DAISY BANK

BOOK OF ELECTRICAL AND MECHANICAL TRICKS

TECHNICAL SERIES, No. 1.

HOW TO DO
Electrical and Mechanical Tricks.

Containing an Up-to-date collection of Interesting, Instructive and Highly Amusing Electrical and Mechanical Tricks.

Published by
THE DAISY BANK PRINTING & PUBLISHING CO.,
Wellington Street, Gorton, Manchester.

Telegrams: "LIBROS," Gorton.

INTRODUCTION.

IN issuing this little book of ELECTRICAL and MECHANICAL TRICKS, it has been the publishers' intention to produce, at a very small fee, a compilation of interesting and useful tricks in the simplest form, and we have no doubt that any amateur electrician with careful perusal and attention to its pages will have no difficulty in finding ample scope to bring to a successful issue many instructive and amusing up-to-date tricks, which he will find of such an astonishing character as to fascinate both young and old alike, and it is to be hoped there is room for this interesting little book, as its object is to fully explain in an easy and definite manner the wonderful workings of an electrical current, showing the way it can be utilized both for parlour and entertainment purposes. It is not our intention to dwell upon these introductory remarks, but leave the contents of its pages for the young electrician to instruct and amuse both himself and others, and as all the tricks can be performed at a very small expense, we have no doubt with little practice and close observation will soon become proficient, wishing all amateurs every success, and close our remarks with the old saying :—

"PRACTICE MAKES PERFECT."

J.A.P.

Technical Series, No. 1.

HOW TO DO

Electrical and Mechanical Tricks.

ELECTRICAL TRICKS.

The youths of the present day marvel at the wonders of electricity, as there is nothing more striking. The flash of lightning fills certain people with terror, whilst the effects of the Aurora Borealis, with its exquisite beauty of colours to be seen, fills one with amazement as it lights up the northern skies. By the aid of electricity we can flash news from one side of the world to the other in the space of a few seconds, whilst we all know of the wonderful healing powers it claims. Although it cannot make the blind see, yet it has been known to make the paralytic walk. But the marvellous work it has achieved in the past is nothing compared to those which await in the future, and the youngest reader of this book will wonder at its claims, whilst the men and women of yesterday never dreamt of such marvellous doings brought about by electricity.

This marvellous word, electricity, derived its name from electron, the Greek term for amber. The ancient Greeks discovered that by procuring a piece of amber and rubbing the same with a piece of cloth or silk, gave it the power of attracting light objects, such as pieces of paper, small shavings of wood, etc.

England claims the honour of leading the way in electricity. Gilbert, an old-time doctor in the reign of Queen Elizabeth, was the first to make headway in this science. He drew the

attention of the noted scientists to the undoubted meaning of this fact, and provided a long list of articles which possessed the electric current in a small degree, besides amber. In his list he divided them into two classes, one consisting of precious stones, crystals, glass, etc., and the other of sulphur, resin, gum, sealing wax, etc., he thus laying the two foundations of the division of electricity into two classes—"vitreous or glassy electricity," and the other "resinous electricity." Since Gilbert's time, it has been proved that electricity exists in all bodies, and even in the minutest atom, but at first sight, friction by rubbing does not appear to have any power as regards producing electricity in metals. For instance, you procure an iron bar and rub vigorously with a piece of flannel or silk; you will notice that small pieces of tissue paper will not be disturbed when you apply the bar, but if you rub a stick of sealing wax or a glass rod with the same piece of flannel or silk, you will notice the attracting power it possesses, the paper adhering to the rod for some time.

As regards the method of attracting pieces of paper, it is only a very poor definition of showing that a certain article is electrified, and a very simple apparatus to prove the slightest amount of electricity in a body can be made by using an electroscope, which is very simple.

HOW TO MAKE AN EASY AND SIMPLE ELECTROSCOPE.

After obtaining the bottom part of a broken wineglass to act as a stand, then with a little sealing wax fasten a small perpendicular piece of wood, and to the top of this make firm a large

hairpin, bent in the shape of a capital S. In the bend of the pin farthest from the upright piece of wood, fasten a small piece of silk thread, to which is attached a small ball of pith. The latter may be taken from the branch of an ordinary elder tree. When still, you will notice the pith ball hangs perpendicularly in a straight line with the point of the pin at which the thread is tied. When you approach the ball with an electrified body, you will notice it leaves its perpendicular position at once. At first it is drawn close to the electrified body, and immediately after it will rebound back in the opposite direction. The first movement is called "electrical attraction," whilst the second movement is termed "electrical repulsion." These two wonderful movements are the two fundamental notes in the whole science of electricity. If you touch the ball with your fingers, it will perform the same movements, backwards and forwards, until all the electricity excited in the substance brought near to the ball is dissipated. The main object in touching the ball with the fingers is to take away all the electrical power which it received from the electrified substance.

HOW TO ELECTRIFY PAPER.

