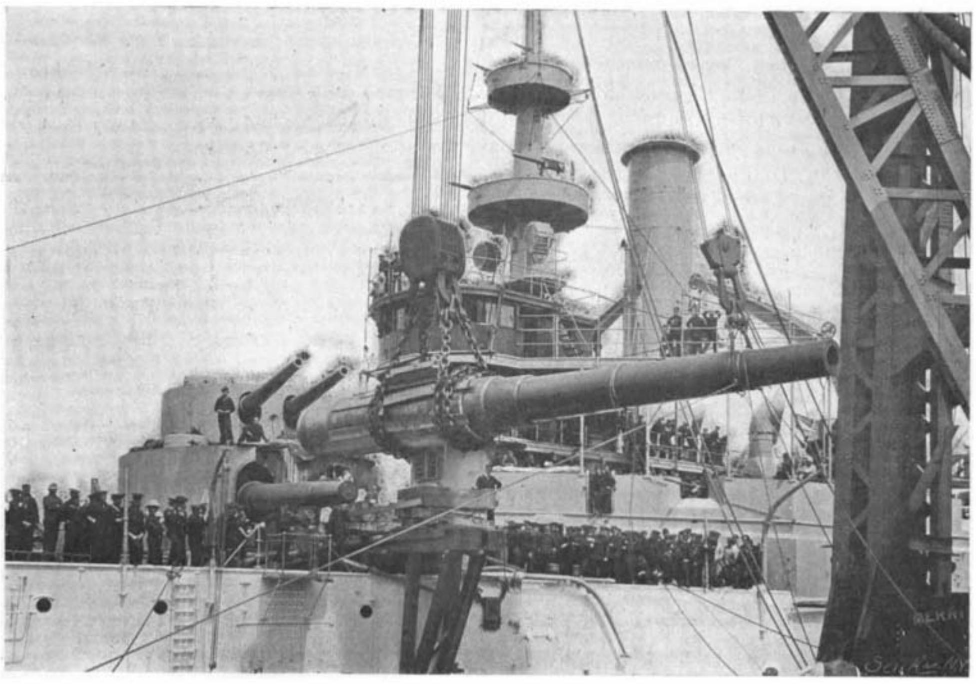
REMOVING THE DISABLED 65-TON GUN OF THE "KEARSARGE."

During the recent cruise of the "Kearsarge" in southern waters, and in the course of some target firing by the heavy guns, a shell exploded in the bore of the port 13-inch gun in the forward turret. As the fragments of the shell swept through the bore, they cut deep scores through the rifling which, in some cases, were over an inch in depth. The gun was condemned and a new one ordered in its place.

The "Kearsarge" is the first of our battleships to carry her main battery in double turrets, the 13-inch guns being carried in the lower turret, and the 8-inch in a secondary turret superposed above the 13-inch turret, in the manner shown in our illustrations. The removal of the damaged gun from a single-deck turret of the ordinary type would have been a comparatively simple matter, involving merely the removal of the 3-inch plating of the roof, and the lifting of the gun directly from the turret, breech first. But in the case of a double structure in which the upper turret with its pair of guns weighed over 170 tons, the problem of getting out the gun took on a very serious aspect, so much so, indeed, that it has been unofficially stated that the builders of the ship required $75,000 and three months' time in which to do the job. To remove the upper turret *en masse* would have been, if not impracticable, at least a very delicate operation, and it is more than likely that its removal would have necessitated its practical dismemberment, and its reconstruction after the new gun had been put in place.



THE 65-TON GUN BEING LIFTED BY THE FLOATING DERRICK FROM THE SHIP TO THE WHARF.

