wheels are put in action at the same time, thus preventing the whole from getting out of true, giving the affair a wide and solid base, and preventing the car from recoiling. As the car, carriage, and gun, as a whole, do not weigh any more than a heavily loaded railway car (40,000 lb.), it requires but a few men to rapidly move the system over an iron track of the ordinary type.

The organization proposed by Commander Mongin consists of an ordinary railway running parallel with the general direction of the forts of an intrenched camp, along the glacis and beneath the fire of the gorge facings. Starting from the points where it was not covered by the masonry of the fort, this track would follow a sort of siege trench with a nearly horizontal bottom. An investment of gabions and hurdles toward the interior would sustain a glacis having an easy slope and provided with an abatis. Here and there (at intervals of 15 or 20 yards, for example) the main track would be provided with a crossing to permit of putting a movable gun in battery upon it. Near by, there would be a small siege magazine, built under the glacis.

When necessary, the materials of the abatis would be separated at the right of these firing places, so as to allow the enemy's works to be seen plainly without those inside exposing themselves. Thus established in such positions, the artillery would enjoy all the advantages of the attacking batteries. Like the latter, it would show nothing but the guns themselves. Again, the enemy might not be able to recognize its location except by observing the cloud of smoke due to the firing. The gunners would not have to fear the bursting of shells on the talus of the parapets, and most of the enemy's projectiles, which did not directly touch the material, would pass beyond without producing a useful effect. When the besieger had succeeded in regulating his firing in an alarming manner, these movable pieces would be run 40 or 50 yards to the right or left, thus obliging the enemy to modify his aim at every instant.

If the form of the ground did not permit of excavating a long trench in a straight line without its being taken by a raking fire, it would be broken up into an embattlemented form, whose rectangular parts would be covered with high traverses of a symmetrically irregular shape.

Finally, it must not be lost sight of that the carriages employed permit of an indefinite field of fire in a horizontal direction, and that they might, should occasion require it, be turned about and strongly support the firing of the fort should the enemy attempt a *coup de main* on the gorge.

Instead of continuing the track along the entire length of the attacked forts, merely 200 or 300 yard sections might be constructed to the right and left of the latter, and batteries of movable pieces be thus created that would advantageously replace the armed, annexed batteries of stationary guns.

There is no doubt that a gun which can be shifted as soon as the enemy's fire is regulated is capable of producing as great an effect as three guns occupying a stationary position, or, in other words, that such a gun will finally reduce three guns of the enemy to silence.

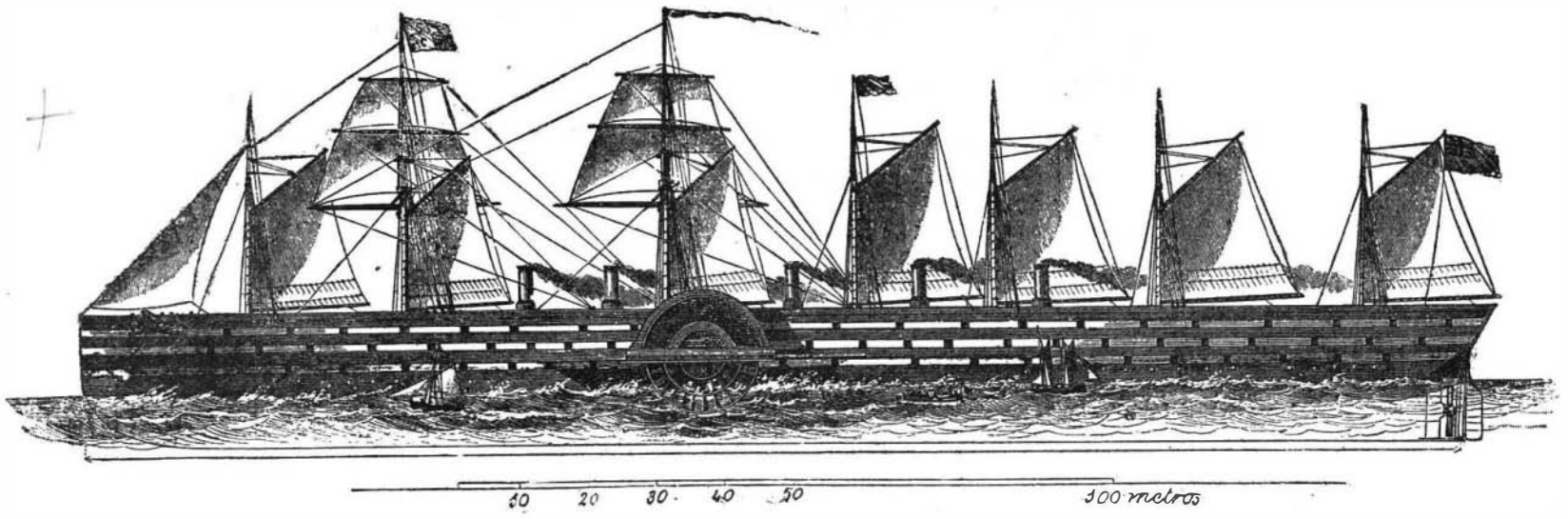
Moreover, it is possible to combine the two means of resistance to the fire of the enemy's artillery, that is to say, mobility in a horizontal position and armor plate protection. Hence the idea of armor-clad rolling batteries, which was carried out for the first time in France toward the end of the year 1870.