Take a piece of brown paper about eight inches by five inches, hold it before the fire to take out all the moisture, and when it is fairly hot draw it briskly under your arm several times, so as to cause a friction on both sides at once by your coat. The paper will then be found to be so powerfully electrical, that if you place it against the wall of a room, it will adhere there for a few minutes without the slightest move-

ment. While the paper adheres to the wall, place a *light*, fleecy feather against it, and it will be attracted to the brown paper in exactly the same way as the piece of paper was attracted to the wall. If you take the paper down and warm it and draw it through the arm as before, then hang it up by a piece of thread attached to one corner, it will hold up several feathers on each side. If these should fall off from different sides at the same time, they will all cling together very strongly. If after a minute you shake them all off, they will all fly together in a very singular and amusing manner.

THREE ELECTRICAL TRICKS CAUSED BY FRICTION.

1.—Warm and rub the paper as before, then lay it on a table and place a ball made of elder pith, about the size of a pea, upon it. The ball will, on its own account, immediately run across the paper, and if a needle be pointed towards it, the pith will again run to another part, and so on, for a considerable time, until the electricity is completely exhausted.

2.—Procure a pane of glass, and after warming it, place it upon two books, one at each end, and then sprinkle some bran underneath ; rub the upper side of the glass with a black piece of silk, or a dry piece of flannel, and the bran will begin to dance up and down with much rapidity.

3.—Place your left hand upon the throat of a cat, and with your thumb and middle finger press slightly the bones of the animal's shoulders, then pass your left hand gently along the back. Perceptible shocks of electricity will be felt on the left hand. You may also obtain shocks by touching the tips of the

ears after rubbing the back. If the cat be a black one, and you make the experiment in a dark room, the electric sparks will be very plainly seen. Now place the cat on your knees, apply the right hand to the back, with the left paw resting on the palm of your left hand. Apply the thumb to the upper side of the paw, so as to extend the claws, and by this means bring your forefinger into contact with one of the bones of the leg where it joins the paw, when from the end of this bone, the finger slightly pressing on it, you will be able to feel distinctly successive shocks, similar to those obtained from the ear. These are, no doubt, very amusing and harmless tricks to be performed with your domestic pet, and it is perhaps unnecessary to state that the performer must be on good terms with the household pet.

THE MAGICAL FEATHER.

Warm a glass rod, and rub it with a warm flannel or silk. Then bring a downy feather near it.

At the first contact the feather will adhere to the glass. During that time it becomes electrified with the same electricity as has been excited in the glass rod.

Soon afterwards the feather will fly rapidly from the rod, and you may drive it round the room in the air by following it with the glass rod, and holding the latter between it and the surrounding objects.

Should it come in contact with any object, such as a lamp-glass, or book or shelf, that has not been electrified, it will instantly fly back to the glass rod, and again after contact start

away on its mad career through the air, thus causing a great amount of harmless fun.

THE DANCING PAPER.

A stick of sealing wax rubbed against a warm piece of flannel or cloth acquires the property of attracting light substances, such as small pieces of paper, lint, etc., if instantly applied at the distance of about an inch.

THE MAGICAL BALLS.

Suspend two small pith balls, by fine silken threads of about six inches in length, in such a manner that when at rest they may hang in contact with each other ; on applying a piece of sealing wax, excited as in the former experiment, they will repel each other instantly.

ELECTRIFIED DOLLS.

Get two round pieces of wood and coat them with tinfoil ; attach one of them to the prime conductor by a chain and let it hang about two or three inches from the knob. Place some pith balls upon the bottom piece of wood and bring it under the other.

Immediately this is done, and the upper piece is charged by electricity from the machine, the pith balls will jump up and down, and from one to the other with great rapidity.

If some of the pith be formed into little figures, they will also dance and leap about in the most grotesque and amusing

manner. The same may be made to dance by holding the inside of a dry glass tumbler to the prime conductor for a few minutes, while the machine is in action, and then placing it over them, when they will jump about, to the astonishment of the spectators, as the cause of their motion is not quite so apparent.

THE ELECTRICAL KISS.

This amusing experiment is performed by means of the electrical stool. Let any lady challenge a gentleman not acquainted with the experiment to favour her with a kiss. The lady mounts the glass stool, and takes hold of a chain connected with the prime conductor. The machine then being put in motion, the gentleman approaches the lady, and immediately he attempts to imprint the seal of soft affection upon her lips, a spark will fly in his face, which deters him from his rash and wicked intention. The real cause of this rapid repulsion is: The lady, by being connected with the chain, becomes completely charged with electricity, and if any lady or gentleman in the company will just touch the end of the lady's nose, they will no doubt see a small electric spark.

ELECTRICAL SHOCK FROM A SHEET OF PAPER.