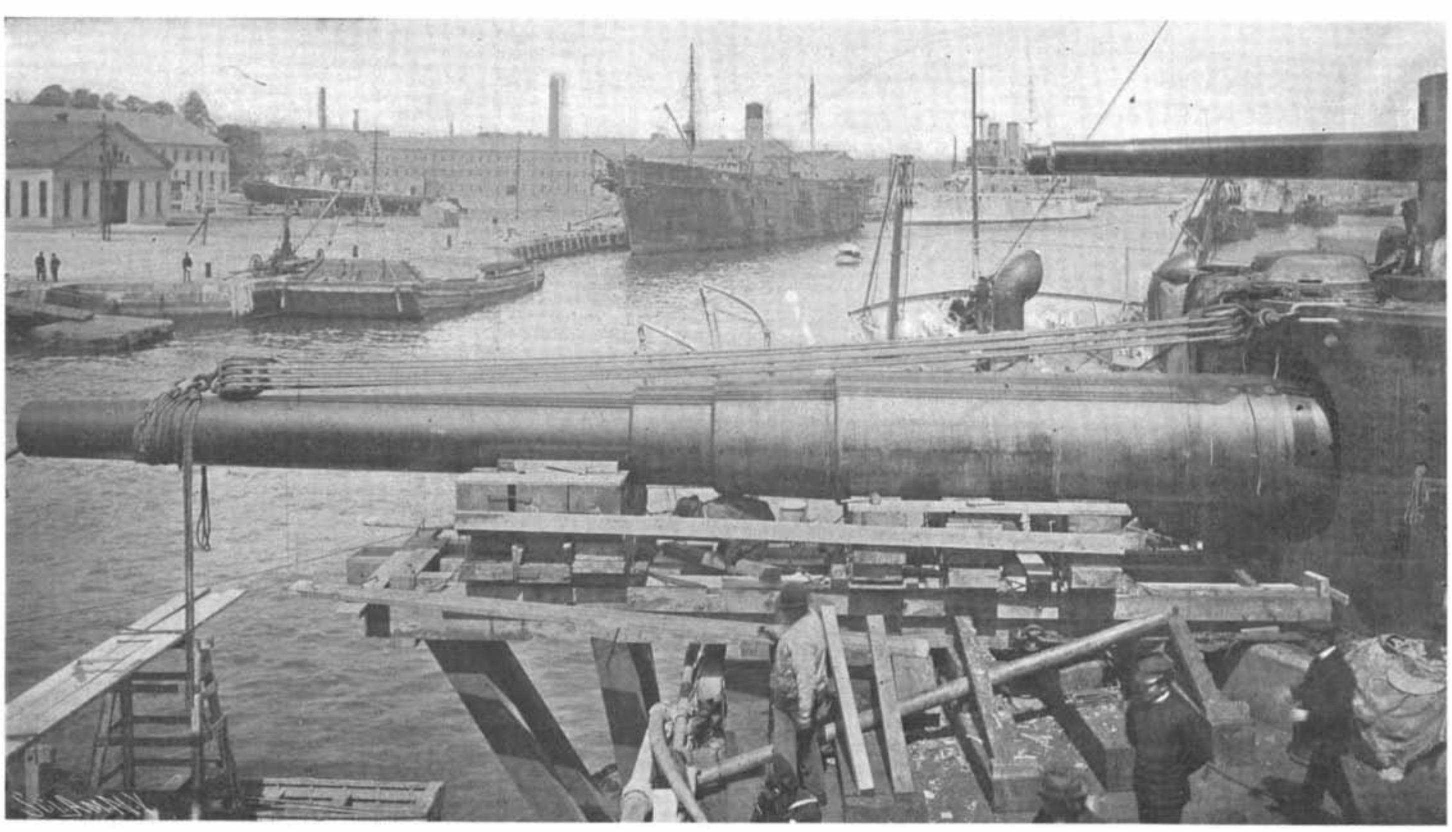
The "Kearsarge" was sent to the Brooklyn navy yard, and a careful survey of the turret was made by Naval Constructor Capps, to determine whether it would be possible to remove the gun without disturbing the superposed 8-inch turret. It was ascertained that by lifting the gun from its recoil sleeve, and doing a slight amount of chipping on the horizontal joints of the sleeve, the gun could be removed, without any further dismantling of the turret than the removal of two port-plates and some of the angle iron framing at the ports.

