TEST OF THE NEW 16-INCH GUN

Not since the Armstrongs made their memorable test with the 16.25-inch gun, built by them for the British navy, has there been a trial of heavy ordnance to compare in spectacular interest with the test of the new United States army 16-inch gun, which was successfully carried out on Saturday, the 17th inst., at the Sandy Hook proving ground. We use the word spectacular advisedly; for, although the construction of modern ordnance is a matter of the coldest kind of calculation, and the gentlemen who design the guns have a wholesome horror of sensationalism, the achievements of these, the most potent engines of destruction known in modern life, will always in the public mind be estimated from the sensational standpoint.

From the accompanying table it will be seen that the great Armstrong gun is of slightly greater caliber; yet the reader must beware of making hasty deductions from this fact, and supposing that it is, therefore, a more powerful piece. Diameter of bore is but one of many elements that go to determine the energy of a gun. The strength of the gun steel, quality of powder, weight of projectile, muzzle velocity, each of them has its say in the matter of the ultimate power of the gun; and for these reasons the new army gun is a vastly more powerful weapon than its Armstrong prototype.

Comparing the two guns, then, we find that the new weapon is 6 feet longer over all, 19½ tons heavier; that its projectile is 600 pounds heavier; that because of the better quality of powder that has been developed during the intervening fifteen years since the Armstrong gun was built, the 16-inch gun requires only 640 as against 960 pounds of powder for a full charge, but that with this smaller charge the heavier projectile is propelled with a velocity greater by 219 feet per second, giving a muzzle energy greater by 33,610 foot tons. The direct test, however, of the relative efficiency of the two guns is the amount of energy developed per ton-weight of the gun itself, and this for the Armstrong gun of 1887 is 492 foot-tons, and for the United States 16-inch gun 677 foot-tons. As the 16-inch gun was designed several years ago, we give for purposes of comparison the data of a 12-inch modern high-velocity gun built by Krupp, with a velocity that brings the energy above that of the Armstrong gun of double the weight.

Type of gun.	Bore in inches	Total length in feet.	Weight in tons	Weight of projectile in pounds.	Weight of powder in pounds	Kind of powder.	Muzzle velocity in feet per second.	Muzzle energy in foot-tons.	Muzzle energy in foot-tons per ton weight of gun.
Armstrong..	16.25	43 5	110.5	1800	960	Slow burning cocoa.	2087	54,390	492
U. S Army.	16	49.7	130	2400	640	Nitro-Cellulose Smokel'ss	2306	88,000	677
Krupp	12	50	57.6	*771 6	334	Nitro-Cellulose Smokel'ss	*3330	59,280	1029

* In this comparison it must be remembered that the velocity falls off much more rapidly in the lighter shell; so that the "remaining velocities" will be proportionately greater in the 2400-pound projectile than in the case of the other two.

