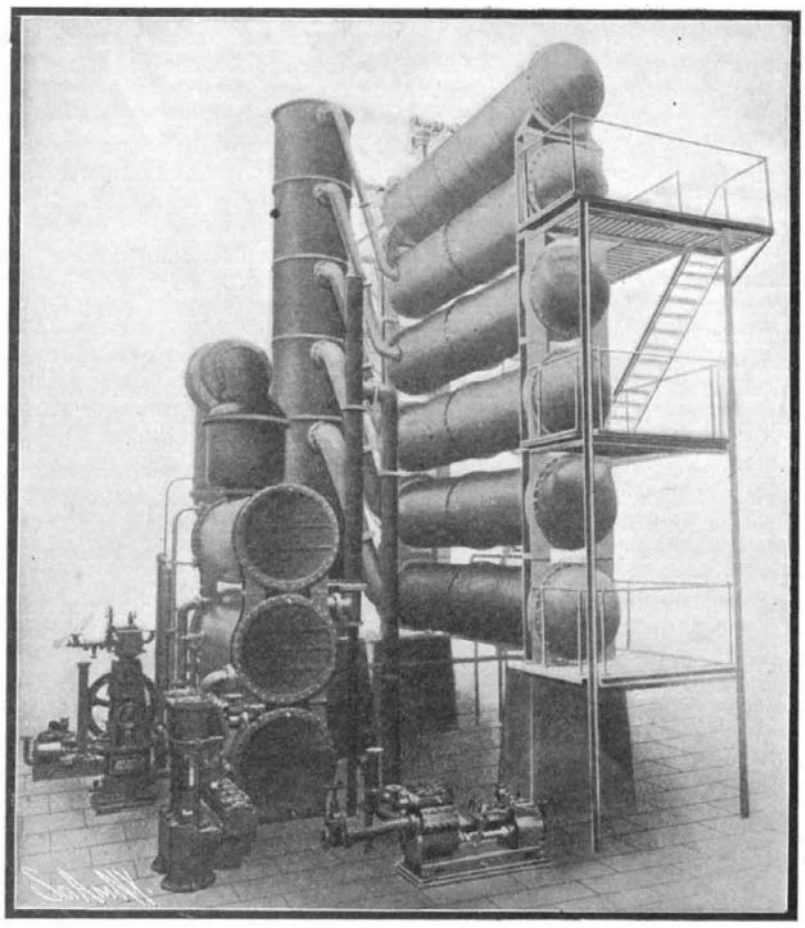
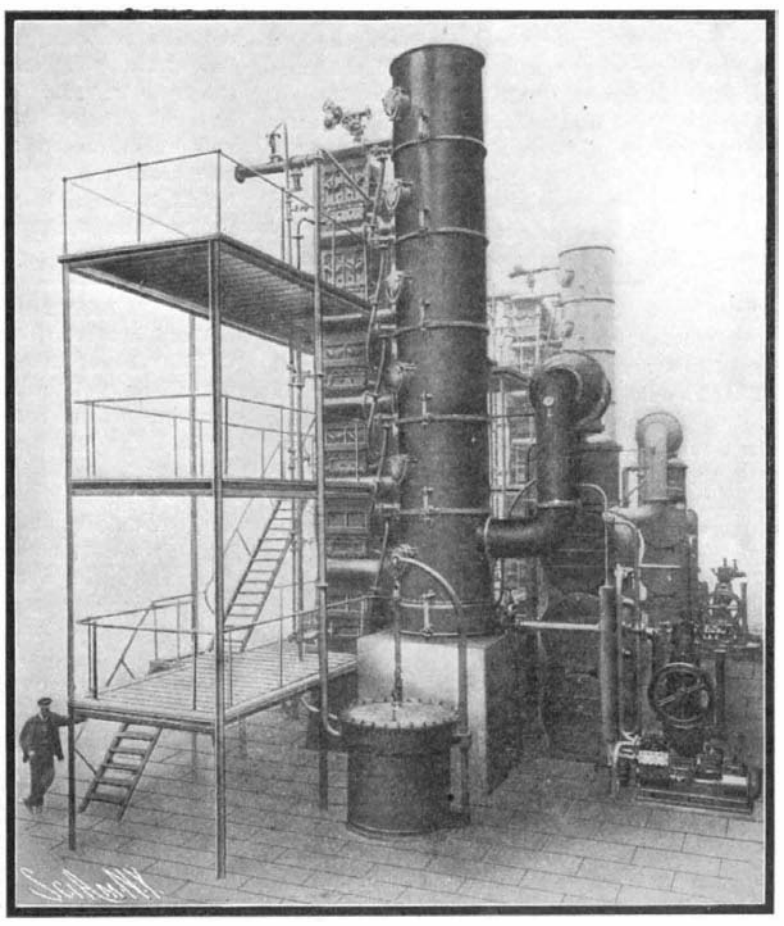
THE DISTILLATION OF SEA WATER AT SUAKIM.

