AN INTERESTING POWERFUL STEAM DREDGER FOR HARBOR WORK.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The construction of the new docks at Liverpool for the accommodation of the transatlantic liners, combined with the deepening of the navigation channels and the existing basins to facilitate the passage of heavy-draft vessels, has been attended with several engineering difficulties. One of the most predominant problems is the vast amount of dredging that has to be carried out, a by no means easy task, in view of the fact that the bed of the river is composed of sandstone, rock, and clay. To enable this work to be carried out expeditiously and effectively, a more powerful type of dredger has become necessary, and this has recently been carried out in the construction of the vessel "Vulcan" by Messrs. Ferguson Brothers, of Glasgow, which is one of the most powerful of its type that has ever been built.

The "Vulcan," owing to the complex nature of the work that has been undertaken, possesses several interesting features. It is of the center-ladder barge-loading type. The boat measures 207 feet in length; beam, 42 feet; molded depth, 14 feet; and is fitted with triple-expansion engines developing 1,250 I. H. P. and propelled by twin screws.

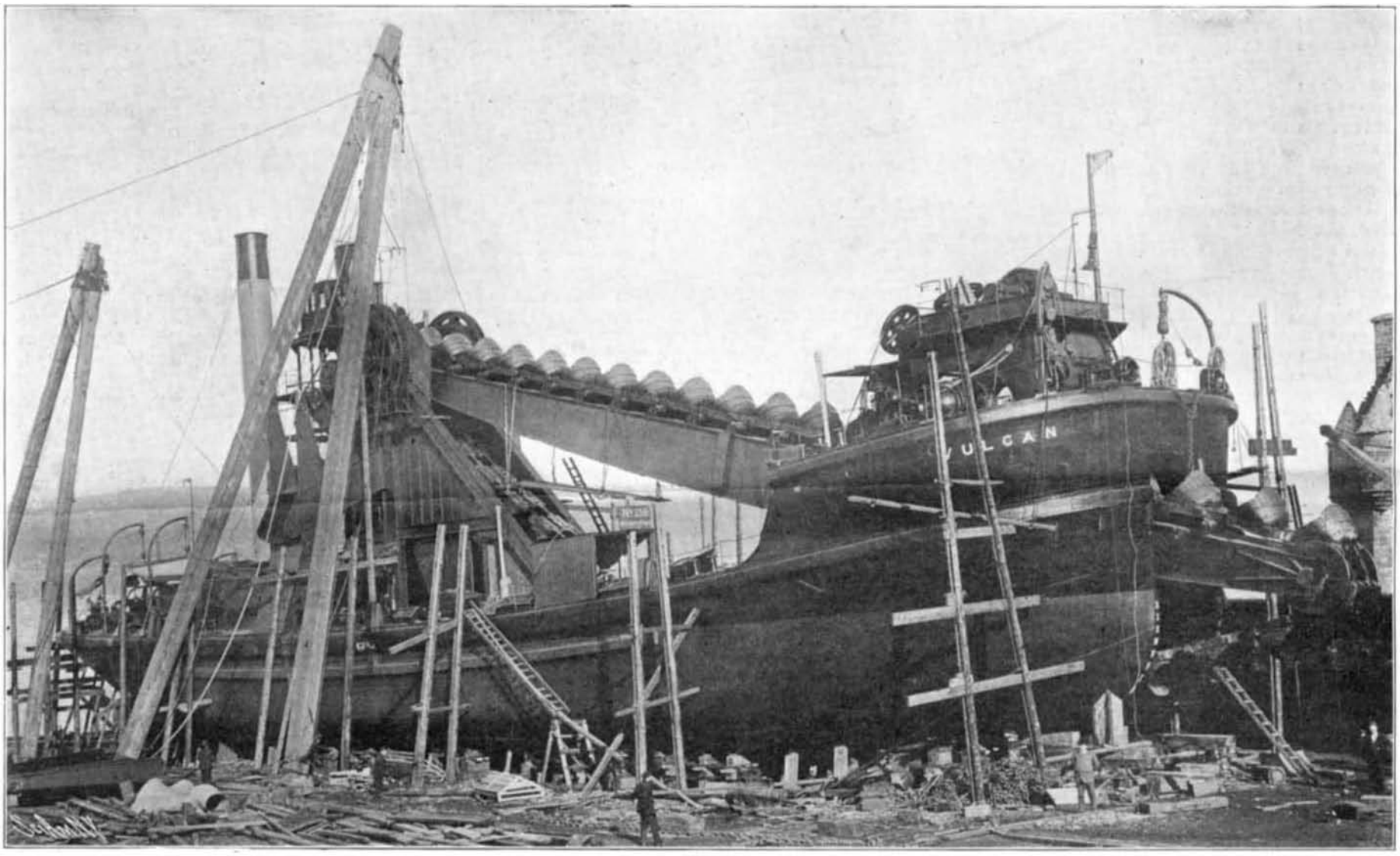
The vessel has been specially designed for carrying out dredging operations of hard material and working close up against the harbor walls. It is capable of cutting its own flotation and of dredging in any depth from its floating level down to 56 feet, the maximum depth, and at which level it has a dredging capacity of 1,000 tons per hour. The bucket ladder is carried out in advance of the hull a sufficient distance to render it possible to dredge close up against the sea walls and piers, when buckets are lowered to a depth of 48 feet.

The vessel is most strongly constructed, and has been built under Lloyd's special survey to class 100 A1. The hull is divided into fourteen watertight compartments. The two sides of the hull, which constitutes the bow well in the fore part of the vessel where the bucket ladder projects, are strongly connected by a raised forecastle, built of strong, heavy girder beams and bracing plates, carried across the vessel above the well. This forecastle is of sufficient height to allow of the bucket ladder being raised when desired for overhauling the lower tumbler, and to insure the sag of the chain of buckets being above the bottom of the vessel. The dredged material is discharged on either side through shoots, and the lifting and lowering operation of the shoots is accomplished by means of an independent engine.

