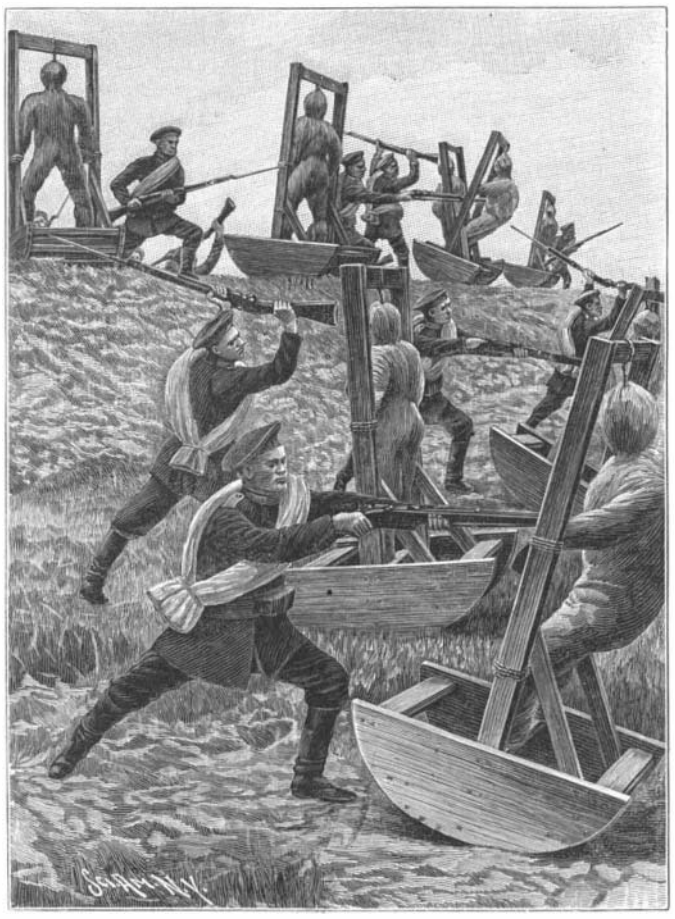
RUSSIAN BAYONET EXERCISES.

Since January 13, 1874, military service has been rendered obligatory in Russia on all men from their twenty-first year. Out of about 870,000 young men reaching their majority every year, some 287,000 are taken in to the active army, and the remainder are inscribed partly in the reserve and partly in the second reserve, or "Zapas." The term of service is in European Russia five years in the active army, thirteen years in the reserve, and five years in the "Zapas"; seven years in the active army and six years in the reserve, in Asiatic dominions; and three years in the active army and fifteen years in the reserve, in Caucasia. In case of need the Minister of War has the right of keeping the men under the colors for another six months. College men, doctors and teachers are exempted, and certain privileges are granted on account of education. The lowest estimate which can be made of the peace strength of the Russian army puts the number of officers at 36,000 and of the rank and file at 860,000 men, the total number being 896,000. In war the total strength is approximately 63,000 officers and 3,440,000 men, the total being 3,500,000.

Even with such a vast army it is, of course, necessary to maintain the same efficiency as in smaller armies, and in Russia, as in Germany, many unique exercises have been adopted, among them being the one shown in our engraving, which represents a bayonet exercise with oscillating dummies. These oscillating dummies are placed on the top of the intrenchments which the soldiers scale. After the men have delivered their blows they go down the other side, at the bottom of which another row of similar dummies has been placed. Their attack is rapid, and the soldiers, going through the ranks of their silent victims, place themselves in skirmishing order. The dummies consist of wooden cradles to which are secured uprights and cross pieces; figures simulating men are secured to the top piece and the side rails. At first the appearance is rather grewsome, suggesting a series of gallows.



BAYONET EXERCISE WITH OSCILLATING DUMMIES IN THE RUSSIAN ARMY.

THE POPOFF-DUCRETET APPARATUS FOR WIRELESS TELEGRAPHY.