BY OUR BELGIAN CORRESPONDENT.

The Egyptian government has recently installed at Suakim, on the shore of the Red Sea, two very large plants, one for the distillation of sea water and the other for the distribution of fresh water, not only for individual consumption, but also for the supplying of locomotives and steam generators. The plants were installed by the Mirrlees Watson Company, of Glasgow, which had already done work of the same character at Kossier, Camaran, Mombassa, and elsewhere. Each of the two installations is designed for the daily furnishing of 350 tons of pure water. Each pound of coal burned should produce 45 pounds of pure water.





TWO VIEWS OF A SEXTUPLE SEA-WATER DISTILLING APPARATUS USED AT SUAKIM.

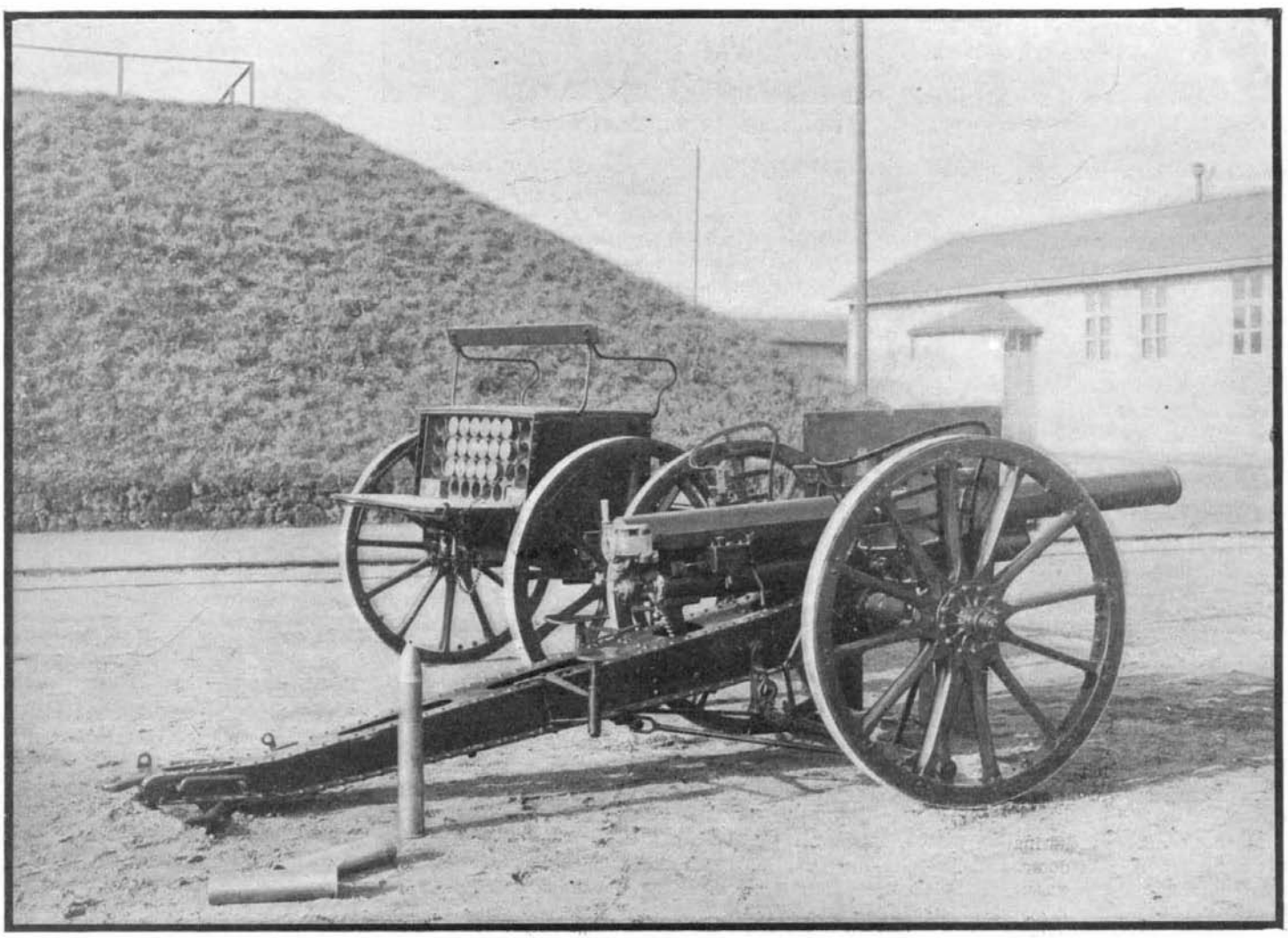
The distilling apparatus are of the well-known Yaryan multiple evaporation type. There are two sextuple-acting distillers, besides auxiliary and air pumps, surface condensers, and feed-water heaters. Each apparatus is warranted to give a daily discharge of 350 tons of potable water. The steam produced in the first part of the apparatus serves for partially heating the second, and so on. The pressures are 40 pounds to the square inch in the first reservoir and 27 inches of vacuum in the last. Each apparatus is provided with an independent battery of boilers, a mechanical salt water filter, and a series of filters for aerating the distilled water before it is sent to the storage tanks.

