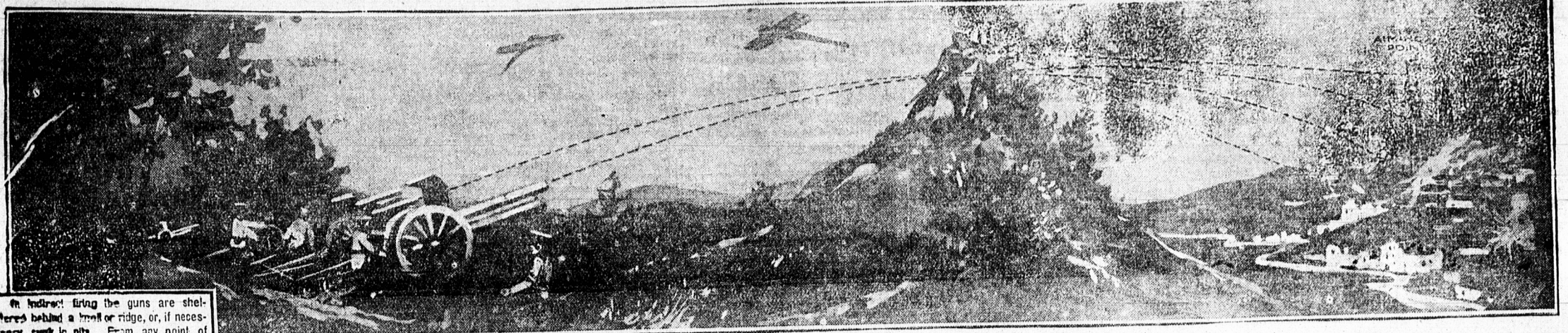


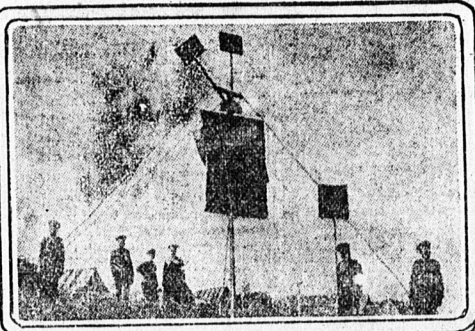
SCIENCE ASSISTS THE FIGHTERS OF TO-DAY

WHY AND HOW INVISIBLE BATTERIES

FIGHT DEADLY DUELS IN WARFARE



In indirect firing the guns are sheltered behind a hill or ridge, or, if necessary, sunk in pits. From any point of vantage, where he can best see, the battery commander directs the fire. It is not necessary that the gunners have more than the range, time of flight and direction of fire. The battery is completely concealed, just as the gunners cannot see the enemy. It is necessary, however, that some prominent object, to be used as an aiming point, come within range of their vision. The officer at the observation position can see the aiming point and the target and with a specially devised instrument extends imaginary lines from both objects to himself, measuring with mathematical precision the angle thus formed and of which he is the apex. The gunners aim at the aiming point and deflect their field pieces the number of degrees shown in the angle measurement, thus training directly upon the target which they cannot see. With the range properly gauged, the trajectory of the projectile carries it over the ridge directly to the target. Concealed, or masked batteries, because of the use of smokeless powder, can be located only with great difficulty, save from an aeroplane.



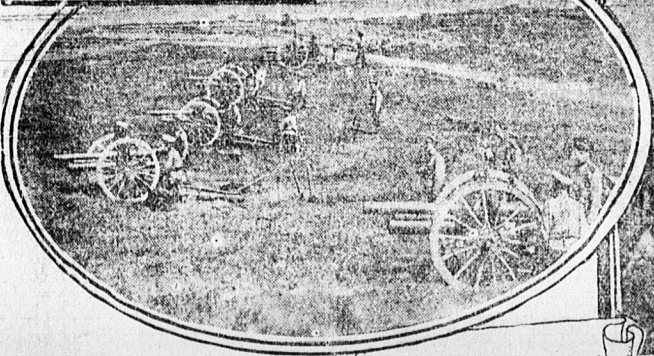
One of the Peculiar Signaling Devices for Artillery in Use in the Russian Army. They Are Utilized After the Manner of Signals on Board War Vessels.



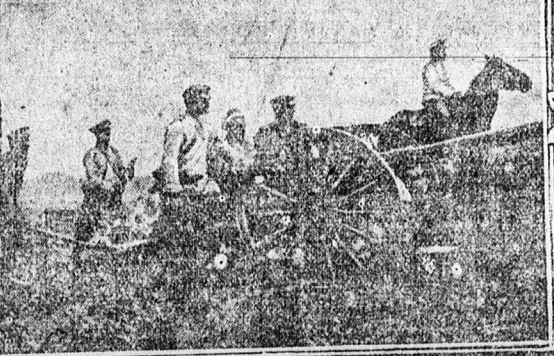
Battery of the United States Field Artillery Demonstrating the Method of Indirect Fire at Manoeuvres. It Is Noted That the Artillerymen Have Wheeled the Carriage Ahead of the Piece in Action The Brush, Showing Between the Limber and the Gun, Indicates the Masking of the Position.