THE 15-INCH AND 17-INCH PORT-PLATES AFTER REMOVAL FROM THE TURRET.

By the courtesy of the Department we are enabled to present three photographs, showing the methods by which the work was done. The first step was to remove from the interior of the turret the mantlet plates adjoining the gun port. Extra long wrenches were then used to unscrew the 3-inch bolts by which the port armor plates are fastened to the backing. Then the two plates themselves, which are 15 and 17 inches in thickness, and weigh respectively 35 and 28 tons, were picked up by a floating derrick and placed on the adjoining wharf. When the armor plates had been removed, the reverse angles which run around the port opening, and abut on the backing, were cut loose and removed. This left sufficient clearance to admit of the gun, which is 49 inches in diameter over the breech, being removed through the port. Had the 13-inch gun been of the old pattern, in which the trunnions form part of the gun itself, its removal by way of the gun-port would have been impossible; but fortunately it was of the latest pattern, in which the gun recoils within a sleeve, the trunnions being formed upon the sleeve and not upon the gun. The sleeve is formed in two halves which are joined in a horizontal plane. It was found that by unbolting the sleeve it was possible to raise the upper half to a vertical distance of 10 inches, or until it touched the roof of the turret. Then, by lifting the gun itself vertically through 5 inches, or half this distance, it was found that the gun could be drawn forward clear of the sleeve provided about 1¼ inches of metal was chipped away from the corners of a lip which projects inwardly at the forward end of the sleeve. These facts were determined by making a full-sized drawing of the gun and sleeve, and allowing about a quarter of an inch clearance after the corners of the sleeve had been removed. It should be explained that the forward lip of the sleeve, which is turned in toward the center for a depth of 2½ inches, is provided to secure the gun against counter-recoil after it has been fired, and the chipping was necessary simply upon the corners of this lip at the joint.

While this work was being done inside the turret, a ways was laid from the turret port athwartship across the deck to receive the gun. This ways consisted of several lines of timber which extended out for several feet beyond the deck, its outer end being carried by heavy struts extending from the upper edge of the waterline belt of armor to the outer end of the ways. To prevent any distortion of the deck, due to the great load of the gun, heavy bracing was carried down from the main deck through to the protective deck. When everything was ready, the gun was lifted 5¼ inches from the sleeve by means of a special breech saddle, under which were two 90-ton hydraulic jacks, and by a third 90-ton jack placed beneath the chase of the gun outside of the turret. When the gun had been lifted clear of the sleeve, two special, sliding, saddles of metal, turned to the radius of the gun and the sleeve, were placed one at each end of the sleeve between the sleeve and the gun. The inner face of these saddles was babbited. The gun was now pushed out of the turret by hydraulic jacks, and as it passed on to the ways it was received by heavy wooden sliding saddles, one under the chase and another, 6 feet in length, at about the center of gravity of the gun. Obviously, with clearances so slight, it was necessary that provision be made for correcting the compression of the ways under the weight of the gun; and this was done by providing flat oak wedges, 10 inches wide, which were driven home from time to time beneath the wooden saddles to keep the axis of the gun up to its proper level. As soon as the gun was clear of the turret it was picked up by the 250-ton floating derrick and placed on the wharf. The new gun was then slung onto the ways, and was forced back into its place in the sleeve by means of hand-operated jacks, which were heeled against transverse timbers that had been provided for the purpose between the longitudinal timbers of the ways. It should be explained that the heavy tackle which is shown made fast near the muzzle of the gun and carried back to the turret was one of several measures of precaution taken against any possibility of accident.

Work was commenced on April 25 and the gun was in position and the turret plates restored by the 23d of May, the whole job being successfully carried through at a cost which will be within $10,000. We are indebted for our information to Naval Constructor Capps, under whose supervision this most interesting and difficult work was carried out.



THE INJURED 13-INCH GUN RESTING ON THE WAYS, OUTSIDE THE TURRET.

The illumination of Niagara Falls by searchlight will take place during the passage of all trains at night.

Water in Ancient Rome.