The salt water is drawn from the sea by the circulation pump. During its passage through the tubes of the condenser, it is slightly heated and is then sent to a reservoir, whence it is forced into the first and second heaters. In the first it is heated by the steam coming from the sixth, and flowing to the condenser. In the second it is heated by the hot distilled water of the sixth, which also goes to the condenser. The feed water then passes into a heating coil arranged upon the bottom of the last part of the apparatus, and afterward ascends through analogous coils into the successive receptacles, becoming gradually heated until it reaches the last, where it is exposed to the heat given off by the steam of the boilers. It passes thence into a special apparatus called a "lime catcher," which is heated directly by a coil coming from the boilers. All the impurities that have not been eliminated by cold filtration, deposit in the "lime catcher" upon a carbon filter. The water is now at its point of ebullition, and in this state it passes through the evaporating coils of the first-acting part of the apparatus.

The hot water and the steam then enter the separator. The steam that is produced therein goes to the jacket of the second-acting part of the apparatus, where it is employed anew for evaporating the water taken from the first separator. The same thing occurs with the following acting-parts of the apparatus up to the sixth. What then remains—about 25 per cent of the original volume—is removed by special pump. A large number of cocks and valves permit of regulating the flow of the feed water into the various receptacles, so as to make the system as automatic as possible. A scaffolding is so arranged as to allow of easy access to all the parts and permit of the cleaning of the tubes of the receptacles. These latter are 3 feet in diameter and are provided with bronze tubes 3 inches in external diameter, and 17½ feet in length. The distillation, it seems, may be employed conjointly with machines for the production of pure ice.

THE RUSSIAN ARMY AND ITS GUNS.

