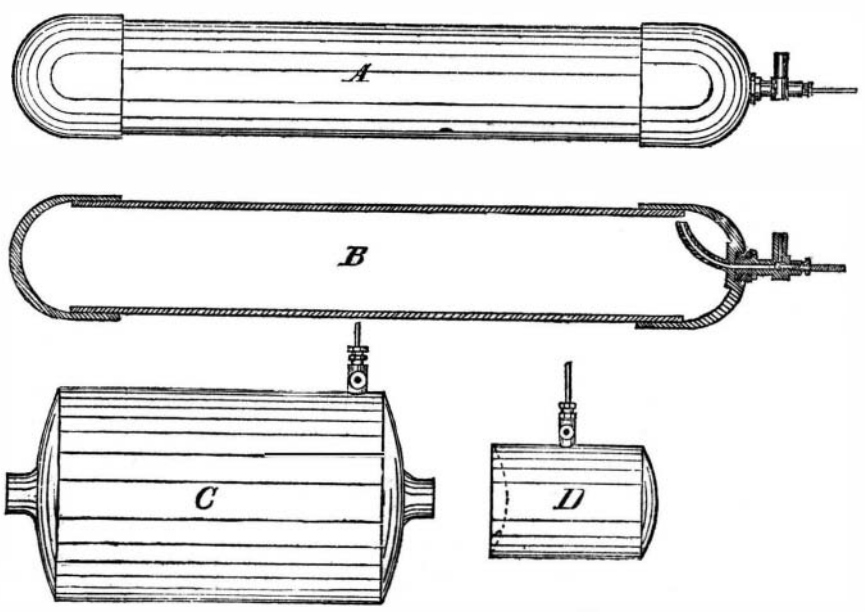
thing now apparent, either in point of efficiency or in cost' to prevent the success of the inventor's experiment. His mode of stowing the meat is illustrated in the annexed engravings, the object sought being of course to give a free circulation of the icy draft about every piece. For loading and unloading, it is proposed to use a scow, as shown in Fig. 1, in which the meat is packed after being taken from the ship, and so transported by canal, inland or to the wharves. The scow is fitted with a refrigerating machine and arranged somewhat similarly to the ship, as will be seen by comparing the two sections given. The mode of stowing the quarters will be understood from Figs. 2 and 3, of which Fig. 2 is a thwartship, and Fig. 3 a fore-and-aft, view of the hold. The meat is laid in regular lines upon a light framework in such a manner as to be securely held, and at the same time to take up but little room. The pipes, C and *b*, in Fig. 2, are respectively the inlet and outlet pipes for the cold blast.

The Frigorific, we learn, will shortly sail from France; and as the inventor has invited several members of the French Academy of Sciences to make the voyage in her, carrying with them any articles the possibilities of the preservation of which it is especially desired to test, it is probable that the experiment will be conducted under very close scientific investigation, and that a valuable report will be made.

FLASKS FOR LIQUID CARBONIC ACID.

In our article on carbonic acid gas as a motor, published recently, we neglected to state specifically that the apparatus described was the invention of Mr. W. N. Hill, chemist of the U. S. Torpedo Station, at Newport, R. I., although the fact was clear from the context. We hasten to rectify this inadvertence, and at the same time take occasion to add an engraving of the flasks referred to in our article as those in which the liquid carbonic acid is stored, after it is produced by the machinery at the rate, as we are informed, of 55 pounds per hour (continuous working).



FLASK FOR LIQUID CARBONIC ACID.

The Highest Signal in the World.

A new surveying signal has lately been erected on the summit of Mount Shasta, Cal., by the Coast Survey Department. The signal is a hollow cylinder of galvanized iron, twelve feet high and two and a half feet in diameter, surrounded by a cone of nickel plated copper, with concave sides, three feet high and three feet in diameter at the base; and its altitude is, according to the observations taken by the members of the Coast Survey, 14,402 feet. The nickel plating of the signal is a brilliant reflector, and will, from 6 to 9 A. M., and from 3 to 7 P. M., reflect the sunlight in such a manner that the reflection can be seen from the valleys and the mountains from which the summit of the mountain is visible. It is believed that it can be used for observations at a distance of one hundred miles, and possibly further.