The test of Saturday served in every particular to establish the accuracy of the calculations on which the construction of the gun was based. Army gun construction has been eminently successful from the very first; and while the ordnance experts had no doubt as to the behavior of the gun under trial, there was, as Gen. Crozier, Chief of the Ordnance Bureau, stated before the gun was fired, a certain measure of uncertainty introduced, because of the very size of the gun and the unprecedentedly large charge of powder that was to be fired. Smokeless powder has shown at times in all countries a somewhat erratic action, and the General, with a characteristic candor, did not hesitate to state that chamber pressures might arise, when the gun was fired, greater than the piece could stand. Hence, at his suggestion, the guests retired to a distance commensurate with their sense of disastrous possibilities, even that war-worn veteran, Gen. Chaffee, not disdaining to take cover behind a neighboring heavy gun. In the process of loading, a 2,400-pound shell was brought up to the breech on a truck and rammed home by the united efforts of some twenty men on the rammer, fetching up in the lands with a "chug" that made even the 130-ton mass tremble. The powder was then loaded into the breech in six canvas bags, each carrying about 107 pounds, the last bag having in its center several pounds of fine-grained, quick-igniting powder, to make sure of the ignition of the charge. It should be mentioned here that a special bed of concrete 10 feet deep, 12 feet wide and 30 feet in length had been prepared for the reception of the gun, and the mount used in testing the 18-inch Gathmann gun, which lay alongside, was bolted to this platform, and proved equal to its heavy duty. Although calculation has been made as a mere matter of interest of the maximum range of the gun at an elevation of over 40 degrees, no attempt was made to throw a shell to the estimated distance of 21 miles. As a matter of fact, the elevation was only about 1½ degrees for the first two, and 4 or 5 degrees for the third round. From the spectacular point of view, the discharge must have been disappointing to those who were looking for sensations. The report lacked the sharpness and angry snap of an 8-inch or 10-inch piece, and the concussion was of the mildest. The rush of flame extended perhaps for 100 feet in front of the gun, and