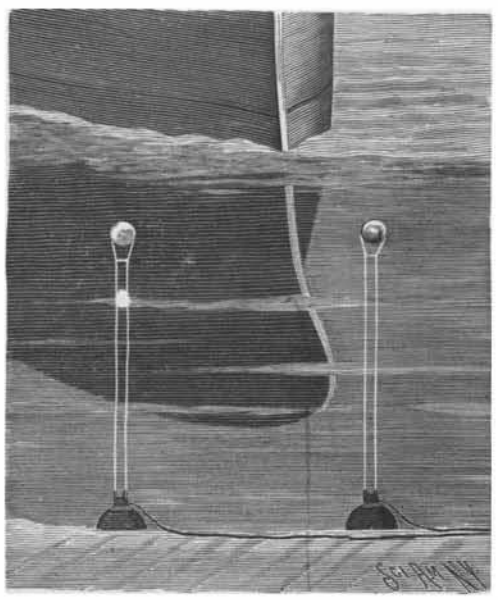
EXPLOSION OF SUBMARINE MINES IN BALTIMORE HARBOR.

The naval operations of the late war with Spain have afforded another demonstration of the value of submarine mines as an element—we had almost said the chief element—of coast defense against an attacking fleet. Their value was abundantly proved during the blockade of Santiago, the actual objective of which was the capture or destruction of Cervera's squadron. From the day of their departure from the Cape Verde Islands to the fatal Sunday morning on which they were driven upon the Cuban coast, these cruisers and torpedo boats were the storm-center of the war. No sooner had they cast anchor within Santiago Bay than our whole available naval force was concentrated at the entrance, in the expectation that the capture or destruction of these ships would probably mean the immediate close of the war—an expectation which proved to be remarkably correct.

Cervera's fleet being definitely located at Santiago,



SUBMARINE MINES IN PLACE, WITH ELECTRO-CONTACT BUOYS ATTACHED.

it was to the obvious advantage of this country that the crisis should be reached at once; yet, as a matter of fact, the ships remained unmolested in the harbor for several weeks, and were only finally destroyed as the result of their own voluntary departure from the harbor.

What was it that prevented our fleet from entering the harbor, and necessitated the dispatch of an army twenty thousand strong to assist in the capture of the vessels? It was not the guns of Morro Castle, for these have proved to be old muzzle-loading weapons of very limited range and power, nor were the more modern guns on the opposite shores of the entrance sufficient to successfully resist a modern armored fleet such as was drawn up at the mouth of the harbor. Our battleships and armored cruisers could easily have forced the entrance if the nondescript batteries that guarded it had been the sole means of defense. It was known, however, throughout Sampson's fleet that the tortuous channel was sown with the deadly submarine mine, and the existence of these defenses was sufficient to keep our powerful fleet outside during all the long weeks of the blockade.

It is not stretching the point too far to assert that if it had not been for a few sunken mines between Smith Cay and Morro, the army operations at Santiago would never have taken place. But for the existence of these mines, Admiral Sampson would have entered the bay, captured or sunk the Spanish ships, and confronted the city of Santiago with the alternative of capitulation or bombardment within a very few days after Cervera cast anchor in the harbor.

Apart from its enormous destructive power, the submarine mine exercises a powerful moral effect on the enemy, because of its invisibility and the practical impossibility of determining its exact location. It is the most quickly available of all systems of coast defense, and, unlike all other means of defense, its cost is out of all proportion to the damage it can inflict. It is pre-eminently the weapon of the weak.

Submarine mines are of three different kinds:

1. Observation mines, otherwise known as judgment mines, which are fired by an operator on shore, when the hostile ship is judged to be within range.

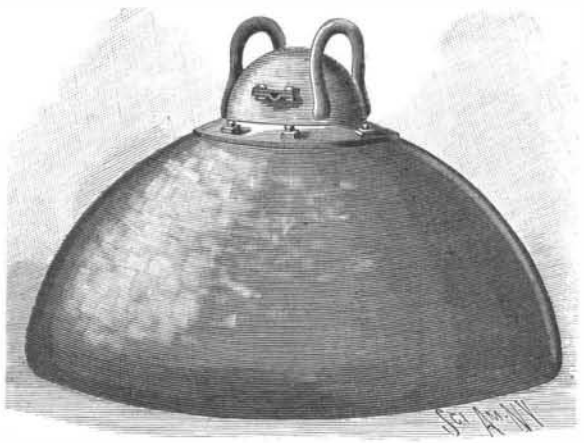
2. Automatic mines, which are self-firing on being struck by the hull of a ship.

