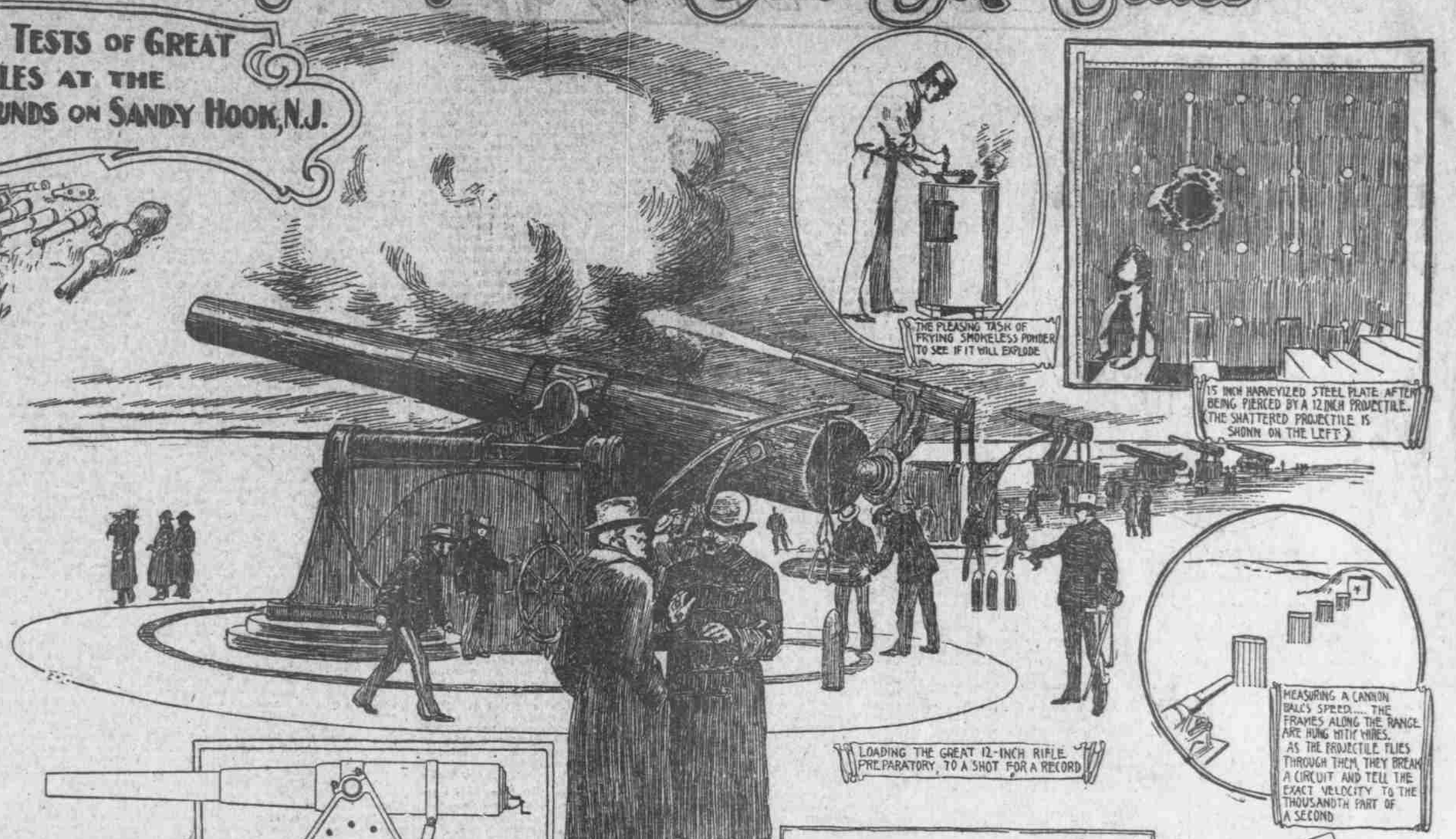
Trying the Temper of Our Big Guns

INGENIOUS AND DARING TESTS OF GREAT CANNON AND PROJECTILES AT THE FAMOUS PROVING GROUNDS ON SANDY HOOK, N.J.

