THIRTEEN-INCH GUN FOR THE "KEARSARGE."

As far as the body of the new 13-inch gun for the "Kearsarge" is concerned, there is very little difference observable as compared with the 13-inch guns of the "Oregon." It is generally similar in its construction as far as the tube, jacket, and hoops are concerned. The improvements, which are many and very valuable, are in the direction of greater convenience of handling and rapidity of fire.

If this gun be compared with one of the older type 13-inch, it will be seen that the greatest changes have been made in the breech-mechanism and in the mounting. The older gun was mounted directly upon its carriage by means of trunnions which were formed upon the gun itself, and recoiled with it upon firing. The new gun is mounted and slides within a large cylinder or sleeve, as shown in the illustration. This sleeve is provided with trunnions which are journaled upon the gun mounting. When the gun is fired it recoils within the sleeve, its movement being controlled and the gun brought gradually to rest by means of four recoil cylinders which form part of the sleeve, and are placed two above and two below the gun. The piston rods are attached to four lugs on a massive ring which is shrunk on the breech of the gun. Consequently, when the gun is fired the pistons recoil with the gun, the cylinders remaining stationary in the sleeve. The recoil is controlled by a set of powerful coil springs within the cylinders and at the back of the pistons, aided by the resistance of a mixture of glycerine and water, which flows past the pistons by means of a series of longitudinal grooves cut in the walls of the cylinders. The grooves are so arranged that the flow of the fluid is gradually throttled as the gun recoils, thus bringing the great mass of sixty tons to rest without any sudden shock. Although the gun starts on the recoil with an energy of 33,627 foot-tons, it is brought to rest within a distance of 40 inches. Glycerine and water are drawn in after the pistons during the recoil and are shut in by a valve when the recoil is completed. When the valve is opened the elasticity of the coil springs serves to force the gun slowly back to its firing position in the sleeve.

The sleeve is made in halves for convenience of manufacture, and is strongly bolted together as shown in the engraving. The gun is turned and finished with great accuracy, and slides upon special wearing surfaces consisting of several rings of metal which are recessed and hammered into the interior surface of the sleeve and then carefully bored to size. Other important improvements tending to rapidity of fire have been made in the breech-mechanism.

In the first place, the breech-block has six equal channels cut through the thread, as against the four channels which were common in earlier guns; and hence it is only necessary, in unlocking the breech, to give the block one-twelfth of a turn, as against one-eighth. In the new mechanism, the three operations of rotating the block, withdrawing it onto the tray, and swinging the block and tray aside clear of the breech, are performed by the continuous rotation of a single crank at the side (in our engraving the left side) of the breech.

The construction and operation are as follows: The crank and shaft, which are carried by a bracket bolted to the breech, serve to operate a worm which engages a worm-wheel at the top of the hinge-shaft of the breech-block tray. Below the worm-wheel is another wheel, which in the first part of the rotation of the hinge-shaft acts as a worm-wheel on a circular worm-rack on the breech-block, rotating the block. The instant the rotation of the block is complete the same worm-wheel acts as a gear-wheel on a horizontal rack attached to the side of the block and withdraws it from the screw box onto the tray. As soon as the block is clear of the box, the continued turning of the hand-crank traverses the tray and block to the left, clear of the breech.

This improved mechanism has reduced the time and labor of these big guns to a very marked extent. At an official test of a 13-inch gun fitted with the Fletcher mechanism, as it is called, the breech was opened in 8¾ seconds, and all the operations of opening breech, loading and firing were executed in 1 minute 47 seconds. This is a reduction of nearly fifty per cent as compared with the older guns.

The 13-inch guns for the "Kentucky" and "Kearsarge," if fired with brown powder (smoke-producing), have a muzzle energy of 33,627 foot-tons. If smokeless powder is used, they will have a resulting energy at the muzzle of about 44,000 foot-tons. As a very satisfactory smokeless powder is now being made for the navy, it is not likely that any of the obsolete brown powder will ever be taken into the magazines of these new ships.