As long ago as the time of the advent of the first apparatus for telegraphing without wires, the question was asked whether it would ever be possible to perceive signals at distances great enough to render the system practical. The improvements that have been introduced since then relate to the power of the transmitting and the sensitiveness of the receiving apparatus. The experimenters that have occupied themselves with the question are very numerous. One of them, M. A. Popoff, in conjunction with MM. Ribkine and Troitsky, officers of the Russian corps of engineers, while making some experiments last May between two islands situated near Cronstadt, finding that the receiving apparatus had ceased to operate, conceived the idea of introducing a telephone into the circuit of the radio-conductor and battery, in order to verify the passage of the current, and was astonished to find that the signals of the transmitter could be distinctly heard. From this he concluded that the electric waves produced in the radio-conductor variations of resistance that were directly perceptible at the telephone, and that it was possible to simplify the receiving apparatus by suppressing the relay and the automatic decoherer. It will be remembered, in fact, that the receiving apparatus usually employed up to the present are based upon the use of the Branly tube, the metallic filings of which become conductive after they have been reached by the electric wave, and would remain so, were not the tube struck in order to decohere them. Hence the necessity of certain complications in order to obtain the shock automatically immediately after the passage of the wave. According to M. Popoff's experiments, this is not necessary with the telephone. The filings, under the influence of the electric waves, undergo different states of conductivity, and the current of the local battery that traverses them is sufficiently modified to produce in the disk vibrations that are probably very feeble, but perceptible to the ear. The radio-conductor must, however, undergo certain modifications in order that its sensitiveness may reach a maximum, and the form that has therefore been finally given it is that of a microphone consisting of steel needles resting through their extremities upon plates of carbon. The apparatus that M. Popoff has studied and constructed in order to render the application of the apparatus very easy consists of a wooden box, which contains a dry battery, the radio-conductor and the telephone. For the carriage of the apparatus, the radio-conductor is placed in the interior of the box at *M*; but for use it is fixed at its upper part, at *A*, and the connections with the battery and telephone are made by spring-jacks which may be quickly put in place. A hinge permits of ascertaining at what inclination it presents the greatest sensitiveness. By means of a special device, *D*, and a flexible cable, the apparatus is connected with the yard of the mast that has been previously established, while a flexible cord, starting from a terminal, *E*, establishes a communication with the earth.

The local circuit of the battery is closed upon the radio-conductor and telephone by means of a small commutator, and the telephone is put to the ear. As soon as the transmitting station operates there are very distinctly heard sounds that are now short and now long, and that correspond to the signals of the Morse alphabet. The sensitiveness of the apparatus is such that upon taking as a transmitter a Ruhmkorff coil that gives a spark of but 4 mm., M. Ducretet has been able to establish communication between his shops upon Rue Claude-Bernard and another station situated upon Boulevard Port-Royal, at 500 meters distance.

Last winter M. Popoff made a most interesting application of his apparatus in the Gulf of Finland. A Russian armorclad was stalled among the rocks upon the coast of Hohland Island, and her somewhat critical position forced her to winter there, no communication with the continent, 47 kilometers distant, being possible.

M. Popoff was commissioned to establish communication by wireless telegraphy, and so a station was installed on Hohland Island, another near the city of Kotka, and a third upon the ice-breaking ship "Ermack." By the end of January everything was finished and regular exchange of dispatches was begun. These permitted of saving the lives of twenty-seven fishermen who had floated off on a cake of ice, the position of which it was possible to signal in time to the "Ermack." The transmissions were not interrupted, even when the snow was falling so fast that it was impossible to distinguish an object at a distance of two meters. It seemed, on the contrary, as if the electric wave was propagated more easily under such circumstances. Up to the month of April, the epoch at which the armorclad was saved, 440 dispatches were exchanged.

This new apparatus will not supersede those already in service that permit of the inscription of dispatches with the Morse receiver, but will prove useful alongside of them for cases in which they might not operate. On account of its great simplicity and sensitiveness, it will serve for stations that it might prove convenient to install for temporary use. In the service of wireless telegraphy it may be considered as playing the same rôle as does the "speaker" in telegraphy with wires.—La Nature.

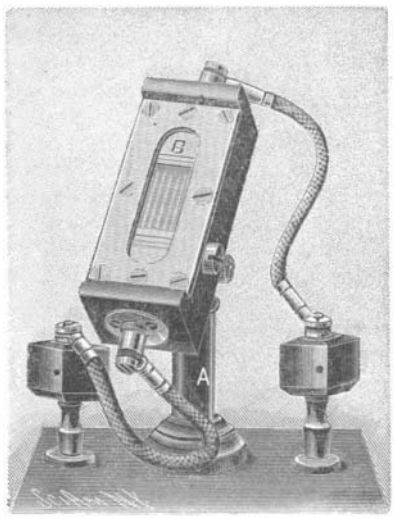


Fig. 2.—DETAILS OF THE POPOFF-DUCRETET RADIOCONDUCTOR.

