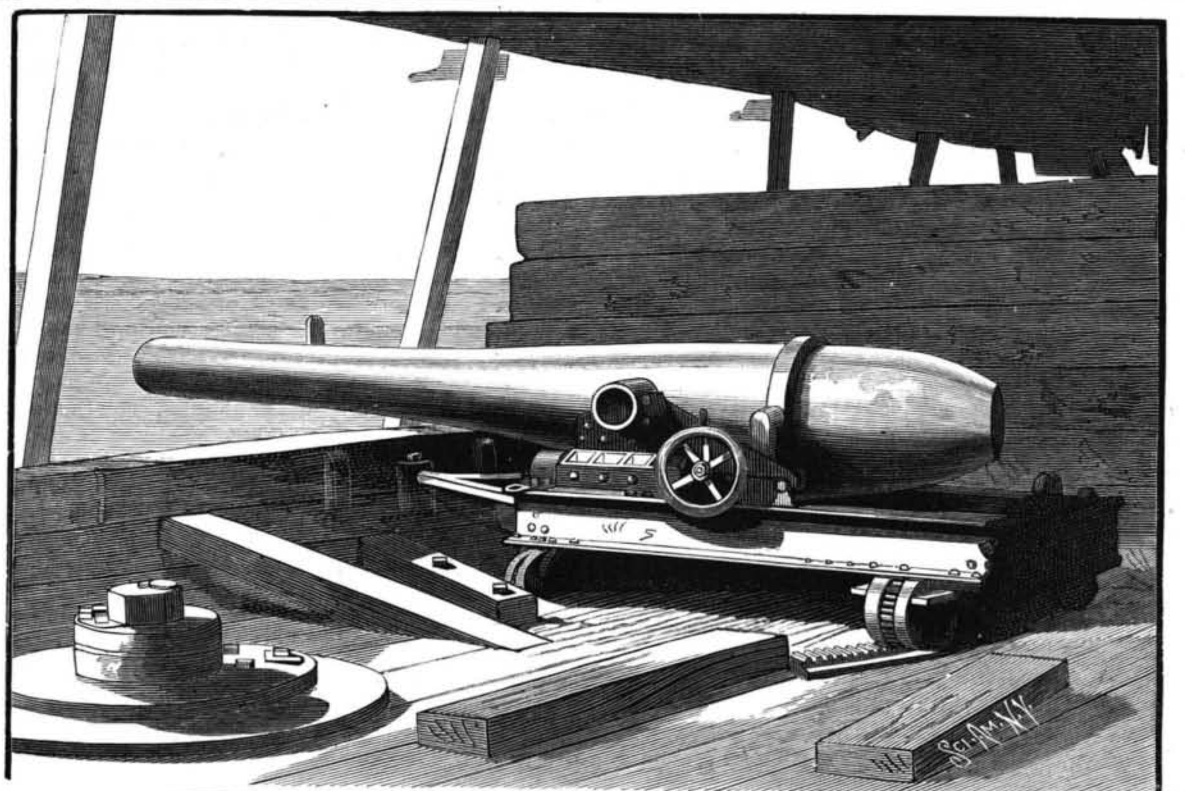
TEST OF THE CAST STEEL BREECH LOADING RIFLE.



THE SIX INCH CAST STEEL BREECH LOADING RIFLE BEFORE THE TRIAL.

As the interest of American steel manufacturers, as well as that of the public generally, has been excited by the recent test of the first Bessemer cast steel rifle cannon at Annapolis, a detailed description of the gun and its trial may be of value to our readers.