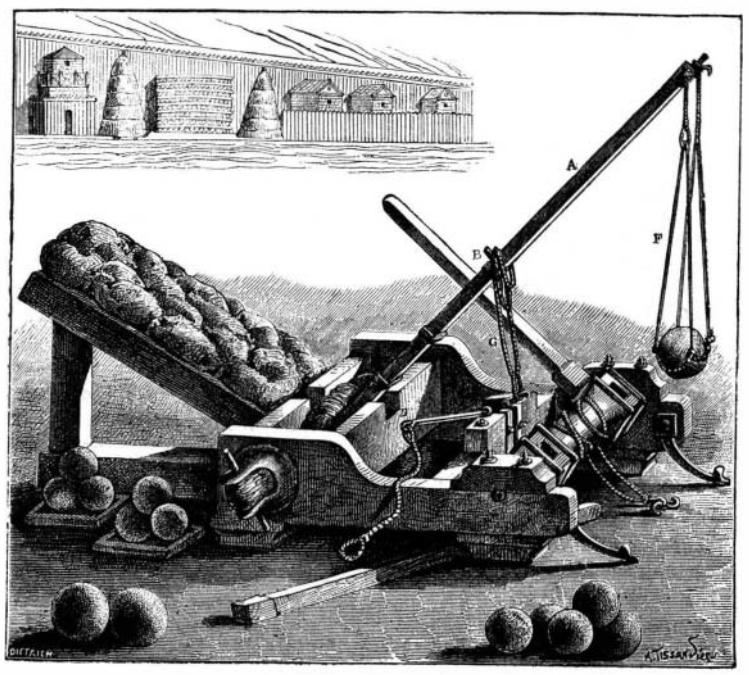
ANCIENT WAR ENGINES.

At the time when Napoleon III. was writing his life of Julius Cæsar, he caused to be constructed, at the Museum of St. Germain in Paris, a set of models of the weapons of war employed by the ancient Romans. These models (which were built, with the greatest care, according to the descriptions of Latin authors and after the representations in bas-relief on Trajan's Column), having served the purpose of the Emperor, remained objects of little interest until recently, when, under the direction of M. Maitre, Director of the Museum, a series of experiments were conducted upon them in order to determine their power. The results obtained are of historical importance, since they enable us to form a good idea of the means of attack on which the armies, which dominated Europe eighteen hundred years ago, relied.

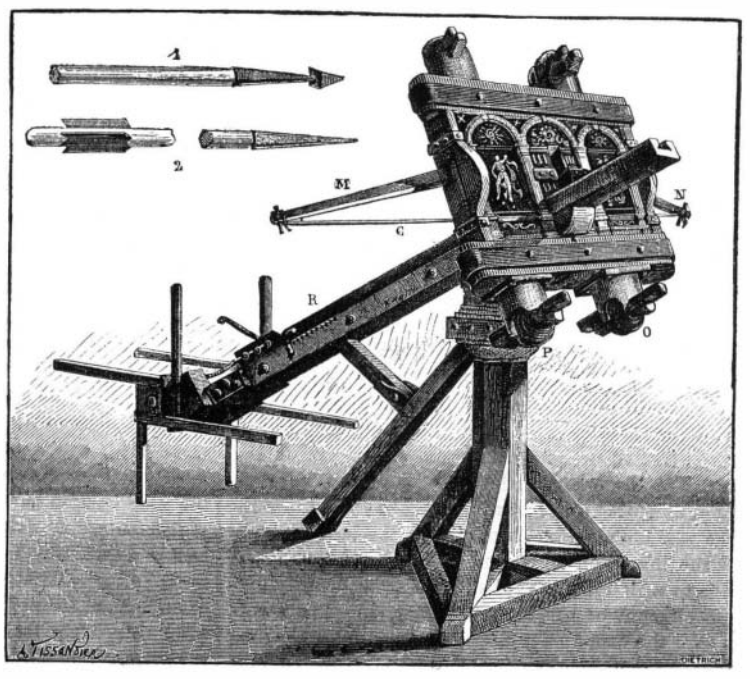
Two of the largest war engines are represented in the annexed engraving, for which we are indebted to *La Nature*. The onager, Fig. 1, consists of a wooden lever, A, which at its lowest end is inserted in a bundle of tightly twisted cords. These last are fixed on a massive frame, and there submitted to extreme torsion, so as to store up in them a powerful reacting force. By the aid of a windlass, the lever, A, is drawn back, thus still further twisting the cords, and the lever is secured in this position by the rope, C, passing over a hook, B. A sling, F, is suspended from the extremity of the lever, and carries the stone bullet. By means of a stop, the catch, B, is freed, when the lever flies forward with great force, bringing up against the cushion placed to receive its impact. The movement is so rapid that the eye cannot follow it, and the projectile is hurled to a distance, varying from 415 to 515 feet, according to weight. The velocity of the ball is low and its flight can easily be seen. The diameter varies from 3·1 to 5·8 inches. It is supposed that these missiles were thrown from the onager at very near range, and that they were also used to drop or roll down upon attacking parties from the summits of fortresses or palisades.