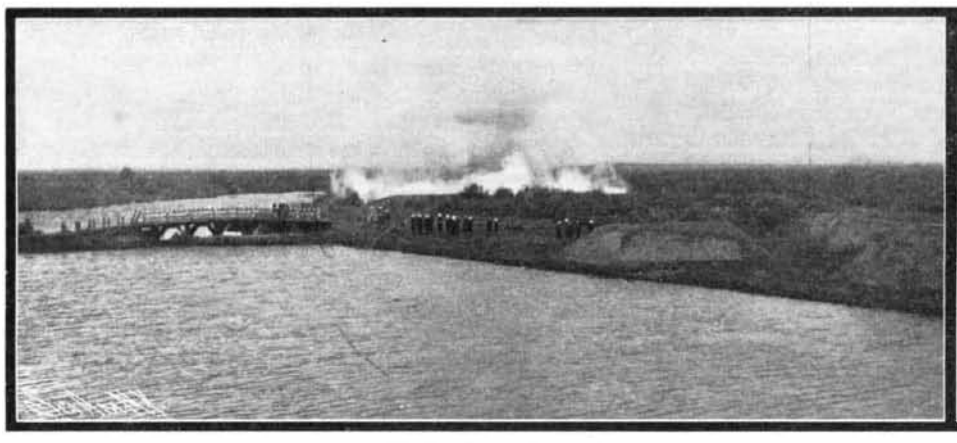
Every year about 850,000 Russian youths reach the age of twenty-one, when they are liable to service either in the Czar's army or his navy. For twenty-two years thereafter they are either under military or naval training, or are subject to a call to arms. The government, however, is quite lenient, and for one reason or another a large number of men are exempted from service. No clergymen, doctors, or teachers need serve. About 220,000 men are annually taken into the navy or the active army, while the remainder form a vast reserve. The term of service varies in different parts of the empire. In European Russia the period of active service is five years; in Caucasia, three years; and in Asia, seven years. The reserve is formed of two divisions, the first being composed mainly of those who have received



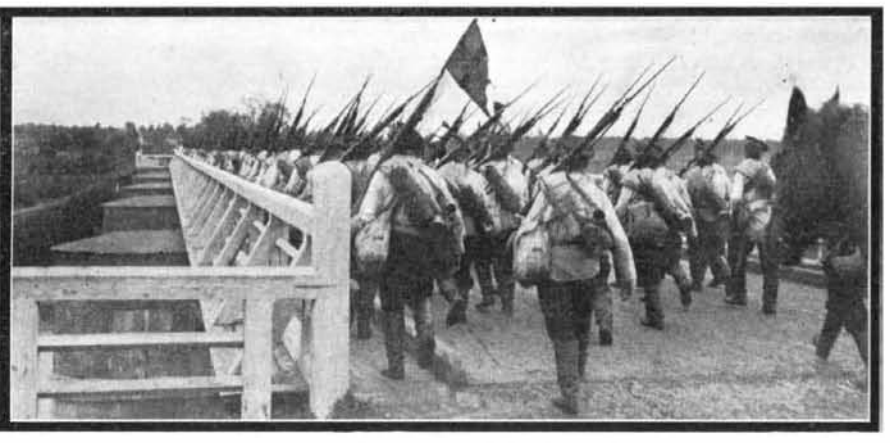
THE SCHNEIDER-CANET 3-INCH, RAPID-FIRE FIELD GUN, UPON WHICH THE LATEST RUSSIAN FIELD GUN IS MODELED.

Russian General and Staff.

Russian Infantry, Showing the Serviceable High Boots and Method of Carrying the Kit.