The gun was of Bessemer steel, cast solid in one piece by the Steel Casting Company, of Pittsburg. The casting took place January 11, 1888, and after the outside had been turned down and the bore rough finished by this firm, the gun was finally chambered, fine bored, and rifled at the Washington Navy Yard, where the breech block and elevating band were also fitted. The rifling and chamber reaming were beautifully done, and reflect credit on the government workmen at the Washington yard. According to ordnance nomenclature, the piece is known as a 6 inch breech loading rifle, with breech closure on the slotted screw system and obturation (gas checking) modified from the De Bange system. In this, the leak of gas through the junction of the screw breech plug and the bore of the gun is prevented by a plastic packing ring of asbestos and tallow held in an annular case of canvas. The pressure of gas in the gun on firing expands the ring and makes a tight joint. The interior profile of the bore and chamber was made to assimilate as nearly as possible to the standard built up naval gun of Bureau of Ordnance design. Its principal dimensions were:

Weight, 10,510 pounds; length, 193·5 inches; diameter across breech, 21·78 inches; diameter of bore (across lands), 6 inches; diameter of chamber, 7·50 inches; capacity, 1,400 cubic inches; twist of rifling, from 1 turn in 180 to 1 turn in 30 calibers; weight of projectile, 100 pounds; weight of powder charge (full), 48¼ pounds.

WRECK OF SHED AFTER THE EXPLOSION.

The projectile was the common cast iron shell, 21 inches long, 6 inches in diameter, with ogival head and rotation band of copper. This band has a slightly greater diameter than the bore of the gun, so that the gas pressure, when the gun is fired, forces the soft metal into the grooves of the rifling, and thus gives rotation to the projectile.

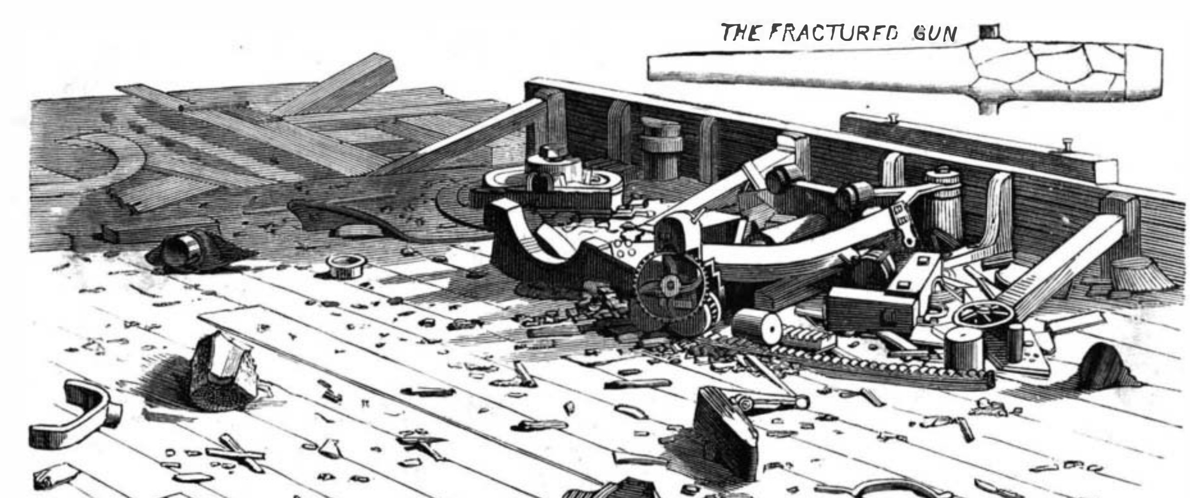
The powder used was manufactured by Messrs. Du Pont, and is known as brown prismatic or cocoa powder from its color. Every grain has the form of a right prism with a hexagonal base and a quarter inch hole in the axis, the object of the hole being to allow ignition in the center and thus cause the grain to burn with an increasing surface for combustion. The height of a grain is one inch, and there are about ten grains to the pound. It is the same kind of powder that is used in the regular service guns, and the charge was the same as is fired in the built-up 6 inch guns of the navy. From previous records of firings with this powder, this charge of 48¼ pounds could be depended on to give a muzzle velocity to the projectile of 2,000 feet per second, with a pressure on the walls of the gun of about 15 tons to the square inch.

Preparatory to the test, the gun was mounted on a carriage in which the energy of recoil was absorbed by the resistance offered by water in being driven through a small orifice, while after recoil the gun was run out quickly to battery automatically by compressed air in two small reservoirs in rear. The carriage worked admirably during the trial.