3. Electro-contact mines, which are electrically connected with the shore, and, on being struck, cause a bell to ring at the firing station, where the operator switches on the firing current or not, according as the vessel is a hostile or friendly ship.

The accompanying illustrations show the form of ground mine most commonly employed in this country. It consists of the mine proper, containing the explosive, which is placed on the bottom of the channel, and the electro-contact buoys, which are anchored above the mine at a predetermined depth below the surface of the water. The body of the mine is made of cast iron. It is of a hemispherical shape, and is 4 feet in diameter and about 2 feet in height. The shell is 2 inches in thickness, and at the crown is a filling plug with electrical connections over which is bolted a wrought iron cap. The electric cable passes in through the clip shown on the side of the cap. The capacity of the mine herewith illustrated, which represents one of those which were used in the defense of Baltimore Harbor, is 250 pounds of explosive. When it is to be used as an automatic or as an electro-contact mine, the floating buoy is attached to the ears of the cap.

The floating buoy is a hollow, buoyant sphere, in which is placed a circuit closer, and it is provided with wires which lead from the buoy to a fuse in the ground mine and to the signal station. The mechanism usually consists of a ball or a pendulum, which, on the buoy being struck by a passing vessel, swings into contact with a metallic ring and closes the circuit. If the mine is fully automatic or self-firing, the closing of the circuit sends a current directly through the ground mine and explodes it; but if it is to be fired from a station on shore, the circuit closer merely serves to give warning to the operator, who, by the throw of a switch, sends a powerful current through the mine and explodes it.

Our readers will remember that immediately upon



SUBMARINE MINE OF TYPE USED FOR DEFENSE OF OUR HARBORS.

Charge, 225 to 250 pounds.

the declaration of war the harbors of this country were planted with mines, which were maintained in working order until news came of the destruction of the Spanish fleet at Santiago. This occurrence and the overtures for peace on the part of the Spanish government led to the removal of these obstructions to navigation. In some cases the mines were removed and in others they were exploded, in order to observe the probable effect they would have upon a passing vessel. Those placed for the defense of Baltimore were all removed from the ship channel except one group of three, which was exploded on July 18, with results as shown in Fig. 1.

This group consisted of three mines, placed 100 feet apart, in a triangle, and connected with the firing case-

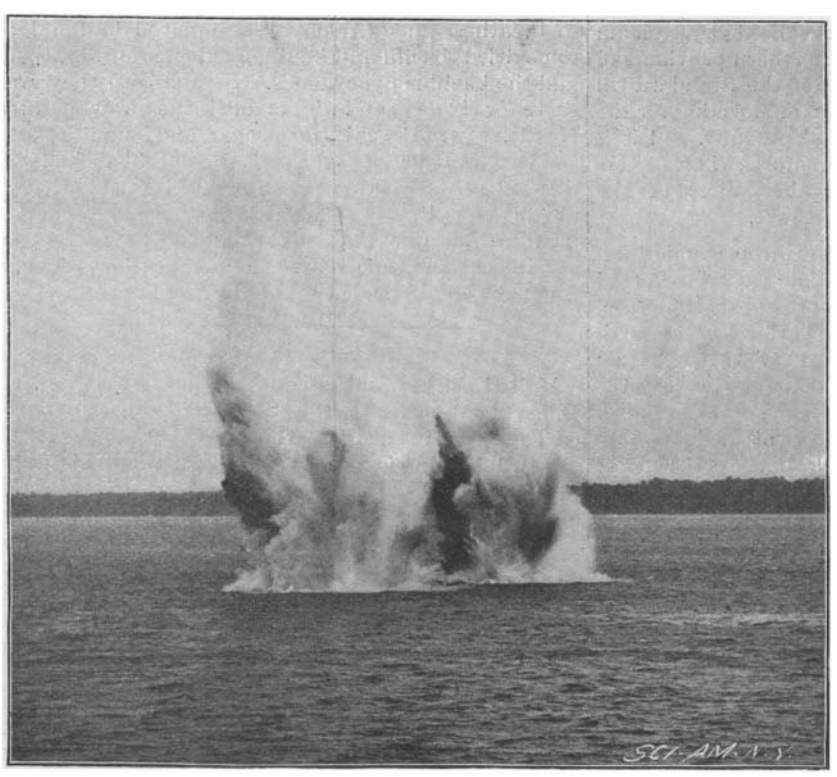


Fig. 1.—EXPLOSION OF A GROUP OF THREE GROUND MINES IN BALTIMORE HARBOR.

