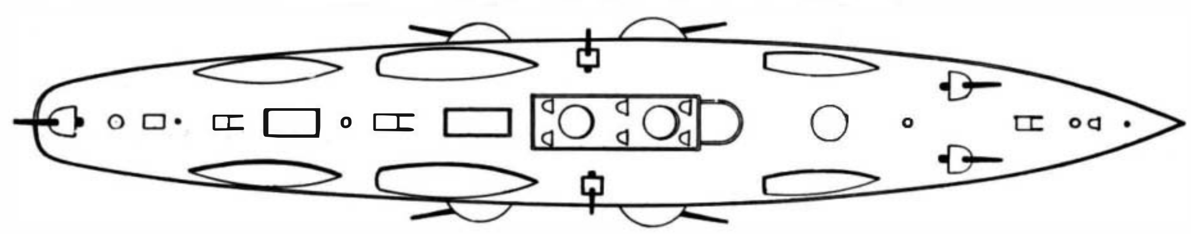
OUR NEW CRUISER "TOPEKA."

It was announced by the American Embassy at London, on April 2, that the United States had purchased a second-class cruiser of 1,800 tons displacement, and which had a speed of 16 knots per hour. It was soon known that this boat was the "Diogenes," which was built for Peru in 1883. She never became the property of that country, owing to financial complications, and she remained in the possession of the Thames Shipbuilding Company. She lay in the Thames for more than ten years, and it was not until the Chinese-Japanese trouble that she was sought after. She then became the property of Japan, and was fitted with Maxim guns. Open hostilities, however, prevented her from leaving English waters, and since then she has been lying in the Thames awaiting a purchaser, and she was finally bought for the United States navy by Lieut. Colwell, the United States naval attaché, who hoisted the United States flag over her on April 2.

The "Topeka" is 250 feet long, her beam is 35 feet and she has a draught of about 10 feet. She has twin screw engines, which are below the water line. Her machinery is in excellent condition, and required but little overhauling to prepare her for her trip to this country. During her trial trip, when she made 16 knots speed per hour, she burned only about 60 tons of coal for 24 hours. She could have gone 10 knots an hour with the consumption of 25 tons of coal. This second-class cruiser will be particularly valuable to the United States, owing to the fact that her draught is only about 10 feet. She is thus admirably adapted as a river gunboat. When building, the "Topeka" was brig rigged, as it was then intended she should be devoted to cruising purposes. The rigging has now been changed to that of a schooner. She has two bow chasers on the forecastle deck and one stern chaser on the poop. The Maxim guns are carried on sponsons and have a range of 120 degrees.

As soon as the cruiser was purchased she was coaled and provisioned and started for the United States, but on April 9 she put into Weymouth, owing to heavy weather. She started again for New York on April 13 in company with the gunboat "Somers," which was built in Germany. A cable dispatch from London, dated April 15, says that the vessels have arrived at Falmouth, and that the "Somers" appeared to be partially disabled. The explanation of the purchase of such a small cruiser as the "Topeka" is that she would be more effective for service than the steam yachts and tugs recently acquired and now being converted into auxiliary gunboats. It is contended by the naval authorities that, if the United States is to buy a number of small vessels not capable for service against any of the Spanish war vessels now in preparation for service, it is better to get regular warships than those of the merchant marine, which must be largely built over for naval purposes. The "Topeka" is more like the cruisers "Marblehead," "Detroit" and "Montgomery" than any other vessels in the United States navy.



DECK PLAN OF THE CRUISER "TOPEKA."

This is probably the first case in which a warship was ever bought by telephone, for the new cruiser was purchased in a hurried manner; in fact, the negotiations were carried on over the telephone. After the verbal agreement had been made Lieut. Colwell immediately started for the Thames Iron Works to raise the American flag over the newly acquired vessel.

THE RANGE-FINDER FOR DETERMINING THE DISTANCE OF A HOSTILE SHIP OR FORT.