Place an iron japanned tea tray on a dry, clean glass; then take a sheet of writing paper and hold it close to the fire until all its moisture is dissipated, but not so as to scorch it. Hold one end down on the table with the finger and thumb and give

it about a dozen strokes with a large piece of india-rubber from left to right, beginning at the top.

Take it up by two of the corners and bring it over the tray, and it will fall down on it like a stone ; if one finger be now brought under the tray, a sensible shock will be felt. Then lay a needle on the tray with its point projecting outwards, remove the paper, and a star sign of the negative electricity will be seen ; return the paper and the positive brush will appear.

In fact, it forms a very extemporaneous electrophorus, which will give a spark an inch long and strong enough to set fire to some combustible bodies.

If four glasses are placed on the floor and a book laid on them, a person standing on them becomes insulated, that is, a bad conductor between him and the ground prevents the electricity escaping into the earth.

If he then holds the tray vertically the paper will adhere strongly to it, and sparks may be drawn from any part of his body ; or he may draw sparks from any other person, as the case may be, or he may set fire to some inflammable bodies by touching them with a piece of ice.

The above is a very simple, easy, and inexpensive trick, and if carefully carried out will cause a great amount of fun to both young and old.

TO MAKE A GOOD IMITATION OF THUNDER CLOUDS.

Procure a wooden stand, and on this erect two pieces of wooden uprights. To these uprights attach two small pulleys,

over which can be worked easily a silken thread or cord. Then stretch another silk cord across from one upright to the other. On these cords place two pieces of thin cardboard covered with the ordinary tinfoil, and cut so as to appear like clouds. These you must fix horizontally, and be made to communicate by means of thin wires, one to lead to the inside of a charged jar and the other to the outside of another charged jar. If you pull the loop of the silk cord, one of the clouds will be brought much nearer the other. Continue this process slowly until the clouds are about an inch from each other. Then a beautiful flash resembling lightning, only in miniature, will be seen to pass from one cloud to the other.

IMITATION THUNDERBOLT.

If you put one of the jars behind the stand, and take away the second cloud, any small vessel, after being communicated by means of a wire to the outside of a jar, may be made to swim about in water, just under the remaining cloud, but the mast must be made of separate pieces, and very slightly fastened together. If you observe very closely you will notice that when the cloud is passing over the vessel the mast will be struck and shattered to pieces, thus giving you a clear, but small representation of the havoc caused by lightning.

THE DANCING FILINGS.

If you scatter some filings upon a piece of paper, and hold a magnet directly underneath it, you will notice the filings will raise themselves upright, and directly you withdraw the

magnet the filings will instantly fall flat. This has a very amusing and most singular effect. The filings appear to rise and fall as if by some supernatural agency, and thus causes the onlookers to gaze with amazement at the dancing particles.

TO PROVE MAGNETISM IN THE HAND.

You can easily prove to your friends whether you have any great amount of electricity in your body. Procure a cork, and fasten a pin into it with the point upwards, and then place a sheet of notepaper so that it will remain perfectly balanced. Then place your hand over the paper, making a rotary movement, and the paper will commence swerving from right to left, thus proving the magnetism in your body.

MECHANICAL TRICKS.

THE MAGIC BOTTLE.

This trick, if well managed, is one of the most wonderful that can be performed in a drawing-room without apparatus ; but it requires dexterity at the conclusion.

The person performing the trick offers to pour from a common wine bottle, port wine, sherry, milk, and champagne in succession, and in any order.

To accomplish the trick, you must make solutions of the following chemicals, and label the bottles with numbers, thus :—

1.—A saturated solution of the sulphocyanate of potash.

2.—A diluted solution of the above—one part of the solution to four of water.

3.—A saturated solution of nitrate of lead.

4.—A saturated solution of perchloride of iron.

5.—A saturated solution of bicarbonate of potash.

6.—Sulphuric acid.

7.—A clear solution of gum-arabic.

Procure a champagne bottle, and wash it out well, then pour three teaspoonsful of No. 4 into it. As the quantity is very small, it will not be observed, especially if you are quick in your movements. Pour some distilled, or rather rain, water into a common water-bottle or jug, and add a tablespoonful of No. 7 to it; then set it aside ready for use.

Provide some wine-glasses of four different patterns, and into one pattern pour the solution marked No. 1, into another the solution marked No. 2, and so on for Nos. 3 and 5. Return the solutions to their respective bottles, and arrange the glasses on a small tray, remembering the solutions that were poured into each pattern.

Everything being ready, take the champagne bottle that you have prepared, from two or three others, and holding it up to show the company that it is clear and empty, you must desire some person to hand you the water-bottle or jug, and then fill up the bottle with the water.

Pour some of the contents of the bottle into an unprepared glass, in order to show that it is water; then say, "Change to champagne," and pour the liquid from the bottle rinsed with No. 5; then pour into a glass rinsed with No. 1, and it will change to port wine; but if poured into No. 3, it will change to milk, and if into No. 2, it will produce sherry. Be careful in pouring the fluid from the bottle, not to hold it high above the glasses, but to keep the mouth of it close to the edges of the glasses, otherwise persons will observe that it undergoes change of colour after it is poured into the wine-glasses, and on this account the glasses should be held rather high.

