

The long caliber 6-inch rapid-firer can pierce almost as thick armor at the shorter ranges as the 8-inch, and its rapidity of fire is four or five times as great.

Although the "Alabama" is afloat, she will not be commissioned for eighteen months, unless the work is pushed along much faster than is usual on our battle-ships. If there is no delay waiting for armor, guns, etc., this fine vessel might be in the fighting line by the summer of 1899.

#### THE HEAVENS IN JUNE.

BY GARRETT P. SERVISS.

At 9 P. M. in the middle of June the great star Arcturus is overhead. Even for those who know and care but little about astronomy it is worth while to look carefully at Arcturus, because Arcturus is the very mightiest sun that the heavens are known to contain. Its distance is about a thousand millions of millions of miles, or more than ten million times the distance of our own sun. Since the intensity of light decreases as the square of the distance increases, it is easy to show that if we were as near to Arcturus as we are to the sun, the earth would be vaporized by the blast of unimaginable heat which would smite it, for Arcturus must exceed the sun in light and heat giving power in the ratio of six thousand to one! As to the actual size of Arcturus, it is not improbable that its globe would more than fill the entire space that is belted by the orbit of the planet Mercury! Not to know Arcturus, then, is to be unacquainted with the most stupendous physical phenomenon within the range of human vision.

An easy way to make certain of the identification of Arcturus is this: Look for the Great Dipper, which will be found between the pole and the zenith, with its handle upward. Follow with the eye the bending line of the handle, beginning at the bowl, and continue it, beyond the last star in the end, to a distance about equal to the entire length of the Dipper, and thus the eye will be led to a bright yellowish star, which is Arcturus. Far southward shines the white star Spica, in Virgo, and farther west the planet Jupiter, the three—Arcturus, Spica and Jupiter—marking the corners of a large triangle.

Northeast of Arcturus will be seen the beautiful circlet of the Northern Crown, and half way between the Crown and the horizon, the brilliant Vega will catch the eye. This star ranks next to Arcturus among the recognized giants of starry space. Its distance is more than five hundred millions of millions of miles, and in light-giving power it probably exceeds the sun about two thousand times! Those who have telescopes may enjoy an exceedingly beautiful contrast of color by looking alternately at Arcturus and Vega.

#### THE PLANETS.

Mercury is a morning star, visible to early risers at the beginning of the month, but lost in the rays of the sun at the end. It passes from Aries into Gemini, to become an evening star in July.

Venus is beginning to overmatch Jupiter in splendor as an evening star. At the opening of June she is in Gemini and at the close in Cancer. With a telescope she appears in the form of a gibbous moon, more than eight-tenths of her disk being illuminated. Venus is a kind of mirror to the earth. Being very nearly of the same size as our planet, she presents an appearance similar to that which the earth would present if we could look at it from a corresponding point of view. But when, as will happen in December, Venus comes between the sun and the earth, her inhabitants will behold a planetary spectacle more magnificent than any ever presented to our eyes; for then the earth will be seen in their midnight sky, in the phase of a full moon, with all its continents, and oceans, and streaming storm clouds plainly visible to their telescopes; and accompanied by its ever faithful attendant the moon, which itself will appear as a planet of no mean size. Its cloudless condition, in contrast with the earth, would instantly arrest the attention of an astronomer on Venus.

Mars in these warlike days sulks in his tent. He is far off and faint in the morning sky, passing during the month from Pisces into Aries.

But while the celestial god of war thus apparently neglects his interests on the earth, the great master planet Jupiter occupies a commanding place, crossing the meridian early in the evening and remaining conspicuous during the first half of the night. Jupiter has developed a remarkable series of dark elliptical spots in his north tropical zone during the past two years, and at present these spots appear to be increasing in number. Three of them are being carefully studied by observers of Jupiter, and their velocity of motion is said to be greater than that of spots which were seen in the same latitude three or four years ago. The commotion of Jupiter's surface markings is always a fascinating thing to watch. Tremendous changes are evidently going on there, but the clew to their nature is yet lacking. Jupiter is in the western part of Virgo, moving slowly toward the southeast.