The balista, represented in Fig. 2, is a much more formidable weapon, since it is a huge crossbow mounted on a frame, which often was supported on wheels so as to be conveniently moved from place to place. For the bow is substituted two short arms, M and N, passed through bundles of twisted cords, O and P, similar to the arrangement in the onager. As the string of the balista cannot be pulled back by hand, this is done by catching it over the wooden piece, R, which last is then drawn back by the windlass. When a sufficient tension is obtained, the cord is fastened on a catch, and an arrow is placed in front of it in a suitable groove. By freeing the catch, the string flies forward, throwing out the projectile, which is of the form marked 1 and 2 in the engraving, and made of tough wood and iron The length of the missile is 4·1 feet and weight from 2½ ozs. to 1¼ lbs. The range varied, with the weight, from 690 to 480 feet.

At the upper portion of Fig. 1 are sketched the various types of defensive fortification used during the period when the above described weapons were in vogue. These consisted in walls flanked by salient towers. The Romans knew of but three varieties of fortress: the *castrum*, which included not only regular camps but any walled place; the *castellum*, which is analogous to the baronial castle of the middle ages; and the *burgi*, which were similar to but less important than the *castella*.



THE ONAGER.



THE BALISTA

ROMAN WAR ENGINES.

TO FILL holes in burrstones, use melted alum mixed with burrstone pulverized to the size of grains of sand.

A New Reagent for Gold.

Sergius Kern says: "Studying the action of sulphocyanates on some double salts of gold, I have found a remarkably delicate test for gold; experiments prove that even less than $\frac{1}{16000}$ of a grain of gold may be easily detected by using my reagent.

The gold is first separated from foreign metals, and next converted by means of sodium chloride into sodio-gold chloride; the solution is then concentrated by evaporation. In order to detect gold, an aqueous solution of potassium sulphocyanide is used, containing for one part of the salts about 15 to 20 parts of water. About 92 grains of this solution are poured into a test tube, and some drops of the concentrated solution, obtained by treating the sample as described above, are added. If gold is present, a red orange turbidity is immediately obtained, which soon falls in the form of a precipitate; on gently heating the contents of the test tube, the precipitate dissolves and the solution turns colorless.

The reagent is so delicate that one drop of a solution of sodio-gold chloride (15 grains of the salt dissolved in 600 grains water) gives a very clear reaction.

This reaction showed the existence of very interesting double sulpho-cyanides of gold."—*Chemical News.*

A New Electric Machine.

The apparatus, by S. C. Tisley, consists essentially of an electro-magnet with shoes, forming a groove in which a Siemens armature is made to revolve: this is much the same as the original machines made by Siemens and Wheatstone, but the difference occurs in the break or commutator; here there are two springs or rubbers employed in taking the current off frem the commutator. The commutator consists of three rings; one of these rings is complete for three quarters of the circle, the other quarter being cut away; another ring is cut away three quarters, leaving the one quarter; and in between these two rings is a third ring, insulated and connected with the insulated end of the wire wound round the armature; on this center ring are projecting pieces, one a quarter of a circle and the other three quarters, so arranged as to complete the two outer circles. The rubber spring which comes into contact with the quarter of the middle circle is connected with the electro-magnet of the machine, and the armature is so arranged that at the time of contact the best magnetizing current is displayed. The other spring rubber is in connection with the wire on the armature during the other three quarters of its revolution; and this is connected with any external piece of apparatus required to be worked

By this arrangement, the alternate currents being utilized, they are all in the same direction; and by the length of contact the whole of the current is obtained in the best condition for heating wires, decomposing water, giving an electric light, and other usual experiments.

At present a model machine has been constructed on this principle, the armature of which measures 5 inches long by 2 inches in diameter, on which is wound about 50 feet of cotton-covered copper wire, No. 16 B. W. G. The magnet has about 300 feet of covered copper wire, No. 14 B. W. G.: the whole instrument, without the driving gear, weighs 26 lbs.: with this apparatus 8 inches of platinum wire, of 0·005 inch diameter, can be made red hot, water is rapidly decomposed, etc.

The armature is constructed specially to prevent the accumulation of heat to which every class of dynamo-magneto-electric machine is liable. It is made in two halves, a groove of zigzag form being cast in each half; so that, when the two are screwed together, a continuous channel is maintained through the bearings for a current of cold water to pass during the whole time the machine is at work.

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