THE ORDNANCE GRAVEYARD WEIRD AND INGENIOUS GUNS THAT WERE BETTER ON PAPER THAN IN SERVICE.



THE PLEASING TASK OF FRYING SMOKELESS POWDER TO SEE IF IT WILL EXPLODE

15 INCH HARVEYIZED STEEL PLATE AFTER BEING PIERCED BY A 12 INCH PROJECTILE. (THE SHATTERED PROJECTILE IS SHOWN ON THE LEFT.)

MEASURING A CANNON BALL'S SPEED.... THE FRAMES ALONG THE RANGE ARE HUNG WITH WIRES. AS THE PROJECTILE FLIES THROUGH THEM, THEY BREAK A CIRCUIT AND TELL THE EXACT VELOCITY TO THE THOUSANDTH PART OF A SECOND

LOADING THE GREAT 12-INCH RIFLE PREPARATORY TO A SHOT FOR A RECORD

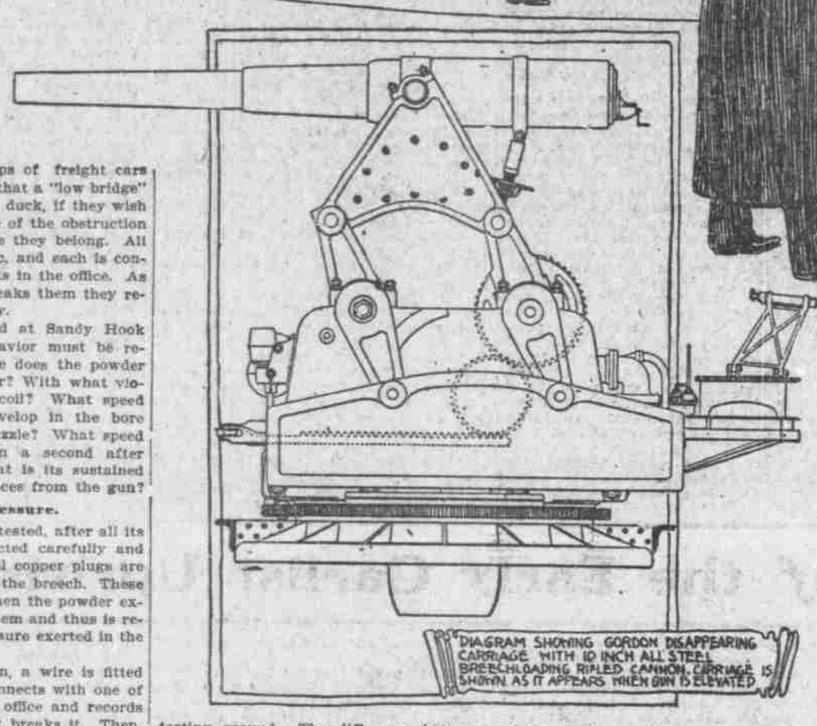


DIAGRAM SHOWING GORDON DISAPPEARING CARRIAGE WITH 10 INCH ALL STEEL BREECHLOADING RIFLED CANNON. CARRIAGE IS SHOWN AS IT APPEARS WHEN GUN IS ELEVATED

