magnesium oxide (MgO), and it is the result of the reaction that takes place when the magnesium (Mg) combines with the oxygen (O) of the air. The experiment shows in a brilliant way the direct combination of these two elements.

How to Make Explosive Matches. For this experiment you need a few ordinary parlor matches and some sodium silicate (Na_2SiO_3), or *water-glass* as it is called. To make the latter put 1 tablespoonful each of silicon dioxide (SiO_2) or *silica*, as it is called, and sodium hydroxide ($NaOH$), that is, caustic soda, in a beaker and pour on enough boiling water (H_2O) to dissolve them; when this is done, sodium silicate (Na_2SiO_3), or water-glass is formed thus:

SiO_2	+	$2\,NaOH$	=	Na_2SiO_3	+	H_2O
Silicon dioxide		Sodium hydroxide		Sodium silicate or water-glass		Water

To make the matches explosive, dip their heads in the water-glass (Na_2SiO_3), let them dry, and then dip them into melted paraffin. Now when a friend asks you for a match, hand him one of these and on striking it it will pop and sputter like a string of Liliputian firecrackers.

How to Make Rainbow Lights. Here are two very pretty experiments, but you must do them outdoors. Put ½ teaspoonful each of strontium nitrate ($Sr(NO_3)_2$), powdered charcoal (C), powdered iron (Fe), powdered magnesium (Mg), and sulphur (S), together with 1 teaspoonful of potassium nitrate (KNO_3) in a tin pan and mix them together, but *do not rub or grind them.* Now set the pan on a brick where the sparks can fly about and not do any harm. Put one end of a fuse a foot long in the mixture and light the free end of it; when the burning fuse ignites the different

substances they will burn with varicolored lights and throw out brilliant scintillating sparks. The colored lights are produced by the burning metals, while the sparks are set up by the oxygen (*O*) liberated from the potassium nitrate (KNO_3), which oxidizes the different metals.

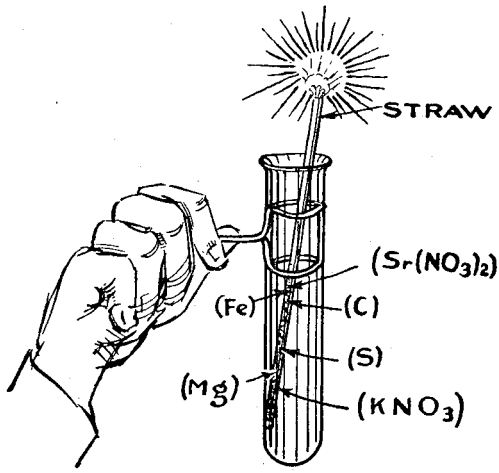

FIG. 166.—Making Rainbow Lights.

Get a paper straw, such as you use when imbibing soda-water, fold over one end, fill it two-thirds full of the mixture used in the foregoing experiment, and then set it in a test tube, as shown in Fig. 166. Now light the upper and free end of the straw, and when this mixture is ignited by it you will have a very pretty rainbow-color effect.

How to Make Fourth of July Sparklers. Make a mixture of 1 teaspoonful of potassium nitrate (KNO_3) and 2 teaspoonfuls of powdered magnesium (*Mg*) on a sheet of

paper and stir them together, but *do not rub or grind them.* Now coat half a dozen pieces of iron wire each about 6 inches long, with melted paraffin and then roll them in turn in the mixture until they are coated all over with it. When

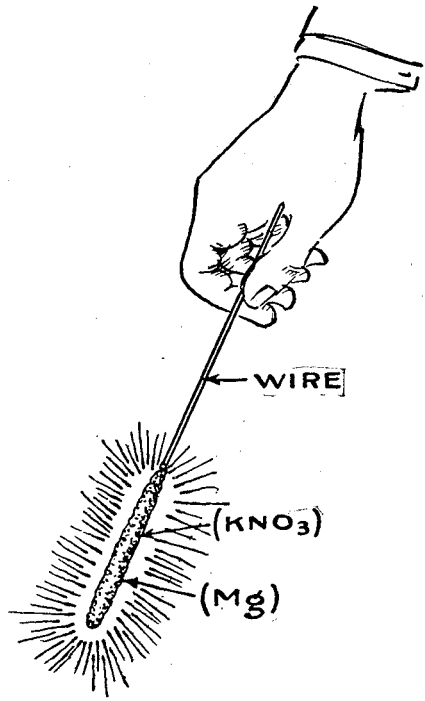

FIG. 167.—A Fourth of July Sparkler.