The accuracy of modern rifled guns is one of the wonders of engineering. Two experimental shots fired a few years ago at the same elevation from the same gun fell within thirty yards of each other, after traversing a distance of twelve miles. If a modern rifle is laid upon the target, with proper elevation and allowance for windage, it is safe to say the shot will find the mark.

The correct elevation of the gun can only be determined if the distance of the target is known, and the exact determination of the distance of a moving object is a problem that has worried the gunner ever since the day when round shot was first thrown from the sides of the wooden fighting ship.

In the early days, the determination of the range was a matter of guesswork. The gunner assumed a distance, elevated his gun accordingly and watched the course of the shot. If it fell short, he increased the elevation, and if it passed over, he decreased it.

This was all very well in a day when the guns were too feeble to do much execution, except at close range, and a few dozen shots thrown away made little impression upon a ship's magazines. With the advent of modern ordnance, however, with its 60-ton guns and costly charges, the necessity of accurate fire became imperative, and ordnance experts set about devising some scientific method of finding the range at sea. The earliest and best known device of the kind was the invention of Lieut. Fiske, of the United States navy, which has been installed on many of our ships and is widely in use in the various navies of the world.

The Fiske range-finder is based upon the well known principles of land surveying with the transit and engineer's chain. If a surveying party come to a broad river whose width has to be determined, a base line is measured along the bank, and the angles which this line makes with a mark on the opposite bank are measured by the transit. Then, knowing the length of the base line and the two angles, the distance across the river can be determined by trigonometry.

Applying this to the range-finder, a base line is carefully measured between two points near opposite ends of the ship, and over each point a range-finder, answering to the engineer's transit, is permanently set up. If the telescopes of the two finders are simultaneously converged upon the same point on a distant object (ship, fortress or city), the observers will be in possession of the trigonometrical data necessary to compute the distance, namely, the base and the two base angles.

In the din, hurry and slaughter of a sea fight, however, it would be difficult to make the necessary calculations, as the distance between the ships, and therefore the observed angles, keeps changing, and in order to make the determination of the distance automatic, Lieut. Fiske placed his telescopes in the circuit of a Wheatstone bridge and caused their change of position to record the distance of the object on the graduated scale of a delicate galvanometer. All that was now necessary was for the observers at the two range-finders to keep the cross-hairs of the telescope upon the same point of the ship, and the electric current translated (as it were) the angles into distances and recorded them by the movement of a needle over an arc graduated into hundreds and thousands of yards.

On our front page are illustrations which will make the operation of this most ingenious instrument clear to the reader. It represents the "Indiana" about to open fire upon a hostile ship. The converging lines are drawn from two range-finders, which are placed in elevated positions above either end of the superstructure deck. These finders are permanent fixtures, and the distance between them is accurately known. The smaller cuts show a range-finder and a diagram of the telescopes and the electrical connections.

The range-finder consists of a powerful telescope, which is mounted on a standard and is capable of horizontal rotation above a graduated disk. Upon the disk, and extending an equal distance on each side of the zero point on the graduation, is a metallic contact arc. Fixed to the telescope standards is a contact strip, which rotates with the telescope and slides over the contact arcs. In the diagram A and B represent the centers of the disks on two range-finders and C and D the arms that carry the telescopes and contact strips, which are shown sliding in contact with their arcs. The electric current from the battery, h, passes through the centers or pivots, A and B, and then into the arcs. From the right-hand arc it circulates in the wires, b and d, from the left-hand arc in the wires, a and c, and traverses the galvanometer.

When the two telescopes are parallel, the equilibrium of the Wheatstone bridge is complete and consequently the needle of the galvanometer shows no deflection. This equilibrium occurs, moreover, whatever be the position of the telescopes on the dial, provided that they are perfectly parallel. But if the telescope, C, for example, be turned until it is in the position, C', the parallelism being destroyed, and, along with it, the equilibrium of the two parts of the bridge, the needle of the galvanometer will be deflected. This deflection will increase in proportion to the length of the arc traversed by the telescope.