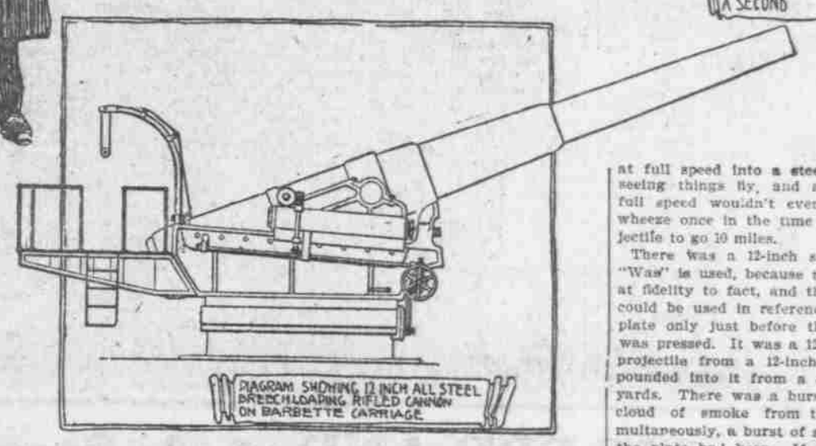


DIAGRAM SHOWING 12 INCH ALL STEEL BREECHLOADING RIFLED CANNON ON BARBETTE CARRIAGE

SHE is as dainty and as pretty as the prettiest shotgun that ever was turned out by a loving old maker of guns. She sits 14 feet up in the air, with a poise as light as that of the swallow that has just perched for a moment on her long, thin muzzle. If you were told to climb up and swing her, you would not dream of using more than one hand to do it.

She is 40 feet long and weighs 64 tons. She throws half a ton of solid steel 10 miles and never trembles from the shock. She explodes 487 pounds of powder in her womb and never weakens. Her blast will knock you head over heels, though you stand 50 feet outside of her line of fire.

She is the American 12-inch, all-steel, rifled, seacoast-defense gun, the queen of them all, and, until the American 16-inch gun shall have been tested, the ruler of the shore.

She is an earthquake harnessed. She is leashed death and ruin. How do we know what she can do? She never has been proved in that final battle test when the warships ring the land around her with fire and must make her great voice silent, or else themselves go down in the sea, with all their armor, batteries and men.

She Has Been Tried.

But we know what she can do, because we have sowed the long, white sea beach and the open ocean for ten miles off shore with tons on tons of steel projectile, in order to know. We have "tried her out" at the Army Ordnance Proving Grounds, hidden away on Sandy Hook, the wave-washed spit of land that New Jersey sends reaching into the Atlantic Ocean, like the long, white skeleton arm of Davy Jones himself. That long, white arm for many years has trembled and echoed daily to every noise that every gun can make, from the spiteful little Nordenfelt to the steel mortar that can throw a thing that presently will drop from the sky eight miles distant and plunge through a battle-ship from the deck to keel with much more certainty than even a bolt of lightning would.

At the very point of the Hook is a little office in a little building. It looks a bit like a chemist's laboratory, a bit like an architect's draughting-room, a bit like a machinery-maker's ante room. That is where the ordnance officers of the United States convert every shot that is fired into long tables full of figures.

Telegraphs Each Shot.

The gun itself telegraphs a good part of the story of each shot into the office. Sit in that quiet place—always as quiet and silent as most offices connected with great noisy works like forges and saw mills and other roaring industries usually are, and suddenly there will sound "Click! Click! Click!" all around the room, just as the faraway throbbing complaint of a great gun loosed trembles on the air. Those clicks have all been separate and distinct. But no ear ever was fine and quick enough to catch them as anything except one commingled sound. They have stopped while the ear still is gathering them and transmitting their message to the brain.

Those few sharp sounds that sounded like one have recorded the five-mile flight of a projectile. Click one told when it left the muzzle. Click two recorded its flight a thousand feet away. Click three said that the projectile had just passed the mile. So they caught its passage—one mile, two miles, three miles, five miles away. Small wonder that the ear could not catch the different messages separately. That shot, if it was a 12-inch, 1000-pound projectile from the 12-inch gun, traveled 1852 feet in the first second. It was a quarter of a mile from the muzzle of the cannon before the finger that pressed the firing button had even consciously ceased pressing.

Lightning-Like Flight.