In a remarkable address delivered before the Institution of Civil Engineers of London, its president, Mr. Mansergh, has destroyed the secular legend of the profuse distribution of water to the inhabitants of ancient Rome. Some extracts from his address follow, translated from a French version, and therefore not in his very words.

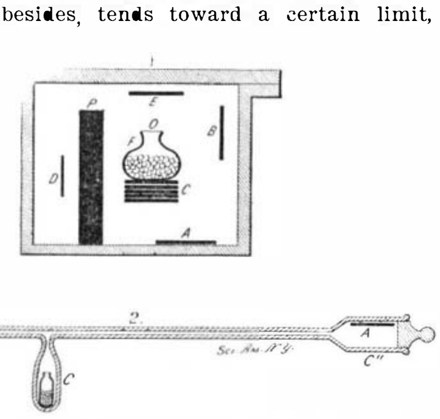
"We are used to hearing of enormous quantities of water brought to Rome by the great aqueducts which Frontinus has described and which existed down to the beginning of the Christian era. I had always thought that the figures given were much exaggerated," he says. "To-day it is evident that the volume of water so distributed was never properly measured, either at the inlets of the aqueducts or at their outlets, and no one seems to have understood the methods of calculation that will give the volume delivered when the section of the aqueducts and their slope are given."

The estimates of Frontinus were based on the discharge of a number of different openings of different sizes, and he takes no account of the difference between the discharge of 100 separate openings each an inch square, for example, and the discharge of one opening of 100 square inches. The unit of measure cited by Frontinus was a *quinaria*, a circular opening four square centimeters in area.

The discussions based on the data of Frontinus led to the conclusion that Rome was furnished with the enormous quantity of 1,400,000 cubic meters of water every twenty-four hours. These figures are absurd because they imply that the water flowed with velocities that have never been realized in practice. Moreover, we know from Frontinus and from Pliny that the nine aqueducts were rarely in operation at the same time, and having regard to all the data it follows that the daily supply of water was about 144,000 cubic meters, which would give about 144 liters (about 38 gallons) per head to the population of a million inhabitants. This supply will not seem excessive when we consider the great expense of water in the public baths and in the fountains. It must be remembered also that most of the houses were supplied by water carried by slaves, and that many wells and springs were also utilized in dwellings.

THE EXPERIMENTS OF M. CURIE.

M. Curie, in continuing his researches with regard to the rays given off by radium, has studied the remarkable phenomena of induced radio-activity. M. and Mme. Curie had already found that a substance, when placed in the neighborhood of the radiferous salts of barium, became itself radio active, and that this induced activity persists for a long time after the exciting body is removed. It diminishes, however, with time, at first rapidly, then more and more slowly. The phenomena of induced radio-activity have been also studied by Mr. Rutherford, who shows that air which has remained for some time in the neighborhood of oxide of thorium (a radio-active body) and then carried into a current to a distance, retains its property of communicating the radio-activity to other bodies. Mr. Rutherford explains these phenomena by supposing that the oxide of thorium gives off a special kind of emanation which is capable of being conveyed by the air, and that this is the cause of the induced radio activity. At present the question is far from being clear, and M. Curie, with M. Debierne, has made the following experiments in which he brings out some interesting facts. The phenomenon is much more strongly marked when it is carried out in a closed vessel. The active matter is placed in a thin glass bulb, *F* (see diagram), open at *O*, and placed in the center of a vessel completely closed. Three plates, *B*, *D*, *E*, suspended in different parts of the vessel, become active after one day's exposure. The plate, *D*, sheltered from the radiation by a lead screen, *P*, becomes active like the others. A plate, *A*, resting on the bottom, is made active upon the upper face, but not on the lower. In a series of plates in contact, *C*, placed against the bulb, it is only the exterior surface of the lower plate next the air that becomes active. All substances seem to take the activity in about the same way (lead, copper, glass, ebonite, paraffine, etc.). With a very active specimen of chloride of barium, the plates exposed for several days took an activity 8,000 times stronger than that of a plate of uranium of the same dimensions. When exposed to the air they lost the greater part of their activity in one day; the loss is much slower if the plates are left in the closed vessel, from which the exciting substance has been removed. Lastly, if the experiments are repeated with the bulb closed, no induced effect is produced in the plates. In a second experiment the small chamber, *c* (see diagram), containing the active body, communicates with the two others, *c'* and *c''*, containing the bodies, *A* and *B*, to be acted upon, by capillary tubes of diameter 0.004 inch and lengths 2 and 30 inches. The chambers were very small, and it was found that the excitation of *A* and *B* was produced as rapidly and as strongly as if they were placed in the same chamber as the exciting body. These phenomena were observed with different radio-active salts of barium and also with salts containing actinium; on the contrary, polonium compounds, even very active, did not produce the effect. As it is known that the latter do not emit rays which are deflected by the magnetic field, these two facts must be connected. It may be concluded, from these experiments, that the phenomenon is not produced by the ordinary rays of radium, but rather by extremely absorbable rays which act upon the air in immediate contact with the body. The induced activity is transmitted in the air by convection from the active body to another placed near it, and may thus pass even through capillary tubes. The activity, besides, tends toward a certain limit,