the smoke of the ignition charge of black powder mushroomed out and drifted lazily away to the westward. The shell struck a few thousand yards out to sea, throwing a vast column of spray heavenward and ricocheted, twice, sharply to the right before sinking below the waves. The first charge consisted of 550 pounds of powder, which gave a powder chamber pressure of 25,000 pounds to the square inch, and a muzzle velocity of 2,003 feet per second. The second charge of 640 pounds raised the chamber pressure to 38,000 pounds and the muzzle velocity to 2,306 feet per second. The third shot, because of the elevation of the gun, passed clear of the velocity screens and no velocity was taken. In his address before the firing of the gun, Gen. Crozier stated that the calculated pressure of the maximum charge was 38,000 pounds, and the maximum velocity 2,300 feet per second; so that, considering the unprecedentedly large charge of powder employed, the results were remarkably close to the estimate.

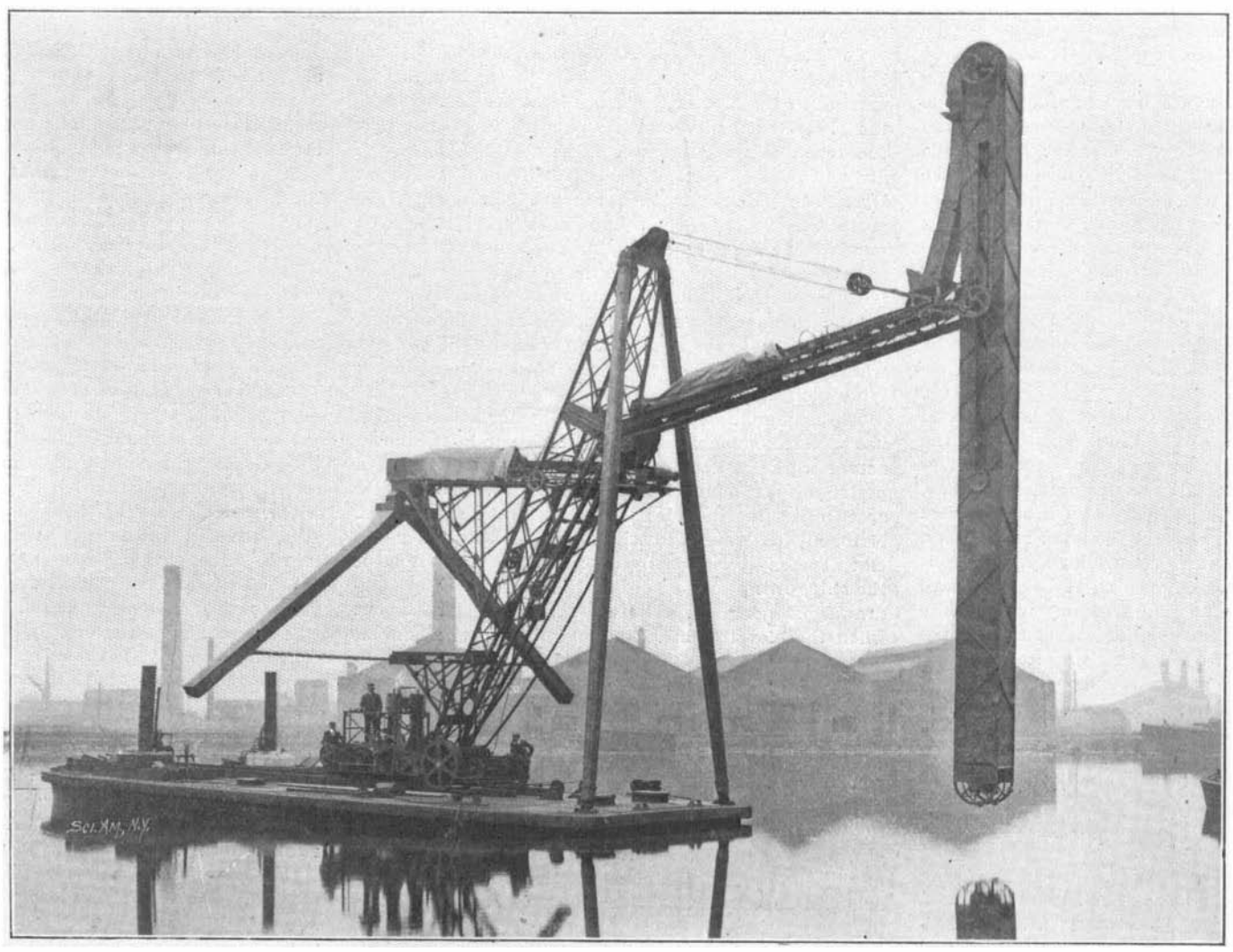
In connection with the firing of the 16-inch gun the party of visitors was treated to a display of high-angle firing from a 7-inch mortar. On account of the low muzzle velocity, it was possible for the eye to follow the mortar shell in its skyward flight, and it could be heard singing its weird note long after it become invisible. The shots fired from this gun rose to a height of two miles before dropping into the sea. Owing to the low temperature of the atmosphere, the course of the shell was marked by a fine streak of what looked like mist, caused by the condensation of the moisture in the air by the rapid passage of the shell. The second shot fired from the mortar was one of the new torpedo shells containing 120 pounds of the deadly high explosive maximite. Although on test this explosive has proved to be insensitive to shock, the guests were recommended to drop behind the bomb-proofs, since accidental detonation within the gun would have thrown the scattered fragments with high velocity in every direction. As it was, the shell dropped about two miles away, but owing to the failure of the delayed-action fuse, it did not detonate. We take this opportunity of acknowledging the courtesy of Maj. Rogers Birnie, Maj. Charles S. Smith, and Col. J. P. Farley, extended on many occasions during the construction of the gun and in the recent Sandy Hook tests.