To prevent accident to spectators and guns lying near by on the battery platform, a house of heavy timbers, 12 inches square, in two layers, was built over and on both sides of the gun where it lay mounted in the gun shed; besides which, bomb-proofs were provided near by on the grounds to the rear, from which the action of gun and carriage could be seen reflected in mirrors.

The firing trial took place on December 5, and was under the direction of Lieutenant A. M. Knight, Inspector of Ordnance in charge of the proving ground, assisted by Lieutenants Wilner and Gleaves and Ensign Dashiell. The owners of the gun were present, as well as many naval officers and representatives of the press. It was intended to fire ten rounds as rapidly as possible with full charges—the regular naval gun test—but, at the request of President Hainesworth, of the Steel Casting Co., a reduced charge of 36 pounds of powder was decided on for the first round. The gun was pointed at a thick hill of earth thrown up for such purposes. The shell was entered and run home; then came the charge in a tight fitting serge bag, and the breech was closed and primer put in. Every one took shelter in the bomb-proofs, and the 60-foot lanyard was pulled. A tremendous crash, with a shower of mud from the earth butt, followed. The gun recoiled 21¾ inches, and everything worked perfectly. This charge gave a velocity of 1,700 feet per second and a pressure of about eleven tons.

The rapid firing test of ten rounds, with full charge, was next prepared for. A shell was run in, the full charge of 48¼ pounds entered, and the breech closed. When all had taken shelter, the lock string was pulled. A terrific explosion followed. The air was filled with flying timbers and pieces of steel and a dense cloud of dust. The roof of the gun shed was wrecked, the logs were blown in every direction, and many of them were split and crushed to splinters. Pieces of the gun lay around on all sides. The wreck of building, carriage, and gun was complete. The breech was blown 130 feet to the rear, with the plug in it and the pressure gauges uninjured. The chase and muzzle were projected forward 10 feet, while the shell probably struck the butt from 15 to 20 feet from the point aimed at. When the wreck could be cleared away, it was found that the breech of the gun, from the trunnions to the rear face, had been ruptured and broken into twelve large pieces and several smaller ones. The annexed sketch will give an idea of the lines of fracture.

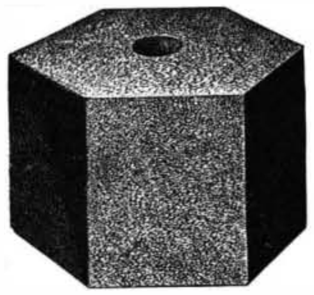


REMAINS OF GUN AFTER CLEARING AWAY THE WRECK.

The carriage was completely demolished.

On examination of the gauges which were in the breech block, a pressure of 14·1 tons to the square inch was recorded—less than the expected mean pressure of

15 tons. This is the first cast steel gun that has been tested at the proving ground. Another, of open hearth steel, by the Standard Steel Casting Co., awaits a trial, which will probably take place during the coming month.



ACTUAL SIZE ONE GRAIN POWDER.

The Brooks Underground System in Brooklyn.

The Brooks system of underground telephone conductors now being laid in Brooklyn by the New York and New Jersey Telephone Company consists in saturating the textile covering of the cables with a mixture of resin and resin oil and drawing the cables into the wrought iron pipes. The pipe is first prepared by scouring the inside sufficiently to remove the sharp edges or protuberances, and reaming the sharp ends in order that the covering of the cable will not be abraded when pulled into the pipes. Instead of using the ordinary socket or coupling, a T-coupling is used. For a pipe 2½ inches in diameter the T is provided with a 1 inch plug, and when the lengths are screwed together the plug of the T points upward. For every 500 or 1,000 feet length, or such length as may be most convenient, there is a splice box, and for the length to be pulled in there is another splice box, over which there is placed a winch. When the lengths of pipe are screwed together, the length is beaded over a wire, which is drawn from a reel as each successive length of pipe is added.