THE MAGIC SHILLING.

Procure a small, round box, about one inch deep, to which fit accurately a shilling; line the box with any dark paper (crimson, for instance), and paste some of it on one side of the coin, so that when it lies in the lower part of the box it shall appear like the real box. This shilling is concealed in the hand, and before performing the trick, it will heighten the effect if a number of single shillings are hidden about the room, in places known to yourself. Having borrowed a coin, you dexterously place this on one side, and substitute the prepared one; and putting it gravely into the box, ask all to be sure they have seen it enter. When the lid is on, shake up and down—the noise betrays the metal; now command it to disappear, and shake laterally from side to side. As the shilling is made to fit accurately, no noise is apparent—the coin seems to be gone; in proof of which you open the box, and display the interior. The paper on the coin conceals it. Whilst you direct the audience to look into a book, or a pair of slippers for the missing shilling, the prepared coin can be slipped out, and the box handed round for examination, in which, of course, nothing will be found. This trick may be repeated two or three times with the greatest success, and is so simple that nobody guesses the manner of its performance.

DESCRIPTION OF THE MAGICIAN'S TABLE.

When a secret confederate is required, have a table four and a half feet long, two feet eight inches high, two feet nine inches wide, with a curtain round it, twenty-two inches deep.

In the top of this table are several secret square holes, of different sizes, from three to five inches across ; these having covers which exactly fit, and hung upon concealed hinges, so that they may be let down ; but when lying flat, the top of the table appears to present a perfect surface. Under this surface are buttons, which prevent those lids from falling down when not made use of. Under the top of the table is fastened a box, or drawer, open at the top, and at the side which is farthest from the spectators. This box is about twenty inches deep and concealed by the curtain, and in this box is placed the secret agent who assists the performer.

THE ENCHANTED COIN.

Put fifteen pieces of money into a hat, take out five and mysteriously pass them back into the hat and cover it. To do this trick you must have in your left hand a plate, and under the plate and in your left hand have previously placed five pieces of coin such as you will have placed in the hat ; after you have counted the fifteen pieces into the hat, you then ask the person whom you have selected from the audience to assist you in performing the tricks, to count the money out of the hat into the plate, to see that there is no mistake, after which you turn the money out of the plate into the hat, and at the same time let fall the five pieces you have secreted in your hand under the plate ; and then ask him to draw out five pieces, which will still leave fifteen. You take the five that is drawn out and place them in a drawer, then you go through the magic words, "Presto, Pacillo, Pass." You then open the drawer (after placing your finger on the spring to hold the inside

drawer in which the five pieces were placed), and show the audience that the five pieces are gone. You then tell him to get the hat and see how many pieces are in it. He gets the hat, and to the surprise of all, he counts the original number, fifteen.

THE MYSTERIOUS COIN, OR HOW TO MAKE CROWN PIECES PASS THROUGH A WINE-GLASS, A CHINA PLATE, A TABLE, AND FALL INTO THE HAND.

You may address the company, and say, "I will show you the nature of this trick, if you will only look sharp enough to see how it is done. Therefore, watch closely, and if you have very penetrating eyes, you may see the money go through this glass and fall upon the plate, and from that through the table into my hand. I will do it deliberately, so that you may have every opportunity of detecting the deception, which will make you as wise as myself."

Now you take a plate and place it on the table, place upon that a wine-glass upside down, and take the empty leathern case and hold it before the audience, to convince them that nothing is inside. Place it, in a careless manner, over the riveted money, which you had before put a little aside from the view of the spectators. Place a small ball on the bottom of the glass, then take the case with the concealed coins therein, and place them over a ball, which will be secreted therein. Now tell the company to keep a sharp look-out, and they may dis-

cover the whole process. Take the loose coins and throw them on the table ; bring them again under the table, and exchange them for a ball previously deposited on the shelf, and lay the same upon the table. Remove the case alone, which, of course, will leave the money exposed on the top of the glass. "Now," says the performer, "I presume that you have discovered the whole mystery ; but if not I will give you another opportunity, and will return the money whence it came." Cover the money with the case, and bring the ball which you previously exposed to the spectator under the table, and exchange it for the money on the shelf, which you again toss upon the table. Remove the case with the coins concealed therein, and the ball will appear on the top of the glass as at first. Our performer makes the following concluding speech : "Now, as you have, I suppose, discovered the whole mystery, I hope, ladies, that you will not set up an opposition line against me ; since, if you do, you will very seriously injure my pockets, and, of course, attract all the company, and leave me in an empty house with empty pockets."

GREAT TRICK OF THE EGYPTIAN FLUIDS, OR IMPOSSIBILITIES ACCOMPLISHED.