Charge of 225 to 250 pounds dynamite. Water 31 5 feet deep. Column of water 200 feet wide and 225 feet high.

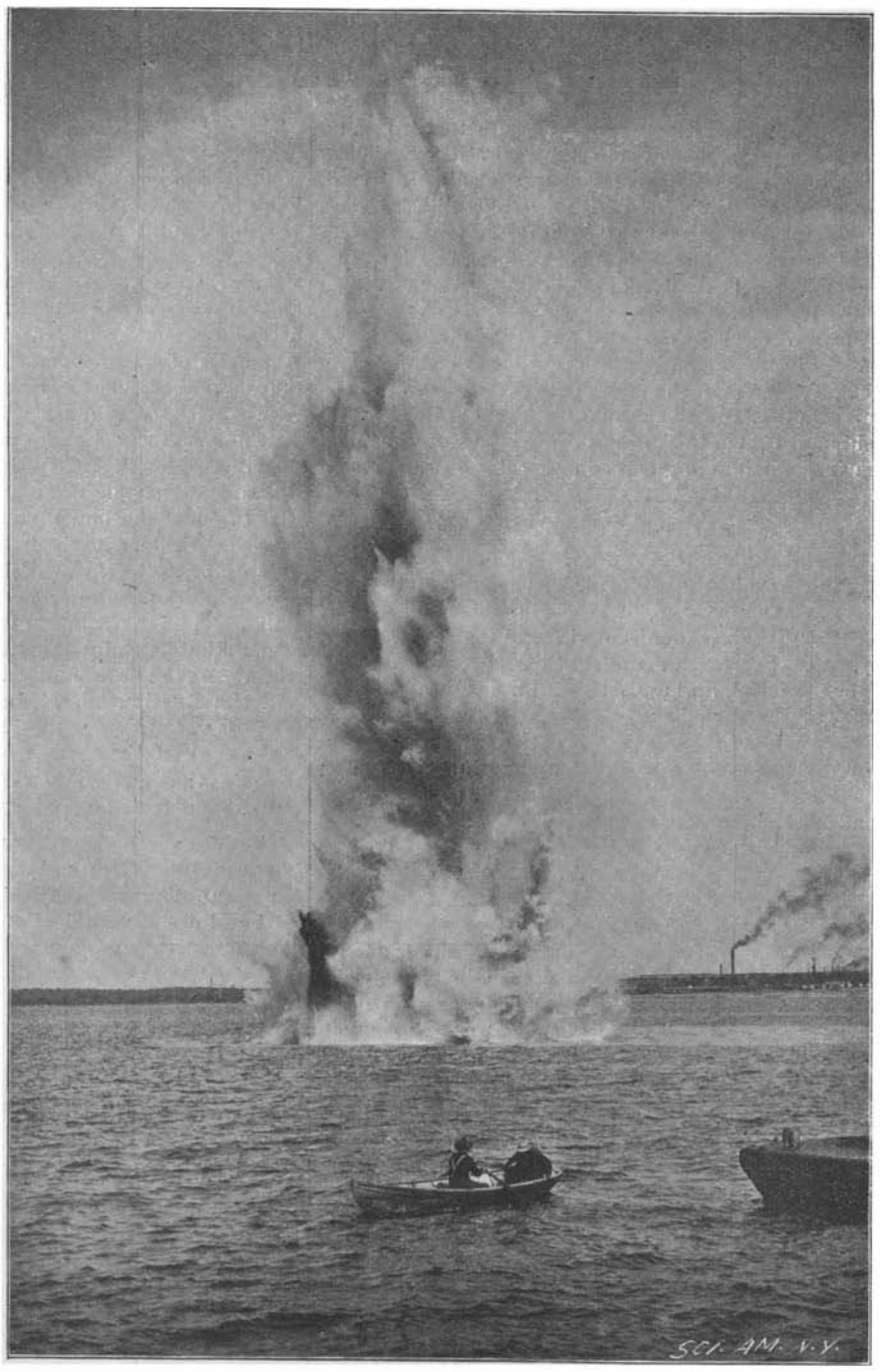


Fig. 2.—EXPLOSION OF A DOUBLE MINE IN BALTIMORE HARBOR.