When a sufficient pulling length is formed, a few lumps of caustic lime fresh from the kilns are placed in the splice boxes, the object of which is to dry the air contained in the pipe. Every screw thread before screwing up is well covered with a mixture of white lead and linseed oil, such as is used to make an ordinary screw joint moisture-proof. The pipe is the common lap-welded wrought iron; the wire left in the pipe is for the purpose of drawing in the rope which is used for pulling in the cable.

Common resin of the heaviest quality is broken up and thrown into the caldron, and for a barrel of resin there is added a barrel of resin oil. The oil is known in the trade as "London oil" or "kidney oil." The cost of the resin is about $1.50 per barrel; the oil costs about 11 cents per gallon. When sufficient of this mixture is placed in the caldron to cover the cable, the fire is kindled underneath, and the contents of the caldron heated to about 360° Fahrenheit.

When the mixture is heated to above the boiling point of water, 212° Fah., yellow or red bubbles begin to rise and float over the surface until the moisture is all evaporated. The heat is carried to about 360° Fah., and remains at that point until all floating bubbles cease. It takes two hours or more after the heat has reached 360° Fah. in the liquid for it to penetrate the coil of cable sufficient to drive out all moisture. When the floating bubbles cease to show themselves, the cable is ready for pulling into the pipes. In some cases fresh lime is pulverized in a mortar and introduced into each T-joint, which prevents the cable from adhering or sticking to the pipe when pulled in, and if that is not done, about a gallon of common illuminating oil, such as coal or kerosene, is put into the highest points of the pipe, and this keeps the cable from adhering to the pipe, as the resin and resin oil mixture is an exceedingly sticky substance. Two men with a winch can pull in 500 feet in 20 minutes; but with horses and without the aid of a winch, 520 feet was pulled in in Brooklyn in five minutes.

After the cable is introduced, and after the splices are made in the splice boxes, the mixture is drawn from a spigot in the caldron heated at a temperature of 400° Fah., and turned on to the splices until no more of the mixture can be introduced at that point. The splices are wrapped on the outside with a piece of canvas or coarse cloth, so that none of the splices will touch the iron of the boxes, otherwise the hot mixture will not drive away the moisture left on the splices from the hands of the splicer.

When the splices for a length of cable are made, the T-joints are unplugged, and the pipe filled with the mixture at a temperature of 360° Fah.—*Electrical World.*

GIGANTIC FOSSIL MAMMALS.

Mr. Strauch, the learned director of the museum of the St. Petersburg Academy of Sciences, has recently sent us a photograph of the celebrated mammoth which exists in the collection of that establishment. We reproduce it herewith.

The mammoth (*Elephas primigenius*) of this museum is the one whose entire carcass was found in 1799 on the

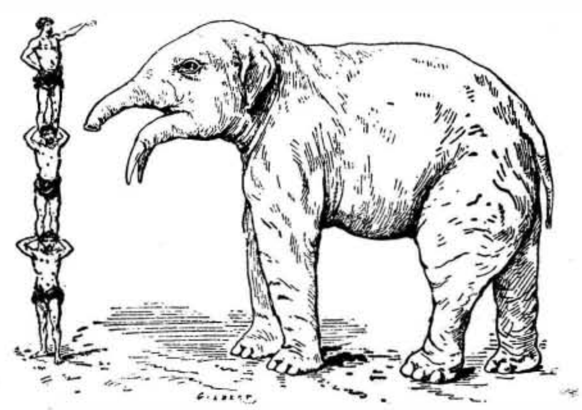


Fig. 2.

shores of the Arctic ocean near the mouth of the Lena. As seven years elapsed between its discovery and its shipment to St. Petersburg, a portion of its flesh was devoured by dogs and wild beasts. The greater portion of what remained was removed from the bones by Adams because it rendered carriage too difficult. The photograph shows that the skin and flesh have been preserved only upon the head and around the feet.