The machinery for carrying out the actual dredging operation is of a particularly massive description, so that the hardest materials can be dealt with by the buckets. There is a two-speed gear provided, so that the dredging can be carried out at varying speeds according to the nature of the bed in which the apparatus is at work. The buckets each have a capacity for 21 cubic feet of material, and the connecting pins for the bucket chain are made of manganese steel.

The bucket ladder is suspended independently of the upper tumbler shaft, which is driven by large double friction spur wheels, and can be adjusted to convey the necessary power to the buckets according to the hardness of the soil in which the dredger is working. The bucket ladder is provided with a hoisting gear of heavy wire rope and tackle working in upper and lower sheave blocks, which are suspended from a crosshead fixed on a box framing structure built into the fore end of the craft. Strong forged side rods connect the lower sheave blocks to the bucket ladder. The wire cable is wound on a large grooved drum gear driven from a double-cylinder engine placed under deck. The gearing between engine and winding barrel is of the sun and planet motion type, controlled by double friction brakes actuated by a compound ladder lever for holding, heaving, or lowering the load as desired, the engine being free to run with or without the load. The deck is also provided with a large steam derrick, for overhauling the buckets and links and other general purposes.

The control of the vessel is maintained from a wheelhouse placed at the highest point of the dredger, which is at the top of the main gear framing. The propelling engines of 1,250 I. H. P. are fitted with steam reversing gear, and have auxiliaries of the latest design. Steam is generated in two cylindrical multitubular boilers. Aft of the bucket ladder are compartments for coal storage and feed tanks, for which there is a capacity of 100 tons and 50 tons respectively. The vessel has a speed of 8½ knots, which is half a knot above the contracted speed.



THE POWERFUL STEAM DREDGER "VULCAN" IN DRYDOCK.

The first unit of the central station of the Mond Gas Power and Heating Company, at Dudley Port in Staffordshire, from which producer gas at a nominal price is to be generated and supplied for manufacturing purposes over an area of 120 square miles, is completed. The whole installation comprises four units, each consisting of eight producers. Each producer is capable of gasifying one ton of fuel per hour throughout the day and night continuously. Steam is raised by vertical boilers arranged for burning small coal with forced draft, and also by gas. The pipes for supplying the gas from the generating station to the various industrial centers have been laid, and are mostly of the Mephan-Ferguson steel locking type. Operations will soon be commenced, and it is anticipated that the scheme will prove of vast utility to the manufactories, as the low price at which the gas will be supplied will render it cheaper than any other system of generating power.

THE INVESTMENT, SIEGE, AND CAPTURE OF PORT ARTHUR.

BY RICHARD BARRY, SPECIAL CORRESPONDENT AT PORT ARTHUR.

In all the long history of military exploits, there is not one that can compare, in point of difficulties surmounted, with the reduction of Port Arthur. That this fortress should have been taken by assault entitles the Japanese operations to rank with the finest work done by any army in any age; that it should have been taken in five months from the day on which the investment was completed (the day on which the Russians were driven into their permanent works) is an exploit which has never been approached. For, mark you, Port Arthur's defenses had been laid out on the most approved and up-to-date theories. Nature, moreover, has cast the topographical features of the place on lines that are admirably suited to defense. The harbor is surrounded by two approximately concentric ranges of hills, the crests of which are broken by a series of successive conical elevations. The engineers took the suggestion thus offered, and ran two concentric lines of fortifications around the city, building massive masonry forts on the highest summits, and connecting them by continuous defensive works. The inner line of the forts lay at an average distance of one mile from the city, and constituted the main line of permanent defense; the outer line, at an average distance of a mile and a half from Port Arthur. Beyond these again were the semi-permanent defenses. The positions of the various forts were chosen in such a relation to each other, that they were mutually supporting—that is to say, if any one were captured by the enemy, it could not be held because it was dominated by the fire from the neighboring forts; and, indeed, it often happened that the Japanese seized positions from which they were driven in this way.

In the majority of cases the slope of the hills was very steep, and what was even worse for the Japanese, smooth and free from cover; so that if an attempt were made to rush the works, a charge would have to be made over a broad, steep glacis, swept by the shrapnel, machine gun, and rifle fire of the defenders. Once across the danger zone, the attack was confronted by the massive masonry parapets of the fort, over which the survivors, cut down to a mere handful, would be powerless to force an entrance.

The defense of Port Arthur, however, did not stop at the outer line of fortifications, but extended no less than eighteen miles to the northward, to a point where the peninsula on which Port Arthur is situated narrows to a width of three miles. Here a range of conical hills, not unlike some of those at Port Arthur, reaches from sea to sea; and these had been ringed with intrenchments for troops and masked (or hidden) emplacements for artillery. Between Nanshan and Port Arthur the Russians had built four more