Tear Nicholas at an Artillery Observation Point in Recent Manoeuvres, Directing the Fire of Guns Concealed in the Valley on His Left.



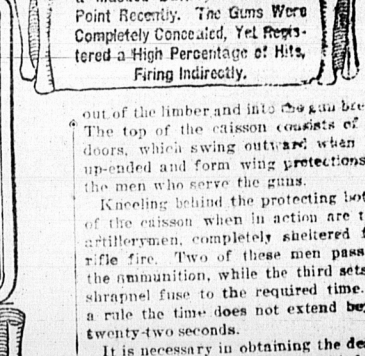
Typical six-gun field battery of the Russian artillery forces prepared for indirect fire. It will be seen that the Russian gunners wheel the limbers several yards in the rear of the line. The observation point appears on the ridge, directly above the fifth gun from the right of the line.



Russian Gun and Crew in Action in Manchuria, Holding in Check Advancing Japanese Skirmishers Outside of Tashichiao, During the Russian Retreat.



This photograph is of one of the guns in a New York National Guard Battery at Battle Practice. The Battery is in Position Behind a Low Ridge, Completely Masked. Note the Barrel of the Gun in Recoil, Thrown Back on the Carriage.



Artillery Officers of the United States Army Directing the Fire of a Masked Battery at Mountain Point Recently. The Guns Were Completely Concealed, Yet Registered a High Percentage of Hits, Firing Indirectly.

ALTHOUGH the most potent factors in the great conflict now raging between the armies of the Triple Entente and those of the Teutonic Alliance are gunship and the individual intelligence and faculty for initiative on the part of the rank and file of the opposing forces, military experts have long pointed out that the European war will be won or lost by these alone. That which is large in the balance of the arms and equipments of the armies engaged. Little, however, is left to judge between them, in comparison, for there is much that is closely guarded by the general staffs of all the countries engaged.

Concerning the field artillery branch of the heavy arms of the nations engaged, Great Britain's batteries are the heaviest, although the British guns in the field are only a small portion of the ordnance piled against that of the German Empire. The calibre of the ordnance is known by the armies as follows: Great Britain 3.3 18.48 pounds France 2.95 15.96 pounds Germany 3.03 15 pounds Russia 3 14.41 pounds Austria 3.01 14.72 pounds

In addition to the various arms, particularly those of France and Germany, whose guns of greater calibre are known by the name of heavy artillery, there is the more mobile force of Royal Horse Artillery equipped with guns of three-inch calibre. Great Britain's guns are made in the State arsenals and by the Elswick Ordnance Company and the Vickers, Maxim and Coventry Ordnance works. The guns of the German army for the most part are made in the State arsenals, as are those of France in the French government works. Russia's guns are manufactured by Putilov and the Belgian guns by Krupp and Cockerill. Austria's guns are made by the State and by Skoda and Ehrhardt.

As was the case in South Africa and Manchuria, ordnance originally designed for other functions is now used in the field. These pieces embrace the functions of ordinary field pieces, although

of much greater calibre. Howitzers and mortars are carried in the field armaments of the Powers engaged that can hurl projectiles varying in weight from 50 to 250 pounds. No boundary line can be assigned which will separate these field equipments from those of the light units.

The British sixty-pounder gun has a calibre of five inches, its charge is nine and a half pounds of cordite and its shrapnel range is 10,000 yards, or about six miles. The German ten-centimetre gun has a calibre of four inches and has an effective shrapnel range of 5,750 yards, more than three miles. A common shell can be used up to more than six miles. The French fifteen-centimetre howitzer is a very popular piece in the army of the republic. A few years ago 120 batteries were said to have been armed with it. The gun is a short piece, the shell weighs ninety-four pounds and it has an effective range of 7,000 yards. On war footing three ammunition wagons accompany each gun.

COMPARING HOWITZERS OF GREAT BRITAIN AND GERMANY
The Germans also possess a fifteen-centimetre howitzer the rate of fire of which is two to three rounds a minute, the shell weighing eighty-seven and a half pounds. The British six-inch howitzer has a projectile weighing 122 pounds and has an effective range of 7,000 yards.

The heaviest field equipment used by Germany, other than her siege artillery, is an 8.4 inch mortar which weighs 4.9 tons. It has to be fired from a special vehicle, and can be operated only from a platform. It requires four hours to bring it into action and the shell weighs 250 pounds and carries a heavy charge of high explosive.