Base of water column, 100 feet wide; height, 246 feet.

mate. They were each charged with 225 to 250 pounds of dynamite and were placed in 30½ feet of water; but, as the bottom consisted of soft mud, it is likely that in course of time the mines settled considerably. The photograph was taken at a distance of 1,200 feet and from a point 35 feet above the water. A careful measurement by triangulation showed the column of water to be 225 feet high and the base of the disturbance 200 feet wide.

The other mines, which had been removed away from the channel and placed in water 22 feet deep, were exploded on the 27th of August and the results photographed as before.

Fig. 2 was a double mine exploded at a distance of 500 feet. The base of the column was 100 feet wide and its height 246 feet.

In each explosion, except the first one, fragments of the cast iron shell were thrown to a great height and some of them were recovered. The negatives made as the column of water was ascending show the iron fragments in their flight.

A study of these photographs will give a more vivid impression of the terrific energy of these machines than can be gathered from any verbal or written description. They fully justify the caution which prevents a naval commander from entering a harbor protected by mine fields until by countermining operations he has cleared the way for his fleet.

A High Balloon Ascent.

A remarkable balloon ascent occurred at the Crystal Palace, near London, on September 15, by Prof. Berson, of Berlin, and Mr. Spencer. The large balloon reached an altitude of more than five miles, the exact height being 27,500 feet. This altitude has only been once exceeded, and that was by Glaisher and Coxwell in 1862, when they ascended 37,000 feet. A complete equipment of instruments was carried, and the observations and scientific results were most satisfactory. Mr. Spencer says the balloon went straight up at the rate of 1,000 feet a minute for 10,000 feet, when it struck air currents which turned it toward the southeast; at 18,000 feet it took a southwesterly direction; at 25,000 feet there was a decided feeling of dizziness and breathing became difficult. The aeronauts than began inhaling compressed oxygen, and the result was instantaneous. The men would have been unconscious had they delayed using the oxygen a moment longer, but with the aid of this gas they were able to attend to the manipulation of the balloon and the instruments. At 27,500 feet there were only four bags of ballast left, and it was decided it would not be safe to throw any more away. The thermometer showed 29 degrees below zero and the aeronauts shivered and trembled, though they were very warmly dressed. All metallic articles, such as the steel tube of the compressed oxygen, were coated with ice. The sun was so dazzling that they did not dare look at it. The descent was made at a terrific speed in the upper altitudes. When the ballast bags were thrown out to steady the balloon, sand scattered in the air and played around the car. When within 10,000 feet of the earth the balloon began to descend steadily, and the aeronauts alighted in safety in a field of stubble after accomplishing one of the most remarkable ballooning feats on record.

Purity of Cave Air.

Commenting on the statement made in a recent magazine article that the air of the Mammoth Cave preserves a temperature of 54° F., summer and winter, the editor of The Alienist and Neurologist, St. Louis, July, says that he can confirm this fact from his personal experience, and adds this information about the quality of the cave air:

"The cave may be said to breathe twice a year—inhaling during the winter and exhaling during the summer. This breathing of the cave, and the purity of the air and its freedom from germs, are among the most interesting problems to be studied. By what process the air in the cave becomes sterilized remains to be determined; but it is supposed the air gets into the cave after having been first drawn through water, the river in the cave being subject to rising and falling at certain times. Neurasthenics and persons extremely debilitated feel invigorated after they once get into the cave, so that they can endure physical exertion much beyond what they could outside.

"The influence of the cave appears to be rather antirheumatic than otherwise, owing probably to the remains of the saltpeter beds therein, which were the chief source or one of the chief sources of the supply to the gunpowder makers during the war of 1812. A colony of consumptives once took up their abode in the cave, but it did not cure them, and consumptives used to be sent to the cave for its pure air, but the absence of sunlight is a serious counteracting influence to these cases. But a life near this cave, with frequent visits into the cave enjoined, ought, because of its restful quietude and pure air, to prove a good prescription for part of the treatment of chronic city neuratrophics. Asthmatics have also been much benefited by the air of this cave."