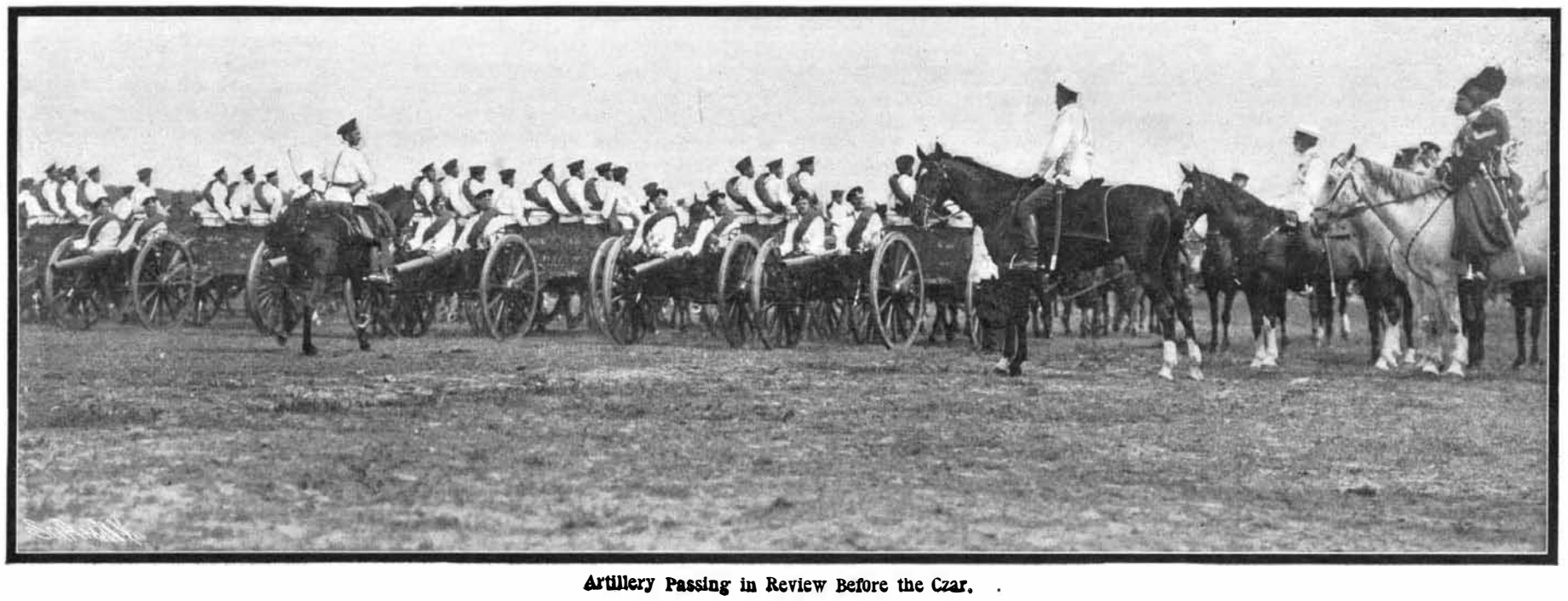


Land Mining Experiments.



Russian Infantry in Marching Order.

Russian Cavalry Off-Saddled.



Artillery Passing in Review Before the Czar.

RUSSIAN ARMY VIEWS.

training in the active army, as well as all able-bodied men who have not received such training. These could be called upon for active service in time of war. The second division comprises all the able-bodied men who have served their term in the first division, and all others who, on account of ill-health, or the like, are exempted from active service. Special conditions exist in the case of the Cossacks. These fierce, war-like people are born fighters. From their very childhood they are trained to deeds of daring, and the whole people are looked upon by the government as a portion of the military organization. At the age of seventeen, military service begins at the Cossack post, and three years later this is followed by field service, which continues for from twenty to twenty-five years. The Cossacks are divided into three classes: First, the active soldiers; second, those on furlough with their arms and horses; and third, those on furlough without their arms and horses. The Cossacks are organized into eleven separate "voiskos," or corps, each "voisko" being obliged to clothe and arm its soldiers.

