Experimental Physics

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LESSON TWENTY (Conclusion)

PHYSICS AND THE WORLD WAR.

As a fitting conclusion to this series of articles, let us consider to what extent Physics helped to beat the Huns. The bulk of the wonderful work done by all branches of science has as yet not been disclosed to the general public; but the following material disclosed by Professor Ames, of Johns Hopkins University, in his address at the University of Virginia, by Dr. Hale in his address before the New York Engineering Societies, by Professor Millikan, of the University of Chicago, in his address at the Philadelphia meeting of the American Institute of Electrical Engineers, and by Major-General Squier in his address at the New York meeting of the A. I. E. E., is more than sufficient to make it evident to us that Science in general and Physics in particular, deserves a lion's share of the glory accruing from the victory of the Allies.

Wireless Telegraphy — It Often Proved the Only Reliable Communication in Battle.

The American public at the beginning of the war held its scientific men in insignificant regard, and was very much surprised to learn of the high degree of mobilization of Germany's scientific men for war work. The "fool professor" was destined to come before the public eye. On our entering the war our wizard inventors with their efficient press agents won the war for us over night by their epoch-making inventions. Days went by, but our epoch-making inventions did not appear, and gradually the usual murder and divorce cases appeared in the papers again, displacing the names and ideas of our wondrous newspaper wizards. An Inventions Board received some 1,600 inventions from our inventors and found about half a dozen of them were worth considering. Magnets of tremendous size were proposed, which when placed in the bottom of the sea would attract all shells, etc., and thus stop the war. Others proposed magnets of various forms, which on trailing along beneath an airplane would drag up any submerged invisible submarine. Another proposed generating a wind so strong that it would push away any approaching airplane, balloon, etc. Thus airplaine raids were eliminated, submarine attacks were ended, and the war was over. These fool inventions were coming in so fast that the Board in self-defence determined not to consider any inventions sent in by these wonder-workers unless a "working model" accompanied the papers. It was evident that the road to a successful termination of the war lay in bringing together men possessing scientific knowledge, and equipt with scientific methods. In ordinary peace times the college professor is at a disadvantage —he is usually ignorant of, or not interested in commercial development, and does not come in contact with the technical trades. However, his researches in pure science are eventually commercialized and become of vast technical importance. In bringing together eminent scientists, presenting them with problems, showing them the conditions, having them perform their researches under the best of conditions and immediately making use of the fruit of their toil—this proved the way to victory. In Washington, London, Paris and Rome, some of the foremost of the Allied scientists were gathered. Among the Physicists we have Millikan, Ames, Mendenhall, Gale, Wood, Duff, Hubbard and others, all in uniform and commissioned as officers in the U. S. Army or Navy. Major-General G. O. Squier, the Chief Signal Officer of our army, is a Physicist of considerable reputation, having received his degree of Ph.D. in Physics at Johns Hopkins University. The rest of our Physicists served in civilian capacities.

Machine Guns — Another Weapon of Science, Worked Havoc to Both Sides Night and Day.

Giant Bombing Planes Were Threatening to Wipe Out Berlin When the Armistice Was Signed.

IN THE "MAY" EXPERIMENTER

The Editors have in preparation some exceptionally interesting articles for the May number of the ELECTRICAL EXPERIMENTER, *among which are the following:*

The Latest in Aërial Railways.

"My Inventions"—No. 4, by Dr. Nikola Tesla.

Electricity and Dynamite — How they help the farmer irrigate land, divert streams, loosen hard soil, and clear land of stumps and stones.

Recording Our Thoughts Electrically, by H. Gernsback.

New York to New Jersey Via Wagon and Auto Tunnel—A Gigantic Engineering Problem.

The Latest Electrical News from France, by Jacques Boyer, Paris Correspondent of the "E. E."

Springtime Fashions in Electric Fans—Several dozen new wrinkles with these useful devices that will interest the whole family.

X-Raying Our Teeth—How disease and mental ailments have been actually traced to ordinarily invisible infections of the teeth. Written by the Medical Director of a Prominent State Hospital.

How to Build a Professional Medical Induction Coil Outfit, by H. Winfield Secor.

Some Interesting Facts Concerning the Electron, by L. R. Jewett.

How to Build an Efficient Open-core Step-up Transformer, by William Holladay.

Choke Coils—How to compute their dimensions with data on actual coils, by Prof. F. E. Austin, Instructor of Electrical Engineering, Dartmouth College.

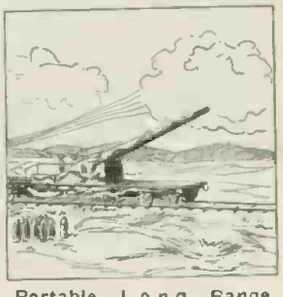
"Science in Slang" — Installment No. 3, by Emerson Easterling.