A "MAGIC" MIRROR.

JAPANESE MAGIC MIRRORS.

The ladies of Japan use, in making their toilet, a small round mirror, several inches in diameter, made of a kind of speculum metal, brightly polished, and coated with mercury. At the back there are various devices, including Chinese and Japanese written characters, emblems, landscapes, etc. These stand out in bright relief and are polished like the front surface. Now, if the direct rays of the sun are allowed to fall upon the face of the mirror and are then reflected on a screen, in many cases, though not in all, the figures at the back will appear to shine through the substance of the mirror as bright lines upon a moderately bright ground. These are so-called Japanese "magic" mirrors, but we believe they are found in China as well, and the example which we illustrate is surmised to be of Chinese origin.

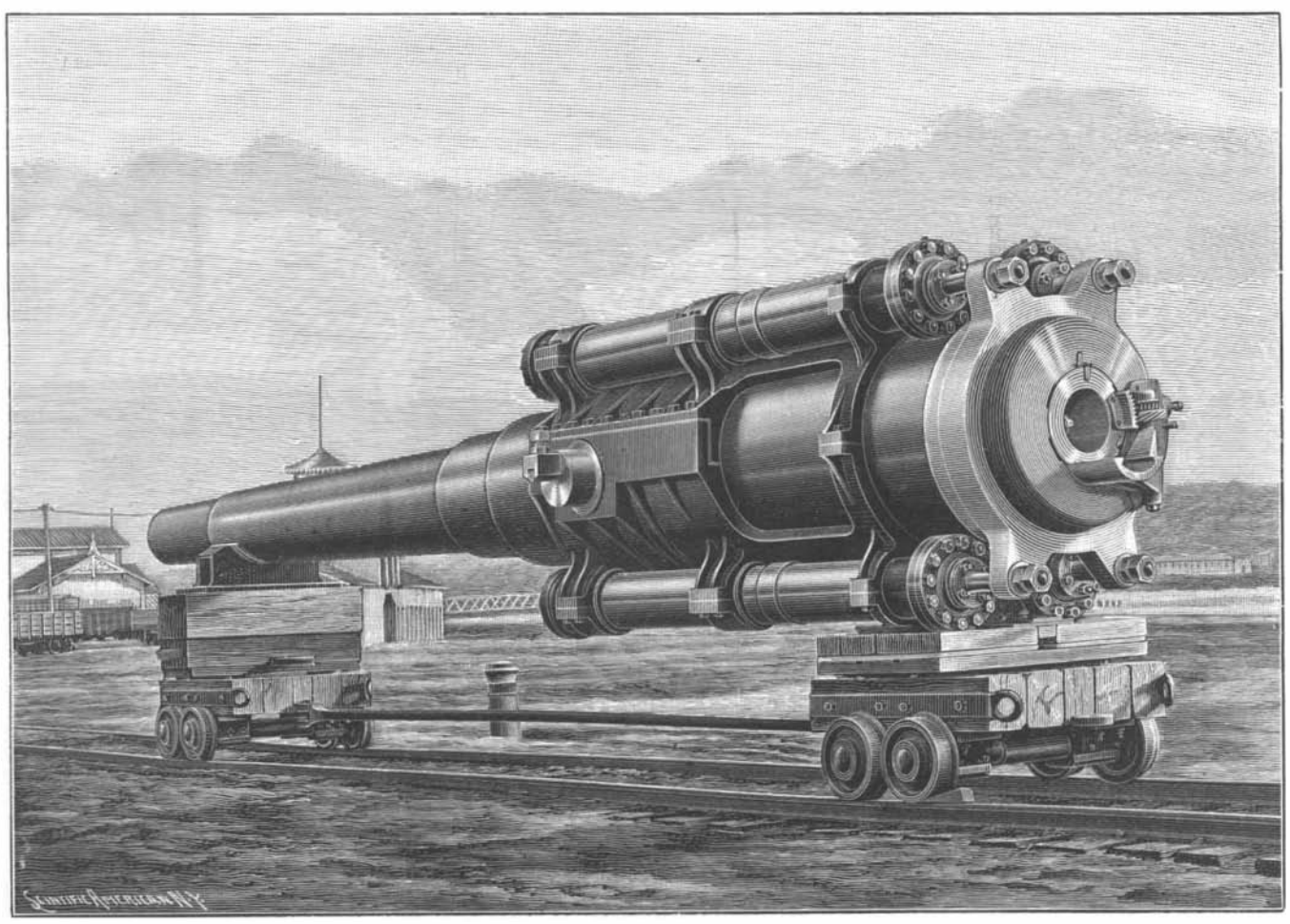
There have been many theories as to the process of endowing mirrors with the peculiar property we have mentioned. Some writers consider that the pressure to which the mirror was subjected during the polishing, and which is greatest on the parts in relief, was concerned in the production of figures. If the back of the mirror is rubbed with a blunt-pointed instrument, bright lines appear in the image corresponding to the position of the part rubbed. This experiment is quite easy to repeat. It would seem as if the pressure on the back during polishing would cause some change in the reflecting surface corresponding to the raised parts whereby the amount of light reflected was greater, or supposing that of the light which falls upon the surface a part is diffused and the rest concentrated, those parts corresponding to the raised portion on the back are altered by the pressure in such a way that more light is reflected, and therefore a bright image appears. The theory now generally accepted is that of Professors Ayrton and Perry in 1878. They showed that the patterns seen in the reflection were due to differences in the curvature of the surface produced by bending and subsequent polishing. Warming a mirror also alters its possibilities. A thick mirror which gave no patterns when cold sometimes developed one upon being heated. Professor Thompson has shown that a glass mirror having a pattern cut on the back developed image properties when the mirror was bent. By using very thick glass, passing a spirit lamp behind a strip of mirror, a dark band may be caused to pass along the screen, illuminated by light reflected from the mirror. Professor Thompson has also found that Japanese mirrors which were not image mirrors when imported could be made so by bending them mechanically so as to make them slightly convex.