No clock ever was made fine enough to begin to denote the minute fragments of time that are occupied in the flight of a shot from a modern, high-powered weapon. The best stop watch in the world is many hundred times too slow to do it. Even if one could be made fine enough for the purpose, the quickest man in the world couldn't stop it in time. Before the sharpest eye had passed the knowledge to the nimblest brain, and that, in turn, had passed the command to the quickest finger that ever moved, a half-ton of metal would have hit its goal 10 miles away. Ordnance officers have to deal not with half seconds or eighth seconds, but with the one-thousandth part of a second. In the office in Sandy Hook is a queer instrument of polished steel. Day after day it records instants of time too small for the mind even to conceive. To measure and record the one-thousandth of a second is play for it. It is always set to do that. But it can measure a millionth part of a second.

Yet the work of recording the course of a big shot is beautifully simple. The real work, that demands many years of preparation and study, is to know what to do with the records after you have them.

Could Record Every Foot.

So simple and perfect is the method that it is entirely possible on Sandy Hook to record the speed of a projectile in every foot of its course, if such knowledge were necessary, which it is not.

As one stands by the long line of taper cannon one can see large frame supports scattered at uniform distances down the range. Each of them is hung with wires, and looks a great deal like the weighted wires hung over railroad tracks just in front of overhead obstructions to tap forgetful trainmen on tops of freight cars gently and warn them that a "low bridge" demands an immediate duck, if they wish to reach the other side of the obstruction with their heads where they belong. All these wires are electric, and each is connected with instruments in the office. As the flying projectile breaks them they record the fact instantly.

When a gun is tried at Sandy Hook every item of its behavior must be recorded. What pressure does the powder develop in the chamber? With what violence does the gun recoil? What speed does the projectile develop in the bore before it leaves the muzzle? What speed does it develop within a second after leaving the gun? What is its sustained speed at various distances from the gun?

Powder Pressure.

When a gun is to be tested, after all its parts have been inspected carefully and cleaned and oiled, small copper plugs are fitted in little holes in the breech. These are pressure plugs. When the powder explodes, it compresses them and thus is recorded exactly the pressure exerted in the powder chamber.

After the plugs are in, a wire is fitted over the muzzle. It connects with one of the instruments in the office and records the time when the shot breaks it. Then, as the projectile pierces frame after frame along the range, they, too, telegraph the exact instant to waiting instruments.

But even the practically instantaneous record made by an electric recorder is not swift enough in itself. Electricity has to be helped with ingenious means. The wires that are scattered along the range do not lead to an instrument that makes a record on paper. That would be far too slow. They lead to the queer apparatus of polished steel that has been mentioned as being able to record inconceivable fractions of seconds. It is known as the Sieber velocimeter. Its noticeable feature is a chunky, beautifully polished cylinder of steel, a few inches long. It has one sharply pointed end. By this end, which is magnetic, it just hangs to an upper supporting arm.

How It Works.

When the shot breaks the first wire, it, in turn, breaks the electro-magnet that holds the steel bar, and down it falls. It has only a few inches to drop. Yet before it falls that short distance, the projectile has smashed through framework after framework. As the successive wires break, successive circuits are broken, and tiny, sharp gravers shoot out from the sides of the instrument and strike that falling bar. Each graver marks it, and by the time the shot has struck its mark, the little steel cylinder just about reaches the end of its drop. Now, knowing to the thousandth part of a second how fast it dropped, the ordnance expert can calculate the swiftness of the projectile, by measuring the distances between the marks scratched on the cylinder by the gravers.

To measure the recoil another simple method is used. One end of a long, thin strip of steel, with its face smoked to a uniform blackness, is fastened to the carriage of the gun. Near the muzzle end of the cannon is an apparatus with a tuning fork so arranged that a little spur on one of its jaws just touches the face of the blackened face of the steel band. When all is ready for firing, this tuning fork is set to vibrating by an electrical instrument that makes it vibrate exactly one thousand times a second, without varying by a single vibration. When the cannon is discharged the recoil naturally jerks the steel band backward, and the little spur on the fork marks a long wavy line on the steel. The band is dipped in a solution that fixes the record so it will not rub off.

