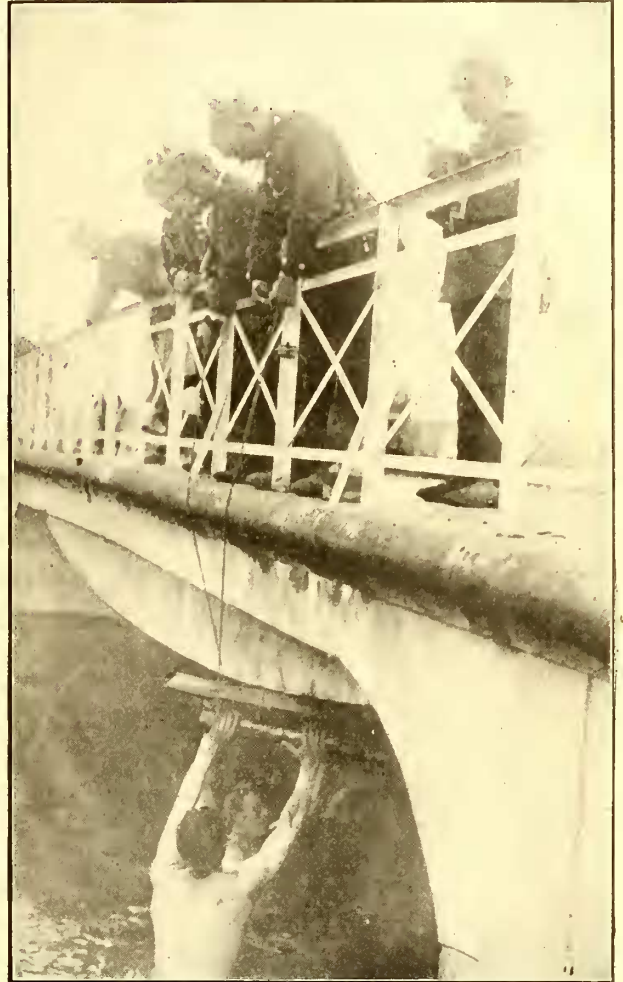
The U.S. Military Academy at West Point gathers its students from all over

the United States and its possessions, under the following rules and requirements:

Each Senator, Congressional District and Territory, including Porto Rico, Alaska and Hawaii, is entitled to have one cadet at the academy; the District of Columbia, two cadets. There are also forty appointments at large, specially conferred by the President of the United States. The law (act of March 4, 1915) provides that until the appointment of Representatives in Congress among the several States under the Fourteenth Census of the United States becomes effective (March 4, 1923), whenever any cadet shall have finished three years of his course at the academy his successor may be admitted.

