

# Scientific American.

ESTABLISHED 1845.

MUNN &amp; CO., EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

## TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico ..... \$3.00  
 One copy, one year, to any foreign country, postage prepaid. 20 16s. 5d. 4.00

## THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)..... \$3.00 a year.  
 Scientific American Supplement (Established 1876)..... 5.00  
 Scientific American Building Edition (Established 1885)..... 2.50  
 Scientific American Export Edition (Established 1873)..... 3.00

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 8, 1899.

## THE RECENT EXPLOSION OF A TEN-INCH ARMY GUN.

After the brilliant record of the Ordnance Department in the construction and testing of built-up guns, extending over many years, the recent bursting of an army 10-inch breech-loading rifle will come as a painful surprise to the general public. It has always been the boast of our ordnance officers that the great care exercised in the design and manufacture of our guns has resulted in the production of weapons that were not surpassed in respect of their accuracy and endurance.

As a matter of fact, however, there are other elements besides those to be found in the gun itself which may conduce to its destruction. It may be burst through faulty loading, as in the case of the 12-inch muzzle-loading gun of the "Thunderer," where two charges were put in by mistake, or in these days of nitro-glycerine and guncotton (smokeless) powders, the gun may be burst by the irregular action of the powder itself.

There is strong evidence that it was the too sudden combustion of the smokeless powder, resulting in abnormal pressures, that caused the disastrous wreck at Sandy Hook, for one of the pressure gages has been recovered which shows that the powder developed a pressure of 36 tons, or nearly two and a half times as great as the allowable limit of 15 tons to the square inch, while it is likely that even this pressure was greatly exceeded.

Mr. Hudson Maxim, who conjointly with Dr. Schupphaus is the inventor of the perforated smokeless powder used by the army and navy, contributes an article, which will be found on another page, in which he explains the probable cause of the explosion. The discussion is of great interest as coming from the inventor of the powder, and in the absence of any evidence of other causes will probably be accepted as the true explanation. That the army powder, which was supposed to be particularly safe because of its low percentage of nitroglycerine, should be liable to semi-detonation, because of the form of the grains and the direction of the perforations, proves that the smokeless powder question is still in its trial stages, and that we have yet to produce the ideal compound.

It is a curious and pertinent fact that a powder with a higher percentage of nitroglycerine would, by virtue of its elasticity and toughness, be free from the danger of shattering and sudden generation of gas, to which causes, it will be noticed, Mr. Maxim attributes the explosion of the gun.

## PROPOSAL TO BUILD THE NEW YORK RAPID TRANSIT TUNNEL.

The proposal of the Metropolitan Street Railway Company to build and operate the proposed New York Rapid Transit Tunnel is the most important development in connection with this great scheme since it first received legislative sanction. The public is familiar with the history of the hitherto abortive attempts, extending over a period of many years, to secure the necessary funds (about \$30,000,000) and start the work of active construction. After surmounting a host of legal difficulties, the Board of Rapid Transit Commissioners found themselves face to face with the fact that New York was prevented by its charter from incurring the additional debt which would be necessary if the road was to be constructed at the city's expense. For some time it has been evident that if the work is to be undertaken at all, it must be done by private capital, and while, for obvious reasons, it is desirable that the road should be built and owned by the city, it is realized that if city ownership and control is made a *sine qua non*, this greatly needed improvement will have to be indefinitely postponed.

At this juncture the Metropolitan Street Railway Company has come forward with a proposition which, while not altogether free from objectionable features, is yet on the whole a fair proposal and contains many features to recommend it to the favorable consideration of the people and the people's representatives, the Rapid Transit Commission.