According to Tilesius, the skeleton is 11¼ ft. in height from the top of the head to the bottom of the feet. It is smaller than the skeleton of the *Elephas meridionalis* of the pliocene of Durfort, which is in the new gallery of the Paris museum. The Durfort skeleton is 12¾ ft. in height at the shoulder bones, and 13¾ from the top of the head. It is 21⅓ ft. long from the end of the tusks to the posterior edge of the pelvis, and 17½ ft. from the front of the head to the back of the pelvis. These dimensions much exceed those of the skeleton of the Sansan mastodon, and even surpass those of the gigantic American mastodons. The Durfort skeleton is the largest entire skeleton of a fossil mammal thus far known.

We have isolated bones that announce still more powerful animals. Thus, Mr. Haussmann, while prefect of the Seine, gave the museum a humerus of the *Elephas antiquus* found very near Paris in the quaternary of Montreuil-sous-Bois. This bone measures 4¼ feet, while that of the Durfort skeleton measures but 4 feet. We have brought from Pikermi the tibia of a dinotherium which measures 3 feet, while that of the Durfort elephant is but 2·6, and also some metacarpals that present just as great a difference.

If the proportions of the tibias, humeri, and metacarpals and total height of the skeletons were the same in the *Elephas antiquus* and the *Dinotherium giganteum* as in the Durfort *Elephas meridionalis*, it would be necessary to suppose that the *E. antiquus* attained a height of 13 feet at the shoulders and 14½ at the top of the head, and that the dinotherium reached 13 feet at the shoulders and 16 at the top of the head.

So, two human giants, one standing upon the other, would not reach the top of the head of the Durfort elephant; and three six-foot men, standing one on the shoulders of the other, would scarcely reach the top of the head of the Pikermi dinotherium.

It is natural to find the maximum of size in the Pikermi dinotherium, for this majestic creature lived, along with two species of mastodon and anchylotherium, and a giraffe and a helladotherium, at the epoch of the upper miocene; that is to say, at the moment when the animal had its apogee.

The *Elephas meridionalis* and the *E. antiquus* lived in company with hippopotami in the warm phases of the pliocene and quaternary, in which there must have existed a rich vegetation. If there is anything astonishing, it is that the mammoth of the glacial regions of Siberia, doubtless living in districts too cold for the development of an arboreal vegetation, reached the large stature exhibited by the skeleton in the St. Petersburg museum.

It will be seen from what has just been said that if we wished to classify some of the largest mammals by order of size, it would be necessary to establish the following ranks:

1. *Dinotherium giganteum* of the upper miocene of Attica.
2. *Elephas antiquus* of the quaternary of the environs of Paris.
3. *Elephas meridionalis* of the upper pliocene of Durfort.
4. *Mastodon Americanus* of the quaternary of the United States.
5. *Elephas primigenius* of the quaternary of Siberia, and the present elephants.

It is not likely that man has seen the dinotherium, but it is certain that he has come face to face with the *Elephas antiquus* and the mammoth. In order to fight them, he had but stone axes, and yet he conquered them. This allows us to believe that our ancestors of quaternary times had spirit and courage.—*La Nature.*

Coal Oil and Natural Gas.

People often talk of the advantages of natural gas as a fuel without having an adequate idea of its importance. It is to-day the greatest commercial wonder of the age. No one can ponder over the following figures without being deeply impressed: It is only fifteen years ago, says the editor of *Stoves and Hardware*, published at St. Louis, that natural gas was first used as a fuel, yet to-day there is required to pipe it 27,350 miles of mains. In Pittsburg alone 500 miles supply 42,698 private houses, 40 iron mills, 37 glass works, 83 foundries and machine shops, and 422 miscellaneous industrial establishments. An idea of its value as fuel can best be obtained when the value of 7,000,000 tons of coal is estimated, as it is asserted that this amount of coal is annually displaced by natural gas. An idea of the effect a retarded production has in advancing prices can be seen in the shut-down movement in oil production.