An Easy Matter.

Now, knowing just how far the gun recoiled—a matter that is, of course, measured easily—it is merely a question of counting the waves marked on the steel to determine how many thousandth parts of a second it required for the weapon to complete the distance. And, by knowing the velocity of recoil, it is possible, calculating the entire weight of the gun and carriage, to find out how great was the force of recoil in pounds, which is a most important factor in determining the strength of emplacements where the weapon is to be mounted finally.

While Sandy Hook is officially a proving ground, it is fully as important as a testing ground. The difference between the two is this: When the Government decides to adopt an arm of a certain pattern, type guns are sent to the Hook before the United States commits itself to the final purchase of that particular kind of cannon. These type guns go to the testing department, where they are subjected to the most severe tests and experiments that can be devised. Practically the testing-ground officers try to smash the gun. They try it with maximum and minimum charges of powder and projectile. They let it "weather." They load it to the bursting point.

Histories of Tests.

Sometimes a gun will undergo tests for a year or more, each shot being carefully recorded and a little history being written about it before the Government gets a final report on it. Many a cannon has had enough to fill a big book written about it in successive reports of tests, and then been rejected. If a gun gets the "O. K." mark from Sandy Hook it is a good one. Foreign governments realize that more keenly than do the people of the United States. Foreign military men consider the proving grounds on Sandy Hook as one of the most authoritative government departments in the world, and its reports are at a premium in every War Office on the globe.

If a type of gun doesn't develop a feverish pulse before its test is ended, and if it is accepted finally, more guns of the same pattern are ordered. An Army officer superintends every step of their manufacture and sees that each is made exactly like the gun that was tested. As each is finished, it is sent to Sandy Hook to be "proved." Five shots are fired from it under service conditions, and if it acts correctly, it is sent on to a Coast fortification. Not a single gun is mounted today in a fort unless it has been through the hands of the proving-ground officers.

Beauties of War.

Testing and proving guns is not war, but it has many of the beauties of war. In the long line of beautiful weapons looking out to sea over the miles of beach that are holy for the purpose at Sandy Hook, and on which no man is allowed to set foot, there hardly is one that could not tell a story of narrowly averted death—premature discharge due to causes which no human skill or caution could prevent—the bursting of a breech block, the yielding of a vent plug, the unaccountable ricochetting of a projectile.

Congress often kindly aids in making Sandy Hook unpleasant. It is common for an inventor to get a bill through, ordering the War Department to test his weapon or his explosive, for the testing and proving grounds are for trying projectiles, shells and explosives as well as guns. Time and again explosives or weapons have arrived at the Hook that were so bizarre and evidently more dangerous to the shooter than they ever would be to the enemy, that the officers in charge declined to risk the lives of their soldiers by assigning any of them to the work of firing them. Not that the officers refused to test them. They sent the soldiers to a safe distance and did the work themselves.

Eight years ago a young Lieutenant, one of the most promising men in the Ordnance Department, was assigned to the duty of testing a new shell. He examined it and found that it was highly dangerous even to handle the thing. But he made no objection. He simply ordered one of his men to get a wheelbarrow. Then he sent the men away on some trifling duty and wheeled the wicked thing a mile down the beach. There he made the test. He was not reckless, and he took all the precautions possible. But, despite his care, the shell exploded and mangled his face, besides injuring his eyes so badly that for many months it was doubtful if he would recover his sight.

Another inventor a few years ago invented a unique cast-iron cannon of frightful calibre, with an equally unique shell to carry an equally unique bursting charge. He went to the Hook to witness the tests, and when he saw that the officers were taking unusual precautions, he became grieved and then indignant, and finally made slurring remarks about the conspicuous amount of bravery that the soldiers did not have. Thereupon the officer in charge said to him:

Fool Inventor Called Down.