Miscellaneous Notes and Receipts.

Wood with Metallic Luster.—A peculiar and certainly valuable process to impart the luster of metal to ordinary wood, without injuring its natural qualities, is described in the Paris Annales Forestières. The wood is laid, according to its weight, for three or four days in a caustic alkaline solution, such as, for instance, of calcined soda, at a temperature of 75° to 90° Celsius. Then it is at once placed in a bath of calcium hydrosulphite, to which, after twenty-four to thirty-six hours, a saturated solution of sulphur in caustic potash is added. In this mixture the wood is left for forty-eight hours at 35° to 50° Celsius. It will be seen from this description that the process is somewhat laborious, and requires much time, but the effect is said to be astonishing. When the wood thus prepared, after having been dried at a moderate temperature, is polished by means of a smoothing iron, the surface assumes a very handsome metallic luster. The effect of this metallic gloss is still more pleasing if the wood is rubbed with a piece of lead, zinc, or tin. If it is subsequently polished with a burnisher of glass or porcelain, the wood actually gains the brilliancy of a metallic mirror, whereby, of course, handsome effects in wood ware can be obtained. Withal, the wood remains very firm and durable.

A New Substance Phosphorescent Under the Roentgen Rays.—A new mass, phosphorescent under the X rays, F. S. Kolle describes in the substance lately introduced by Van Molekebeke, which is said to be more sensitive for phosphorescent screens than all the substances heretofore known and employed. The production of the mass is as follows: Dissolve 1 gramme of uranium nitrate in 4 grammes of boiling water in a porcelain dish, adding 1½ grammes of ammonium fluoride and boiling the mixture a few minutes. The solution, which should not contain any precipitate, is cooled off and crystallized, which takes place in an hour. The octahedral crystals deposit on the bottom of the vessel, and the pale yellow solution turns perfectly colorless. The liquid is poured off from the sediment, and the latter, for the purpose of a complete removal of the ammonium nitrate, is repeatedly washed with cold water. The crystals are insoluble in cold water, but readily soluble in hot water. For the production of luminous screens, the dried preparation is mixed with collodion or gelatine. The quality of the preparation depends upon the perfect development of the crystals. The combination of the body is expressed by the formula $U_2 O_2 Fl_2 4NH_4Fl$—uranium ammonium fluoride.—Bayerisches Industrie und Gewerbeblatt, through Neueste Erfindungen und Erfahrungen.

The Japanese Petroleum Industry.—As is known, competition between the American and Russian petroleum is very keen in the petroleum markets of eastern Asia—a condition of affairs rendered still more acute by the steadily growing petroleum industry of Java and Sumatra. Japan has also entered the list of petroleum producers recently, and the demand for the home article is steadily increasing, although America and Russia still import about 6,000,000 yen annually. The petroleum districts of Japan reach from Hokkaido to Akito in the north, and throughout the entire length of the provinces Echigo and Shinano as far as the province Tolomi. Sixty drills have already been set up, and twenty-eight more will soon be ready for operation. The method of drilling has been largely improved; while formerly drillers did not venture beyond a depth of 200 feet, they risk at present 800 and more; the methods of refining have also been improved essentially. The largest markets for the Echigo petroleum are Hokkaido, Shinana, and the northern provinces of Yezo. A syndicate similar to that of the Standard Oil and the Russian trust is in process of forming for the purpose of improving the industrial pursuits, and it is also expected that, when formed, efforts will be made to gain the eastern market for the export of the Japanese petroleum.—Chemische Revue.