Russia is divided into fourteen military districts. The army on a peace footing is estimated at 42,000 officers and 1,000,000 men, and in war at 75,000 officers and 4,500,000 men, with half a million horses. There are 21 army corps, 213 infantry regiments, 114 regiments of cavalry, and 511 batteries of artillery. In time of peace it is estimated that the infantry numbers 710,000 men, cavalry 130,000 men, artillery 150,000 men, engineers 42,000 men, besides 40,000 others in army service. The infantry is composed of 52 infantry divisions, 24 rifle brigades, 25 separate infantry brigades, 2 separate rifle battalions, 8 separate infantry battalions, 21 fortress regiments, and 12 fortress battalions. Each infantry division is composed of two brigades, each brigade of two regiments, each regiment of four battalions and each battalion of four companies. An infantry regiment is usually composed, in time of peace, of 70 officers and 1,867 men; in time of war, the officers number 79, and the men 3,945. The cavalry is made up of 24 divisions, 5 brigades, 7 separate regiments, and 3 double squadrons; 2 divisions of guards, 17 divisions and 2 brigades of dragoons, and 6 divisions of Cossacks. The cavalry is divided into four- and six-squadron regiments, the former comprising 32 officers and 779 men in time of peace, and 30 officers and 673 men in time of war. The six-squadron regiments comprise 38 officers and 1,071 men in peace, and 36 officers and 948 men in time of war. The artillery is composed of field, horse, guard, grenadier, and line brigades. In time of peace each field battery has four guns, and in war eight guns. Each horse battery has six guns both in peace and in war. Each mortar battery has six guns. The engineers consist of 29 sapper battalions and 8 pontoon battalions.

The Russian people are composed of the aristocracy and the common class; there seems to be no middle class. In no other European country is there such a gulf between the high and low classes of society. The officers are almost exclusively taken from the upper class, and the common soldiers from the lower class. The latter are a very slow, stolid, and ignorant lot, but they possess the merits of explicit obedience to their superiors and indifference to danger or death. Aside from this, owing to their splendid physique, they can endure great hardships, and are admirably adapted for long and difficult campaigns.

In the last issue of the Scientific American we fully described the Russian small arms. We now devote some space to a description of their artillery.

As a result of the experiments made between 1898 and 1900 with different rapid-fire guns, the Czar has adopted the 3-inch rapid-fire gun of the type of 1900, devised by Gen. Engelhardt and constructed by the Pontilov establishment. The manufacture of this material, however, has been submitted to some delays, so that, up to the present, but three batteries of it have been constructed.

The gun is provided with a rapid-closing breech-block of the screw type which operates in a single motion. It is mounted upon a small cradle, which, after a shot has been fired, recoils about 36 inches upon the slides of the carriage. The live power of the recoil is absorbed by a hydraulic brake and a recuperator formed of a series of rubber buffers. The recoil of the carriage is prevented by a rigid trail-spade. The carriage is capable of sliding upon the axle, and thus permits of direct pointing when the spade is inverted in the ground. The Russian gun fires about fifteen shots a minute.

The shrapnel of this gun weighs 14.4 pounds, contains 260 balls of 160.5 grains each, and is provided with an aluminium double-acting fuse of 9 ounces. It forms a cartridge with the charge of smokeless powder and is fired with an initial velocity of 1,928 feet. The weight of the carriage is 4,145 pounds. In battery, the caissons are arranged alongside of the guns, as in the French artillery.

In addition to the three rapid-fire batteries, of which we have just spoken, the Russian campaign artillery comprises: (1) Light horse batteries of 3.4-inch guns; (2) heavy horse batteries of 4-inch guns; and (3) mortar batteries of 6-inch guns. There are also mountain guns.

The 3.4-inch accelerated fire gun is of steel and has its origin in the slow-fire gun of the types of 1877 (Krupp) and 1879 (Oboukov). The improvements introduced in 1895 by Gen. Engelhardt have made of it an accelerated-fire gun, capable of firing from 5 to 6 shots a minute. The barrel, properly so called, is identical in both the light and horse batteries, except that, in the latter, it is a little shorter. It has a movable chamber consisting of a thin tube driven into and secured in the barrel in a cold state. It was originally constructed with the Krupp wedge breech mechanism, but has since been provided with the Bange screw arrangement.