The first experiments on a rational use of armor-clad batteries, movable upon rails, were made in the siege of Paris. Since then the question has been the subject of serious study, especially on the part of Commander Mongin. This high officer now proposes rolling armor-clad batteries that may be said to be indestructible. He thinks that the adoption of a system of trains of guns thus protected would permit of greatly reducing the artillery *materiel* necessary for the armament of detached forts.

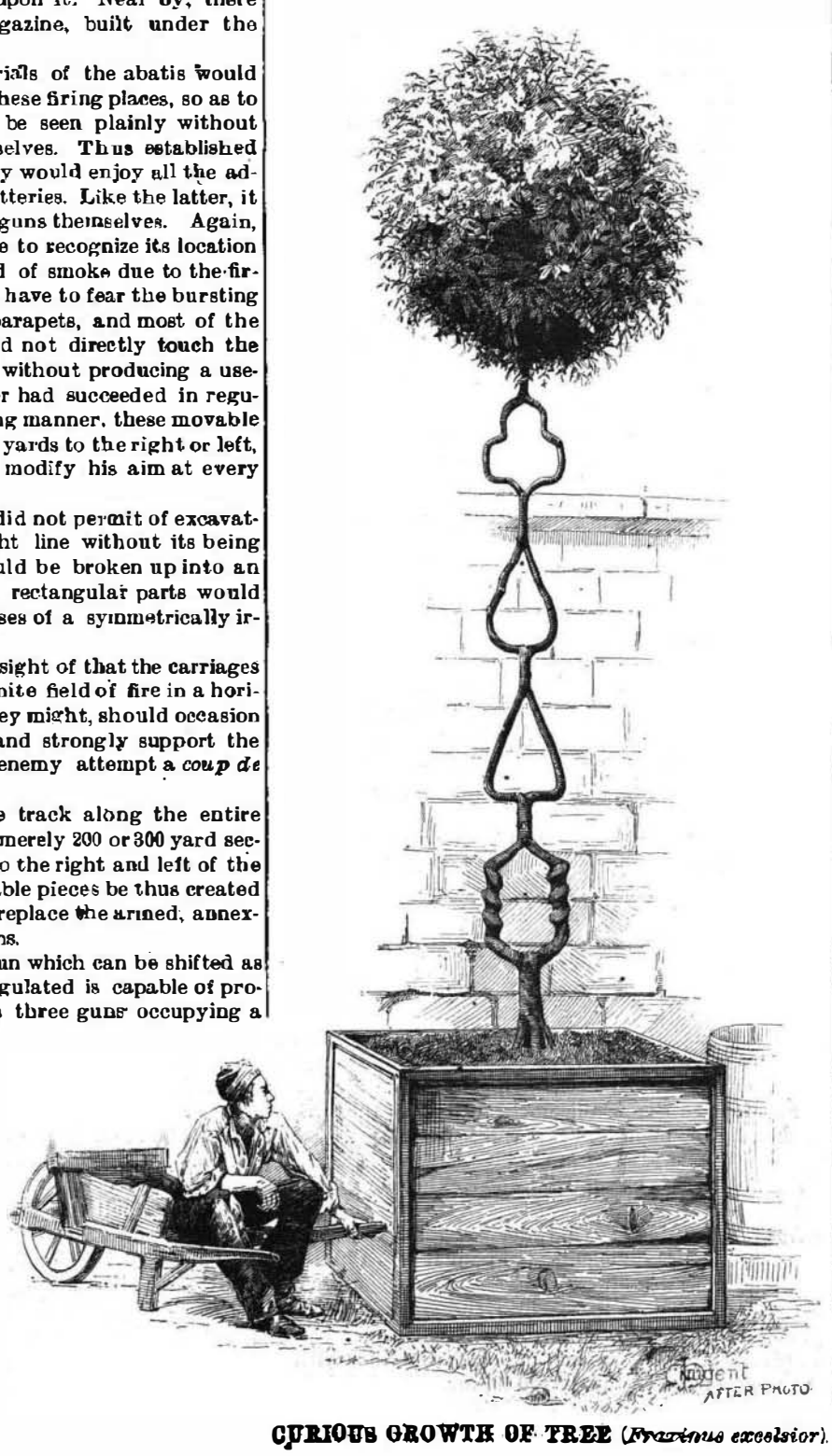
The battery of which he has formed a project may be considered, as a whole, as a hollow girder, iron clad on four of its sides, and externally capable of enduring heavy blows without being disturbed. This girder is fixed upon a strong flooring supported by nine suspended axles that permit of a side movement of the whole (Fig. 2). The axles are of steel, and are provided with iron wheels 3¼ ft. in diameter, having hard steel rims 2 in. thick. Their 8 in. journals are provided with cast steel grease boxes, connected with 25 ton suspension springs, affixed to the flooring of the battery. This flooring consists of two sole bars connected at their extremities, and between the axles, by ten small cross girders, which are themselves connected in pairs in the direction of the longitudinal axis of the flooring by ten struts. The whole, which is of plate and angle iron, is covered with a floor consisting of iron plates juxtaposed and carefully riveted to the sole bars, girders, and struts.