they are cold, light the end of one of them with a match and as the magnesium (*Mg*) burns it will throw out bright scintillating sparks, as shown in Fig. 167.

How to Make a White Flash-Light. Put ½ teaspoonful

each of potassium nitrate (KNO_3) and powdered magnesium (Mg) into an iron frying-pan and mix, but *do not rub or grind them.* This done, sprinkle ½ teaspoonful of powdered sulphur (S) on the mixture and then light the sulphur (S) with a match fastened to a wire, as shown in Fig. 168. The burning sulphur (S) will soon ignite the potassium nitrate (KNO_3) and magnesium (Mg). They will then suddenly combine with a bright, dazzling, white flash.

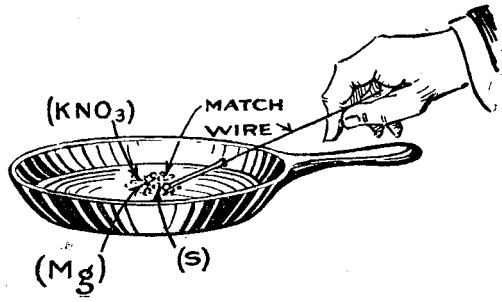

FIG. 168.—Lighting a Flash-Light.

How to Make a Red Flash-Light. To make a red flash-light use ½ teaspoonful of strontium nitrate ($Sr(NO_3)_2$) and a like amount of potassium nitrate (KNO_3). Mix them in an iron pan, taking the precautions explained in the foregoing experiment, and light the mixture. A bright, dazzling red light will be produced.

How to Make a Green Flash-Light. Mix ½ teaspoonful each of potassium nitrate (KNO_3), boric acid (H_3BO_3), or *boracic acid*, as it is commonly called, and powdered sulphur (S) and 1 teaspoonful of powdered magnesium (Mg) in an iron pan, taking the precautions explained for making

a white flash-light, and fire the mixture with a fuse (see "How to Make a Fuse") and it will burn with a brilliant green flash.

How to Make Flash Paper. Magicians use this kind of paper and when they ignite it, it vanishes in a flash of light, hence, it is called *flash paper.* You can buy it for 25 cents a sheet of dealers in magical supplies, or you can make it as follows: Pour 1½ fluid ounces of sulphuric acid (H_2SO_4) and 2½ fluid ounces of nitric acid (HNO_3) into a beaker (you can measure them in a graduated glass) and stir them with a glass rod. This done, pour the solution into a 4-by-5-inch glass photographic developing-tray, and then immerse in it several sheets of thin print paper (that is, paper which is unsized and porous).

Let the sheets of paper remain in the solution for 10 minutes, then pour off the latter and wash the paper under a stream of running water (H_2O) for an hour, so that every molecule of the acids will be removed. Unless the sheets are washed thoroughly they are apt to catch fire spontaneously, and if struck with a hammer they will explode, for what you have really done is to convert the paper, which is practically pure cellulose ($C_6H_{10}O_5$) into nitro-cellulose ($C_{12}H_{14}O_4(ONO_2)_6$), and this is the gentle substance that goes by the ordinary name of *guncotton.*

After washing the sheets, drain them off and hang them on a string stretched across the room to dry. Now if you will hold a sheet by a corner with your fingers and touch the opposite diagonal corner to the flame of a candle it will disappear in a flash of light, and because the combustion is so perfect it will leave an imperceptible amount of ash behind.

