SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

Although there is no shorter or quicker route for the descent of a falling body than that of a plumb line, it has been shown that a body projected horizontally with whatever force, and describing a long trajectory, will reach the earth in exactly the same time as another similar body simply dropped from the same height. There are many simple and ingenious devices for demonstrating this fact. If the experiment could be brought within convenient compass for observation, nothing would be better for the purpose than an ordinary gun, with powder as the propelling power, but this is of course out of the question. It is therefore necessary to resort to apparatus which may be used in an ordinary room, so that both projected and falling ball may be seen and heard. The apparatus is still a gun, but a very harmless and inexpensive one. It is a modified "Quaker gun," a well known toy used for shooting marbles.

Fig. 1 is a perspective view of the gun, showing it immediately after its discharge, and Fig. 2 is a longitudinal section showing the gun ready to be discharged. The gun consists of a wooden barrel chambered at the muzzle to receive the marble and provided with a rod attached to the breech piece, extending into the barrel and arranged to be propelled forward by a strong elastic rubber cord stretched over the breech piece, with its ends nailed to the sides of the gun barrel.

Two changes only are required to adapt the gun to scientific use. First, the notching of the rod passing through the barrel and the application of the trigger, D, for engaging the notches, and second, the support for the falling ball at the muzzle of the gun. The trigger, D, is merely a strip of sheet metal pivoted to the end of the barrel by an ordinary screw. In the muzzle of the gun at the under side is formed a slot, A, and in the end of the gun on opposite sides of the slot are inserted eyes, B. In these eyes is journaled a wire support, C, which supports the ball to be dropped at one side of the muzzle out of the path of the projected ball. The wire support, C, forms a lever, one end of which projects into slot in the barrel and is held by the ball in the muzzle. When the rod in the barrel is liberated by pulling the trigger, D, the ball in the muzzle is projected, thereby releasing the wire support, which immediately turns and allows the other ball to drop. It will be noticed that both balls reach the floor at exactly the same time, without regard to the amount of force applied to the projected ball.

The falling ball is impelled by the force of gravitation only. The projected ball is acted upon by two independent forces—the force of gravitation, which draws it toward the earth, and the projecting force, which tends to move it in a horizontal line. The projecting force is concerned only in carrying the ball horizontally forward, and does not in any way interfere with the action of gravitation, but gravitation brings the ball gradually nearer the earth, until it finally strikes, the force with which it strikes being the resultant of the two forces acting upon it.

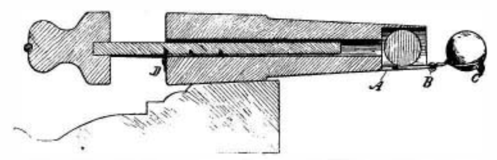


Fig. 2.—LONGITUDINAL SECTION OF GUN.

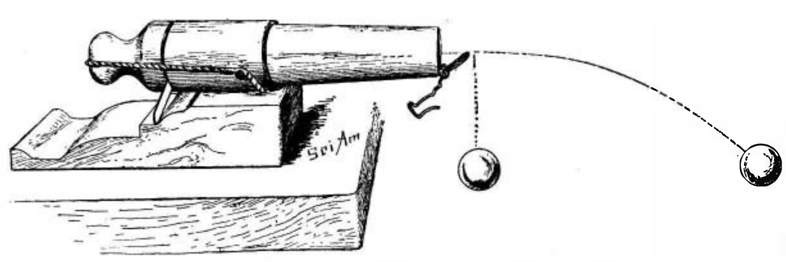
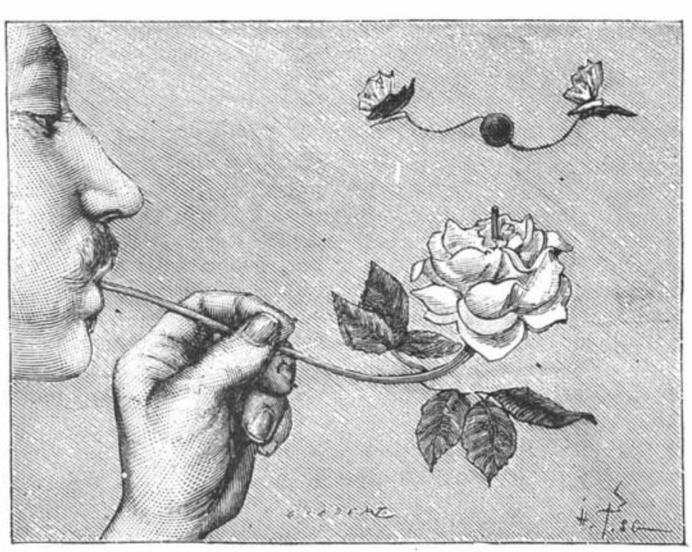