Of siege ordnance the French 10.7 howitzer is probably the most formidable weapon, although it is believed that the Germans have siege pieces of greater calibre which were used against the Liege forts. At the mock siege of Langres in 1907, the French artillery transported this gun by special horse-drawn transport, as it was found too heavy for the type of siege railway made use of. This gun and its means of transportation

have been considerably improved since then.

Field artillery is playing a part of the greatest importance in the present campaign. Sinister reports have arrived from all points in the theatre of operations telling of the immense carnage wrought by artillery fire. In the Franco-Prussian campaign of 1870 the French ordnance was completely outclassed by the German Krupp wedge-lock field guns. The mitrailleuse, a type of machine gun which the French General Staff believed to be superior to anything possessed by the Germans, proved a miserable failure.

While some of the finest field ordnance in the world is made by the firm of Schneider & Co. at Creusot, France, the idea that the French artillery batteries are equipped with pieces made familiar to the South African and Balkan campaigns is a mistaken one. The guns used in the French army are manufactured in the State arsenals and in no circumstances are they for sale.

The greatest secrecy prevails in the manufacture of this weapon, and the designs are never exposed when the regiments are on parade, the pieces being covered with tarpaulins. The manufacture of the guns is superintended by officers of the French army ordnance corps, and it is said that if any of the pieces are in danger of capture by the enemy a secret key can be removed which renders the guns absolutely useless.

The field artillery equipment of Great Britain has undergone a complete change since the close of the South African campaign. During several phases of that conflict it developed that the French guns used by the Boers easily out ranged the standard field pieces of the British forces. These guns were popularly known as Creusots, and were manufactured by Schneider & Co. at Creusot, France.

In order to cope with this Boer superiority in artillery, it was necessary to send to the front naval guns taken from British war vessels. These were mounted on improvised gun carriages, and it was the presence of the naval guns in Ladysmith that enabled the garrison to overcome disparity in ordnance and hold out against the Boer investing force until relief came.

The long recoil system is employed in all the field guns used in the European armies. With this system the gun carriage is immovable, and the recoil is taken

up in cylinders, either placed under the carriage or along the trail. The principle is the same in all services, although the mechanical arrangement may differ somewhat. The principle is to hold the carriage rigidly in position while the gun recoils on the carriage. The energy of the recoil is utilized to run the gun out after each discharge to its normal position on the carriage. The long recoil system was developed in France about sixteen years ago.

As has been demonstrated in the present campaign, the object of modern field artillery is effective fire with shrapnel. The three-inch shrapnel projectile in use in the United States army carries 204 bullets, and these bullets to be effective against men in the field must have tremendous striking energy. The jacket of the shrapnel projectile is thin and a small charge only is required to shatter this and release the bullets.

The explosion of the shell, however, does not impart to the bullets any increased impetus or velocity. The velocity of the bullets when scattered after the bursting of the shell is really the velocity of the shell proper. The design of the projectile is to burst the shrapnel over and over and over the target, and it is especially effective against troops sheltered behind imperfect cover or in shallow intrenchments. When burst over coverworks the bullets will search for troops in shelter. It is regarded as impossible for troops to advance any considerable distance in the open under shrapnel fire.

ORDINARY FRENCH SHRAPNEL EFFECTIVE AT THREE MILES

The ordinary field pieces of the French forces, it is said, have an effective shrapnel range of more than three miles. The French army field piece was developed by General Langlois. He is a practical artillery officer, and these men evolved the field piece which is now in use with remarkable success in the French army. It is noteworthy that American machine tools are used in several of the French arsenals.

The French, British and Russian artillery resort to indirect fire. That is, in assuming a position from which to shell the enemy, the battery commanders shelter their guns behind a ridge or knoll, so that neither the guns nor their crews can be seen from the point of attack. The fire is directed by the battery commander, who

takes up a position from which he can directly see the target.

With a range determining instrument the officer at this observation point gives the range to the gunners, and at the same time some prominent point of the landscape, such as a tree, a post or a church spire is selected as an aiming point. It is necessary that this point be visible to the gunners as well as the commander of the observation position, who measures with mathematical accuracy the angle of imaginary lines extending from his position to the aiming point and the target.

With a similar apparatus on the gun, the gunner is thus enabled with reasonable certainty, when he receives from the commander the range and the deflection, to reach the target from his position of concealment. With the use of smokeless powder it would be practically impossible for an enemy to locate a battery properly intrenched and firing indirectly. The utilization of aeroplanes in warfare, however, has changed materially this phase of artillery operations.