How to Make Colored Flash Paper. To make colored flash paper you need only to dip the sheets after you have put them through the acid bath, and washed and dried them, in a saturated solution of the following compounds. Half fill a glass photographic tray with warm water (H_2O), and put in as much lithium chloride ($LiCl$) as it will dissolve. You will then have what is called a saturated solution; this will give the paper a *red* flash. Use a saturated solution of copper chloride ($CuCl_2$) for making *blue* flash paper. Use barium chloride ($BaCl_2$) for *green* flash paper, and potassium nitrate (KNO_3) for *violet* flash paper.

How to Make Flash Handkerchiefs. To make a handkerchief disappear in a flash of fire, magicians use what they call a *flash handkerchief*. This is made in exactly the same way as flash paper, except that you use a handkerchief of cheese-cloth. When the latter is treated with the acid solution, it becomes a very pure form of guncotton, for cotton is a purer form of cellulose ($C_6H_{10}O_5$) than paper. As it is explosive when ignited in a confined space, do not roll it up or enclose it when you touch it off.

How to Light a Paper Without a Flame. An experiment that is a favorite with professional *fire-eaters* is to light a piece of paper by simply breathing on it. Now I submit that the breath of even a fire-eater is not nearly hot enough to raise the *kindling temperature* of a piece of paper to a point where it will catch fire. So there must be some trick in it, and here it is.

Get a glass tube that has a bore of about $\frac{1}{32}$ inch and an outside diameter of $\frac{1}{16}$ inch and cut it into 2-inch lengths. Seal one end of each of the tubes, as shown at

A in Fig. 169, then fill them with sulphuric acid (H_2SO_4) and seal the other end, as at B; now mix 1 teaspoonful each of sugar ($C_{12}H_{22}O_{11}$) and potassium chlorate ($KClO_3$) and put as much of this *quick-match*, as it is called, as you can get on the head of a lead pencil on a sheet of tissue paper, as at C, and then wrap the mixture and an acid tube up in it tight.

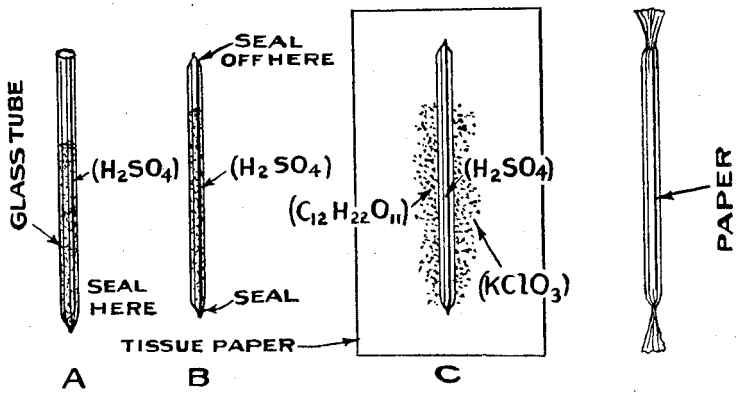

FIG. 169.—Lighting a Paper without a Match.

Now wrap this up in a sheet of ordinary paper, or one of flash paper, and when you want to ignite it with your breath you not only breathe on it (which hasn't anything to do with the case) but you squeeze the paper and break the tube. The acid in it will then come in contact with the quick-match mixture and they will instantly blaze forth and set the paper on fire. You can buy these acid tubes all ready to use of dealers in magical supplies for a very low price.

How to Light a Paper With a Piece of Ice. Fix a piece of metal potassium (K) about one-fourth the size of a pea to one corner of a perfectly dry sheet of paper by gluing a bit of paper over it, but let a corner of the metal stick out, and it cannot then be seen. When you are ready to fire the paper, press a piece of ice to the projecting corner of the potassium (K). The instant the water (H_2O) of the melting ice touches the metal, hydrogen (H) is set free and the heat of the reaction makes it catch fire. The paper will be ignited in turn.

The Great Fire-Eating Trick. When you have learned this great secret you can blow out a stream of bright sparks from your mouth "to the horror of all beholders," or at least this is what the magical catalogues say. Here is the great secret. Put 2 tablespoonfuls of water (H_2O) in a beaker and stir in as much potassium nitrate (KNO_3) as it will dissolve.