Fig. 1.—FALLING AND PROJECTED BALL.

THE MAGIC ROSE.

All our readers know the experiment which is familiar to rifle and pistol marksmen, and in which an eggshell is made to remain in equilibrium at the top of a jet of water. A very light ball of cork, or even a pellet made of bread crumbs, is capable of resting in equilibrium in a current of air, and the method of performing the experiment we have already given in a preceding number. One of our readers, Mr. Martinaud, an electrician, sends us, under the name of the "magic rose," a charming little device based upon the same principle. The apparatus is not new, but is none the less interesting, and is not much known. The artificial rose, which is of paper, is traversed by a metallic tube that forms its stalk. This tube, on the one hand, extends slightly beyond the petals of the flower, and on the other is prolonged in such a way that it can be held in the mouth, the flower being at a distance of about ten inches from the eyes.

If the tube be blown into regularly, and a small elder pith ball, to which two artificial butterflies are affixed by slender wires, be placed over the flower, the ball, when well centered in the current of air, will remain suspended therein at an inch or so from the flower. As the current of air is invisible, the effect produced is very surprising, and the butterflies, incessantly in motion, appear to be engaged in rifling the flower of sweets, after the manner of living ones. It sometimes happens that the ball revolves in the current and carries along the butterflies, which thus describe a circumference around an axis. It is unnecessary to say that the blowing must be done with great regularity.—*La Nature.*



THE MAGIC ROSE.

Blisters on Panels.

This is a subject which has puzzled a great many, and various have been the different explanations given concerning the cause and remedy; we propose among the others to give what we believe is one great cause, and that is the direct influence of the sun's rays. We have noticed that in nearly every instance the blisters show themselves during the summer months. We have also noticed that immediately after a shower, when the carriage has been exposed to the rain and then left standing with great drops of water on the panels, the danger is greatest, although the theory has been that the shower has cooled them off; we think different, in at least this respect. The rain may have cooled the great body of the surface off, but where the spots of water are allowed to remain, and the full force of the sun is brought to bear upon them, they are then converted into what might be called suctions; the heat is in a measure concentrated into a small surface, which in the act of drying draws the softened paint up into what we call blisters; that is our opinion, formed after some little observation.

After the blister is once allowed to dry, there is no way to get it down; any attempt to do so would break it off, as it then becomes brittle, exactly as it does when you blister with the iron or lamp when burning off. In this case, if taken in time, it has this advantage over the other: it is not burnt paint as the other is, but simply softened up and drawn; it looks as though it was twice as large as the other, but in reality is not; by simply pressing down on it while it is hot you can restore it to its place, of course with the loss of considerable of its luster; it will naturally show where it has been, but will not be a blank space, as it would be if allowed to flake off. Another way blisters are liable to form is to allow the job to stand either in the coach house or shop near a window; the sun is very likely to form a focus on some of the panes, and, striking on the panels of the body, or, as in some cases, on the carriage parts, the rays are concentrated on one particular spot, acting just as though it was what in our boyhood days we used to call a burning glass.