Two end panels and two intermediate stays divide the battery into three compartments, each containing one gun. The armor in front consists of two 16 in. thick plates of rolled iron connected all the way up by a mortise joint, and containing three embrasures at a minimum distance apart of 13 ft. from axis to axis, which are provided at the top and throughout their entire length with a rabbet 6 in. in depth. The prime cost of an armor-clad rolling battery amounts to but $80,000—a sum to which must be added the cost of three 6 in. guns.

These batteries may be advantageously employed during the course of the operation of defending the *enciente* of a place or the intervals between the forts of an intrenched camp. They are likewise of a nature to constitute the elements of a siege park of great power. It is even permitted us to foresee the coming of the day when they will make their debut upon our fields of battle.—*La Nature.*



THE STEAMSHIP GREAT EASTERN.



CURIOUS GROWTH OF TREE (*Fraxinus excelsior*).

CURIOUS GROWTH OF TREE (*Fraxinus excelsior*).

In this country the artificial training of shrubs and trees has not attained that degree of perfection that is observed in the countries of Europe. This is due probably to the fact that the gardens and parks abroad have been, many of them, kept in a most perfect state of cultivation for years, and even for centuries. Italy is especially noted for the beauty of form and design that has been imparted to the garden by the use of trimmed shrubs and hedges. This style of gardening has been extensively followed in nearly all the countries of Europe; and although there is no pretense at courting nature, this has, nevertheless, asserted itself, and age has added to this method a dignity which greatly heightens its original effect.

At Versailles, at Fontainebleau, at the Imperial Gardens in Austria, and in Germany, this same style is to be found. In England, also, we observe the same effect, not so much in the public gardens as in the private parks.

At Haddon Hall there are two quite celebrated box-wood trees, one representing a ship and the other a peacock of heroic size. At Chatsworth, near by, there are many curious shapes to be found. The tree shown in the accompanying cut is at present in the Jardin d'Acclimatation, in Paris. By examining the part nearest the ground, it will be observed that it originally consisted of five separate trees grafted together, which were successively divided and grown together again, producing the curious loops and forms observable in the illustration, which is a faithful delineation, taken directly from a photograph of the plant itself.

THE GREAT EASTERN.

This steamship, which for more than a third of a century has remained the largest ever constructed, was designed, about 1853, by the distinguished engineer Brunel, for the trade between England and Australia. It was calculated that a ship could be built having sufficient capacity to carry enough coal for the round trip in addition to a great many passengers and a paying cargo. She was built by J. Scott Russell at his works in Millwall, London, and was ready to be launched in November, 1857, but could not be moved until the following January. Even that early in her history her unlucky star assumed the ascendency, and in all her subsequent wanderings seemed ever present.

When launched, her cost was $3,831,520.