Soak a piece of thick, soft cord, about a foot long, in it over-night, then dry it thoroughly and cut it up into pieces about 1 inch long. Now light one of these pieces and roll it up loosely in a little ball of cotton about 1 inch in diameter; put this in your mouth and then blow until a shower of sparks issues forth, as shown in Fig. 170. You can heighten the effect by pretending to eat a tuft of cotton every time you blow out sparks. When you inhale, always do so through your nose, and when you exhale, always be sure to do so through your mouth, in which case the experiment will succeed beautifully.

How to Make Colored Fire.—Red Fire. Put 1 teaspoonful of strontium nitrate ($Sr(NO_3)_2$) and powdered sul-

phur (S), and 2 teaspoonfuls each of potassium nitrate (KNO_3) and powdered charcoal (C) in a soup-plate, or a pan, and mix them together with a stick, but *do not rub or grind them.* Make a little pile of the mixture in the center of the dish and light it with a fuse, and it will burn with a brilliant red light. It is the strontium nitrate ($Sr(NO_3)_2$) that gives the light its bright red color, while the sulphur (S) and charcoal (C) provide the material which burns, and

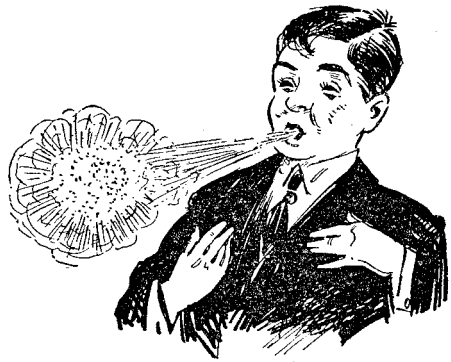

FIG. 170.—The Great Fire-Eating Trick.

the potassium nitrate (KNO_3) supplies the necessary oxygen (O) for them to burn in.

Green Fire. Put 1 teaspoonful of powdered sulphur (S) and 2 teaspoonfuls each of potassium nitrate (KNO_3), powdered charcoal (C), and powdered zinc (Zn) in the dish, and mix and light them with a fuse, as in the last experiment. The mixture will then burn with a bright green color.

Yellow Fire. Put 1 teaspoonful each of sodium chloride ($NaCl$), which is common table salt, and powdered sulphur

(S) and 2 tablespoonfuls of potassium nitrate (KNO_3) and powdered charcoal (C) in a dish, or pan; mix and fire with a fuse as in the preceding experiment, and the mixture will burn with a bright yellow color.

Bengal Lights. Put 1 tablespoonful of potassium nitrate (KNO_3) 1 teaspoonful of powdered sulphur (S), and ½ teaspoonful of antimony trisulphide (Sb_2S_3) in a dish, or pan, and mix and ignite them with a fuse, as in the foregoing experiments. This mixture will then burn with a bright white light. If you will add ½ teaspoonful of powdered magnesium (Mg) to the above mixture, the light will be exceedingly brilliant.

How to Make Phosphine Smoke Rings. And I might add, a horrible odor at the same time. Put enough water (H_2O) in a glass retort to make it one-fourth full, and drop in 3 or 4 pieces of potassium hydroxide (KOH) or *caustic potash*, as it is commonly called, each of which is about as large as the stone of a cherry. Now when they are dissolved, drop in 2 bits of white phosphorus (P), each about the size of a large pea, add 1 teaspoonful of ethyl ether[1] ($C_4H_{10}O$), which is *common ether*, and put the glass stopper back in the retort.

This done, set the retort in the ring of your support-stand, have the free end of it dip into a glass dish of water (H_2O), and then set the alcohol lamp under the bowl of the retort, as shown in Fig. 171, and you are ready for the experiment. All you have to do now is to light the lamp and let the solution boil gently, and very soon a colorless gas called phosphine (PH_3), but which used to be called *phosphoreted*

[1] When 2 molecules of alcohol lose 1 molecule of water, ether results.