Saturn, near the northern edge of Scorpio, rises about 7 o'clock in the evening on the 1st of June, and crosses the meridian about midnight, having been in

opposition to the sun on May 30th. Its north pole and the northern side of its rings are presented toward the earth. Its most conspicuous satellite, Titan, will be seen at eastern elongation on June 8, at western elongation on June 16, and at eastern elongation again on June 24.

Uranus remains in Scorpio, and during the month retreats slowly westward from the neighborhood of the double star Beta.

Neptune is in Taurus, and in conjunction with the sun on the morning of the 13th.

#### THE MOON.

The moon is full on June 4; at last quarter on June 11; new on June 18, and at first quarter on June 26. It is nearest to the earth on the 19th and farthest from the earth on the 4th. Greatest libration east, June 27; greatest libration west, June 11.

The lunar conjunctions with the planets occur as follows: Uranus, the 3d; Saturn, the 4th; Mars, the 14th; Mercury, the 17th; Neptune, the 19th; Venus, the 21st; Jupiter, the 26th.

On the morning of June 21, about 5 o'clock, Eastern standard time, the sun enters the sign Libra and the astronomical summer begins. Eleven days later the earth will be at the cooler extremity of its orbit, or in aphelion, a fact which those who find comfort in the reflection that things might, at any time, be worse than they are, will do well to recollect when July rolls in its tide of heat.

#### SAN JUAN'S BOMBARDMENT.

In our last week's issue we referred to the bombardment of the fortifications of San Juan, the capital of Porto Rico, on May 12. At that time only meager details of the engagement were available. Now, however, full particulars of the battle have been published. As will be seen by our plan of the harbor of San Juan, the reef on which the city is built is practically an island separated from the mainland by a tidal ditch. The whole sea front of the island is precipitous, especially so at the western point, where rocks frown above the entrance to the bay within. At this spot stands the old stone fort called Morro Castle, with its thick walls and tiers of guns. It was in the time of smooth-bore guns practically impregnable. Having fears of buccaneers in the old days, the Spaniards erected a defense line running along the shore front for three-quarters of a mile, where they built another big castle. The defense line was carried all the way around the inner front of the island or peninsula, and within this area they built the town.

When the fleet approached the lighthouse tower, 171 feet above the sea, it did not show any light, indicating that the people of the town were expecting trouble. The "Detroit" with the tug "Wampatuck" slowly led the way in. The torpedo boat "Porter" ran off to the east a half mile or so from the line of the squadron and stopped within a mile of the shore. On arriving within 1,400 yards of Morro Castle the "Detroit" turned west and steamed slowly along the beach for a quarter of a mile, while the "Wampatuck" with her flag of truce drifted on, followed by the "Iowa," the "Indiana," "New York," "Amphitrite" and "Terror." It was at five o'clock that the "Detroit" turned east, and at that moment a signal fluttered on the "Iowa" which called for the hoisting of the American ensign on every ship. For six minutes the flags floated in peace, and then some Spanish officer having no regard for the flag of truce opened fire on the "Wampatuck" and sent her skurrying away out of range. Admiral Sampson told Captain Evans that the fire might be returned. The forward turret of the "Iowa" was turned so that the long 12-inch rifles were headed at the yellowish walls of the old castle, and at 5:15 o'clock the word "fire" was given, and the huge projectiles were hurled at the point whence the guns had been firing at the flag of truce. The aim was so good that no further shots were fired from that part of Morro during the remainder of the engagement. The 8-inch guns then took part, and the "Detroit" followed with her 5-inch guns. Then came the "Indiana" with her 13-inch rifles which took the place of the flagship, which was steaming slowly out to sea, her 8-inch guns also firing. The fleet was now steaming slowly in a circle.