The Great Eastern is 692 ft. in extreme length, 83

ft. beam, and 27,000 tons actual capacity. She was built of iron, and double cased to about three feet above the water line. The motive power consisted of eight engines, four for the paddle wheels, which were 56 ft. in diameter, and four for the screw, 24 ft. in diameter. The cylinders of the paddle engines were 74 in. in diameter by 14 ft. stroke; and those of the screw were 84 in. in diameter and 4 ft. stroke. The heating surface of the boilers supplying the paddle engines was 44,000 sq. ft., while that of the screw engine boilers was still larger. The united nominal horse power was 4,000.

The first voyage to New York was made in 1860, and during the voyage she nearly averaged 336 miles per diem, or 14 miles per hour. Steam was carried at a pressure of from 15 to 24 pounds, and the total quantity of coal consumed was 2,877 tons. Since then her history has been strange and eventful, and the opinion we expressed in our issue of July 7, 1860, upon her visit to New York, has been most peculiarly borne out by the facts: "Although we cannot but regard the Great Eastern as a failure in *payability*, yet she is not so in a scientific sense. She is a grand experiment."

This ship, which, notwithstanding the many hard knocks she has received, seems to be in almost as good condition as when launched, now attracts attention because of the new use she is to be put to. For some time she has been exhibited at Liverpool, and has lately been taken as a "show ship" to Dublin. It is to be hoped that this venture will prove more remunerative than former ones; it certainly should, since the vessel is well worth a long journey to see, and a critical examination of her hull and machinery cannot fail to be both instructive and interesting. It is to be hoped that those in charge will brave the dangers of the Atlantic, and bring the leviathan once more to this country.

Simple Chemical Experiments.

The following are given in *The Chemist and Druggist*, by way of suggestions to druggists in the preparation of a variety of salable articles for the holiday season.

THE MAGNESIUM LIGHT.

Directions.—Take hold of the end of the ribbon by a pair of pliers, and introduce the other end into a flame, when it will at once take fire and burn brilliantly.

Material.—A piece of magnesium ribbon. To be packed by putting in an ordinary oval pill box laid in cotton wool, and wrapped in blue paper, labeled the above, and charged 6*d*. a box. The chemist that puts it up to judge for himself the quantity of wire.

INK AND WATER TRICK.

The following in a box, with bill of directions, may be profitably sold for 1*s*. or 1*s*. 6*d*.: 3 packets labeled respectively Nos. 1, 2, and 3. No. 1 contains about ʒ ss. fer. sulph. gran.; No. 2 about ʒ j. tannin; and No. 3 about ʒ ss. acid. oxalic. pulv.

Directions.—Take two decanters (preferably different shapes, so as to avoid suspicion of changing) and fill them both with water. Introdnce into one of them a *small* portion of No. 1 powder and the same of No. 2. This will form a black compound resembling ink. Into the other put another portion of No. 1 only, and shake till dissolved. This liquid will be clear like water. Now wrap up a pinch of No. 3 and the same of No. 2, each in a small piece of blotting paper (different colors, so as to prevent mistake), and conceal these in the palm of your hand. You are now ready for the trick. Step among the audience and explain that you have two bottles, one containing ink and the other water. This they may see for themselves. Now place the ink bottle at one end of the room, cover with a borrowed handkerchief, and, while doing so, contrive to slip in the blotting paper containing No. 3. Shake well, and let it stand covered. Go to the other end of the room aud do the same with the "water" bottle, slipping in No. 2 packet. On removing the covers, chemical action will have taken place in the bottles, and the two liquids will appear to have changed places, the ink bottle containing water and the water one ink. It is well to practice this trick several times in private before showing to an audience.

GROWTH WITHOUT LIFE.

A small bottle containing about ʒ j. cupric chloride in crystals, and a 4 oz. bottle filled with *strong* solution of K_4FeCy_6. The two might be put in a cardboard case (such as is used for proprietary medicines) with bill of directions, and charged about 1*s*.

Directions.—Take a tumbler of water and put in a dessertspoonful of the solution. Mix by stirring, and then carefully drop in a crystal or two out of the small bottle and let the glass stand quite still for a few minutes, when a beautiful structure resembling brown seaweed will grow up and soon fill the glass. A tall, narrow jar is best to use, and the exact quantities can be best judged by practice.

TO CONVERT STEEL INTO COPPER.

Dip the bright blade of a steel knife (or a piece of bright steel) into the solution supplied. In a few minutes it will be fonnd to be coated with copper.

Contents of the Box.—ʒ j. bottle solution of copper sulphate acidulated.