The safest way to guard against all danger is, be careful about how the carriage is subjected to either the rain or heat. If caught in a shower, have a chamois skin with you; it will not take very long to dry the surface off, and then you are sure you are running no risks. If compelled to stand any length of time in the sun, turn the carriage around once in a while, so as to allow the sides to cool alternately. The danger is not near so great when the painting has been done properly on the job. Never allow the carriage to stand in the coach house near a window, unless you have a cover for the exposed parts, or curtains on the windows, and above all do not cool your carriage off too suddenly while it is heated, by dashing water over it in that condition; let it cool off gradually by standing in a shady place, or at least until you can bear your hand on it without almost burning it. The reason is that the varnish and paint is softened up so that the sudden reaction will be very likely to cause it to crack, if not to flake off altogether. Water should never be allowed to dry on a carriage, either by the action of the sun or atmosphere, but should be dried off with a chamois.—*Carriage Monthly.*

The Coolest Town in the World.

In the Berlin *Meteorologische Zeitschrift* for June, so says *Nature*, Dr. Hann gives an interesting account of the winter temperature of Werchojansk (Siberia), deduced from several years' observations. The town, which lies in the valley of the Jana, about 9 feet above the level of the river, in latitude 67° 34′ N., longitude 133° 51′ E., and at a height of about 350 feet above the sea, has the greatest winter cold that is known to exist upon the globe. Monthly means of —58° F. occur even in December, a mean temperature which has been observed nowhere else in the polar regions; and minima of —76° are usual for the three winter months (December-February). In the year 1886 March also had a minimum —77°, and during that year December and January never had a minimum above —76°, while in January, 1885, the temperature of —89° was recorded. These extreme readings are hardly credible, yet the thermometers have been verified at the St. Petersburg Observatory. To add to the misery of the inhabitants, at some seasons the houses are inundated by the overflow of the river. The yearly range of cloud is characteristic of the climate; in the winter season the mean only amounts to about three-tenths in each month.

Artificial Emeralds.

At a recent session of the French Academy of Sciences, Mr. Daubree, in behalf of Messrs. Hautefeuille and Perrey, presented an interesting note on the production of emeralds. These learned chemists have succeeded in producing very beautiful crystals of emerald by fusing silica, alumina, and glucina (with traces of oxide of chromium) with acid molybdate of lithia. The materials were heated to a temperature of from 600° to 700° for fifteen days.

There were obtained 15 grammes of small crystals of about a millimeter, having all the mineralogical and physical characters of the natural emerald. The longer the operation is continued, the larger the crystals become.—*Annales Industrielles.*

THE MAGIC ROSE BUSH.

In lectures on chemistry, the professor, in speaking of aniline colors, in order to give an idea of the coloring power of certain of these substances, performs the following experiment:

Upon a sheet of paper, he throws some aniline red, which, as well known, comes in the form of iridescent crystals. He shakes the surplus off the paper into the bottle, so that it would be thought that nothing remained on the paper. If, however, alcohol, in which aniline colors are very soluble, be poured over the paper, the latter immediately becomes red.

This experiment may be varied as follows: Instead of scattering the aniline over paper, it is dusted over the flowers of a white rosebush, and the flowers are shaken so as to render the dust invisible, and then, when a visit is received from an amateur of horticulture, we tell him that we have a magic rose bush in our garden, the flowers of which become red when alcohol or cologne is poured over them. The experiment is performed with the aid of a perfumery vaporizer, and the phenomenon causes great surprise to the spectators who are not in the secret.—*La Nature.*

THE MAGIC ROSE BUSH.

India Rubber.

At the recent Manchester exhibition Charles Macintosh & Co., of that city, made an exhibit divided into two parts, one of which is devoted to the origin of India rubber and the various materials used in its manufacture, and the other to the processes of manufacture of finished articles. Professor Watson Smith says:

Probably no exhibit illustrating the India rubber industry has ever before been shown of so complete a kind.