In the meantime the soldiers in all the forts had begun to fire on the squadron, but it was a useless task, for the shots from the old smooth-bore guns did not reach the vessels. At first the fire was so feeble that it is thought that the artillerymen were enjoying a peaceful rest when they were rudely awakened by the roar of the big guns. At Santo Domingo barracks there was a battery with at least four modern rifles of 8 or 10-inch caliber and other batteries appeared to be equipped with modern guns. These opened on the fleet soon after the first gun was fired from Morro, but not since modern rifles with gun sights were invented has any one seen such shots as from these crest batteries. Shot after shot, mounting into hundreds, were fired, but hit nothing, every shot flying far above and beyond the great targets. Even the unarmored "Detroit," which lay perhaps 1,200 yards from the nearest battery, remained wholly un-

touched. The Spaniards did not neglect the "Porter," and she would have been an easy prey if they could have hit her, but their efforts were futile. The marksmanship of the American squadron on the first round was not, on the whole, quite worthy of the record made at the targets. The majority of the shots hit Morro, but three or four at least fell so far short as to strike the water, but the first round of the squadron in its elliptical course cured that completely. The Spaniards, as the "Iowa" came down on them for the second round, worked their guns with increased frenzy and their aim was worse and worse, until the "Iowa" reached the turning point and once more began firing with her 12-inch rifles, the "Indiana" following. The Americans now had perfect range and were as cool as at target practice, while the Spaniards shot wilder and wilder and at last fled. The first shot which seemed to reach the city struck the huge barracks just east of Morro. A cloud of yellow brickdust rose high in the air, obscuring the building, and the flames and smoke of a conflagration appeared. Within ten minutes a half dozen other shots had fallen elsewhere in the town, and by the time the "New York" turned out to sea again seven different fires were seen in different parts of the city.

The forts nearest Morro were wholly obscured by the smoke of the shells. The forts replied with an occasional gun, and most of the Spanish at this time had fled to the bombproofs. The guns at the east of the city, however, continued to work steadily because they had received little attention from the ships. The "Detroit" now turned to the west, and running close under the guns of Morro, attacked a new earthwork built on an island on the west side of the channel. There were a couple of modern 8-inch guns there, but the little vessel forced the gunners to retire. Both the "Montgomery" and the "Porter" were ordered out of range, but a casual observer would say there were no cases on record during the cruise where orders were obeyed with such deliberation.

Three circuits were made. The first gun, as has been said, was fired at the forts at 5:15 A. M., and at 7:20 A. M. the "Iowa" opened fire for the third and last time. Before her guns were fired a big breach was plainly visible in the curtain wall of Morro, and from that time on, nothing of the fort could be seen because of the smoke and dust. The "Indiana" began the last round at 7:26 o'clock, the "New York" at 7:30, the "Amphitrite" at 7:40 and the "Terror" at 7:56.

The big fort east of the city near the Tierra gate was hit as the "Iowa" turned away, firing her last shot. Five guns had been worked steadily from within the fort, but only two were fired after that and they quit soon after the "New York" got a broadside on the city, but they opened again after she pulled out and then one shot from the hill battery just east of Morro was fired. It struck against the iron stanchions used for hoisting the boats to and from the superstructure of the "New York" and burst.

The boat was knocked to pieces, and a fragment of the shell struck Frank Widemark, seaman, and he was killed; three or four others were injured. A 10-inch shell struck a gallows frame on the "Iowa" and burst at about the same time, hurling fragments in all directions; three men were injured. Both these shots were plainly accidental because they came on board at long range and because the following shots fell as wide as usual of the ships. As the squadron drew off, the "Terror" lingered behind, firing at five minute intervals, until 8:05 o'clock, when the last shots from the fleet were sent. The hill battery kept wasting its ammunition until 8:29.

The admiral and all the officers, save only those stationed under cover, fought on the bridge and upon the decks. Admiral Sampson went from point to point on the bridge or deck as the exigencies of the smoke made it convenient. Though the battle may be considered as an unimportant incident of the war, like the bombardment at Matanzas, it certainly proved the lack of training of the Spanish and demonstrated the skill and ability of the Americans. The destruction in the town was not great, but nearly all of the big guns were dismantled.