Mix wine and water together, then separate them by means of a red and white tape. To perform this trick you must have three covers (tin) made, of an obeliatic form, terminating at about one inch and a half on the top. Upon the top of two of these covers is soldered a piece of thick brass, copper, or lead, say about a quarter of an inch in thickness. In the centre

make a hole about the same in diameter, about two inches from the top, and on the inside will be a partition or floor, through the centre of which make a small hole. (This partition must be water-tight.) Previous to performing the trick fill the two covers (the tops of them), one with water, the other with wine, then cork them well, which excludes the air, and consequently keeps the liquid from coming out at the small hole made in the centre of the partition. Then take two sound tumblers and put about as much water in one as there is water in one of the covers. Place the cover over that, the tumbler that has the water, then put about the same quantity of wine in the other tumbler as there is in the other cover, and place that cover over it. Now have a tumbler with a hole through the centre of the bottom (made with a drill), have this hole closed with a long peg from the under side, then through your trick-table have a small auger hole made to admit the peg. This tumbler must also be covered with a similar cover in external appearance. You then take the covers off the tumblers containing water and wine, and in presence of the audience mix the two liquids, then pour both into the tumbler that has the hole through the bottom. Place the tumblers back and cover them over. Now lift the tumbler up containing the mixture that the audience may see it (keeping your hand in front of the peg), place it back with the peg through the hole, cover it over, then take a red and white tape string that has previously been fastened to a small stick, and place it in the top of the cover, that is, over the false tumbler. Then take the end of the red tape, which has a small wire to it, and after removing the cork from the cover over the wine, drop the end of the wire into the

whole. The air is then let into the wine, which lets it run down into the tumblers underneath. Do likewise with the white tape. Then reach your hand under the table and draw the peg out of the tumbler and let the mixture run down into a tumbler or cup secreted there for that purpose. Now remove the covers and show the audience that the tumbler you poured the mixture into is empty, and the one your poured it out of contains it again, which will greatly astonish them.

THE MAGICIAN'S SNOWBALL.

Take a cup and fill it with rice, then change it into a handkerchief. To do this trick you have two cups (tin) made to fit one within the other, but let the outside cup be about two inches deeper than the inside one. Let the rims be turned square down all round, but let that of the inside cup be a trifle larger than the outside one, so that when the tin cover (which you must also have) is put over them it will fit sufficiently tight to lift out the inside cup when it is taken off. Previous to performing this trick you must place in the bottom of the deep cup a white pocket handkerchief, then place the other cup in it, after which bring it out in presence of the audience. Then fill the inside cup (which to the audience appears to be the only cup) with rice, place the cover over it, after which repeat the mystic words, "Presto, Pacillo, Pass." Then remove the cover and the inside cup will have stuck to it and be concealed from view. Now take out the handkerchief, and it will greatly astonish those who see it.

THE MAGNETIZED CANE

is a very surprising little fancy, and is calculated to create much astonishment in the parlour or drawing-room. To perform this trick, take a piece of black silk thread or horse-hair, about two feet long, and fasten to each end of the same bent hooks of a similar colour. When unobserved, fasten the hooks in the back part of your pantaloon-legs, about two inches below the bend of the knees. Then place the cane (it should be a dark one and not too heavy) within the inner part of the thread, and by a simple movement of the legs, you can make the cane dance about, and perform a great variety of fantastical movements. At night your audience cannot perceive the thread, and apparently the cane will have no support whatever. The performer should inform the company before commencing the trick that he intends to magnetize the cane, and by moving his hands as professors of magnetism do, the motion of the legs will not be noticed.

MODE OF PERFORMING THE EGG-BAG TRICK.

Take a long bag and exhibit it to the audience, turn the bag inside out, then back again, after which take several eggs out of it. To perform this trick, you have a bag about half a yard wide, and about five-eighths deep, made of black cambric. Then take strips of the same cloth about three inches wide and sew them on each side of the strip lengthwise of the bag. These are called cells. It is in these that the eggs are placed. Let the end of the cells be closed at the mouth of the large bag, so that the mouth of the cells will be the reverse of that of the

large bag. These are filled with eggs made of wood, with the exception of one or two natural eggs, which you take out first, and break, to convince the audience that they are genuine. When you turn the bag you keep these cells next to you, and as the large bag is turned upside-down, the eggs are in the bottom of the cells at the mouth of the large bag. The performer will then catch the bag just above the eggs, and give it a few raps across the other hand, to convince the audience that there is nothing in it, after which he turns the bag again and takes out several eggs, which to the audience is a great mystery.

HOW TO MAKE SYMPATHETIC INKS.