In 1895, the pointing devices (rack breech-sight and Broca muzzle-sight) were placed in front and upon the side of the barrel. The object of this arrangement was to expose the breech during the loading, and consequently to increase the rapidity of firing by permitting of pointing during the loading.

The carriage (Engelhardt type of 1895), upon which the barrel is mounted, permits of checking the recoil without undue strain on the parts through a trail-spade provided with an elastic joint. This spade, which is jointed to the trail through the intermedium of two rods, is connected with the stock by a combination of two jointed rods. Upon the posterior rod are strong rubber buffers separated by thin metallic disks. These buffers are held at the rear by a plate screwed to the end of the rod and bearing in front against the back face of the shoe. When the shot is fired, the piece recoils, the trail-spade enters the ground, and the carriage continues its recoil in causing the spade to pivot around its bearing point. During this rotation, the spade compresses the buffers, which, expanding after the recoil, bring the gun back to battery. In order that the carriage may not be submitted to an excessive strain through the recoil, rubber buffers are interposed between the axle and the body. Besides, in order to permit of pointing in direction when the stock is rendered immovable by the spade, there is added to the carriage an arrangement that permits of displacing the latter upon the axle. What especially prevents this gun from being a rapid-fire one is the rising of the piece during the firing. Such rising, however, has been notably reduced in the new 3-inch gun.

The 3.4-inch gun fires 15-pound projectiles with a charge of smokeless powder and an initial velocity bordering upon 1,410 feet, such projectiles being a shrapnel with rear charge, a case-shot and an explosive shell. The fuses are double acting and graduated for time. The weight of the carriage is 4,160 pounds.

The 4-inch heavy gun is destined to disappear as soon as the rapid-fire gun is put in definitive service. It is very heavy (4,840 pounds), and would, at the most, be adapted only for the heavy artillery of the army. The gun is of steel of the 1877 type (Krupp) or of the 1879 (Oboukov), these two types differing only in the arrangement of the jacket that covers the tube. It is provided with a wedge breech-block of the Krupp type and is mounted upon an elastic carriage of the Engelhardt type of 1877. At the moment of firing, the carriage displaces itself 2 inches with respect to the axle, by compressing rubber buffers that deaden the shock. This arrangement has permitted of the addition of a trail-spade for checking the recoil without excessive strain on the carriage.

The initial velocity is 1,225 feet, and the 26-pound projectiles fired are a double-walled shell with percussion fuse, a shrapnel with a rear charge and a case-shot with double-acting fuse.

The 6-inch mortar used for high-angle firing was adopted in 1886, as the result of ideas that were materialized after the Turko-Russian war of 1877-78. It is the first of the short army pieces that the majority of the powers have constructed. The barrel, which is of steel, is of the Oboukov type, with wedge breech mechanism. The carriage is original. Between its body and the axle there are two rubber buffers as in the 3.4-inch gun. These buffers, which stand almost vertically *en route*, serve as suspension springs during a march and of elastic bands in firing. Under the body of the carriage are suspended two ground-brakes connected by a cross-piece. Each of these consists of an upper part forming a piston and of a lower one forming a pump chamber, and of intermediate rubber buffers. When the shot is fired, the carriage recoils upon the axle by compressing the axle buffers. The brakes, descending with the carriage, rest upon the ground, and their pistons compress the corresponding buffers. These parts then, in the absence of trail-spades, support the entire stress of the recoil.

Despite its caliber, this weapon, which is thin-walled, is not heavy, the weight being 1,800 pounds in the piece in battery, and 4,300 in the horse-drawn piece. But its range (10,495 feet) is short as compared with the ranges at present obtained. With a maximum initial velocity of 720 feet, it throws a 68-pound shrapnel, a 62-pound fougade shell containing 13 pounds of melinite, and an "illuminating shell." This latter, due to Capt. Nilus, is adapted to illuminate the sites of the enemy at night long enough to permit of pointing.