"This gun and this shell and this projectile are sent here to be tested. We are going to do it fairly, as you can see. But we know that they are all extremely likely to burst and kill some one. It is our duty to take the risk, and it is equally our duty to guard our men. That we are going to do. When the gun is loaded, we shall remain near it to fire it and observe it. You have not only the privilege of retiring behind the bomb proof, but probably we shall insist on your doing so. Or would you prefer to sit on top of your gun?"

The inventor decided not to sit on his gun. Indeed, when the word was given that all was ready, he was one of the first behind the bomb proof. It was just as well. In a fraction of time after the firing button was pressed, there was no gun. The explosive had burst in the shell, the shell had burst in the gun and the gun was in pieces. Luckily its construction was so weak that it did not scatter with the deadly results that might have been expected. Otherwise, not an officer would have escaped.

There is a gun lying in a prominent part of the ordnance graveyard on the Hook. That is, at first sight it appears to be a gun. On examination it turns out to be a beautifully built-up piece of iron mosaic work.

Preserved in Mosaic.

It was a patent gun. The first shot fired from it broke into so many little pieces that the authorities had them all collected and put together again for a relic. Some of the fragments were found miles away. Hardly one of them is larger than a man's hand.

A famous corpse in the graveyard is the multi-charge gun. In its time it was far more famous than any of the late patent guns for firing high explosives. It made heartburnings in Congress, and there were many kindly and pleasing remarks about the obstinacy and hide-bound idiocy and old fogyism of the Ordnance Department because it persisted in reporting to Congress that the multi-charge gun was no good.

But the inventor of the gun had a pull, besides his genius for gunmaking, so he got an appropriation and built his terrible engine of war. It was like an ordinary cannon from the muzzle to about half way to the breech. But there it swelled out into wonderful and hideous protuberances. Each of these protuberances was designed to hold an enormous charge of powder. The idea of the maker was that the first charge of powder would ignite the second and the second the third, and so on, and that all these charges combined would drive the projectile with frightful force.

The multi-charge gun was fired just once. Perhaps it cannot be said truthfully that it ever was fired even once, for the first charge of powder in the first chamber wrecked it before the rest had even become ignited.

Other Pleasing Occupations.

There are all kinds of pleasant occupations on Sandy Hook besides firing guns. You meet a man casually. He is carrying a large glass jar with something that looks like water in it. He is merely an expert carrying a new explosive that he must test.

There is a great line of romantic and mighty granite walls, partly in ruins, just behind the proving grounds. They are the remains of a great fortification begun by the Government in the Civil War and abandoned when stonework no longer was useful for forts. In the deep casements are stored tons of powder of all kinds. Red tape forbids the destruction of powder sent to the Hook to be tested. And, as half a ton generally is the minimum quantity that the self-respect of the ordinary inventor permits to dream of sending, there is enough there to blow a fair part of New Jersey into the moon and introduce the apple-jack industry on that planet with celerity.

If the visitor happens to see a man bending over a little round stove in the open air and watching a frying-pan fondly, it is well not to rush up to him in the hope of finding him in the act of frying country sausages. He is trying smokeless powder to see how it acts. Frying smokeless powder is not a profession that makes the chef a favorable subject for a life insurance company, but there are many men on the Hook who are proficient in that form of cookery.

It Looks Nice.

Smokeless powder comes in nice, soft-colored black cubes, generally about the size of dice. It cuts nicely with a knife, and when it burns it does so slowly and like resin. When it explodes it does so a little bit less slowly, something like lightning. Not everybody would find his ideal of life in poking a thermometer into a panful of it.

Even when the gun holds together all right and the powder explodes all right and the projectile starts away all right, the gentle modes of diversion on the Hook have not reached an entirely hopeless end. All sorts of things may happen when the projectile hits the target.