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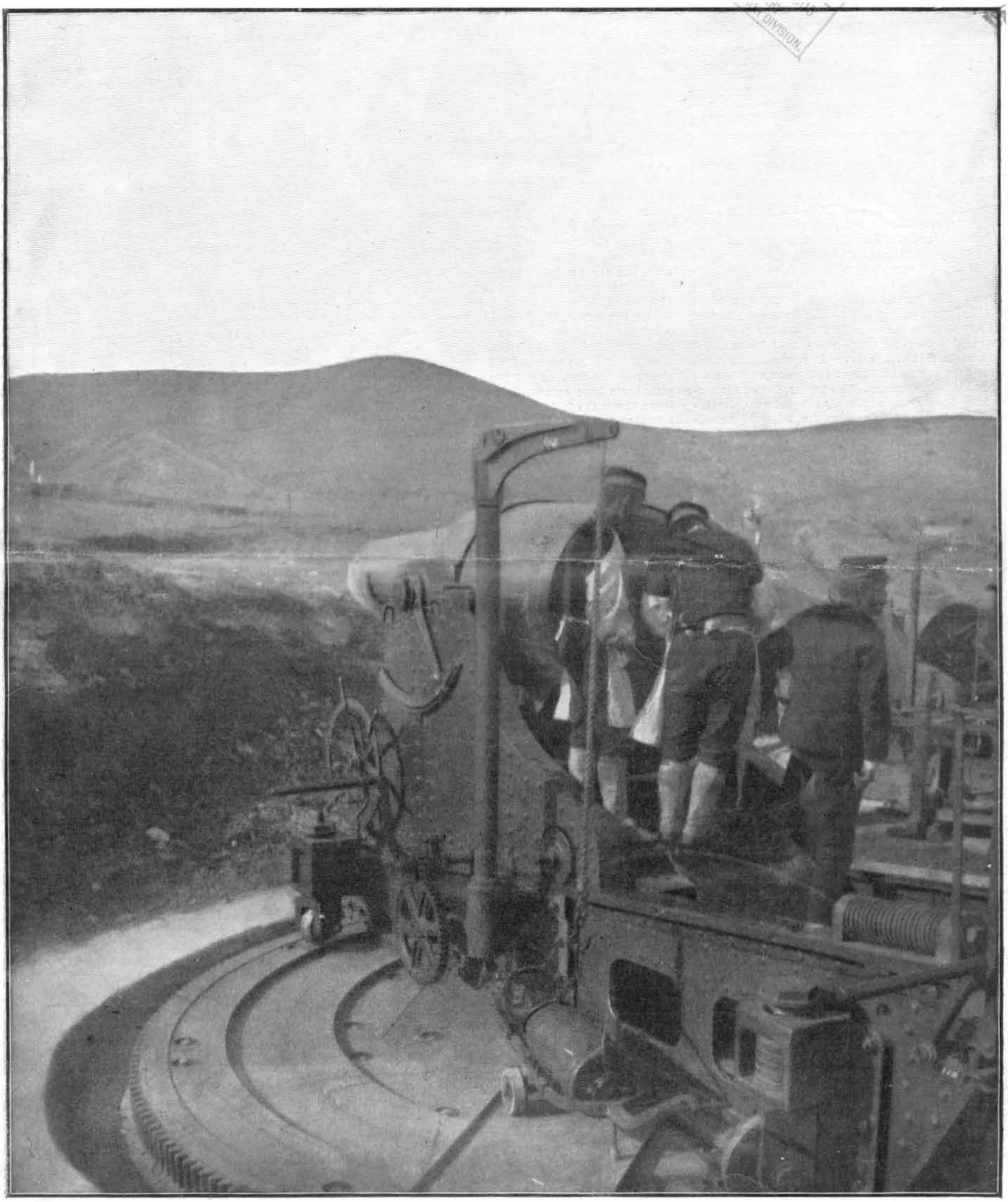


Eighteen of these mortars were emplaced in distant valleys, hidden from the view of the Russian Forts. Aiming was directed by observers stationed on 203-Meter Hill, who telephoned the effect of each shot. The shells passed high over the hills seen in the background, and fell, literally, like a thunderbolt out of the sky, upon the doomed fortress and fleet.

Photo. by Richard Barry, Special Correspondent at Port Arthur.

Loading One of the 11-Inch Mortars that Wrecked the Fortifications and Sank the Russian Fleet.

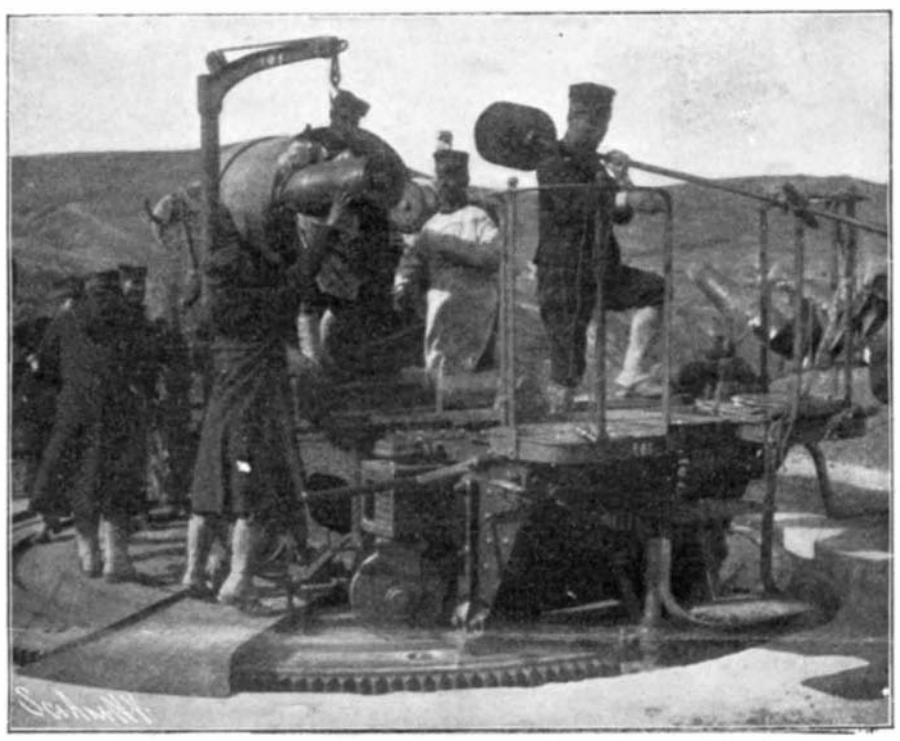
THE BOMBARDMENT OF PORT ARTHUR.—[See page 24.]

Four men were needed to lift the shell and carry it to the loading crane.

Carrying the 11-inch Shell to the Mortar.