The mountain gun is old, and presents no interest. The same is the case with almost all mountain guns, the various powers having begun the transformation with campaign guns. The piece is of a caliber of 2.5 inches and weighs 214 pounds. It is mounted upon a carriage weighing 334 pounds. There are both mounted and horse-drawn mountain batteries.

Eight batteries of four Maxim machine guns of 0.275 inch (the caliber of the Russian gun) were, in 1900, formed in Siberia. Each of these comprises 1 captain, 2 lieutenants, 7 non-commissioned officers, 50 men and 22 horses, and an ammunition supply for 5,850 shots per gun. The machine guns are drawn by mountain artillery fire-carriages, and each of them carries 1,350 cartridges upon loading-bands. The supply of ammunition is contained in four two-wheeled carriages, with 4,500 cartridges to each. In addition, the battery is provided with six two-wheeled service carriages. Some of these batteries of machine guns participated in the operations in China, particularly in the engagements at Tien-Tsin. Since then, five companies of machine guns have been created by a ukase of March 23, 1901, and apportioned to four divisions of infantry of Europe and to one brigade of chasseurs of Siberia.

Engineering Notes.

The huge one-span arched steel bridge which is to carry the Cape to Cairo Railroad across the waters of the Zambesi River, just below the Victoria Falls, will shortly be swung into position. This bridge will be the highest in the world, with a main span of 500 feet. The materials used in the construction of the bridge are to be transported from one bank to the other across the gorge by an ingenious method devised by the engineers of the scheme, Sir Douglas Fox and Partners. About 40,000 tons of plant will be carried across the river at a point where the banks are over 600 feet apart, and this will be effected by means of an electric cableway. There will be little manual labor required, merely a few men for driving the electrical machinery, which will do all the hauling. The plant was built at Darlington, in England, and, after a thorough test at the maker's works, was shipped to South Africa.

The Aeronautical Institute of Great Britain proposes to carry out in the latter part of this year a series of trials with screw propellers designed for aeronautical purposes. The trials are to be held in London, in some convenient building of suitable size so as to secure immunity from interference by variations in the force and direction of air currents. The method of testing the propellers is to attach them to a motor provided with a carriage of known weight, which will be driven by the propellers along wires or rails. The run will be as long as possible, and it is hoped in this way to secure valuable kuowledge of the action of propellers, which cannot be gained by any other than a straightaway test such as this. It is proposed at first to test only rotary propellers and those up to about four feet in diameter. For this purpose, the Aeronautical Institute will provide a motor of from one-quarter to one-third horse-power, together with all the other necessary apparatus except the actual propellers, which will be supplied by those desirous of participating in the tests. Silver and bronze medals are to be awarded to the successful competitors.

While the longest ropes are used for haulage purposes, some of the most interesting data in connection with wire ropes are obtained in connection with their use for hoisting purposes. Hundreds of thousands of lives are literally each day hung by a small wire thread as the men are lowered into, and hoisted from, the bowels of the earth, and in many cases the only means of communication between the surface and the underground workings, which are from a few feet to a mile in depth, is by a comparatively small hoisting rope. Think of hanging from the end of a cable only a few inches in diameter and a mile long and being hoisted at a rate which is faster than that of the average railroad train, and some idea of the hoisting problem can be gained. To the honor of the wire-rope manufacturers it must be said that very few shaft accidents are due to the breaking of the rope, excepting where the cage is overwound and unwarranted demands are made upon the rope, or which are traceable to false economy on the part of the users of wire rope. No part of a mining plant is more carefully inspected and watched than the hoisting rope, and very few mine managers will take any unnecessary risks in the hoisting of men. The skill of the wire-rope maker is taxed to the utmost to provide ropes for hoisting from great depths. To make a rope of practicable size that will be sufficiently flexible and that will bear even its own weight, is no mean problem, for in such cases the weight of the rope is often much more than the material lifted. Hence we have taper rope intended to give a varying section dependent on the amount of rope off the drum or reel.—Mines and Minerals.