The target generally is a huge steel plate, anywhere from six to sixteen inches thick. It is bolted to a backing of great timbers and tons of sand are heaped behind it. The plate is made by persons who are interested in making armor for battle-ships that no projectile can pierce. The gun and the powder and the projectile are made by other persons, who are devoted to the task of knocking any known steel plate into little, little bits. This makes a meeting of plate and projectile truly interesting and often heated. The projectile need not be loaded with a bursting charge to make its attack on the plate resemble a dynamite explosion. You couldn't expect to slam a locomotive at full speed into a steel plate without seeing things fly, and a locomotive at full speed wouldn't even have time to wheeze once in the time it takes a projectile to go 10 miles.

There was a 12-inch steel plate once. "Was" is used, because this article aims at fidelity to fact, and the present tense could be used in reference to that steel plate only just before the firing button was pressed. It was a 12-inch solid steel projectile from a 12-inch gun that was pounded into it from a distance of 5000 yards. There was a burst of fire and a cloud of smoke from the gun, and simultaneously, a burst of something where the plate had been. If the air did not really and truly turn black for a fleeting moment, the eyes of all observers lied.

And then things began to rain down from the sky. Some of the things came like real rain—fine and plentiful. That was sand. Others of the things came hurtling and made covers agreeable. That was kindling wood. Others of the things came with a roar and a scream and a whirr and a bang. That was steel. And then it stopped raining. And then somebody shouted "Look!"

Away in the sky was a black speck. It was as big as a dime. It was as big as a bird. It was as great as a tumbling safe. It was a huge thing blotting out the sky. It hit the beach and a fountain of sand went up many hundreds of feet and some inches. Five hours of hard digging uncovered it. It was a dainty bit of the 12-inch steel plate, weighing about 4000 pounds, enough to cause comment had it fallen on a tender toe.

Like a Furnace.

When a big projectile bores a hole through a steel plate, it generally makes an aperture as clean as if it had been done with tools. For half an hour afterward it is impossible to hold the hand in that hole. One might as well thrust it into a furnace. Sometimes the projectile is bent and warped and twisted and split, as if it had been made of tin. At other times it isn't even marked; that is, it isn't even marked from its flight through the plate. But it always is marked if it buries itself into sand. What the best nickel steel cannot do the tiny grains of the seashore do every time. When that revolving shot dives into them, they engrave it wonderfully with millions of delicate and minute lines.

A half-ton projectile fired on Sandy Hook often has sheared through 15 inches of steel, 10 or 15 feet of oak timbers, a small mountain of sand, and gone as straight as an arrow on its course until it struck the sea. Then it would just touch the crest of a trifling little wave, and up it would fly straight into the air.

Water is the one thing that they cannot calculate on the proving grounds. When a shell hits steel and timber and sand they know pretty well how it will go. But a shell that hits the water may go in any direction. A ripple that is not big enough to rock a rowboat may divert a shell and jump it miles out of its course.

A Record Shot.

One of the record shots at Sandy Hook with a 12-inch rifle sent the projectile more than 19 measured miles out to sea. That projectile ricochetted eight times before it finally took its last plunge. Every time it struck the water it roared as if a sea monster were bellowing in mortal agony. Every time it jumped, it jumped higher in the air than the masts of a full-rigged ship.

At an ordinary routine test, a projectile from a 10-inch steel rifle struck the plate true, went through eight inches of steel, struck a huge oak timber and sheared it clean transversely as if it had been cut with a circular saw, and then hit the head of a little five-inch bolt and ricochetted and went into the air till it was out of sight. It came down not a thousand yards from the gun.

Around the base of every projectile there is a band of soft copper. It fits the rifling of the bore accurately and thus forces the shell to take its rotary motion. Often, after a shell has gone through a steel plate, long pieces of this soft copper are found forced clean into the hard steel, as a toothpick might be forced into cheese.

J. W. M.

CIRCUMSTANCES HAD CHANGED.

Mrs. Muchwed—Before we were married you said that mamma could stay here as long as she pleased.

Mr. Muchwed—Yes, but she doesn't please any more.