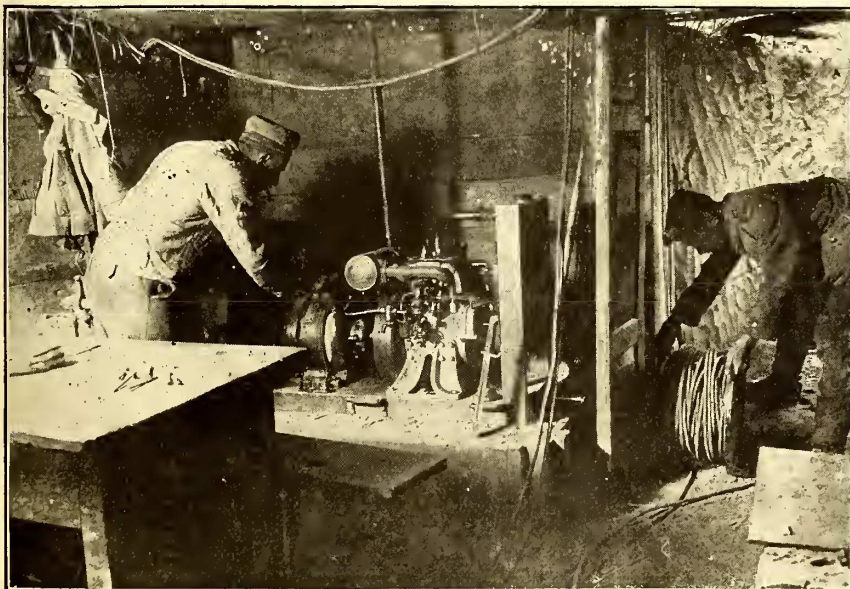
Appointments are usually made one year in advance of admission, by the Secretary of War, upon the nomination of the Senator or Representative. These nominations may either be made after competitive examination or given direct, at the option of the Representative. The Representative may nominate two legally qualified second candidates, to be designated first and second alternates. The alternates will receive from the War Department a letter of appointment, and will be examined with the regular appointee, and the better qualified will be admitted to the academy in the event of the failure of the principal to pass the prescribed preliminary examinations. Appointees to the Military Academy must be between seventeen and twenty-two years of age, free from any infirmity which may render them unfit for military service, and able to pass, unless a satisfactory certificate is submitted, a careful examination in English grammar, English composition, English literature, algebra through quadratic equations, plane geometry, descriptive geography and the elements of physical geography, especially the geography of the United States, United States history, the outlines of general history. The Secretary of War is authorized to permit not exceeding four Filipinos, to be designated, one for each class, by the Philippine Commission, to receive instruction at the United States Military Academy at West Point; *Provided* That the Filipinos undergoing instruction shall receive the same pay, allowances and emoluments as are authorized by law for cadets at

the Military Academy appointed from the United States, to be paid out of the same appropriations: *And provided further*, That said Filipinos undergoing instruction on graduation shall be eligible only to commissions in the Philippine Scouts;



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German Military Engineers Engaged in Mining a Bridge. At the Push of an Electric Button This Mighty Structure Will Be Blown to Atoms.



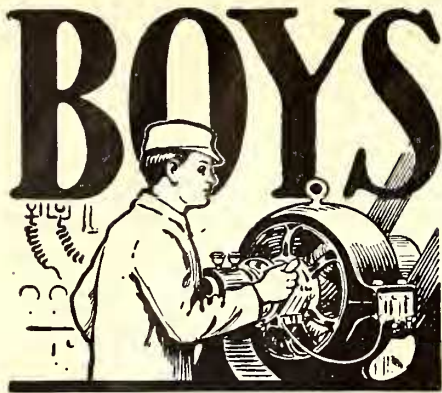
Another Phase of Military Engineering—A Trench Electric Generating Plant, Many of Which Are Near the Firing Line.

serve for eight years, unless sooner discharged. The course of instruction, which is quite thorough, requires four years, and is largely mathematical and professional. The principal subjects taught are mathematics, English, French, drawing, drill regulations of all arms of the service, natural and experimental philosophy, chemistry, chemical physics, mineralogy, geology, electricity, history, international, constitutional, and military law, Spanish, civil and military engineering, art and science of war, and ordnance and gunnery. About one-fourth of those appointed usually fail to pass the preliminary examinations, and but little over one-half the remainder are finally graduated. The discipline is very strict—even more so than in the army—and the enforcement of penalties for offences is inflexible rather than severe. Academic duties begin September 1 and continue until June 4. Examinations for cadets not having made satisfactory progress in studies are held in each December and June, and cadets found proficient in studies and correct in conduct are given the particular standing in their class to which their merits entitle them.

From about the middle of June to the end of August cadets live in camp, engaged only in military duties and receiving practical military instruction. Cadets are allowed but one leave of absence during the four years' course, and this is granted at the expiration of the first two years. The pay of a cadet is \$709.50 per year, and, with proper economy, is sufficient for his support.

Upon graduating, cadets are commissioned as Second Lieutenants in the United States Army. The whole number of graduates from 1802 to 1915, inclusive, has been 5,476. It is virtually absolutely necessary for a person seeking an appointment to apply to his Senator or Member of Congress. The Superintendent is Colonel Clarence Page Townsley, Coast Artillery Corps, U. S. A., and the military and academic staff consists of 134 persons.