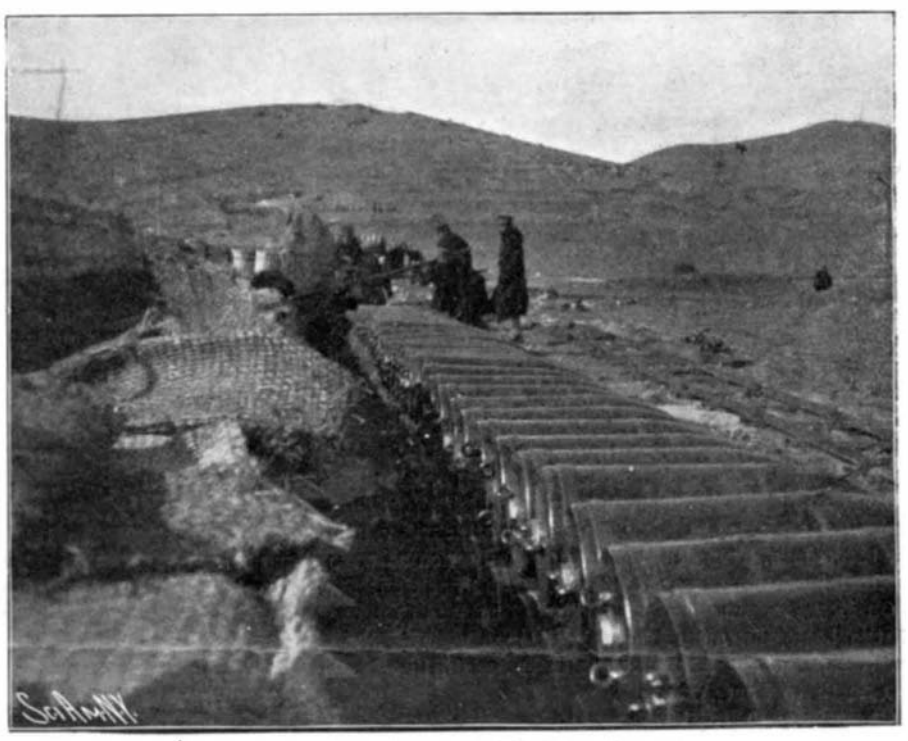
The powder was kept in a bomb-proof cellar and was carried to the gun in a huge case strapped to a man's back.

Up With the Powder.



The swabber departs with his swab, and the chief gunner assists the shell to the breech.

The Shell is Lifted to the Breech by a Crane.

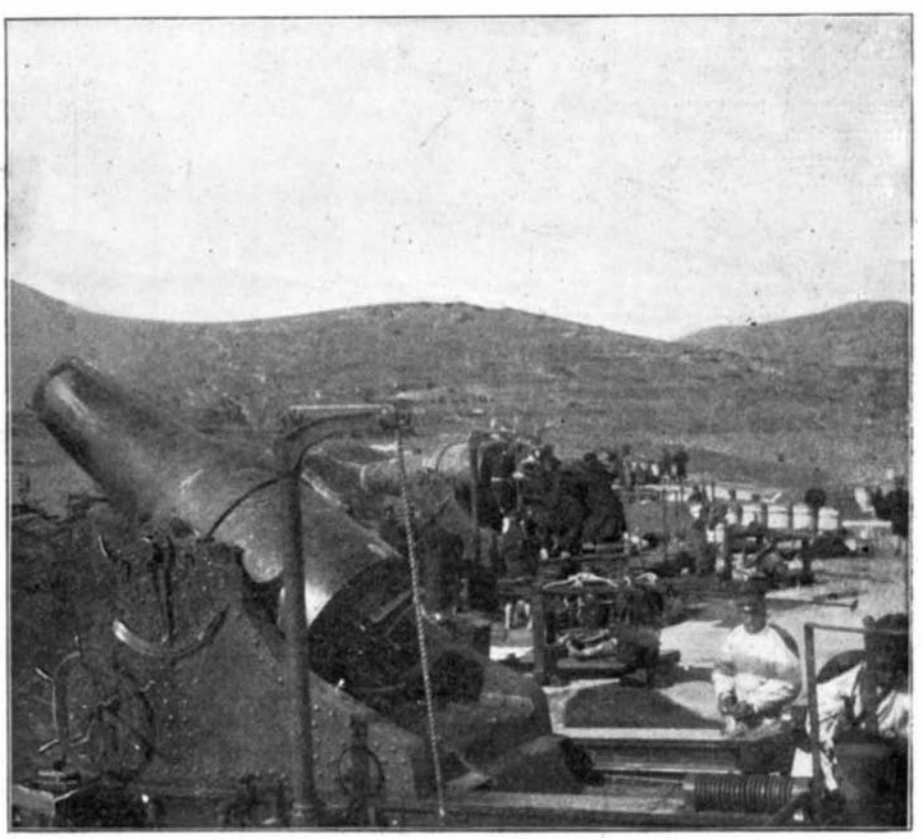


Protected by an embankment of cement-barrels filled with shale from all but a plunging fire, these 11-inch shells lay in the open in rows of one hundred. Each shell weighs 500 pounds.

An Open Caisson of Shells.

The mortars, their mounts, and the materials for the concrete emplacements, were all brought to the site of the batteries over a narrow-gage road, which was under fire for two months.

Bringing Up the Shell Over the Narrow-Gage Road by Hand.



This picture was taken under fire on October 28 at a distance of 2,000 meters from the Russian batteries and 4,000 meters from the citadel of Port Arthur. The nearest gun is loaded, trained and elevated, ready for firing.

A Battery of 11-Inch Mortars.

Photos. by Richard Barry, Special Correspondent at Port Arthur.