From the beginning to the end, the student is surprised and delighted with the developments of the exact discrimination, as well as the power and capacity, which are displayed in various forms of chemical action. Dissolve two substances in the same fluid, and then by evaporation, or otherwise, cause them to re-assume a solid form, and each particle will unite with its own kind, to the entire exclusion of all others. Thus, if sulphate of copper and carbonate of soda are dissolved in boiling water, and then the water is evaporated, each salt will be re-formed as before. This phenomenon is the result of one of the first principles of the science, and as such passed over without thought; but it is a wonderful phenomenon, and made of no account only by the fact that it is so common and so familiar.

It is by the action of this same principle, "chemical affinity," that we produce the curious experiments with

sympathetic inks. By means of these, we may carry on a correspondence which is beyond the discovery of all not in the secret. With one class of these inks, the writing becomes visible only when moistened with a particular solution. Thus, if we write to you with a solution of sulphate of iron, the letters are invisible. On the receipt of our letter, you rub over the sheet a feather or sponge, wet with a solution of nut-galls, and the letters burst forth into sensible being at once, and are permanent.

2.—If we write with a solution of sugar of lead, and you moisten with a sponge or pencil dipped in water impregnated with sulphuretted hydrogen, the letters will appear with metallic brilliancy.

3.—If we write with a weak solution of sulphate of copper, and you apply ammonia, the letters assume a beautiful blue. When the ammonia evaporates, as it does on exposure to the sun or fire, the writing disappears, but may be revived again as before.

4.—If you write with oil of vitriol very much diluted, so as to prevent its destroying the paper, the manuscript will be invisible except when held to the fire, when the letters will appear black.

5.—Write with cobalt dissolved in diluted muriatic acid; the letters will be invisible when cold, but when warmed they will appear a bluish green.

We are almost sure that our secrets thus written will not be brought to the knowledge of a stranger, because he does not

know the solution which was used in writing, and therefore knows not what to apply to bring out the letters.

Other forms of elective affinity produce equally novel results. Thus, two invisible gases, when combined, form sometimes a visible solid. Muriatic acid and ammonia are examples, also ammonia and carbonic acid.

On the other hand, if a solution of sulphate of soda be mixed with a solution of muriate of lime, the whole becomes solid.

Some gases when united form liquids, as oxygen and hydrogen, which unite and form water. Some solids, when combined, form liquids.

Chemical affinity is sometimes called elective or the effect of choice, as if one substance exerted a kind of preference for another, or chose to be united to it rather than to that with which it was previously combined; thus if you pour some vinegar, which is a weak acetic acid, upon some pearlash (a combination of potassa and carbonic acid), or some carbonate of soda (a combination of the same acid with soda), a violent effervescence will take place, occasioned by the escape of the carbonic acid, displayed in consequence of the potash or soda preferring the acetic acid, and forming a compound called an acetate. Then, if some sulphuric acid be poured on this new compound, the acetic acid will in its turn be displaced by the greater attachment of either of the bases, as they are termed, for the sulphuric acid. Again, if into a solution of blue vitriol (a combination of sulphuric acid with oxide of copper), the bright blade of a knife be introduced, the knife will speedily be covered with a coat of copper deposited in consequence of the

acid preferring the iron of which the knife is made, a quantity of it being dissolved in exact proportion to the quantity of copper deposited.

HOW TO FORM A SILVER TREE IN A BOTTLE.

Fill a wide bottle, capable of holding from half a pint to a pint, with a tolerably strong solution of nitrate of silver (lunar caustic), or acetate of lead, in pure, distilled water; then attach a small piece of zinc by a string to the cork or stopper of the bottle, so that the zinc shall hang about the middle of the bottle, and set it by where it may be quite undisturbed. In a short time, brilliant plates of silver or lead, as the case may be, will be seen to collect round the piece of zinc, assuming more or less of the crystalline form. This is a case of elective affinity; the acid with which the silver or lead was united prefers the zinc to either of those metals, and in consequence discards them in order to attach the zinc to itself; and this process will continue until the whole of the zinc is taken up, or the whole of the silver or lead deposited.

Again, many animal and vegetable substances consist for the most part of carbon or charcoal, united with oxygen and hydrogen in the proportion which forms water. Oil of vitriol (strong sulphuric acid) has so powerful an affinity, or so great a thirst for water, that it will abstract it from almost any body in which it exists. If you then pour some of this acid on a lump of sugar, or place a chip of wood in it, the sugar or wood will speedily become quite black, or be charred, as it is called, in

consequence of the oxygen and hydrogen being removed by the sulphuric acid, and only the carbon, or charcoal, left.

When Cleopatra dissolved pearls of wondrous value in vinegar, she was exhibiting unwittingly an instance of chemical elective affinity; the pearl being simply carbonate of lime, which was decomposed by the greater affinity or fondness of lime for its new acquaintance (the acetic acid of the vinegar), than for the carbonic acid, with which it had been united all its life; an inconstancy in strong contrast with the conduct of its owner, who chose death rather than become the mistress of her lover's conqueror.