But since the arc, C C', is proportional to the angle at A, which is equal to the angle at T, it follows that the deflection of the galvanometer will be proportional to the angle at T, or to the distance, A T. Hence by graduating it in hundreds and thousands of yards, the distance of the ship or fort, T, may be read directly from the galvanometer. One of these galvanometers is placed in the conning tower and one at each of the principal gun stations.

It will be seen from the illustration that the operator, on applying his eye to the telescope, has opposite to his mouth a telephone transmitter, a receiver being clamped to his ear. By this means the two operators are kept in constant communication and the errors are avoided that would be caused by the reading of a deflection produced before one or other of the telescopes is well directed toward the point to be observed.

New York Academy of Sciences.

The fifth annual reception and exhibition of the recent progress of science of this society occurred on Wednesday and Thursday, April 13 and 14, at the American Museum of Natural History in this city, and attracted many visitors and members. Fifteen different departments of science were represented, each having something novel and interesting to exhibit. On the night of the 13th Mr. Charles E. Tripler lectured on Liquid Air and gave a demonstration of its qualities. He had on the platform a good sized vat of liquid air, and made numerous and amusing experiments.

His experiments were many and amusing. An egg dipped into the vat became as hard as a rock, and when struck with a hammer broke into bits as though made of stone. A piece of rubber pipe became so hard that it could be snapped like a stick, while the effect of the air on a piece of metal tubing was to corrode it so that it could easily be broken in the hands.

At the conclusion of the lecture Mr. Tripler dumped his vat of liquid air out on the platform, to the consternation of the people sitting in the front rows, who imagined they were going to get wet. It all went up in smoke, however.

On the evening of the 14th Prof. George E. Hale, of the University of Chicago, lectured on the Progress of Astronomical Science and had on exhibition a number of photographs of the buildings and instruments of the Yerkes Observatory, of which he is the Director.

Among other exhibits were those of the Jesup North Pacific expedition, including a number of facial paintings of Indians of the North Pacific coast, in the department of ethnology and archæology.

Hiram Maxim's Opinion.

Cable dispatches from London, dated April 15, say that Hiram Maxim, the inventor of rapid-fire guns, thinks the expected war between the United States and Spain will be terribly one-sided, and that the result is a foregone conclusion. He says: "Any superiority which the Spaniards have in the number of ships is overwhelmingly counterbalanced by the greater strength, equipment and speed of the American warships. Spain has no resources in the way of production of steel or the building of ships, while America's resources are thoroughly adequate."

Another Trolley Decision.

In the suit brought by the Thomson-Houston Electric Company against the Walker Company, of Cleveland, for infringement of the second Van Depoele patent of April 11, 1893, on the under-running trolley, the United States Circuit Court of Appeals, on April 9, decided against the validity of the two important claims remaining after previous adverse decisions.

The two claims in controversy were:

"(1) The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm carried by the car and carrying the contact device and pivoted so as to swing freely around a vertical axis; and (2) the combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm on the car, movable on both a vertical and a transverse axis and carrying the contact device."

It was insisted for the appellants that the two claims in controversy were for the same combinations specified in some of the claims of the earlier patent of April 1, 1890. The appellee contended that they were not, because they omitted to specify any means for holding the contact device in underneath contact with a conductor, and consequently could be construed as covering a sub-combination in which such means were not employed, or if such means must be read into the claims by implication, the claims were not limited to the means described in the specification, and that upon either construction they were not the claims of the earlier patent. The court held with the appellants that the contact device in question was that specified in the first patent, and that the claims are invalid.

THE French school at Delphi has lately unearthed two slabs of limestone which bear an inscription which is of great interest, dating, as it does, from the fourth century before Christ. This inscription, which consists of about two hundred lines, gives the price of work for building operations in Greece at the period named, and from it we learn that an architect was paid less than $150 per annum.