The articles exhibited are the entire trunk of an India rubber tree (*Siphonia elastica*), specially obtained from South America, and from which fine Para rubber is obtained. It is a tree inhabiting dense forests on the banks of the Amazon and several of its tributaries, where it is called the "*Seringue*." The chief district from which its caoutchouc is obtained is, according to Wallace, the country between Para and the Xinqui River. The "*Siphonia*" species comprises trees varying from twenty-five to upward of one hundred feet in height, and all contain a milky juice in more or less abundance, though they do not all yield caoutchouc of good quality, that from some of the species being brittle. The fruit is a rather large capsule, composed of three one-seeded pieces, which split in halves when ripe. The raw seeds are poisonous to man and to quadrupeds, but macaws eat them greedily, and they are an excellent bait for fish; long boiling deprives them of the poisonous principle, and renders them very palatable. The bulk of the caoutchouc exported from Para, whence our chief supply comes, is obtained from *S. brasiliensis*, which is the one common in the forests of the Province of Para, but that brought down the Amazon and Rio Negro is derived from *S. lutea* and *S. brevifolia*. The thin white milk is obtained by making incisions in the trunk, from which it exudes. The trunk exhibited is thus punctured, and a pocket-shaped receptacle of clay has been attached just below the puncture so as to represent the way in which the milk is caught. This clay receptacle is furnished with a lip, so that the milk overflowing may be caught in the earthen vessels used by the native workpeople.

This clay receptacle to the tree holds about a tumblerful, and it requires about three hours to fill if the tree be fruitful; this will give an idea of the rate of flow. When the first cutting ceases to yield, the natives make a second one lower down, and so on until they have exhausted the milk in the tree, which is done by making in all four incisions, all at equal distances. They then pour the milk into larger vessels, gather heaps of Urucari or Inaja nuts, which yield a thick oily smoke, and set them on fire. Now they begin the manufacturing process by covering the wooden forms for sheets, long and flat bottles, etc., with clay (so as to be able to detach the rubber easily afterward), dip the forms into the milk, and hold them over the smoke. As soon as the milk is dry, they dip them a second time, and so on till the rubber is of sufficient thickness, they then take it off the form, and it is ready for exportation.

A tree cannot be again made use of for two years, as it requires that time to recover its exhausted strength. A section of a rubber tree is shown, measuring about 18 inches in diameter, also a bottle of the white milk brought from Para, and now coagulated. The actual trunk of the tree is so arranged as to appear to form the foreground of a picture in which the scene is completed in a very ingenious manner, as a painting, the foliage of the trees being represented, the natives at work curing the rubber, carrying the milk, etc.; a small sapling (*Ficus elastica*) actually growing, and planted close to the picture referred to, assists still further the imagination of the visitor. Specimens of the Urucari nuts are shown, and also of crude rubber as imported—fine Para, negro head or Sernamby, Mangabeira, and Ceara.

In the other parts of the exhibit are three other pictures portraying all the details of the native work—the collecting of the rubber from the trees, smoke curing, a rubber collectors' settlement, and a river boat. An actual specimen of such a boat, made of rubber, is also to be seen. Specimens of washed Para rubber, pure solid rubber block, and fine cut sheet used for making tobacco pouches, elastic bands, surgical bandages, etc., are shown, along with drugs, chemicals, and pigments used in the manufacture of rubber goods. Very interesting also are the six specimens illustrating the products of destructive distillation of caoutchouc.

Elastic Rubber Thread.—The manufacture of this is one of the most important branches. This thread is used for weaving with silk or cotton into elastic webs for boots, braids, and other articles of dress. Among these threads are some exceedingly fine vulcanized varieties shown by this firm. A considerable variety of articles used for mechanical purposes is shown, and also a convenient form of matting recently introduced, which is finely ribbed. It is used as floor cloth, and presents several advantages in such use; it is styled "Rabdotos." There are also waterproof and airproof fabrics and all varieties of garments, mattresses which can be used on board ship, and, by being inflated, will in case of necessity, serve as rafts. A camp equipment is shown, consisting of bed, air mattress, folding bath, and bucket, playing balls, Macintosh tennis balls, and elastic bands.