THE BOMBARDMENT OF PORT ARTHUR.

lines of intrenchments, reaching from sea to sea, all very strong and admirably suited for defense. Now it must be borne in mind that all this wonderful network of fortifications, strong by nature of the ground, strong by virtue of the great skill and care with which it had been built, was distinguished from all other previous defensive works by the fact that in this fortress, for the first time, were utilized all those terrible agencies of war, which the rapid advance of science in the past quarter of a century has rendered available. Among these we may mention rapid-fire guns, machine guns, smokeless powder, artillery of high velocity and great range, high explosive shells, the magazine rifle, the telescopic sight giving marvelous accuracy of fire, the range-finder giving instantaneously the exact distance of the enemy, the searchlight, the telegraph and the telephone, starlight bombs, barbed-wire entanglements, and a dozen other inventions, all of which were deemed sufficient, when applied to such stupendous fortifications as those of Port Arthur, to render them absolutely impregnable.

The Russians believed them to be so—certainly the indomitable Stoessel did. And well he might; for there was no record in history of any race of fighters, at least in modern times, that could face such death-dealing weapons, and not melt away so swiftly before their fury as to be swept away in defeat.

But a new type of fighter has arisen, as the sequel was to tell.

On February 8 the first blow fell upon Port Arthur in that famous night attack by the torpedo boats. On February 9 occurred the engagement between the remnant of the Russian fleet and the Japanese fleet under Admiral Togo, which ended in the Russian retreat into the harbor and the closing of Port Arthur by sea.

On May 26 the Japanese Second Army, which had been landed at Petsewo Bay, attacked the first line of defense at Nanshan, eighteen miles north of Port Arthur, and gave an inkling of the mettle of the Japanese troops by capturing the position in a frontal attack. The Japanese pushed on to Port Arthur and there followed, in quick succession, a series of bloody struggles at the successive lines of defense in which the Japanese would not be denied. The fiercest fight took place at the capture of a double height, Kenshan and Weuteughshan, which Stoessel re-attacked vainly for three days, losing three times as many men as were lost originally in the attempt to hold the position.

On May 29 Dalny was occupied, and became the base of the besieging army. A railway runs from Dalny for three miles to a junction with the main line from the north to Port Arthur.

On August 9 to 11 the outlying semi-permanent works Taikushan and Shokushan, lying about three and one-half miles from Port Arthur, were taken, and the Russians driven in to their permanent positions.

The army detailed for the capture of Port Arthur was 60,000 strong; Stoessel at the date of the battle of Nanshan probably had 35,000 men.

Encouraged by their uninterrupted success in capturing Russian intrenchments by dashing frontal attack, the Japanese, particularly after their brilliant success of August 9 to 11, believed that they could storm the main defenses in like manner. They hurled themselves against the Russian right center in a furious attack upon the line of forts stretching from the railway around the easterly side of the town to the sea. For seven days they battled furiously. But the wave of conquest that had flowed over four lines of defense, broke utterly against the fifth; and after a continuous struggle, carried on day and night, beneath sunlight, moon, and searchlight, they retired completely baffled, with an awful casualty list of 25,000 men.

On September 1 the Japanese, finding that they could not take Port Arthur by assault, settled down to reduce it by an engineering siege. This latter was carried on by means of "sapping and mining," supported by heavy bombardment, its object being to shake the defense by terrific artillery fire, blow up the parapets and other defenses by subterranean mines, and capture the fortress by fierce assaults delivered from concealed trenches close to the fortifications. Sapping and mining may be described as a method of attack by tunneling. The Japanese found that they could not get into the forts by a rush above ground, so they determined to burrow in below ground. The main attack was directed against the line of forts to the east of the city, or the Russian right center. The first operation was to cut a deep trench, not less than six feet in depth and a dozen or more feet in width, roughly parallel with the line of forts, and at a distance of about 1,000 yards therefrom. From this trench three lines of zigzag trenches were dug in the direction of the principal forts of Erlung, Keekwan, and Panlung. These trenches were about six feet deep (deep enough to hide the sappers from view) and eight feet wide (wide enough to allow the troops to march to the assault four abreast). The zigzag consisted of an alternate approach and parallel, the former extending diagonally toward the fortification, the latter parallel with it. The angle of the diagonal approaches was always carefully mapped out by the engineers, and was so laid with reference to the enemy's forts, that it could neither be seen nor reached by shell fire. The digging was done chiefly at night, and the soil was carried back through the excavated trenches in gabions and on stretchers, and dumped out of sight of the enemy. As the parallels were advanced across the valley or level spaces, they were roofed at intervals, with planks covered with soil and grass, so that as the Russians looked out toward the ravine in which the army was supposed to be encamped, there was nothing to indicate that the enemy was cutting a series of covered roadways, right up to the base of the forts themselves. Of course in many cases the trenches were located, and desperate night sorties were made in the endeavor to break up the work. But it went remorselessly forward. When the foot of the fortified slopes was reached, a second great parallel, extending around the whole face of the fortified eastern front, was cut—this latter for the purpose of assembling the troops for the final dash upon the forts. From this parallel the Japanese cut tunnels straight through the hills until they found themselves immediately below the massive parapets of such forts as they wished to reach. Here cross tunnels were cut, parallel with the walls and immediately below them, in which tons of dynamite were placed and the wires laid ready for the great explosion—much of this being done, it must be remembered, entirely unknown to the Russians, secure in their great fortifications overhead. The work of the sappers and miners was now complete.

In the rear a battery of mortars may be seen; Russian shells are falling not two hundred yards away.