Briefly stated, the proposal is as follows: A combination of capitalists who are largely interested in

the Metropolitan Street Railway Company propose to construct an underground railway according to the plans of the commission and lease it in perpetuity to the Metropolitan Street Railway Company. It is proposed that a company be organized to build the tunnel, work to begin on the first section, from City Hall to Fort George, within three months after the right is acquired and to be completed within three years' time. As soon as the first section has proved that it can earn 5 per cent on the cost of construction and equipment, the second section, extending from One Hundred and Fourth Street to the Bronx, will be built. On its completion the road is to be leased by the Construction Company in perpetuity to the Metropolitan Street Railway Company for a yearly rental of 5 per cent of its actual cost. The Metropolitan Company is to pay to the city 5 per cent of the gross receipts of the road after the taxes and the rental to the Construction Company have been paid.

As regards the operation of the road, the Metropolitan Company will pledge itself to run express trains, charging a fare of 10 cents, these trains to run at a rate of 20 miles an hour below Ninety-sixth Street, and for at least 2 miles below Forty-second Street at the rate of 30 miles an hour. The fare on all trains, except the express, to be 5 cents.

A most important provision—one which above all others commends this proposal to favorable consideration—is the proposal of the Metropolitan Company to operate the new tunnel road as part of their great system of electric roads throughout the city. All passengers carried on the way trains for 5 cents are to be entitled to be carried over the surface lines of the Metropolitan Street Railway Company for an additional fare of 3 cents. Conversely, all passengers over the surface lines of the Metropolitan Street Railway are to be entitled to be carried over the tunnel road on trains other than express for an additional fare of 3 cents. Passengers paying the express fare of 10 cents are to be entitled to transfers to any connecting lines of the Metropolitan Street Surface Railways.

Such are the main outlines of the scheme as presented to the Rapid Transit Commissioners, and it must be confessed that as matters now stand it would be wise policy on the part of the city to accept the proposition, subject to one or two important modifications.

The objectionable features, it seems to us, are the proposals that the city shall grant a perpetual franchise and the fact that the proposed line of the tunnel is incomplete to the extent that it will terminate at the City Hall instead of running, as it should do, down to the Battery. We are aware that the extension to the Battery was cut out of the original plan because of the difficulties of construction, but nothing has been brought forward to prove that those difficulties are insuperable; and in view of the fact that the most important business interests of the city are centered nearly a mile south of City Hall Park, we think that the necessities of the case would fully justify the expense of construction.

The request for a perpetual franchise should be emphatically opposed. Fifty years is long enough to enable the various capitalists interested in the scheme to realize every reasonable profit from the undertaking. The spirit of the times is altogether against the pledging away forever of such enormously valuable franchises as those of transportation over growing cities, and we think that the Metropolitan Company may well be content with a term of years that will cover the lifetime of the parties concerned.

With regard to the important question of increasing the fare on express trains to 10 cents, we think that, on the whole, the circumstances of the case will justify it. It is generally admitted that the long distance travel on a 5 cents basis is run at a loss which has to be borne by the local traffic. Transportation companies naturally look with more favor upon local than they do upon long distance travel, and, therefore, in granting the franchise, particular care should be taken to specify that a certain number of express trains must be run daily in each direction. It is possible that at the first opening of the road the working classes and those who have to look carefully at the smaller items of their daily expense will avoid the 10 cent train. If this should prove to be the case, a reduction of fare would inevitably follow, and the matter would thus prove to be self-regulating.

## UNITED STATES NAVY AND ARMSTRONG GUNS AT THE PROVING GROUNDS.

A curiously perverted account of some tests recently carried out at the naval proving grounds has been going the round of the daily press. The story relates that, in consequence of some boastful remarks made by the British naval attaché at Washington to the effect that the Armstrong guns on the "New Orleans" are greatly superior to the United States weapons, the government determined to subject each type to a comparative trial under similar conditions, and accordingly two guns on the "New Orleans" were sent to Indian Head, where they failed under test to come anywhere near the record of the home-made weapons.

As a matter of fact, the United States naval experts are too seriously preoccupied in the work of turning out the very best possible weapons according to their own theories and methods of construction to waste time in any pyrotechnic displays for the benefit of the general press. The bureau finds sufficient satisfaction in the excellent record which it has made in working along its own independent lines, a satisfaction which is not measured by the ability of its guns to "beat" this or that particular make of some foreign power. The naval attaché, moreover, never made any such invidious comparison—the gentlemen who hold such positions being too well grounded in the precepts of good breeding to be guilty of such an obvious breach of professional etiquette.