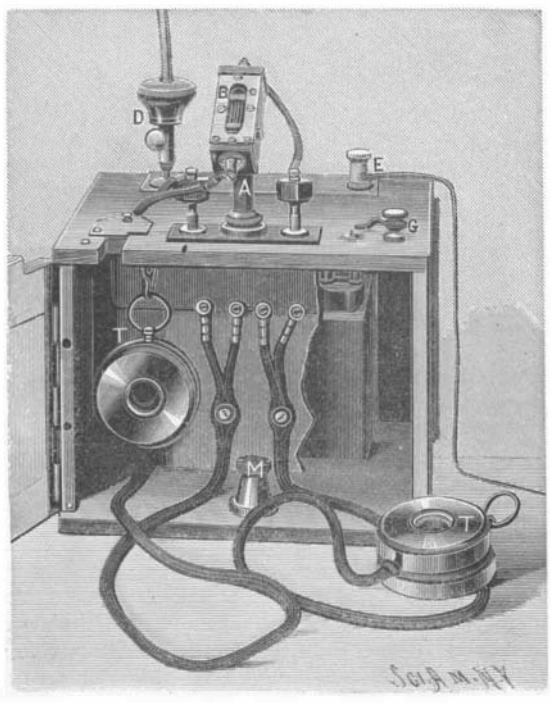
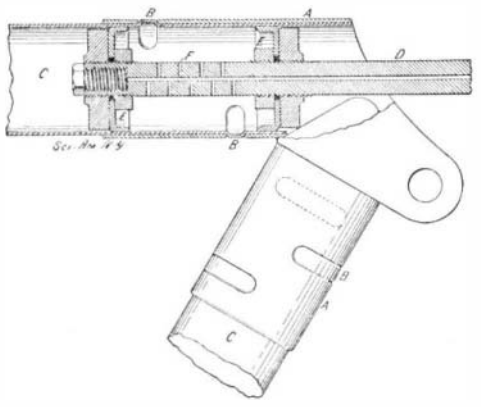


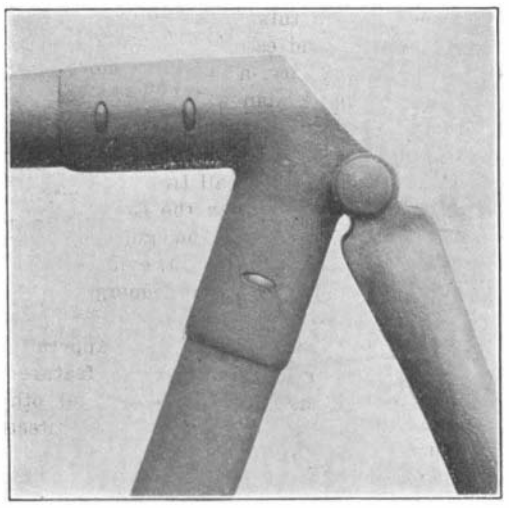
Fig. 1.—GENERAL VIEW OF THE POPOFF-DUCRETET TRANSMITTER.

A HYDRAULIC BICYCLE JOINT.

The prevailing method of joining the various sections of a bicycle frame possesses many disadvantages. The thickness of the tubes which are utilized for this purpose are necessarily thin to insure the desired lightness. In brazing, when it is heated the steel loses its strength, and if the workman carelessly applies the spelter to the part, so that the joint is not well made, the rigidity and solidity of the machine is seriously impaired. In the cheaper machines little attention is paid to the completeness of the attachment, and the result is that after the bicycle has been in use for a short time, the vibration detaches the small areas that are attached by the spelter, with the result that the machine collapses. Considering the great speed at which bicycles are driven, it is highly essential that the joints of the frame, the most vital parts of the cycle, should be firmly and thoroughly effected. Then again, after the brazing, in the



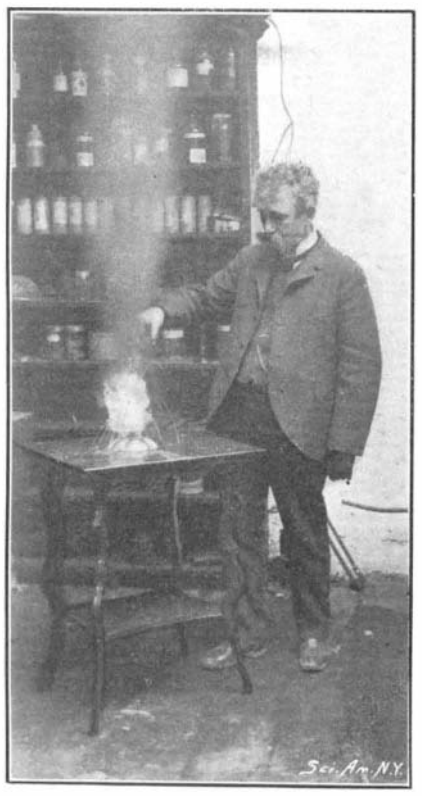
SECTIONAL VIEW OF TUBES, SHOWING TOOL IN POSITION.