WONDERFUL EXPERIMENTS IN COMBUSTION.

In an ordinary wine-bottle put some pieces of granulated zinc, and pour on them a mixture of sulphuric acid and water, in the proportion of about one part of acid to four of water, then close the bottle with a cork, having a hole bored through the middle, in which a piece of glass tube is inserted. Wait some minutes that the atmospheric air in the bottle may be expelled by the hydrogen gas set free by the decomposition of the water, then apply a lighted taper to the end of the tube, when the gas will inflame, giving out so little light as to be barely visible by daylight, but producing so intense a heat that a piece of platinum wire instantly becomes white hot when held in the flame. If you hold a glass tumbler inverted over the flame, it becames covered with minute drops of water, the result of the union of the hydrogen with the oxygen of the air, and in this case water is the only product.

If a piece of charcoal, which is pure carbon or nearly so, be ignited and introduced into a jar containing oxygen or common atmospheric air, the product will be carbonic acid gas only. As most combustible bodies contain both carbon and hydrogen, the result of their combination is carbonic acid and water. This is the case with the gas used for illumination ; and in order to prevent the water so produced from spoiling goods in shops, various plans have been devised for carrying off the water when in a state of steam. This is generally accomplished by suspending over the burners glass bells, communicating with tubes opening into the chimney, or passing outside the house.

To show that oxygen, or some equivalent, is necessary for the support of combustion, fix two or three pieces of wax-taper on flat pieces of cork, and set them floating on water in a soup-plate. Light them, and invert over them a glass jar. As they burn the heat produced may perhaps expand the air so as to force a small quantity out of the jar, and continue to do so until the tapers expire, when you will find that a considerable portion of the air has disappeared, and what remains will no longer support flame. That is, the oxygen has been partly converted into water, and partly into carbonic acid gas, by uniting with the carbon and hydrogen, of which the taper consists, and the remaining air is principally nitrogen, with some carbonic acid. The presence of the latter may be proved by decanting some of the remaining air into a bottle, and then shaking some lime-water with it, which will absorb the carbonic acid and form chalk.

Into an ale-glass, two-thirds full of water at about 140 degrees, drop one or two pieces of phosphorus about the size of peas, and they will remain unaltered. Then take a bladder containing oxygen gas, to which is attached a stop-cock and a long fine tube ; pass the end of the tube to the bottom of the water, turn the stop-cock, and press the bladder gently. As the gas reaches the phosphorus it will take fire, and burn under the water with a brilliant flame, filling the glass with brilliant flashes of light dashing through the water.

Into another glass put some cold water ; introduce carefully some of the salt called chlorate of potassa, upon that drop a piece of phosphorus, then let some strong sulphuric acid (oil of vitriol) trickle slowly down the side of the glass, or introduce it by means of a dropping bottle. As soon as it touches the salt it decomposes it, and liberates a gas which ignites the phosphorus, producing much the same appearance as in the experiment.

Into the half of a broken phial put some chlorate of potassa, and pour in some oil of vitriol. The phial will soon be filled with a heavy gas of a deep yellow colour. Tie a small test tube at right angles to the end of a stick not less than a yard long, put a little ether into the tube, and pour it gently into the phial of gas, when an instantaneous explosion will take place, and the ether will be set on fire. This experiment should be performed in a place where there are no articles of furniture to be damaged, as the ingredients are often scattered by the explosion, and the oil of vitriol destroys all animal and vegetable substances.

Into a jar containing oxygen gas, introduce a coil of soft iron wire, suspended to a cork that fits the neck of the jar, and having attached a small piece of charcoal to the lower part of the wire, ignite the charcoal. The iron will take fire and burn with a brilliant light, throwing out bright scintillations, which are oxide of iron, formed by the union of the gas with the iron, and they are so intensely hot that some of them will probably melt their way into the sides of the jar and not through them.

But by far the most intense heat, and most brilliant light, may be produced by introducing a piece of phosphorus into a jar of oxygen. The phosphorus may be placed in a small copper cup, with a long handle of thick wire passing through a hole in a cork that fits the jar. The phosphorus must be ignited, and as soon as it is introduced into the oxygen it gives out a light so brilliant that no eye can bear it, and the whole jar appears filled with an intensely luminous atmosphere. It is well to dilute the oxygen with about one-fourth part of common air, to moderate the intense heat, which is nearly certain to break the jar if pure oxygen is used.

The following experiment shows the production of heat by chemical action alone. Bruise some fresh prepared crystals of nitrate of copper, spread them over a piece of tinfoil, sprinkle them with a little water ; then fold up the foil tightly, as rapidly as possible, and in a minute or two it will become red hot, the tin apparently burning away. This heat is produced by the energetic action of the tin on the nitrate of copper,

taking away its oxygen in order to unite with the nitric acid, for which, as well as for the oxygen, the tin has a much greater affinity than the copper.