#### STATE COLLEGE OF FORESTRY.

A conference has been held at Albany to decide upon the location of 30,000 acres of land to be purchased by the State for the establishment of a college of forestry under the authorization of an act of the last legislature. Dr. Fernow, director of the new State College of Forestry at Cornell University, who was formerly chief of the Forestry Division of the Department of Agriculture at Washington, formulated the conditions which the Cornell authorities had decided necessary for land for the purpose of the new college, and a canvass was made of the available property in the Adirondack woods which is on the market. This developed that there were not more than three or four tracts available, which it is believed the State could readily secure. These tracts are in Hamilton and Franklin Counties, and it is held that they could be purchased at less than \$6 an acre. No particular plot of ground has been decided upon as yet.

**SOME INTERESTING FEATURES OF THE ELECTRICAL EXHIBITION.**

Not long since we illustrated a new system of wireless telegraphy, designed by Mr. E. J. Clarke, of the United States Electrical Supply Company, of this city. Since then the system has been improved in many ways, and he is now giving an exhibition at the Electrical Show in the Madison Square Garden which is attracting a great deal of attention.

In a showcase in the center of the south gallery is placed an automatic transmitter, which is insulated. A storage battery of four cells is placed in the lower part of the case, which feeds the primary of a 4-inch spark coil, the current from the battery first passing through an automatic circuit breaker (not shown). This automatic circuit breaker does not take the place of the vibrator of the coil (that being provided as usual), but is so arranged that it will make and break the circuit in the same manner as a telegraph operator would when manipulating his Morse key in the act of calling N. Y. N. Y. N. Y., which is the well known telegraph call for New York City. In this way it will be seen that the sparks from the secondary of the coil are intermittent, and their duration is governed by the length of the time during which the automatic circuit breaker allows the circuit to be closed while making the dots and dashes. Immediately in front of the induction coil is placed the improved oscillator, which consists of two solid brass balls about four inches in diameter, as shown at 2 in our illustration, mounted so that the distance between them is adjustable. Outside these balls are placed two smaller balls about an inch and a half in diameter attached to sliding brass rods, on the outer end of which are other balls one inch in diameter, so that the distance between the large and the small balls can be easily adjusted. The secondary terminals of the coil are connected to binding posts on the base of the oscillator which connect direct with the brass standards that serve as supports for the sliding brass rods. The distance between the balls being properly adjusted and the current turned on from the battery, the sound of the secondary sparks passing between the balls can quite easily be recognized as the dots and dashes of the signal N. Y. So apparent is this that telegraph operators visiting the exposition are immediately attracted by the sound. One terminal of the oscillator is connected to earth and the other to a brass rod about ten feet in length placed on top of the showcase.

In the center of the north gallery directly opposite and about 200 feet distant is placed the receiver, which consists of a Clarke coherer relay and receiving instrument constructed almost precisely in the manner described in our issue of April 2, with the exception that a large six-inch vibrating bell is connected up in the local circuit in addition to the telegraph sounder. This six-inch bell is continually ringing out the Morse

signals N. Y. N. Y. N. Y., and by holding down the hammer of the bell the sounder can be distinctly heard repeating the same call. Considerable trouble has been experienced in overcoming the effects of self-induction in this apparatus, but now it is claimed the difficulty has been overcome.

In the center of the garden is placed a large tank of water, and four times each day a miniature warship about three feet in length is placed in this tank, and floated over a submarine mine, which is connected to

an ordinary electric fuse. The apparatus at the tank is placed on the outside, so that visitors to the exposition can readily understand the arrangements, but that is not necessary in any way, as Mr. Clarke is prepared to blow up mines in this way with all the apparatus contained in a waterproof box connected directly to the mine.

We understand a carefully insulated wire has been run from the transmitter to the highest point of the tower of the garden, and that during the next few days it is intended to send messages many miles from the city.