A NEW DERRICK OR "GRASSHOPPER" ELEVATOR FOR UNLOADING GRAIN FROM VESSELS.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The question of facilitating the transshipment of grain from the hold of a transatlantic freighter into lighters in the docks has resolved itself into one of the most important engineering problems of to-day, especially when the immensity of the traffic is recollected. There are several methods for the accomplishment of this work in existence, but in nearly every instance the initial cost of the plant, together with the heavy expense involved in its maintenance, militates against its widespread use.

An important development has been made by the introduction of the "grasshopper," or, as it is technically called, the derrick elevator now in use by the London Grain Elevator Company at the London docks. This machine, although it possesses a somewhat complex appearance, as may be gathered by reference to our illustrations, is in reality in its working arrangements simplicity itself. It has been specially designed for transshipping the corn from the holds of the largest types of American liners engaged in the grain trade, such as the "Minnehaha" and her sister ships of the Atlantic Transport Line, into lighters, for conveyance to other coasting vessels or warehouses. It is the joint invention of Mr. A. S. Williams, of the Atlantic Transport Steamship Company, Capt. W. K. Browne (manager) and Mr. A. H. Mitchell (engineer) of the latter company, and the experimental elevator of this type, which has been submitted to prolonged and exacting tests, was specially built by Messrs. Spencer & Co., Ltd., the well-known English granary engineers of Melksham (Wilts), to whose courtesy we are indebted for permission to reproduce the illustrations to this article.



THE "GRASSHOPPER" ELEVATOR READY FOR USE.

This derrick elevator consists essentially of four parts, viz.: (1) the pontoon; (2) the traveling car, containing the engines of the various driving motions; (3) the structure supports, shear legs, lattice girders; and (4) the trunk which is lowered into the grain in the vessel's hold.