The works of this firm were first established in 1824 by Mr. Charles Macintosh, who first applied India rubber to the warterpoofing of articles of clothing, whence the term "Macintosh." The processes used to render rubber non-adhesive and insensible to cold, usually termed vulcanization, are the invention of Mr. Thomas Hancock, one of the members of the firm. The effect of vulcanizing is also to make the rubber permanently elastic, as well as insensible to cold or heat, besides resisting largely the dissolving action of oils or fatty matters. Vulcanization has enabled rubber manufacturers to produce articles applied by engineers in machines driven by steam or otherwise.

Natural History Notes.

The Resurrection Plant.—The curious property possessed by the "resurrection plant" (*Selaginella lepidophylla*) of curling up into a ball in a dry atmosphere and uncurling when placed in water, like the rose of Jericho (*Anastatica hierochuntina*), is well known, but the cause has not hitherto been explained. Mr. Leclerc du Sablon has made a microscopical examination of the plant, and has determined that the curling up is a purely physical phenomenon, due to the existence in the upper surface of the stems of a layer of short, thick-walled cells that contract more strongly in drying than others which form a thinner layer inside the cortex of the lower surface. The curling of the frond that occurs is therefore very similar to the dehiscence of the spore cases in the nearly allied order of ferns. The curling up of *Selaginella lepidophylla*, however, differs from that of the rose of Jericho in the fact that in the latter the object appears to be to protect the seeds, the rolling along of the plant by the wind serving to carry the seeds to a distance in safety, the plant, meanwhile, losing its vitality. On the other hand, the selaginella preserves its vitality, even in a dried state, for a considerable length of time, not only expanding, but sending out roots when placed in a sufficiently moist situation. Mr. Du Sablon shows that this property is due to the fact that the thick-walled cells contain a dense, opaque protoplasm, such as is present in the cotyledon or albumen of some seeds. This protoplasm is further protected by the thick membrane of the cells from external influences of temperature, etc., so that the plant can easily assume a state of active vitality under conditions similar to those under which seeds germinate.

Cause of Chameleon Changes.—If we take three pieces of glass, and distribute over one several small drops of brown paint, by pressing on this with another glass the drops are spread out, giving to the whole glass a delicate brown tint. If we now separate the glasses a little, the paint collects in drops, and the tint partly disappears. If we take the third glass and place on it a few drops of green paint, and then press it against one of the others, a green tint will show through the layer of brown dots. The skin of the chameleon is, roughly speaking, made up of three such layers, with dots of pigment called chromatophores between them. These dots may be contracted or spread out in thin layers, the resulting color depending on the color of the chromatophores affected. The power of adapting color to surrounding objects is known to naturalists as "protective resemblance," and many cases of it are to be found in both the animal and the vegetable kingdoms.—*The Swiss Cross.*

Receptacles of Secretion in Plants.—Two methods of formation of the cavities containing oils and oleoresins in plant tissues are generally recognized by botanists. In one of these, to which the term "lysigenous" is applied, the cavity is supposed to be formed by the destruction or absorption of a certain number of contiguous cells, and in the other, or "schizogenous," mode of formation, the cavities are said to be formed by the separation of neighboring cells, leaving an interspace. Authorities vary in their opinions as to the mode of formation in the same plant, as, for example, in the rue (*Ruta graveolens*), in which it has been stated that the cavities are first schizogenous and ultimately lysigenous. Mr. Leblois, with the object of clearing up the difficulties thus created, has undertaken a lengthy examination of plants of different natural orders, and has arrived at the conclusion that in all cases the origin and mode of development of oil cells and receptacles of secretion are the same. The oil cell is formed by a mother cell dividing into four cells, which leave a line of separation. These cells, by subsequent divisions, increase the size of the cavity. When several contiguous cells act in the same way, a secretory canal or a long instead of a round cavity is formed. He also points out that the layer of cells immediately surrounding the oil cavity appear to have a protective function.

The Pottery Tree.—Among the useful vegetable productions of Brazil may be mentioned the pottery tree, *Moquilea utilis*. The wood of this tree is very hard and contains a very large amount of silica, not so much, however, as the bark, which is largely employed as a source of silica in the manufacture of pottery. In preparing the bark for the potter's use, it is first burned, and the residue is then pulverized and mixed with clay in varying proportions. With an equal quantity of the two ingredients, a superior quality of ware is produced. This is very durable and will stand almost any amount of heat. The natives employ it for all manner of culinary purposes. The bark, when fresh, cuts like soft sandstone, and the presence of the silex may be readily ascertained by grinding a piece of the bark between the teeth.