Japanese mirrors are made as follows: The mould, which consists of two parts, is constructed of clay mixed with levigated powder of a black stone and a little charcoal powder and water, until the paste is plastic and suitable for being moulded. It is then roughly formed by the aid of a wooden frame into square or round cakes. The surface of the latter is covered with a levigated half-liquid mixture of old crucibles which have been broken and powdered. The blackish paste in the frame receives the concave designs by the aid of a woodcut in relief. The parts of the mould are put together in the frame and dried. Several of these moulds are then placed in a melting box made of clay and the fragments of broken crucibles. This box on the top has an opening into which the liquid bronze is poured. The liquid metal fills the moulds and the gates are chipped or broken off in the ordinary way. For mirrors of the best quality the following mixture is used:

Lead	5 parts.
Tin	15 "
Copper	20 "
	40 parts.

After being cooled the melting box and the moulds are crushed and the mirrors are taken out. They are then scoured and filed until they are roughly finished, and are then polished with a levigated powder formed of a soft kind of whetstone; they are then polished with charcoal and water. When the surface of the mirrors are well polished they are covered with a layer of mercury amalgam consisting of quicksilver, tin, and a little lead. The amalgam is rubbed vigorously with a piece of soft leather, which manipulation must be continued for a long time until the excess of mercury is expelled, and the mirrors have a fine, bright, reflecting surface.

We are indebted to Harry Hales, of Ridgewood, N. J., for the use of the mirror which we were enabled to photograph. The mirror is 6⅝ inches in diameter; the handle is 3½ inches long; and it weighs ⅝ of a pound.



THIRTEEN-INCH BREECH-LOADING RIFLE OF THE "KEARSARGE."