The pontoon is built of steel, and measures 75 feet in length by 24 feet beam and 8 feet draft. It is perfectly square at the bow, to enable it to be brought close up to a vessel's side and to remain there. The steel deck is specially constructed of braced steel girders, to afford a secure and rigid bed to the rails which

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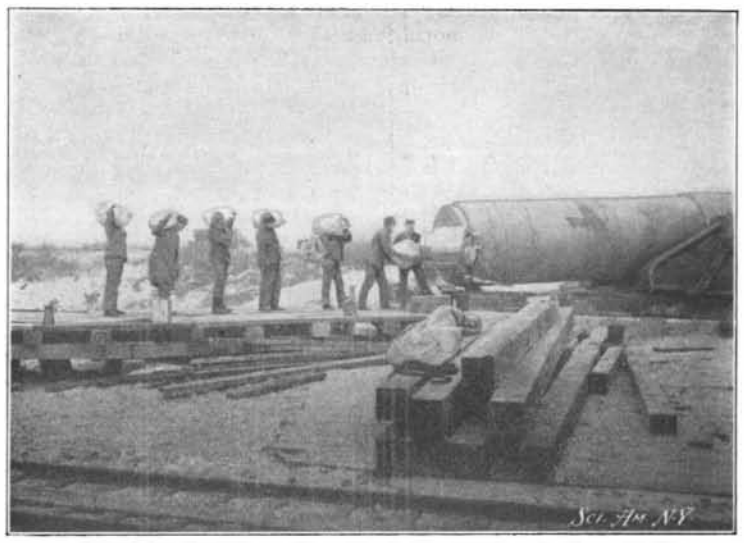
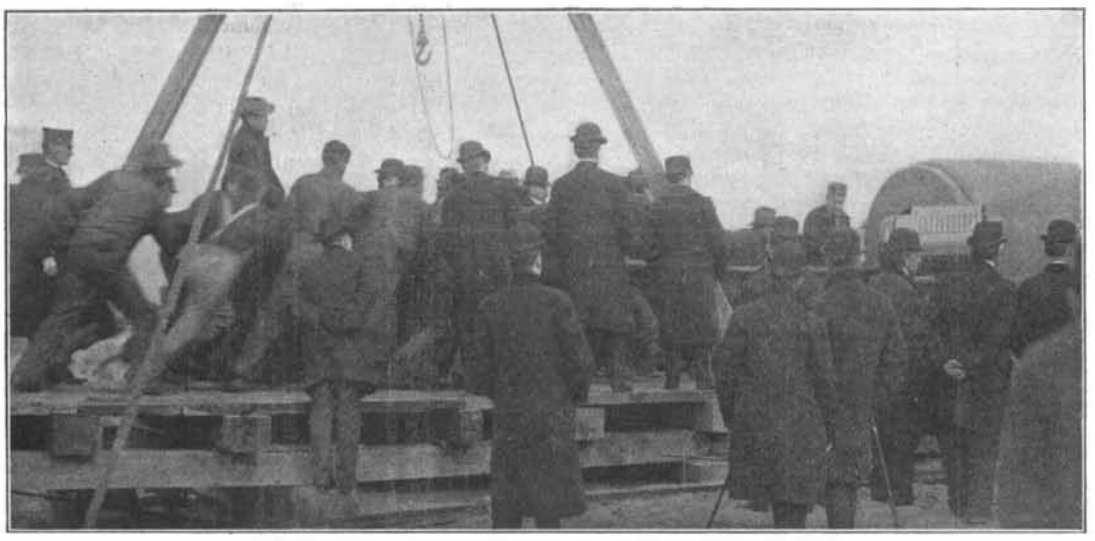
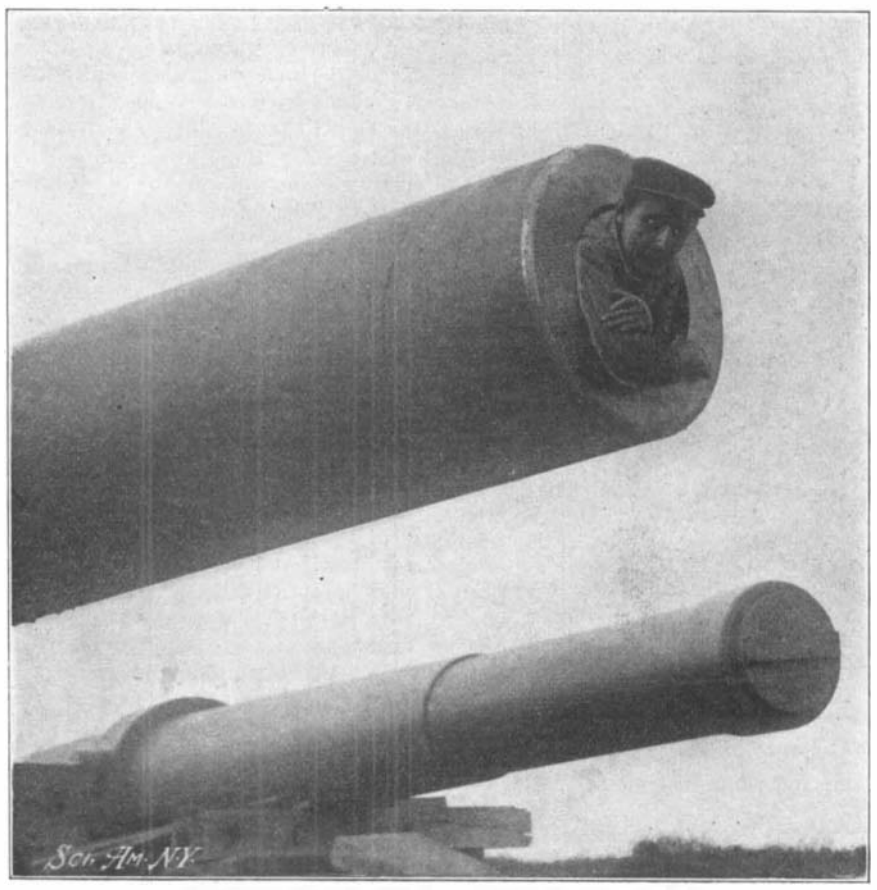