AN INCREDIBLE FEAT.

To take a coin out of water without wetting the hand.

With the powder supplied well sprinkle the surface of the water in which the coin is placed, or the hand may be rubbed over with the powder. In either case the hand may be dipped into the water without becoming wet, and thus the coin may be removed. After performing the feat, a shake of the hand will dislodge the adhering powder.

Envelope contains, in packet form, ʒ ss. lycopodium powder.

THE MAGIC WHIRLPOOL.

Fill a small basin with hot water, and throw upon its surface a few fragments of the substance supplied. They will instantly acquire a rotary and progressive motion, which will continue for some minutes. Before the motion ceases drop on to the surface a little oil of turpentine. The floating particles will quickly dart away as if by magic, and will become almost stationary.

Box contains ʒ ij. camphor in small fragments.

THE DANCING FIRE BALL.

Directions.—Procure a stout and tolerably wide test-tube. Place in it a teaspoonful of the powder and heat over a spirit lamp. When it is liquefied and begins to boil, drop into it a piece of the charcoal about the size of a pea. It will immediately begin to glow, and will dance about on the surface of the liquid as if alive.

Contents of the Box.—(*a*) ½ oz. pill box (deep) containing powdered chlorate of potash; (*b*) piece of charcoal.

A LIQUID PRODUCED BY TWO SOLIDS.

Directions.—Rub together in a dry mortar equal portions of the powders provided, and in a few minutes a blue liquid will be formed.

Contents of the Box.—Half ounce carbonate of ammonia powdered, ½ ounce blue vitriol powdered, or, omitting "blue" in directions, ½ oz. sulphate of soda powdered, ½ oz. acetate of lead.

THE FIRE EATER.

Directions.—Cut off about an inch of the prepared string, wrap it in a piece of tow. Hold it in left hand; with right hand pnt more tow into the mouth, chew it, and appear to swallow it. Now take the handful in which is the string and put into the mouth, taking ont at the same time, unobserved, the piece already chewed. Take a breath *through the nostrils* and breathe it out through the mouth. Repeat a few times and smoke will issue forth, and on opening wide the mouth it will be lighted up with a glow. When the mouth is shut and the tow pressed together, the fire goes out.

Contents of the Box.—(1) A piece of *thick* string about ¼ yard long, prepared by soaking in solution niter and drying; (2) tow. Can be sold for 3*d*.

TRANSFORMATION LIQUID.

Solution of caustic potass 1 oz., powdered nitrate of cobalt 1 drachm.

Directions.—Mix the nitrate of cobalt with the caustic potass, when decomposition of the salt and precipitation of blue oxide of cobalt will take place. Cork the bottle aud the liquid will assume a blue color, from which it will pass to a lilac, afterward, to a peach tint, and finally to a light red.

THE MAGIC LIQUIDS.

Tincture of litmus and sulphate of indigo, of each ½ oz. in separate bottles. Label distinctly.

Directions.—Pour a little of each into separate wine-glasses. Mix these two blue fluids together, and to the great astonishment of everybody, the result will be a beautiful red.

ARBOR DIANÆ.

Being the materials for making a silver tree.

Directions.—Dissolve the crystals in the blue paper in a tablespoonful of water, and add the contents of the bottle to this solution and allow it to stand aside a little while, when it will form a silver tree in full growth.

Materials.—3 ss. of argent. nit. wrapped in blue paper and 3 j. of hydrargyrum in a small flat bottle packed in a one dozen powder box in cotton wool. Label "Poison." To sell at 6*d*. or 1*s*.

HOAR FROST SHRUB.

Ingredients.—In chip box, benzoic acid.

Directions.—Place a sprig of rosemary, or any other garden herb, in a glass jar, so that when it is inverted the stem may be downward, and the sprig supported by the sides of the jar; put some of the crystals on a piece of hot iron, invert the jar over the iron, and leave the whole untouched until the sprig becomes, by the deposited vapor, like hoar frost.

MAGICAL TRANSMUTATIONS.

Ingredients.—(1) Ground logwood chips; (2) ground alum.

Directions.—Infuse the powder No. 1 in water, and when the liquor is sufficiently red pour it into a bottle. Then take three drinking-glasses and rinse one of them with strong vinegar; throw into the second a small quantity of powder No. 2, which will not be observed if the glass has been washed; and leave the third without any preparation. If the red liquor in the bottle be poured into the first glass, it will appear of a straw color; if into the second, it will pass gradually from a bluish gray to black, when stirred with a key or any piece of iron which has been previously dipped in strong vinegar. In the third glass, the liquor will assume a violet tint.