(Continued on page 450)



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Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

<input type="checkbox"/> ELECTRICAL ENGINEER	<input type="checkbox"/> CHEMICAL ENGINEER
<input type="checkbox"/> Electrician	<input type="checkbox"/> SALESMANSHIP
<input type="checkbox"/> Electric Wiring	<input type="checkbox"/> ADVERTISING MAN
<input type="checkbox"/> Electric Lighting	<input type="checkbox"/> Window Trimmer
<input type="checkbox"/> Electric Car Running	<input type="checkbox"/> Show Card Writer
<input type="checkbox"/> Heavy Electric Traction	<input type="checkbox"/> Outdoor Sign Painter
<input type="checkbox"/> Electrical Draftsman	<input type="checkbox"/> RAILROADER
<input type="checkbox"/> Electric Machine Designer	<input type="checkbox"/> ILLUSTRATOR
<input type="checkbox"/> Telegraph Expert	<input type="checkbox"/> DESIGNER
<input type="checkbox"/> Practical Telegraphy	<input type="checkbox"/> BOOKKEEPER
<input type="checkbox"/> MECHANICAL ENGINEER	<input type="checkbox"/> Stenographer and Typist
<input type="checkbox"/> Mechanical Draftsman	<input type="checkbox"/> Cert. Pub. Accountant
<input type="checkbox"/> Machine Shop Practice	<input type="checkbox"/> Railway Accountant
<input type="checkbox"/> Gas Engineer	<input type="checkbox"/> Commercial Law
<input type="checkbox"/> CIVIL ENGINEER	<input type="checkbox"/> GOOD ENGLISH
<input type="checkbox"/> Surveying and Mapping	<input type="checkbox"/> Common School Subjects
<input type="checkbox"/> MINE FOREMAN OR ENGR.	<input type="checkbox"/> CIVIL SERVICE
<input type="checkbox"/> Metallurgist or Prospector	<input type="checkbox"/> Railway Mail Clerk
<input type="checkbox"/> STATIONARY ENGINEER	<input type="checkbox"/> Textile Overseer or Supt.
<input type="checkbox"/> ARCHITECT	<input type="checkbox"/> 48 HOURS CULTURE
<input type="checkbox"/> Architectural Draftsman	<input type="checkbox"/> Navigator <input type="checkbox"/> Spanish
<input type="checkbox"/> PLUMBING AND HEATING	<input type="checkbox"/> Poultry Raising <input type="checkbox"/> German
<input type="checkbox"/> Sheet Metal Worker	<input type="checkbox"/> Automobiles <input type="checkbox"/> French
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SCHOOL OF PRACTICAL ELECTRICITY
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wrote off the spoken words. This he explained was in the experimental stage as yet.

I had been so engrossed in the marvels of this wonderful mansion that I was much surprised when I observed that night was drawing near. Monsieur Knap courteously requested me to spend that evening with him, and I was more than pleased to avail myself of such an opportunity.

We adjourned to the reception room and my host suggested a game of billiards to speed the evening hours along. But as in my tour through the house I had observed not a trace of a billiard table, I was certainly at a loss as to how we would be able to play. But no sooner had this thought flashed through my mind than my host, as if to anticipate me, pressed a button and a regular life-size billiard table rose from the floor. An innocent looking panel had covered the table previously.

When the hour for retiring approached mine host bade me *bon soir* and wished me pleasant dreams. I found my sleeping chamber a marvel of convenience and in planning this apartment it was made evident to me that no necessary convenience had been overlooked. I found that by turning a button on a switchboard conveniently located beside the bed, the window curtains could be closed and opened. And, wonder of wonders, an instantaneous electric water heater presented itself for my convenience. As is well known, hot water spigot service is an unknown quantity in most French houses and a bathroom is a rare luxury indeed. Before retiring I discovered that the windows could be closed or opened at my desire by simply turning a switch which controlled an electric motor. Also there were electrically heated hot water bottles for those having cold feet.