Loading the Six 107-Pound Bags of Powder Into the Breech.

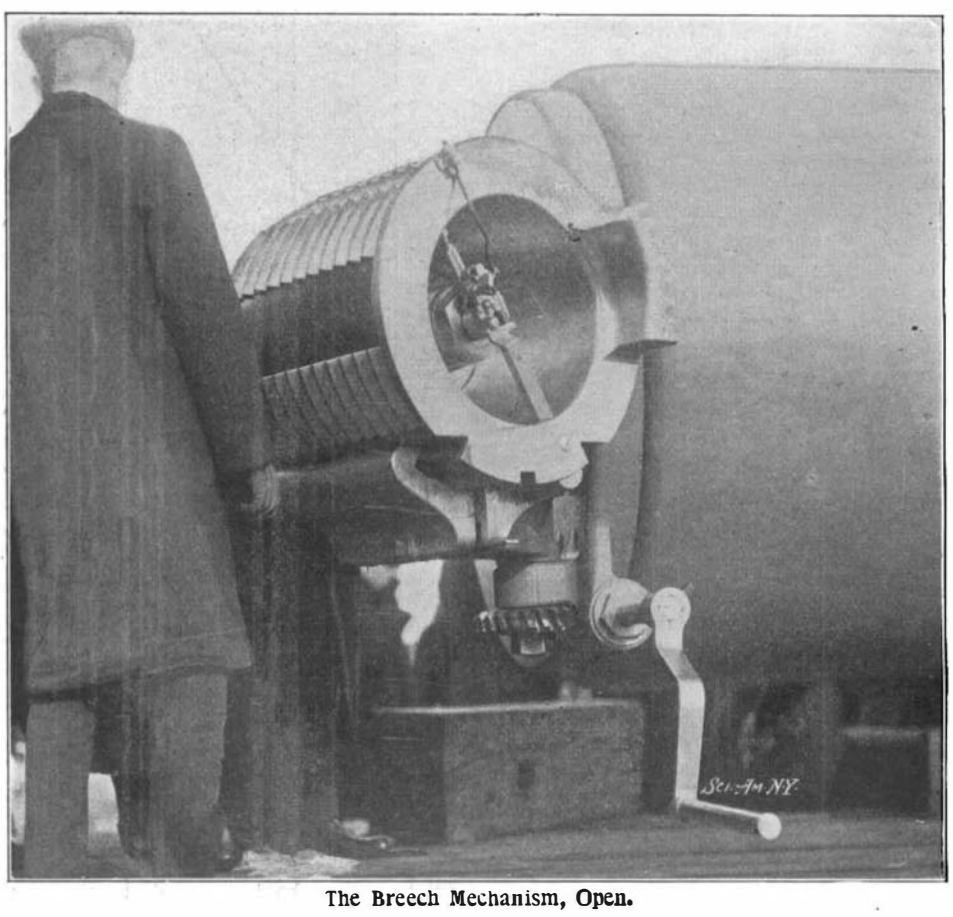


Twenty Men Ramming Home the 2,400-Pound Projectile.

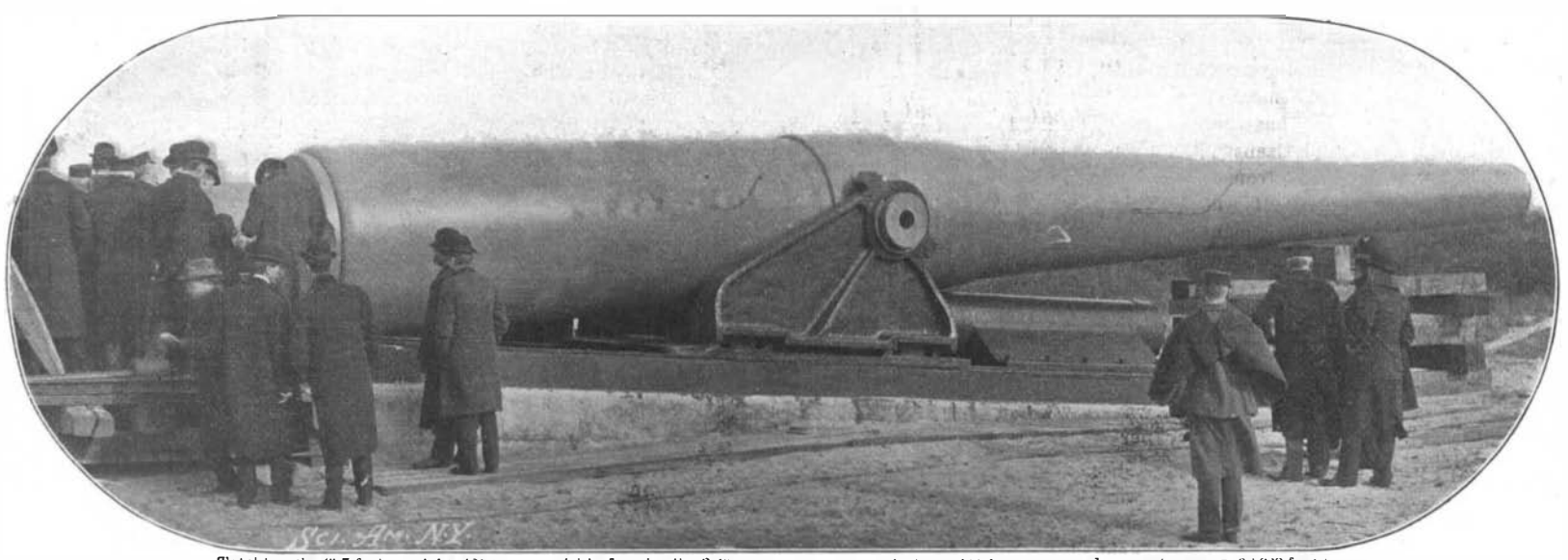
Instantaneous Photograph of the Discharge.



Muzzle of the 16-Inch Gun, With Sergeant Inside.



The Breech Mechanism, Open.



Total length, 49.7 feet; weight, 130 tons; weight of projectile, 2,400 pounds; muzzle velocity, 2,306 feet per second; muzzle energy, 88,000 foot tons.

The Gun on Its Test Carriage.

TEST OF THE 16-INCH ARMY GUN AT SANDY HOOK.

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