Combustion without flame may be shown in a very elegant and agreeable manner, by making a coil of platinum wire, by twisting it round the stem of a tobacco pipe, or any cylindrical body for a dozen times or so, leaving about an inch straight, which should be inserted in the wick of a spirit lamp, and after it has burned for a minute or two, extinguish the flame quickly. The wire will soon become red hot, and if kept from draughts of air, will continue to burn until all the spirit is consumed. Spongy platinum, as it is called, answers rather better than wire, and has been employed in the formation of fumigators for the drawing-room, in which, instead of pure spirit, some perfume, such as lavender-water, is used. By its combustion an agreeable odour is diffused throughout the apartment. These little lamps were in much vogue a few years ago, but are now nearly out of fashion.

HOW TO CRYSTALLIZE CAMPHOR.

Dissolve camphor in spirit of wine, moderately heated, until the spirit will not dissolve any more. Pour some of the solution into a cold glass, and the camphor will instantly crystallize in beautiful tree-like forms, such as we see in show-glasses of camphor in druggists' windows.

TO MAKE CRYSTALLIZED TIN.

Mix half an ounce of nitric acid, six drams of muriatic acid, and two ounces of water ; pour the mixture upon a piece of tin

plate previously made hot, and after washing it in the mixture it will bear a beautiful crystalline surface in feathery forms. This is the celebrated *moiree metallique*, and, when varnished, is made into ornamental boxes, etc. The figures will vary according to the degree of heat previously given to the metal.

HOW TO MAKE CRYSTALS IN HARD WATER.

Hold in a wine-glass of hard water a crystal of oxalic acid, and white threads, *i.e.*, ovalate of lime, will instantly descend through the liquid suspended from the crystal.

DIFFERENT VARIETIES OF CRYSTALS.

Make distinct solutions of common salt, nitre, and alum; set them in three saucers in any warm place, and let part of the water dry away or evaporate; then remove to a warm room. The particles of the salts in each saucer will begin to attract each other, and form crystals, but not all of the same figure. The common salt will yield crystals with six squares and equal faces, or sides; the nitre, six-sided crystals; and the alum, eight-sided crystals; and if these crystals be dissolved over and over again, they will always appear in the same form.

When you have read this book be sure to obtain the companion book, entitled:

Amusing Electrical Tricks

Full of interesting and amusing tricks, suitable for the home or stage, Amateur or Professional.

Ask for the Daisy Bank Series of

TRICK BOOKS,

INCLUDING

Tricks with Cards,

Book of Tricks,

Book of Magic, &c., &c,

All of these have been specially compiled, and will be found very instructive and interesting.

THE DAISY BANK PUBLICATIONS.

GREATEST VALUE EVER PUBLISHED.

Each Publication is carefully compiled and written by an expert.

Life and Trial of MRS. MAYBRICK.

Life and Trial of CHARLES PEACE.

Life of SWEENEY TODD
Demon Barber of Fleet Street.

The Moat Farm Mystery
"Dougal!" the chaplain shouted, "are you guilty or not guilty?"

GREAT THAW TRIAL.
Full and Authentic Account.

MARIA MARTEN
Or the Red Barn Murder.

SAPPHO.
A true translation of Alphonse Daudet's famous novel.

THE KREUTZER SONATA.
Tolstoy's most sensational work.

IVAN THE FOOL.
Tolstoy's Interesting Parable.

RELATIONS OF THE SEXES.
By LEO TOLSTOY.

EAST LYNNE.
Illustrated. Marvellous Production.

WRESTLING & JIU-JITSU
Illustrated with Photographs.

BOXING.
The Art of Self-Defence.

CONJURING.
How to earn £20 a week.

How to Play the Piano
WITHOUT TUTOR.

VENTRILOQUISM
By a Professor.

Thought Reading Exposed
By a Professor.

Forty Tricks with Cards
Amusing and Interesting.

BOOK OF TRICKS.
Grand Miscellaneous Collection.

ELECTRICAL AND MECHANICAL TRICKS.

AMUSING ELECTRICAL TRICKS.

SWIMMING. Easy Methods

ROLLER SKATING.

HANDCUFF & GAOL BREAKING MYSTERY.

HOW TO TELL YOUR FORTUNE WITH A PACK OF CARDS.

HOW TO BECOME A DETECTIVE.

HOW TO TELL YOUR FORTUNE WITH DICE & DOMINOES.

THE GOLDEN ROAD TO THE STAGE.

UP-TO-DATE DREAM BOOK.

BOOK OF RECITATIONS & ELOCUTION

RIDDLE BOOK.
Containing Nearly 2000.

MANUSCRIPT MUSIC BOOK.

BOOK OF MAGIC.
With Illustrations.

DRAWING BOOK.

TOY BOOKS,
2d. & 1d. each.
Full of Nursery Rhymes and Short Stories, with Illustrations.

INDIAN CLUBS & DUMB BELLS.