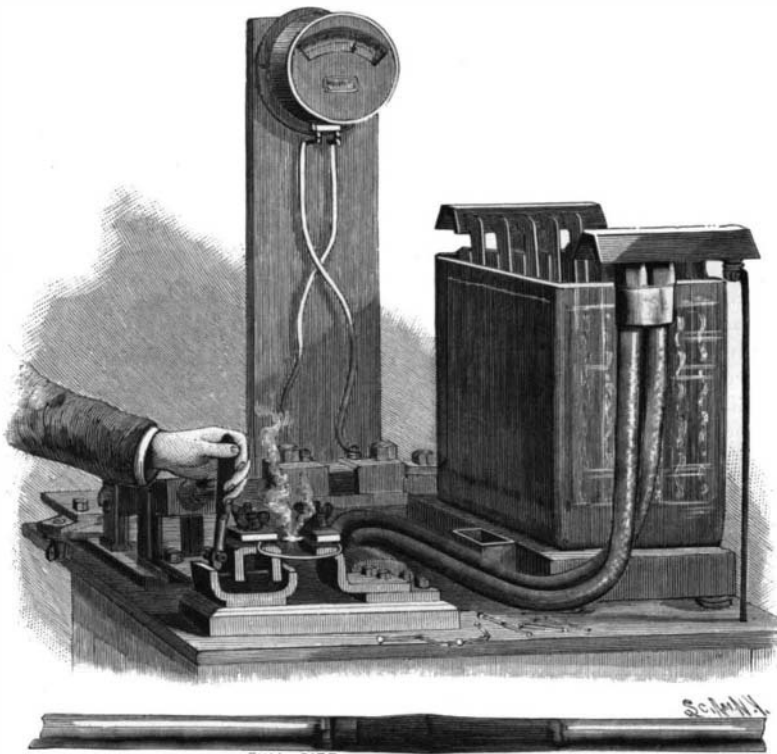
Among the interesting things to be seen at the Electrical Exhibition, now in progress, is the electrical welding outfit shown by the Electric Storage Battery Company, of Philadelphia and New York. The welding is done by one chloride accumulator element known as type F-11, consisting of eleven plates, each 10½ by 10½ inches. These plates are immersed in dilute sulphuric acid in a glass jar resting upon an insulated tray filled with sand. At the side of the cell, and connected to it through heavy cables, is a copper clamp, one jaw of which moves on a sliding contact. The metal to be welded is gripped in the clamps, and when brought to the proper heat, is forced together by means of the movable jaw. The usual method of the exhibition is to place a solid bar in the clamps, heat it to the melting point, break it by means of the sliding jaw, and then weld it. The power required depends upon the size of the bar operated upon.

The bars generally used take 800 amperes for a few seconds and the current then drops to 400 amperes, at which point the weld is completed. The cell operates at 2 volts, and the power required is, therefore, from 1.6 kilowatts to 0.8 kilowatt. The normal discharge rate of the cell is 50 amperes. The outside dimensions of the glass jar are

10½ inches by 12½ inches long by 15½ inches high. This outfit appears to be a very desirable one for the smaller welds required in many branches of manufacture. A very interesting souvenir furnished to visitors consists of two wire nails welded together at the point, as shown in the small detail figure.