Let us now see how our war needs affected scientific research. It is a well-known property of charcoal that it has a high absorbing power for many gases. When the Huns brought forth their little surprise of "poisonous gas," the gas mask was immediately evolved. Research developed that a special treatment of charcoal, made in certain sizes from special kinds of wood had an increased absorbing power. The Physicist knew that charcoal had this absorbing power, and when the problem of increasing this power to make the combating of gas warfare more efficient was proposed, the problem was solved. Airplane engines have been manufactured for many years, but never before has the necessity arisen for high speed quantity production. The problem arose and was solved, the Liberty engine was designed, developing 400 horse-power and weighing only 800 pounds; about 2,000 per month were manufactured. The resistance offered by the wings of different sections, the stability of the airplane, the character of the covering surfaces, etc., have all been investigated in detail. The instruments of navigation and of signaling are perhaps every bit as important as the airplane itself. Instruments for indicating speed, direction, height, distance travelled, etc., have all required extended and careful research by the Physicist. In all airplane work, whether in observations or in making attacks, it is necessary for the men in the machines and the men on the ground to be in constant communication. The wireless telephone is the obvious solution. Wireless telephony has no doubt made more progress in one month of war than in one year of peace. The modifications and improvements made in wireless telephony apparatus in America's physical laboratories by her scientists (most of which have as yet not been disclosed to the public) are positively epoch-making. Our improvements have made it possible

(*Con. on page* 926)

The Submarine—A Terror of the Seas, with a Range of 4,000 Miles.

Tanks by the Thousand Frequently Turned the Tide of Battle for the Allies.



Portable Long Range Guns Routed the Enemy and Leveled His Cities as Well as Fortifications.

HOW AIRPLANES FIND THEMSELVES BY RADIO.

(*Continued from page* 871)

"The use of directional effects of loops or coils for receiving radio signals has resulted in the development of a radio compass for airplanes which gives positive information to the aërial navigator and enables him either to locate his position by triangulation with respect to two beacon land stations or to fly at any given angle with respect to a certain beacon station.

"The apparatus consists of two principal parts—the antenna coils and the tuning and amplifying apparatus. The antenna coils are mounted in the fuselage of the Handley Page airplane, with suitable means for rotating in azimuth. The amplifier is extremely sensitive, consisting of a detector and six-stage amplifier. A novel feature of the amplifier is the use of iron-core transformers for frequencies of 100,000 cycles.

"The direction of the beacon land radio station is determined by maximum strength of signals, in a highly ingenious manner developed originally by the British. The precision of the directional effect is remarkable. In fact, the radio direction finder may well be called a radio eye."

EXPERIMENTAL PHYSICS.

(*Continued from page* 867)

to send and take messages in spite of the enemy's interference by sending out impulses of similar wave length and other distributing influences. The problem of using a non-inflammable gas for inflating balloons and dirigibles has been solved under the direction of a Physicist and a Chemist, both "fool professors".

The submarine has probably attracted as much of the attention of the scientific men as all other war inventions combined, both as to its detection and its destruction. The detection of the submarine is a definite physical problem, and it is estimated that about one-fourth of the Physicists of the Allies have devoted a considerable portion of their time to solve this problem alone. The problem had been attacked from three standpoints, light, sound, magnetism and electricity, three branches which almost comprise the entire subject of Physics. The destruction of submarines has been successfully accomplished by the use of the depth bomb.

In long range artillery work, temperature, moisture, and wind are to be carefully determined; this is done by physical apparatus. Wind direction and barometric pressure information is essential in a gas attack. This information is furnished by physical apparatus. Anti-aircraft gunnery is largely indebted to physical research and calculations for its effectiveness. The speed of the airplane must be ascertained, its direction of motion, its height above the ground, the speed of the attacking shell, and its path.

The airplane camera would be almost useless were it not for our knowledge of the branch of Physics known as *spectroscopy*. Pictures can be taken which the eye cannot see because of fog, cloud, haze or distance. By the use of the proper filters, the enemies guns camouflaged so as to be indiscernible to the eye are photographed and their positions located. The sound method of locating guns is very important. Three sounds are heard from a shell sent by the enemy. First we hear the hissing noise of the shell whizzing thru the air. Shortly afterward the boom of the gun is heard. (Since sound travels at about 1,100 feet per second and the shell's speed is greater than that). Finally we hear the sound of the exploding shell. If the time when the first of these three sounds is heard is recorded at several observing stations, from the speed of sound, and the difference in time recorded at these stations, the position of the