A BICYCLE JOINT MADE HYDRAULICALLY.

final filing away of the superfluous spelter, the thickness of the steel tubing is further reduced. It is computed by engineers that the brazing process weakens the steel to the extent of 45 per cent in the best class of work, and consequently this percentage is far greater where the work is imperfectly performed. Of course, care is exercised to guard against this deficiency in strength by the utilization of extra metal, but even such a precaution does not adequately compensate the reduction in the strength of the material.

In view of these drawbacks, the invention of Mr. Birtwhistle, of Manchester, England, by which the various portions of the bicycle frame are joined together by a hydraulic process, instead of by brazing, should prove highly valuable. In this method the metal does not have to be heated at all, but is treated



The Inventor Pouring Molten Iron Upon Maximite.

in its cold state, so that the strength of the steel is not affected in the slightest degree. A number of small slots are cut in the outer tube and the metal of the inner tube forced outward so as to occupy the space in the slots. How this is accomplished may be comprehensively realized by referring to the sectional diagram of a joint.

This figure illustrates the joining together of the two tubes forming the pillar lug, together with the simple hydraulic appliance for performing the operation. The lug is represented by *A*, and the small slots which have been cut through the metal tube are marked *B*. The two sections of the tubes of the frame which are to fit into and to be attached to this lug are marked *C*. These inner tubes are inserted, and then the hydraulic tool attached. This consists of a small pipe, *D*, of sufficient strength to withstand the high-water pressure that is necessary to force the metal into the slots. To this pipe are fitted two cup leathers, at either end of the lug, marked *E*, inserted in a strong clamp which prevents the outer tube from bursting. A pressure of 7 tons to the square inch is exerted, and the metal of the inner tube immediately beneath the slots of the lug is forced by the pressure into the holes of the outer tube until the whole cavity is filled. The stretched metal cannot protrude above the level of the lug, owing to the outer clamp. The operation also serves to expand the inner tube until it presses tightly against the inner surface of the lug. By this means the two sections, to all intents and purposes, are converted into one homogeneous whole.

The operation is extremely simple, and one salient characteristic of the process which should recommend its adoption is that it is not essential that skilled labor should be employed to accomplish the work, as in the case of brazing, since it is almost impossible to attach the parts imperfectly. The parts can also be fitted much more quickly than heretofore. Several tests have been carried out with frames joined together in this manner, and they have proved to be stronger than those frames which were attached by the brazing process. Some sections of the frame are modified in design somewhat, in order to permit the hydraulic tool to be inserted.

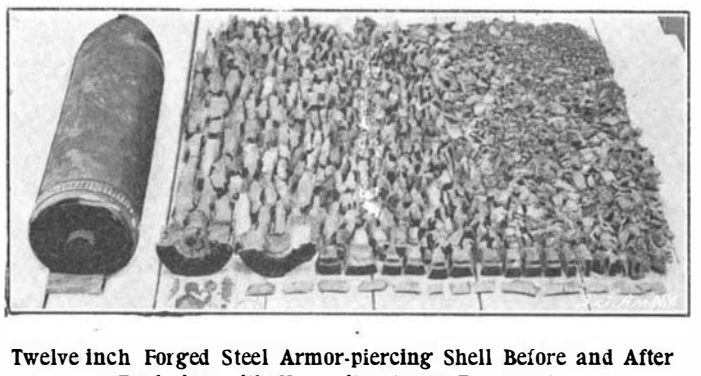
The Birtwhistle Hydraulic Jointing Syndicate, of Manchester, who are operating the invention, have also devised a unique method of prolonging the life of a cycle. The tubes utilized by them for the frames are enameled on the interior as well as externally. Rust is the most insidious foe of the cyclist, since it weakens the metal very rapidly. By this precaution, however, the steel is better protected, and although it does not render the metal absolutely rust-proof, it protects the metal to a considerable extent.

GOVERNMENT TESTS OF MAXIMITE AT SANDY HOOK.