I arose in the morning with the sun streaming through the windows and recalling that I had but to push a button to draw the curtains together, I at once availed myself of this service. A telephone placed conveniently beside the bed enabled me to communicate with the Chef and order some breakfast. In a few moments my *déjeuner* had arrived on an automatic electric elevator beside the bed, similar to the one in the main dining-room. After this refreshing meal I proceeded to dress and found M. Knap in the reception room busily engaged in reading the morning papers.

Before bidding him farewell, however, he asked me to step into his electrical conservatory, where he grew several of the choicest fruits in a very short period of time, and all because he simply bathed them in an electric light during the night, so that they proceeded to grow all the time.

And as I bid him adieu he pinned to my coat lapel a boutonniere of electrically grown carnations.

WHEN THE ENGINEERS GO TO WAR.

(Continued from page 391)

Besides the excellent training given at West Point, and also at Annapolis, the U.S. Government conducts an *engineers' school* at Washington Barracks, Washington, D.C. This school is under the control of the chief of engineers. Its object is to prepare junior officers of engineers for active duties of their corps, to make experiments and recommendations and to give instructions pertaining to civil engineering work of the Army course of instructions, covering a period of 13 months, beginning September 1st and ending September 30th of the following year. Diplomas are given to students who successfully complete the course.

In time of war the engineering squad collectively and individually forms one of the most important units of the regular army for all sorts of defenses, from that of mining a river or harbor to the construc-

tion of a massive concrete redoubt or fortification. Contrary to general opinion it is not always the luck of these highly trained men to be back beyond the firing line, and some of the work includes such hazardous propositions as the rebuilding of bridges or complete Pontoon bridges under fire, as witnessed in many of the pictures which have arrived from the German army battle lines in the present war. Also the destruction of buildings and bridges raked by rifle or artillery fire and the construction of telephone and telegraph lines, which are often under gun fire, besides many other details of military work, such as surveying various building operations, trenches, big gun mountings and railroad track layouts.

The illustrations shown herewith bring out some of the unusual points of military engineering. The first view shows two German engineers placing a mine under a concrete bridge, under the direction of a superior officer. Possibly within a few moments' time this bridge will be no more. The engineers will leave the bridge and at the touch of an electric button this mighty structure of stone and cement will rise like a thing alive for a moment—then collapse into a shapeless heap of ruins. Some of the bridges dynamited by the demolition squad in order to check the advance of the enemy have been half a mile or more in length. Several of the finest bridges in Europe have been thus destroyed, for tactical purposes.

The electrical features, which, of course, include the radio telegraph in modern military manoeuvres, either in time of peace or war, are quite colossal by themselves. Wonderfully powerful electric searchlights sweep over the sky at night in search of the enemy's aeroplanes or Zeppelins, while on the other hand several thousand volts of deadly current may be passing through the barbed wire fences, separating the fighting factions. The soldier on touching such a fence is often electrocuted. Electricity plays a very important rôle in the ignition of the explosives, particularly those used for mining or dynamiting any structure which must be blown up. A small electric battery or dynamo furnishes the current for these operations, and at the touch of the button the electric current passes with the speed of lightning over the fine copper wires, which terminate in a cap or igniter, which fires the dynamite or high explosive charge.

When the army retreats it is often found by the advancing enemy that his foe has prepared a very warm reception for him in the shape of a thoroughly mined and electrically wired field. In some cases these mines are connected up with electric wires placed 1,000 feet or more away, so that the retiring troops can wait until their adversary has advanced on to this area, when, at the push of a button, the ground, troops, cannons and everything are hurled skyward.

The various units of a large army are kept in constant touch with the general in command and all officers of the general staff by telephone, telegraph and wireless. The signal corps take care of most of the signaling installations, such as those just mentioned and the portable wireless outfits now used by the army and navy can be unpacked and set up ready for instant use in a few minutes' time after their arrival upon the spot.

The engineer, or those who have a hankering for the military phases of engineering, will find that a vast amount of interesting work awaits them. There is always a plentiful number of new problems awaiting solution, particularly those covering electrical branches of the art, aside from those of gunnery, range finding, sanitation, transportation, and the building of fortifications.