Aeroplane squadrons are attached to each army corps of France, Great Britain and Germany, in the present field operations. The official reports of Field Marshal Sir John French, of the British expeditionary force with the allied army, have directed attention to the potency of this new arm of the service. While aeroplanes have not revolutionized warfare altogether along the lines that some military experts expected, they have changed completely reconnaissance operations, so that an army to-day with the most efficient and complete aviation corps wields a tremendous advantage over a less fortunate adversary.

So far as artillery is concerned, the advantage of a well marked position is often reduced by aerial scouts, who are able to make accurate notes from a safe altitude. The location of an enemy's batteries can be transferred to headquarters by radio from the air and the screened guns searched out by opposing artillery.

Without the use of aeroplanes, military experts assert, the campaign as it is being fought in the western theatre of operations would have been impossible. The vigilant aerial scouts follow the smallest move of the opposing force, noting the withdrawal of forces here and the reinforcement of the lines there, so that the gigantic field operations have

developed practically into a monster game of chess, with the opposing generals pitting their wits—not the least of which are their aerial wits—against each other.

With the old fashioned method of artillery fire, in general use until quite recently and still in use by the armies of some of the nations involved in the present conflict, the cannoniers stood up behind their guns in the open. This is now changed, at least in the French and British services. Instead of the caissons being about fifteen feet in the rear of the guns when in action, they are wheeled abreast of the pieces. The gun is operated by two men, one training and firing, the other loading and ejecting the empty cartridge case.

The caisson or limber is up-ended, so that the body rests almost perpendicular to the ground. When carried on the march the projectiles have their heads pointing downward, but when the limber is up-ended the projectiles lie parallel with the ground in position to be slid

out of the limber and into the gun breech. The top of the caisson consists of two doors, which swing outward when it is up-ended and form wing protections for the men who serve the guns. Kneeling behind the protecting bottom of the caisson when in action are three artillerymen, completely sheltered from rifle fire. Two of these men pass out the ammunition, while the third sets the shrapnel fuse to the required time. As a rule the time does not extend beyond twenty-two seconds.

It is necessary in obtaining the desired effect with shrapnel fire to explode the projectile at a point between 400 and 500 feet short of the object fired at. The bullets, spreading like the opening of a monstrous fan, are carried on to the object at the full remaining velocity of the shell. The dispersion of the bullets is regulated largely by the position of the bursting powder charge.

In some instances shrapnel projectiles are made with percussion fuses in addition to the time mechanism so as to insure the bursting of the shell when it strikes the ground. In correcting the range after the first shot by direct fire the battery commander watches closely the bursting of the first shell. If it is too short, he brackets or forks the object fired at by an increased range, reaching the object on the third shot by taking a mean of the two ranges.

Concerning the effect of shrapnel fire it has been stated by experts that, while an average taken shows that of every four men wounded by rifle or machine gun fire three recover, of every four men wounded by artillery fire three die.

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EFFICIENCY OF THE RUSSIAN OFFICER

A WRITER in the Sphere calls attention to the great increase in the efficiency of Russian officers. "It must never be forgotten," he says, "that the ancient Russian, which rose to greatness under Vladimir the Great and Yaroslav the Lawgiver and sent forth its hosts by land and sea to attack to wondrous Chazgorod, on the Rospus, lay much nearer the west than was the case in later years.

We are accustomed to think of Russia before the days of Peter the Great as a barbarous state shut off from Western Europe. As a fact, it is probable that in the eleventh and twelfth centuries Russia was at least on a level with Western nations in all essentials of civilization. It centred not in Moscow, which did not become prominent until 1147, but in sacred Kiev, on the Dnieper. The fatal practice adopted by the kings—great princes—of the house of the Vikings—Brik of dividing their dominions among their children led to a miniature feudal demoralization similar to that which prevailed in Western Europe. Every important city became the seat of one of these Rurikovich princes, whose intestine wars brought unhappy Russia to a sad condition of weakness and poverty and facilitated the conquests of the Mongols when, under

that unknown genius Subatari, they poured over Europe in 1228-1238. One of the most important of these states was Galicia, the Galicia now being invaded by the Russians. It was cut off by the invaders from the new Russia, which was slowly and painfully forming around Moscow in the northeast.

Close to it on the west lay the warlike state of Poland, and when, in 1320, Yuri (George) Prince of Galicia, died Casimir the Great invaded and conquered it. From that day to this it has never rejoined the Russian Empire. Russia has, in the course of ages, gathered again beneath her eagle banner all the provinces which obeyed Yaroslav the Great save Galicia. It is a Russian land, its inhabitants identical with the Malo Russians on the other side of the border. Their language is the same. They are still largely Greek Catholics in faith, though centuries of Polish and Austrian rule have been favorable to the spread of the Roman Church.

In the terrible days of humiliation under the Mongols, when the down-trodden land was divided into countless warring appanages, the people had for the centralizing Great Princes of Moscow a title of peculiar honor—that of "Land gatherer," that is "Land reunifier."