An Elephant Funeral.—The *St. James Gazette* prints the following letter from a planter in Ceylon, giving a remarkable account of the removal of the body of a dead elephant by its comrades of the herd:

"I went after a herd of eight elephants, and came up with them about 3 P.M. After stalking I got a chance at the one which seemed about the biggest of the herd, and dropped it at the first shot. It turned out to be a big cow elephant. About two hours afterward I had the tail and feet cut off and taken to the bungalow. Next morning I went to the spot to look at the elephant and found her, or what remained of her, *non est*. After looking around, I saw the herd had been around during the night, and I soon discovered a track where they seemed to have retired in a body. I followed this through a thick bamboo jungle, and about 500 yards further on, I came upon the dead elephant, lying in the bottom of a rocky stream. Judging from appearances, the body of the elephant had been carried to the top of the bank, and from there rolled into the stream. From the tracks, it was plain that the body had not been rolled, but carried to the bank, and it was plain that it had been rolled through the managrass, which grows on the sides of the stream. The jungle through which the body was brought to the stream was very heavy, with bamboos growing close, and the track which the elephants made was several yards wide. Some surprise was expressed at the circumstances by my neighbors till I showed them where the elephant had been shot and where its tail and feet had been cut off, and where the body lay in the stream, which proved conclusively that by some means or other the body had got over the intervening space in the night." It is difficult to understand how elephants with their trunks and feet could raise and support the dead body of a comrade. However, they seemed to have managed it.

Meta-Sulphite of Potash.

This salt has been recommended as a substitute for sulphite of soda in preserving pyrogallic acid in solution. This salt is $K_2S_2O_5$, while bisulphite is $HKSO_3$, and is prepared by supersaturating a rather strong solution of carbonate of potash with sulphurous acid and precipitating with absolute alcohol. A white acicular mass of crystals is obtained which must be collected on a filter and washed with absolute alcohol. The salt has an unpleasant sulphurous taste, is neutral to test paper, and slowly evolves sulphurous acid in the air. Doubtless this slow evolution of sulphurous acid takes place and preserves pyro.

Antagonism of Poisons.

The property alleged to be possessed by certain poisons of counteracting the action of others has been submitted to experimental test by M. Roger and the results reported by him to the Paris Society of Biology (*Med. Pr. and Circ.*, May 23, p. 542) are suggestive of the necessity for caution in accepting some statements that have been made upon this subject. He found that animals succumbed to the effects of a mixture of morphine and atropine long before the ascertained fatal dose of either drug separately had been reached, and the same observation was made with mixtures of atropine and quinine or quinine and morphine.

Poteline.

This is the name of a mixture of gelatine, glycerine, and tannin, to which sulphate of barium, or of zinc, may be added, and which may be colored by vegetable colors. It may be kneaded while warm. When cold it may be used for numerous purposes. It can be turned, filed, bored, polished, and can be used for hermetically sealing bottles, etc. The proportion of ingredients varies according to the uses. For sealing bottles, of course, it must be used liquid. Potel, the inventor, uses it with success for preserving meat, by applying it liquid, at a temperature of 50–60° C.—*Jour. de Ph. d'Als.-Lorr.*

PEROXIDE of hydrogen, according to Dr. Love, of St. Louis, is a most valuable agent in the treatment of diphtheria, ozæna, and in all cases of cancerous ulceration and of suppuration or necrosis. He employs it in a solution containing 0·5 to 3 per cent, using most frequently, however, a strength of 1 per cent, diluting the commercial "ten volume" peroxide with two or three times its volume of water. Of its value in clearing away and effectually deodorizing the decomposing exudate is cases of diphtheria he speaks in the most emphatic terms, and he regards the remedy also as one of great usefulness in scarlet fever, whooping cough, and other specific diseases.