This commenced in earnest just about a year ago, and the following is the result: In 1886, when no attempt was made to lessen production, the average run from wells was 70,666 barrels per day. In 1887, when there was less than two months' organized effort in this direction, the average daily run was 63,545 barrels. In ten months of 1887, ending November 1, when the movement was on foot in earnest, it was less than 44,000 barrels per day. The average price of certificates for the first ten months of 1887 was 64¾ cents, for the first ten months of 1888 it was 87 cents, an increase in value of 34½ per cent.

Vacuum Drying.

Mr. Beauder has applied the vacuum principle for the partial drying of fabric. The cloth is passed in full width on a horizontal cylinder, supplied with a slit through its entire length, just on the place where the cloth is allowed to pass. The cylinder is in communication with another tube, by means of which steam is introduced, which, by going out on the other side, creates a kind of vacuum in the cylinder, and by compelling the air to pass through the fabric and through the slit of the cylinder, effects a partial drying. The cloth is allowed to pass over the cylinder slowly only in order that a sufficient amount of moisture may be removed.

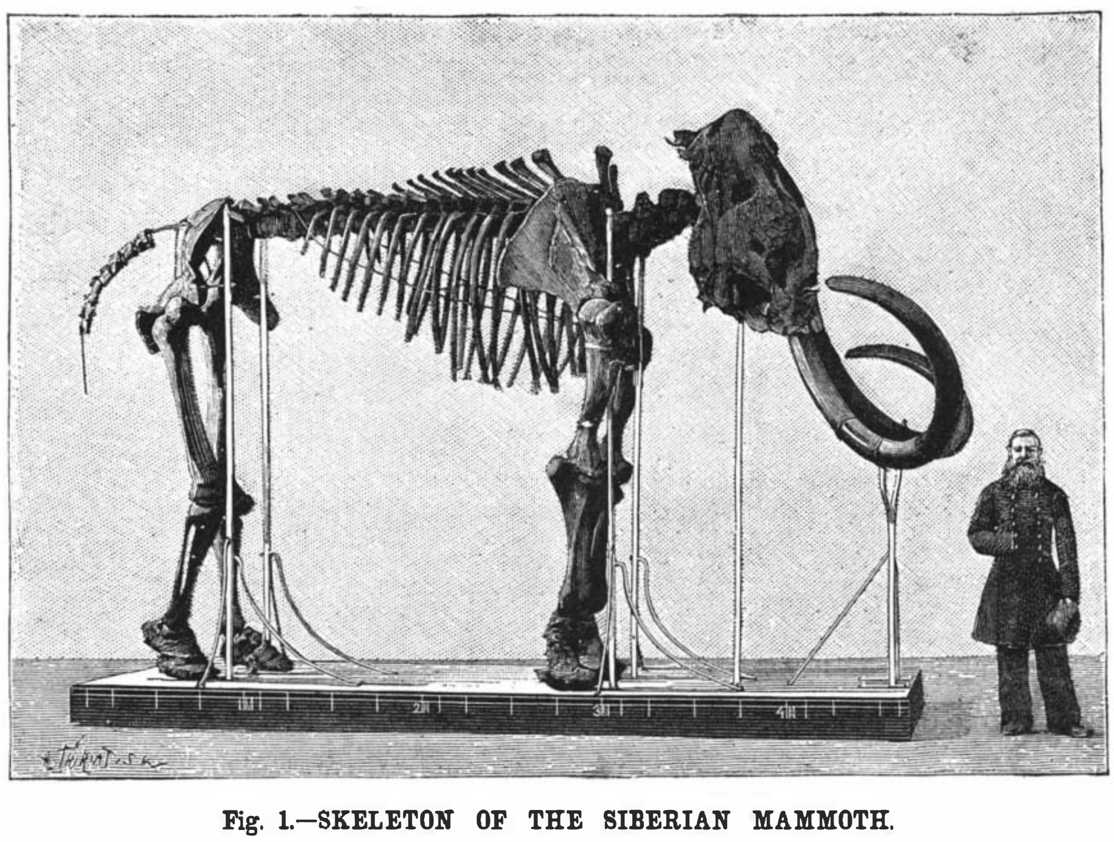


Fig. 1.—SKELETON OF THE SIBERIAN MAMMOTH.