DIAGRAMS ILLUSTRATING THE EXPERIMENTS OF M. CURIE.

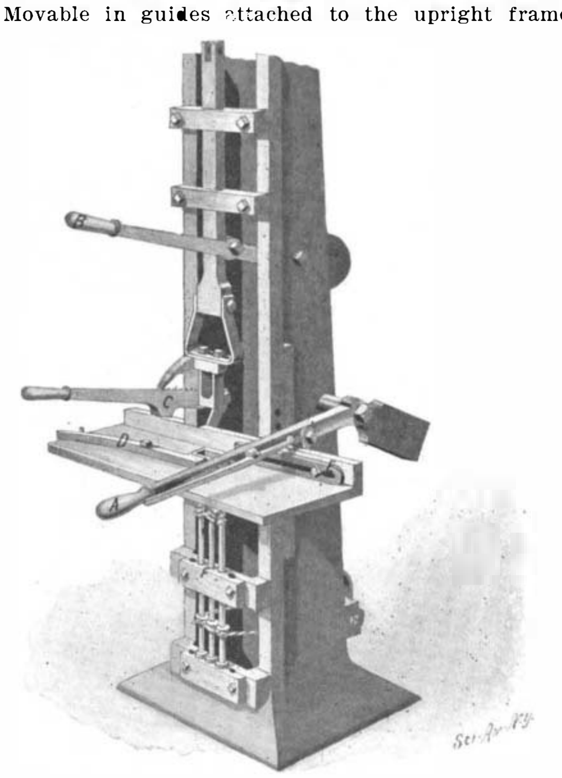
resembling an effect of saturation; this limit is higher as the exciting body is stronger. These experiments are in their first stage, and it is too soon to form a theory as to the cause of the action. M. Curie considers that these phenomena constitute one of the most important properties of radio-active bodies.

A PORTABLE MORTISING MACHINE.

The illustration herewith presented pictures a simple and cheap mortising machine invented by Mr. William J. Smith, of Detroit, Ore.

The machine comprises an upright frame on which a table, *D*, is vertically adjustable. To this frame a weighted table-adjusting lever, *A*, is fixed, by means of which the table can be raised and lowered. Arranged on the vertical backboard of the table is an adjustable gage-plate by which the work is engaged. Against the backboard the work is tightly held by a clamping-lever pivoted to the upper side of the table, which clamping-lever is in turn held in place by a pin inserted in a hole in the table. To prevent vertical movement of the work a second clamping-lever, *C*, is employed, which has a series of notches in any of which a locking-pawl may be engaged.

Movable in guides attached to the upright frame



THE SMITH MORTISING MACHINE.

is a chisel-carrying plunger operated by a hand lever, *B*, weighted so that it automatically moves upward after operation. The upper end of the chisel-carrying plunger may be engaged with a rocking-lever and the chisel operated by power if it be so desired.