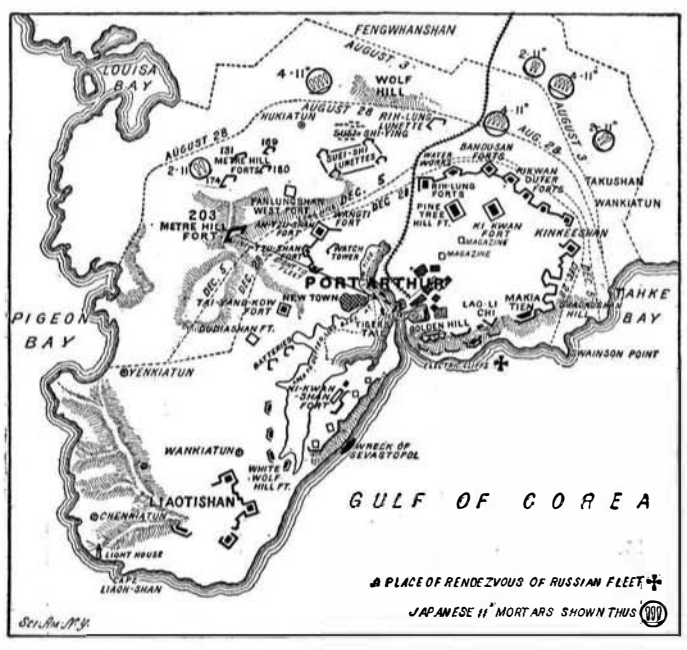
Back for More Powder.

It must not be supposed that while this slow work was being carried on, the garrison at Port Arthur, or the city itself, or even the fleet in the harbor, was being left in peace, or had any respite from the harassments of the siege. For as soon as the investment was complete, the Japanese erected hidden batteries in various carefully-selected positions, until they had no less than 300 guns trained against the city. All the furious assaults that failed so disastrously were preceded by bombardments, the like of which had never been witnessed in the history of the world. These batteries consisted of regular siege guns of from 5 inches to 6 inches caliber, a large number of naval guns of 4.7-inch and 6-inch caliber, and the regular field ordnance of the three divisions and two independent brigades composing the Third Imperial Army.

By far the most formidable pieces used in the bombardment, however, were the powerful 11-inch mortars, which were mounted in batteries of from two to four in various positions behind the ranges of hills which effectually screened the Japanese from Russian observation. The pieces are the Japanese latest type of coast-defense mortars, such as are used along the Straits of Shimoneseki and about the Bay of Yezo. They were brought by sea to Dalny, carried by railroad for a distance of fifteen miles to the end of the track, and from thence were hauled by hand over special tracks laid direct to the emplacements. In some cases, indeed, the guns were dragged on rollers through the sand, as many as 800 men being required to haul a single mortar; for the mortar barrels, without the carriage, weigh eight tons apiece. This task was accomplished under fire, in rainy weather, and in the night, to the accompaniment of bursting shrapnel and other discouragements which would have daunted a less dauntless race. Even when the selected site of the batteries was reached, every one of the eighteen mortars had to be placed upon a concrete foundation eight feet in depth and eighteen feet in diameter. In each case an excavation had to be dug, the concrete prepared and rammed into place, the heavy foundation plates, traversing racks, and the massive gun carriage, weighing much more than the gun itself, erected and adjusted, and the whole of the heavy and costly piece put together with the greatest nicety. All through the long months in which the sappers and miners were cutting their trenches, the engineers were putting in place these huge mortars, which were not originally intended, be it remembered, for such field operations as these; but were designed for permanent sea-coast fortifications around the harbors of Japan.

The mortar itself has a bore of 28 centimeters, or 11 inches. The shells are designed to burst on contact. They are loaded with high explosive designed by the Japanese Dr. Shimose, and corresponding in its terrific bursting effects to the English lyddite, the French melinite, and our own maximite. Each shell weighs 500 pounds. Its cost is $175, and the cost of each discharge, including that of the impelling power, is about $400. During the heavy bombardments, each gun was fired once every eight minutes, and as the grand bombardments lasted in every case about four hours, the cost for these mortar batteries alone must have been over $200,000, and for the whole of the batteries, including naval guns, machine guns, etc., the cost of each bombardment was approximately half a million dollars. The 11-inch mortar has a maximum range, with a moderate degree of elevation, of seven or eight miles; but as none of these batteries were more than three miles distant from the point of attack, they were fired at angles of as great as sixty degrees, the huge shells hurtling high into the heavens, passing over two ranges of hills, and falling like thunderbolts out of the blue sky, vertically upon the devoted city.

But if the batteries were located behind hills that entirely shut out the object of attack from view, how, it will be asked, could the guns be aimed with such accuracy, to sink, as they did, a whole fleet of warships, one by one? It was in this way: For the attack of



Map of Port Arthur, Showing Position of Forts and Location of the 11-inch Mortar Batteries that Sank the Fleet and Brought About Capitulation of the City.

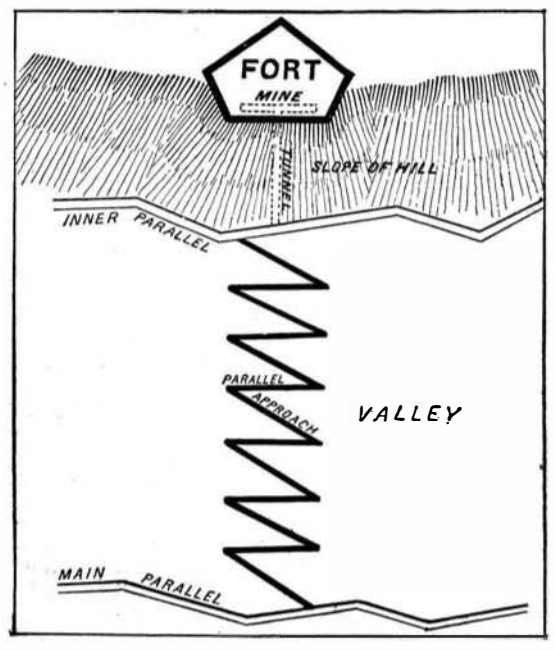


Diagram Showing Method of Attacking Fort by Sapping and Mining. Advance is Made by Open Trenches to Foot of Slope and then by Tunneling.

stationary objects such as forts, docks, buildings, ships at anchor, etc., the artillery officers were provided with a map of the whole area of bombardment, which was laid out in squares, each square having its own number. The Japanese having, at the close of the Chinese war, been in possession of Port Arthur themselves, and having possessed during the past few years an excellent bureau of intelligence, knew the exact location of every building or object of importance in and around the city. Consequently, when the artillery officers were directed to attack a building in a certain square, or a particular fort, they knew exactly what angle of elevation to give their gun, and how far to traverse it, so as to cause the shell to fall with mathematical accuracy upon the particular object to be hit.