The facts of the case regarding these tests are as follows: It being desired to determine what charges of our own smokeless powder for the "New Orleans" guns would give the same muzzle velocity, and, therefore, the same energy, as the English cordite, two of her guns, a 6-inch and a 4.7-inch, with some of their own English service ammunition, were sent to Indian Head, not for the purpose of making comparative tests with our own guns (though incidentally, of course, the results obtained with the two types were compared), but in order to determine what weight of our own powder must be put into the cartridges, which will henceforth be supplied from our factories, instead of from England.

The "New Orleans" guns are fifty calibers long, and are supplied with cordite charges. For the 6-inch gun the weight of charge is 18.65 pounds, the projectile weighing, like our own, 100 pounds. The average muzzle velocity obtained with three rounds of the above ammunition was 2,528 feet per second, the highest being 2,554 and the lowest 2,504 feet per second. This was about 100 feet per second less than was expected. The mean chamber pressure, however, was a trifle under 14 tons per square inch; therefore, if the weight of charge were increased somewhat, the velocity of 2,650 feet per second claimed by Armstrong could, no doubt, be realized without exceeding the usual limit of 15 tons. The falling off was probably due to deterioration of the cordite, resulting from climatic or temperature changes. The same gun was then loaded with a heavier charge of our own smokeless powder, a charge of 26 pounds giving a velocity of 2,576 feet per second, with a chamber pressure of 14.8 tons per square inch.

The above test took place in December of last year, and was compared with the firing of a 40-caliber 6-inch gun of our make, which took place in June of the same year. This gun with 31 pounds of smokeless powder gave a muzzle velocity of 2,601 feet per second for a chamber pressure of 15 tons to the square inch; the projectile weighing 100 pounds, or the same as that of the Armstrong gun. In the article to which we have referred, and which was so universally disseminated through the daily press, it was stated that a muzzle velocity of 3,000 feet per second had been obtained at the December trial, but, as a matter of fact, the velocity of 2,601 feet per second is the highest that has yet been obtained in our 40-caliber guns within the limits of the chamber pressure of 15 tons. This high velocity of 3,000 feet per second is something which we are aiming at, and which we hope to obtain with the 50-caliber guns which are now in process of manufacture for the vessels of the "Maine" class.

The 4.7-inch 50-caliber gun of the "New Orleans" with a cordite charge of 8½ pounds gave an average muzzle velocity of 2,549 feet per second, with a chamber pressure of 14.4 tons; the weight of the projectile being 45 pounds. A charge was fixed for this gun of 13.5 pounds of our own smokeless powder, which on firing gave 2,606 feet per second, the chamber pressure of 14.6 tons. As we have no 4.7-inch guns of our own build, no direct comparison could be made, but our present type of 5-inch gun of 40 calibers has a muzzle velocity of 2,725 feet per second, using a 50-pound projectile. This projectile, however, is relatively light for the caliber and would tend, therefore, to increase the velocity. In the new guns which we are now manufacturing, the projectile will weigh 55 pounds and the gun will be 50 instead of 40 calibers in length. No attempt was made to determine the maximum muzzle velocity that could be obtained within the allowed chamber pressure from the "New Orleans" when using our own smokeless powder, the object of the test being merely, as we have stated above, to determine what increased weight of our own powder would be necessary to give the same velocity as the stronger cordite powder which was supplied with the gun.

It will be noticed that it required about fifty per cent more of our navy powder by weight to give approximately the same velocity as was secured by the cordite. This is explained by the fact that the cordite has greater strength weight for weight due to the large percentage of nitroglycerine employed in its manufacture. Our navy powder is composed almost entirely of guncotton, which is preferred by the ordnance authority, since it has been considered more reliable and safer than the high nitroglycerine compounds.