Before cutting the mortise with the chisel, the work is bored by a gang of bits, *F*, mounted in the lower part of the upright frame and driven by belt and pulley. The table is moved down in order that the bits may come in contact with the work. After boring the table is moved up, and the chisel forced through the wood, making clean cuts at the sides and ends of the mortise. A protective shoe is employed to prevent the chisel from tearing the wood.

A Nice Place to Live.

The useful household magazine, Good Housekeeping, is responsible for the following:

"Imagine keeping a snake in the house to fill a cat's duties. That is what they do in Manila," says an American woman who has just returned from spending a year in the Philippines with her journalist husband. "The first night I spent in our own home was hot and smothering, so I lay wide awake, hoping for a breeze. Suddenly I heard a strange noise overhead. Manila houses are built of bamboo and are about as substantial as a bandbox, so one hears every rustle. I had listened to the scamper of a rat overhead, then came a queer noise like a stealthy slide. The rat gave a shriek of agony. I could hear the lash of the snake's tail and a terrible scrimmage all over the thin floor. They seemed to be rolling over each other and the snake was swallowing the rat. I heard it as distinctly as if I could see it. I shrieked louder than the rat had done, and in a moment every China boy in our establishment was in my room to see what had happened. Before I left Manila I grew as accustomed to finding a house snake on my floor as if it had been a cat. The house pests of the Philippines drive an American woman to distraction. Lizards are everywhere; you find them in your bed, in the dishes in the pantry, clinging to your gowns or napping in your bureau drawers. Some are no bigger than the chameleons we used to pet; others are a foot long. Ants of every size and sort simply inhabit everything you own. Every good housekeeper in Manila keeps the feet of her dining table standing in pots of oil. If you did not take that precaution one would be eating ants in every dish served."

Railroads of Roumania.

From official Roumanian sources, I learn, says Consul Hughes, of Coburg, that there are at present 1,932 miles of railway open to traffic, as against 1,550 miles in 1890 and 1,713 miles in 1895, while 72 miles are under construction and 360 miles under survey. The total expenditure on railways up to the present has been $140,000,000, including about $6,700,000 on the Cernavoda Bridge. Last year, the revenue was $8,992,761.55 and the working expenses about $7,299,750. A combination of lignite and petroleum is now largely used for fuel, a special apparatus having been invented for the proper consumption of the mixture. In 1896 only 2,200 tons of petroleum were consumed in the engines, but last year this rose to 15,200 tons; while the consumption of lignite rose in the same period from 17,200 tons to 67,000 tons. The railway administration recently initiated a weekly through service between Paris and Constantinople and Ostend and Constantinople via Bucharest and Constantza, and a daily service between Bucharest and Berlin via Lemberg.

A League Against the Rat.

Dr. Nashandi, a Japanese bacteriologist who has been visiting Chicago, declares that a league against the rat may be formed, says The New York Tribune. As a disseminator of disease this rodent works much more serious injury to human society than any already charged to his account. The malady with which these animals are most closely associated in the public mind is the bubonic plague. It is not uncommon for rats to die of that cause in a house before any human beings are attacked by it. Rats are such ramblers that it is possible for them to infect a whole neighborhood before the fact is discovered, and they even die in inaccessible places, so that their bodies remain hidden but active sources of infection for days and weeks.

The Current Supplement.

Probably the most interesting article in the current Supplement, No. 1326, is "The New Edison Storage Battery," by Arthur E. Kennelly. The storage battery seems destined to work a revolution in electric automobiles. The project of the Krupp Works is described and a number of their large guns are shown. "Preventive Medicine—The City of Havana as a New Field for Its Application" is by Dr. Erastus Wilson. "The Bacteria Beds of Modern Sanitation" is by Eliza Priestley. "The Gods of the Filipinos" is by R. I. Geare. "Agriculture in Hawaii" is an interesting article. "The Distribution and Conversion of Received Currents" is begun in this issue.

Contents.

(Illustrated articles are marked with an asterisk.)