The attack upon the warships, however, was another proposition, for they could be, and were, shifted, from time to time. To make sure of hitting them, it was necessary to have some direct line of vision. The Japanese knew that such a line of vision could be obtained from the top of a hill to the west of the city known as 203-Meter Hill—the Russians knew it, too. Hence that awful struggle for possession of this hill, which cost so many thousands of lives. The Japanese won the position. When they had taken it, they placed observers provided with the hyposcope—a telescope that enables the observer to observe the surrounding country without exposing himself above the surrounding parapet—upon the summit, in suitable positions, and held the hill with sufficient force to prevent its being retaken. The batteries were then trained at the individual warships, and the effect of the shells was telephoned from 203-Meter Hill to the various batteries, and the errors corrected, according as they were long, short, or wide, until the huge shells commenced to drop with unerring accuracy down through the decks and out through the bottom of the doomed warships. The ships tried to escape observation by hiding on the outside of the harbor behind the Tiger's Tail hills, and in a cove behind Golden Hill; but there was no escape, and ultimately every ship of the squadron was sunk.

That was the beginning of the end. The 11-inch batteries when directed at the forts tore gaping holes in the parapets, and according to the testimony of Gen. Stoessel, they were simply irresistible. One by one, after furious bombardments, the walls of the great forts were blown up by the explosion of the subterranean mines that had been laid by the sappers and miners, and the Japanese massed in readiness for the attack in the inner parallels, swept in through the wide gaps thus formed, and seized the fortifications, from which, a few months before, they had been swept back in terrible and crushing defeat.

Geology and Geography at the American Association for the Advancement of Science.

BY EDMUND OTIS HOVEY.

Geology and geography together occupied a large share of the attention of the members of the American Association for the Advancement of Science at the third Philadelphia meeting of the Association, which was held at the University of Pennsylvania, December 28 to 31, 1904. Section E, Geology and Geography, of the Association held its regular meeting on December 28, the principal feature of which was the address of the retiring vice-president, Prof. Israel C. Russell, of Michigan University, on "Co-operation Among the Geographic Societies of America." An abstract of this important paper appears in the current SUPPLEMENT. The officers of the section are, vice-president and chairman, Prof. E. A. Smith, of University, Ala.; secretary, E. O. Hovey, of New York city.

The general programme was introduced by Prof. A. P. Brigham, of Colgate University, with a paper on "Early Interpretation of the Physiography of New York State," in which was outlined in an interesting manner the observations made by the early white travelers through the Mohawk Valley and westward, and the descriptions published by President Timothy Dwight, Governor De Witt Clinton, and others. Some of these observations were very keen, especially when we consider that the whole region was heavily forested at that time, and indicate that the idea of the existence of an ancient lake (the "Iroquois Water" of recent writers on the Glacial Geology of New York) is not so new as some have supposed.

In a paper on "The Menace to the Entrance of New York Harbor," Prof. Lewis M. Haupt discussed the projects which have been and are now being carried on by the general government for improving the channels of the Lower Bay. The details of this paper will be found in the SCIENTIFIC AMERICAN of January 7.

Dr. J. W. Spencer, of Washington, D. C., submitted a communication on "The Submarine Great Cañon of the Hudson River," in which he collated the results of soundings which have been made during a period of more than a century, but especially those of the last forty years. Prof. J. D. Dana first recognized the submarine channel of the Hudson as evidence of late continental elevation. Lindenkohl first perceived the cañon-like character of the outer portion of the channel near the border of the continental shelf, the channel suddenly becoming a gorge 2,400 feet deep in the submerged plain. Lindenkohl thought that the cañon was terminated by a bar, but Dr. Spencer has determined that no bar exists, and that the cañon cuts through the edge of the continental bench for about eight miles farther. It then widens to a valley, which can be readily recognized for an additional 12 miles and to a depth of 9,000 feet at a distance of 71 miles from the head of the submarine channel, near Sandy Hook. The cañon is double, the upper part being four miles wide, while the inner, lower, more sinuous portion is less than two miles across. The period of great elevation, amounting to about 9,000 feet, coincides with that of the early Pleistocene. Since that time there has been a subsidence to somewhat below the present level, followed by a re-elevation of 250 feet, as seen by the shallow channels of the continental shelf. The region is now sinking at the rate of two feet a century, and is undergoing other and less important changes.

In a second paper on "The Improbability of Land in the Vicinity of the North Pole," Dr. Spencer said in part:

"When Dr. Nansen discovered the deep Polar Basin, sharply defined by a continental shelf, 300 to 350 miles wide, north of Siberia, with this continuing to Spitzbergen, situated in its very edge, it was proof that no land was to be expected rising out of the basin until the continental shelf on the American side should be reached. The broad Siberian shelf continues even north of Bering Straits, and there are soundings which suggest the location of its approximate border. Alaska encroaches upon this shelf apparently to near its border, thus reducing its breadth to probably 50 miles. Beyond into Beaufort Sea, the Mackenzie River empties by a fjord known to a depth of more than 1,140 feet, and another from behind Bank's Land of 1,836 feet, not far from its own head far within the line of the islands. Among the islands, another of the discovered fjords reaches to more than 2,400 feet.