The French Lodeve Teasel.—The keen competition between the teasel and the metallic card has forced European planters and dealers to procure better teasel seed and use a great deal of care to grow a better article, so as to compete more successfully with its rival; for, of course, the entire displacement of the teasel is out of the question, at least for some time to come, because the metallic card, as at present made, is only suited for first roughening the cloth, the subsequent gigging operations requiring the vegetable card. All the efforts made to obtain a better teasel material must, therefore, always be thankfully acknowledged. Provence, and more especially the district around Avignon, is the principal country for cultivating the French card teasel, which is esteemed to be the best, by reason of its great resisting power. It was recognized long ago that that district was too limited in extent to supply the large demand for teasels in France and other countries, and experiments were tried to cultivate the thistle in other countries. These have been successful recently, and it was found that the region of Lodève and Carcassonne, south of Provence, in the department Aude, was well suited for the purpose. The region referred to possesses all the fundamental conditions for producing a good growth. This teasel is beyond doubt the best that can be used for the better grade of napped cloths, which require a fine and first-rate nap. The action of the finer hooks is distinctly visible in the goods in the process of teaseling, as well as when finished. A noteworthy advantage is that a core-rotten Lodève teasel is hardly ever found, but this disagreeable occurrence is only too common with all other kinds of teasels.—Der Confectionnair.

The Purification of Bad Butter.

It is with a certain feeling of regret that we understand that a new industry is about to be introduced in Ireland—namely, the making of good butter from bad. It has long been thought that, if we could once be sure that there was no margarine about, butter could be judged by its taste. What, then, are we to say to a process by which bad, rancid butter fat can be turned again into "fresh" butter? The data on which the process is founded are comparatively simple, and the process itself, although somewhat elaborate, is, after all, only a rewashing and then a remaking of the butter. What is unpleasant about it is that in future freshness and cleanness of taste is to be no security that the butter is the fresh product of fresh cream—no guarantee that from cow to butter pat all has been clean and free from rottenness. The rancidity of butter is due to the liberation of butyric acid, and other volatile acids and their derivatives, through the action of microbes—in other words, through the operation of decomposition. As is well known, this decomposition mostly takes place in butter which has been badly made; for really well-made butter, from which all the casein and buttermilk has been worked out, will keep for a very long time. In the process which has been lately introduced for the removal of these offensive products of decomposition the butter is melted down with a certain quantity of buttermilk, and stirred until a fine emulsion is obtained. Hot air is then drawn through the melted liquid, by which means a churning action is set up, and, while the volatile acids are carried off, the solid impurities sink to the bottom, and are removed. Then a current of cold air is made to take the place of the hot, and under its influence the butter begins to separate in granules, as in the ordinary method of churning. The result is admirable; good butter is made from bad, which is no doubt extremely ingenious.—Hospital.

Liquid Air as a Drink.

"At a meeting of the Society of Biology, held on June 9," says the Paris correspondent of The Lancet, London, July 23, "M. D'Arsonval referred to some researches which he had made with regard to the action of liquid air upon sundry tissues and upon mucous membranes. Actual contact did not take place, and the substance could be introduced into the stomach. M. D'Arsonval had offered a guest some liquid air mixed with champagne, and he, without waiting till the champagne thawed, swallowed the whole glassful containing about 15 cubic centimeters (about 1-10 gill) of liquid air. After a few moments his stomach was acutely distended, but a sudden violent expulsion of food and gas relieved this condition. If liquid air be poured upon the hand, it assumes the spheroidal state and breaks up into globules which scatter in various directions. It has been proposed to employ it in diving operations, for a diver carrying a liter (quart) of liquid air upon his back would have 1,000 liters of air to breathe. M. D'Arsonval also placed in liquid air some dried bacilli and bouillon cultures of diphtheria and the bacillus pyocyaneus. In one case they were there for six days and nights until the air evaporated. He then sowed the cultures on agar, and found that, contrary to what he had expected, the liquid air had very little effect. Growth went on regularly, the individual bacilli were slightly damaged, and the only marked modification was that the bacillus pyocyaneus had lost its chromogenic power—a modification which, of course, is not of the least importance."

Patents in Russia.

United States Ambassador Hitchcock writes to the Department of State from St. Petersburg that it is a curious fact that nearly seventy per cent of the patents granted in Russia are issued to aliens. This is important, in view of the new market for manufactured goods in the far East, a market which will probably, for a long time to come, be under the control of Russia. Patents are granted for inventions and improvements which represent an essential novelty in their totality, or in some part or parts, or in a combination of parts. One patent can cover several inventions or improvements, when, combined, they form a distinct process and cannot be used separately. No patents are granted where there is no essential novelty. It is a curious fact that the poor Russian subjects upon adequate proof to that effect can be freed from the fee which the government exacts upon filing the case. The expense of procuring Russian patents was considerably reduced when the new law went into operation.