TO MELT IRON IN A MOMENT.

Ingredient.—Roll of sulphur.

Directions.—Heat a piece of iron (a poker will do) to white heat, then apply the roll of sulphur. The iron will immediately melt and run into drops. This experiment is best performed over a wash basin of water, allowing the melted iron to drop into the water.

CRYSTAL ROOM ORNAMENT, TO MAKE.

Ingredients.—Sulphate of alumina, sulphate of copper, sulphate of soda, sulphate of potass, sulphate of iron, sulphate of zinc, sulphate of magnesia, of each ½ oz. in separate chip boxes.

Directions.—Dissolve each of the salts in warm water in a separate tumbler. When dissolved, pour all together into an evaporating dish and mix well with a glass rod. Place the dish in a warm place where it cannot be affected by dust, and where it is not liable to be agitated. When evaporation has taken place, the whole will begin to shoot out into crystals. Their color and peculiar form of crystallization will distinguish each crystal separately, and the whole together will display a very curious and pleasing appearance. Preserve carefully from dust.

ARTIFICIAL CORAL FOR GROTTOES.

Ingredients.—Vermilion, 2 drachms; pale resin, 1 oz.

Direct these to be melted together. Have ready branches of twigs peeled and dried; paint them over with this mixture while hot. The blackthorn is the best branch for the purpose. Hold these over a gentle fire, turning them round till they are perfectly covered and smooth.

SILVER TREE.

Ingredients.—(1) Nitrate silver, 2 drachms; (2) quicksilver, 1 drachm.

Dissolve No. 1 in ¼ pint of filtered water, and set the glass vessel containing the solution on the chimney piece where it is not likely to be disturbed. Now pour in No. 2; in a short time the silver will be precipitated in the most beautiful arborescent form, resembling real vegetation.

TIN TREE.

Ingredients.—(1) Muriate tin, 3 drachms; (2) nitric acid, 10 drops; (3) piece of zinc attached to copper wire.

Directions.—Put No. 1 into a glass vessel with sufficient water to three parts fill, then add No. 2, shake well until dissolved. Now place No. 3 through a cork and insert in solution so that no part shall touch top, bottom, or side of glass vessel. Let the whole rest quietly for a short time. The tree will grow, and have a very lustrous appearance.

LEAD TREE.

Ingredients.—Sugar of lead, ¼ oz.; zinc fastened to a wire (copper or brass) twisted in the form of a spiral spring. From the center suspend a small porcelain doll with wire twisted round it.

Place the lead acetate in a bottle of water, shake well, then thrust zinc and appendages into it, and cork securely. In a few days the tree will begin to grow, and produce a most beautiful effect.

TO GIVE GHASTLY APPEARANCE TO COMPANY.

Ingredients.—Mixture in bottle; piece of tow.

Composition of Mixture.—Salt, inf. saffron, spt. vin. methyl.

Directions.—Dip a small piece of tow into the mixture, and ignite in a room of company, when the whole will have a very ghastly appearance. Extinguish all other lights in the room.

CRYSTAL ORNAMENT.

Ingredient.—Alum, 18 oz.

Directions.—Dissolve in 2 pints of soft water by boiling it gently in a close tinned vessel over a moderate fire, keeping it stirred with a wooden spatula until the solution is completed. When the liquor is *almost* cold, suspend a small basket, ears of corn, moss rose, hyacinth, or almost any vegetable specimen, by means of a small thread or twine from a lath or small stick placed horizontally across the aperture of a deep glass or earthenware jar, into which the solution is poured. The respective articles should remain in the solution twenty-four hours; when they are taken out, they are to be carefully suspended in the shade until quite dry. The whole process of crystallization is best conducted in a cool situation. When the objects to be crystallized are put into the solution while it is quite cold, the crystals are apt to be formed too large; on the other hand, should it be too hot, the crystals will be small in proportion. The best temperature is about 95° Fahr.

CHAMELEON PICTURES.

Put into small bottles, say 2 drachm, some bromide of copper, muriate of cobalt, and acetate of cobalt in solution. Label distinctly.

Directions.—Draw a scene on paper with bromide of copper. The trees stretching across the sky, and the snow-covered ground, may be changed to vernal beauty by heat. This is done by painting in the grass, foliage, etc., in muriate of cobalt, and the blues—of the sky and water—in acetate of cobalt. These tints will be invisible until held before the fire.