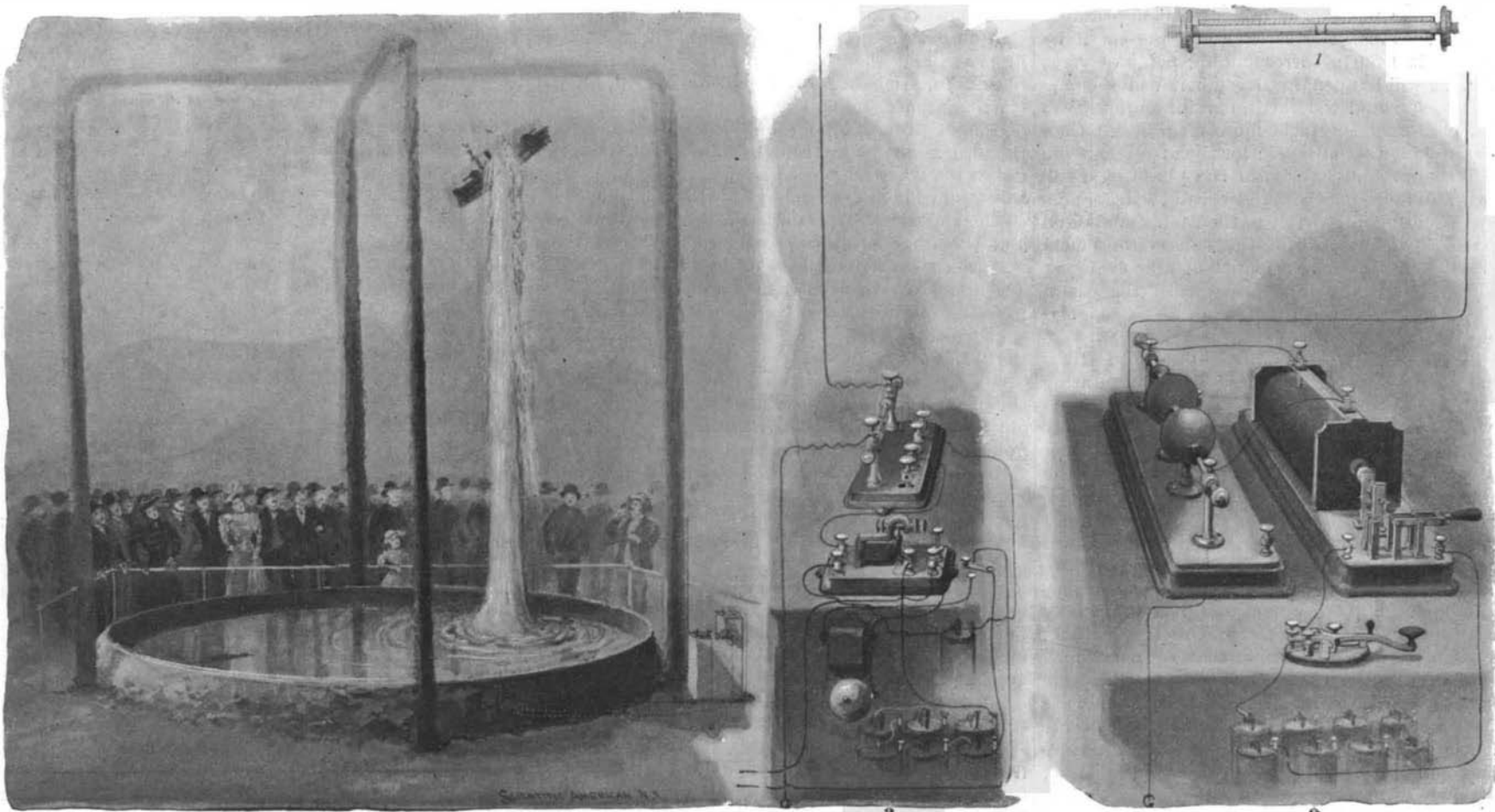
**Training the Sight.**

Mr. R. Brudenell Carter, F.R.C.S., in a lecture before the London Society of Arts, directs attention to the fact that acuteness of vision may be increased by training. He suggests that the average acuter vision of country over town children is due to the fact that the latter see chiefly large objects and under large visual angles, while the former are habitually attending to smaller and more distant objects, seen at smaller angles. He suggests, therefore, that school teachers should be instructed to test the vision of new pupils and record the same in a register, informing the parents of any defects observed.—Medical Times.



**ELECTRIC WELDING BY MEANS OF AN ACCUMULATOR, AND A SAMPLE OF WORK.**

a coherer, relay and battery placed immediately outside of the tank in the manner shown at 3 in our engraving (the coherer tube being shown enlarged at 1). One terminal of the coherer is connected to earth, and the other to an insulated wire rising about ten feet in the air. When the time comes for exploding the mine under the warship, the oscillator in the south gallery is stopped and connection made at the tank between the coherer and the vibrating bell which is used for testing purposes. The oscillator is now started for an instant to see if the bell at the tank rings, thus proving that the coherer is in proper adjustment. The bell is now disconnected, and connection made to the submarine mine instead, and at a signal from the attendant the man at the transmitter again presses the button, which throws the current into the oscillator, the coherer completes the local circuit and the mine instantly explodes, breaking the warship into splinters, and throwing it and the water high in the air. Of course it is understood that the mine is provided with



1. The coherer. 2. The transmitter. 3. Relay and testing bell.

**EXPLOSION OF A SUBMARINE MINE BY ELECTRICAL WAVES FROM TRANSMITTER USED IN WIRELESS TELEGRAPHY.**