In our last issue we gave a fully illustrated description of the Gathmann gun, and the preliminary tests which have been made of the Gathmann system to determine its military value. We now present an equally interesting set of photographs illustrative of a remarkable and successful series of tests of another method of discharging shells charged with a high explosive. The Gathmann gun is designed to throw an extremely large amount of high explosive from a high-velocity gun of great caliber. The shell is not designed with a view to the penetration of armor-plate, it being judged sufficient to deliver this great quantity of guncotton at the face of the plate and explode it on contact. The Maxim system, which is named after the inventor of the new explosive, Hudson Maxim, seeks to provide a high explosive which can be loaded into a service, armor-piercing shell, and, on account of its insensitiveness to shock, can be carried through any thickness of armor that the shell can penetrate, and be exploded by a time-fuse at the rear of the plate.

The accompanying photographs show results of tests with Maximite, which have been going on for about a year at the Government Proving Grounds at Sandy Hook. The most important of these results have been attained during the last three weeks, and this is the first time that the data have been given to the public. Although the exact composition of Maximite is a government secret, we may say that it is a picric acid compound, consisting mainly of a picrate. Its temperature considerably below that of boiling water, namely, 174 deg. Fahr. as against 252 deg. Fahr., the fusion point of picric acid. If heat be applied to the explosive, it first melts and then evaporates, until the whole of it has disappeared. A valuable feature is that it is impossible to heat Maximite rapidly enough to produce an explosion. Set on fire in the open, it burns like pitch, and one of the illustrations represents the inventor pouring molten cast iron upon a block of the explosive.

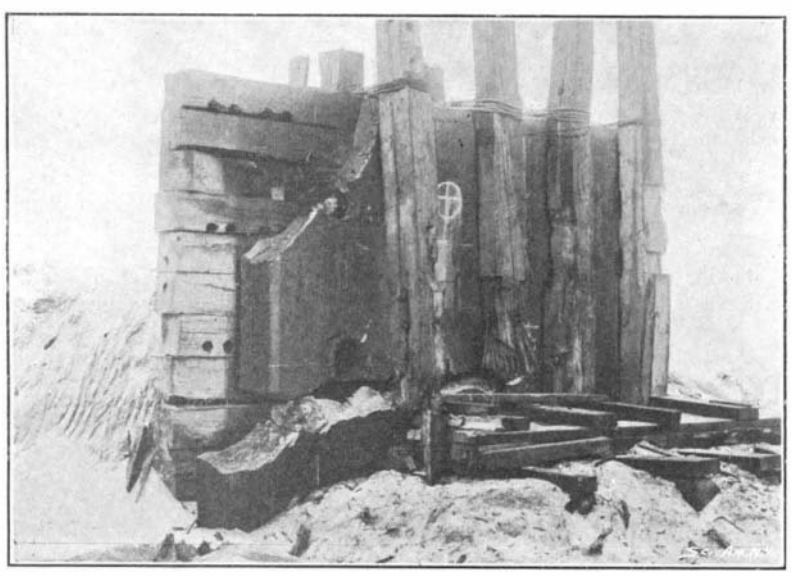
Armor-plate 5¾ inches Thick, After Penetration by 12-inch Shell Carrying 70 Pounds of Maximite.



Twelve inch Forged Steel Armor-piercing Shell Before and After Explosion with Maximite; 7,000 Fragments.

Among the first tests of this material by the Ordnance Board was the firing of a 5-inch, armor-piercing projectile through a 3½-inch, nickel-steel, armor-plate. The projectile was recovered intact from the sandbutt behind the plate. It was then armed with a fuse, buried in the sand, and exploded for fragmentation. The sand was sifted, and over 800 fragments recovered.

About the same time, a 12-inch armor-piercing shell was filled with Maximite, buried in the sand, and exploded for fragmentation. The shell, before and after explosion, is shown in the accompanying photographs. More than 7,000 fragments were recovered. Following this test, a 12-inch, armor-piercing forged steel shell, containing 70 pounds of Maximite, was fired through a 7-inch Harveyized nickel steel plate, and was recovered from the sand behind the plate. This 12-inch shell and the 5-inch shell above-mentioned were, of



Twelve-inch Armor-plate and Support, Before Firing 12-inch Armor-piercing Shell, with Fuse, Carrying 23 Pounds of Maximite.

Wreck of 12-inch Plate After Penetration and Explosion of 12-inch Shell.

GOVERNMENT TESTS OF MAXIMITE AT SANDY HOOK.

inside the end of the inner tube. The pipe at *F* is pierced with a number of holes through which the water passes, as it is forced from the hydraulic pump to which it is attached, into the chamber between the two cup leathers. The lug and tube are then placed

products of combustion are almost entirely gaseous, and as the heat developed on detonation is very great, it possesses, as the result of its high gravity, a very high explosive value. Some of the qualities of the new compound are remarkable. It may be fused at a