All of these features prove that the archipelago of high mountains is only a dissected plateau, now sunken and with drowned valleys between the island, which valleys incise the continental shelf in such manner as to indicate that the shelf itself cannot extend far beyond the outer line of the known islands. A sounding about 30 miles north of Grinnell Land, with a depth of 432 feet, further suggests that the edge of the shelf is being approached, for the outer margin of this seems to be limited by a depth of about 300 feet beneath sea level." From these submarine topographic features, which are the very best guide, the author supposes that no important islands exist beyond the line of the known archipelago, and that the deep Polar Basin reaches for 300 to 350 miles from the Pole, approaching the American continental shelf north of Grinnell Land.

The formal session of Section E closed with the reading of eight papers by title in the absence of their authors, and the sessions of the succeeding days of the general convention were given over to the Geological Society of America. The vice-president and chairman for Section E for the next annual meeting of the Association is Prof. William North Rice, of Wesleyan University, Middletown, Conn., and the secretary is Edmund Otis Hovey, of New York city.

Prize for Electrical Inventors.

American inventors have an equal chance with citizens of other countries at a prize of 6,000 francs, offered by the "Association des Industriels de France contre les Accidents du Travail," now organizing to hold a congress in June, 1905, with the object of investigating apparatus which will insure the greater safety of workmen employed on high tension electric conductors. The prize will go to the inventor for the apparatus that will best indicate safely and clearly whether an electric conductor is alive or not. It must be equally applicable to direct and alternating currents of all voltages and must be reliable and incapable of doing damage to itself, the operator, or the distribution system under any circumstances. But his success will mean a very great boon to those men whose work brings them into close proximity to high potential electric wires and machinery. Now that a current of 60,000 volts has become practicable and is much employed for long-distance transmission, this enormous potential being coupled with large quantities of the electric fluid, the danger to the electrician and to workmen who must be employed in caring for such a line and for the apparatus at its ends has become a very serious matter. Danger through carelessness cannot be remedied by any apparatus, perhaps, but such a device as that proposed by the French congress would give timely warning which would save many lives.—Iron Age.

Correspondence.

A Planchette Inquiry.

To the Editor of the SCIENTIFIC AMERICAN:

If you have readers who are interested in experimenting with planchette, I wish they would tell me what means they have found best to make it impossible that the board shall be moved by the fingers of the operator, consciously or otherwise. I can accomplish the purpose by placing upon it two sheets of paper, one of them the transparent sort that is used to protect photographs, and the other a paraffined sheet such as candy is sometimes done up in. By careful selection of the right kinds of paper, I succeed in getting a combination which renders it impossible for the operator to move the planchette; the upper sheet slips on the lower. But it is a troublesome and awkward business, and I hope readers can tell me of something better, or that possibly you can suggest something. I have thought of a ball-bearing device, placing an edge round the board, which shall inclose a number of bullets a trifle larger in diameter than the edge is thick, and laying a smooth board on them. Do you think of anything better? I suppose the subject must have been studied by many people, as nobody can fail to perceive the absolute necessity of cutting out the possibility of any motion coming from the operator's fingers. The amazing results that planchette yields with certain people, the above precaution being taken, assuredly justify taking the necessary pains to cut off all possibility of movement by the operator. G. M. T.

Albany, N. Y., January 2, 1905.

Tuberculosis from Milk.

To the Editor of the SCIENTIFIC AMERICAN:

In the December 24 issue of your valued paper, I notice an article, "Bovine and Human Bacilli Found to be Distinct," which is certainly interesting, as the finding of this German imperial commission, in a way, sustains the stand taken by many scientists of Europe; but at the same time, we ought not overlook that Koch, in his London address, did not maintain that there is a difference in species, but merely that the virus of human consumption is not identical with the virus of bovine perlsucht, and his assertion that these differences between human and bovine tubercle bacilli are not bridged by any connecting links, provoked the strongest opposition; and observations called forth by Koch's assertions have positively demonstrated the existence of intermediary stages; and the opinion is constantly gaining ground, that bovine tubercle bacilli is especially virulent for man, and such an authority as Prof. von Behring, in his Cassel lecture, said: "We shall surely not go wrong when we assume that with a little patience and expert knowledge, we shall be able to make these two varieties absolutely similar again, even in respect to their virulence." Therefore, if we keep in mind the above, the fact that the German imperial commission found in some corpses bovine bacilli in the glands and human bacilli in all other portions of the body—this fact, I say, is significant, and still more significant and important is the fact that three of the cases were young children; and not only is the surmise permissible, but it is pretty sure that they received the bacillus from a diseased cow. This cannot be passed off with a casual advice of carefulness as to using prescribed measures against infection for bovine bacillus. Measures have been tried, measures have been made, and no amount of measures will ever succeed, and especially in America, where about seventy to eighty per cent of our cattle are tuberculous or tubercularly affected. Take the large herds and perform the usual test, and you will be surprised at the number of animals that will react! It is simply frightful—if you stop for a minute to consider this grave danger, this scourge of humanity! Just to think we have tubercular calves, then tubercular cows, tubercular milk, and then tubercular children! What are we doing in this blessed country of ours to offset this great danger? Nothing whatever! The mere killing of an animal here and there has no effect whatever; and in this respect Germany is certainly far ahead of us, as the government in a few parts of the empire has taken up Prof. von Behring's method of immunizing against tuberculosis, and the same has since (1901) proven a great success. Immunize the cattle here, prevent bovine tuberculosis, and you will in time exterminate human tuberculosis.

I hope you will give these few remarks space in your valued paper, as it is a subject worthy of discussion in every way, a subject in which we New Yorkers are especially interested, as here in the city we come daily in contact with this terrible disease, and Prof. von Behring's method ought to be certainly taken up here and tried; and to judge by experiences in Germany, success is assured.

THEODORE D. ADLERMAN, M.D.

New York, December 29, 1904.