The Danger of Gas.

Much has been written regarding the attempt to put electric wires in gas mains, but far more yet remains to be said about how to keep gas out of electric conduits. Deaths among electric workmen from asphyxia and from injuries due to explosions caused by the presence of illuminating gas in underground conduits are being recorded with an increasing and unpleasant frequency.

What to do to keep the gas out, and if it is present how to render the operation of laying underground conductors a safe one, are problems which confront the electrical engineer. Obviously, if all the conditions were under control of the electrical company, the remedy should be applied to the first cause, leaky gas mains; but as such a treatment of the subject is impracticable, and as accidental leaks may occur at any time even in properly constructed mains, the electrical subways should be made as far as possible gas tight. No matter how much care may have been exercised in the construction of subways, they may at any time be found to contain gas in dangerous quantities, and precautions should always be adopted to guard against accident by those entering the manholes.

A good plan, much used by cable splicers when compelled to work in a manhole which is found to contain gas, is to allow fifteen or twenty minutes for ventilation after taking off the cover before entering; then to proceed to close up with pipe clay all the openings into the ducts. Pipe clay is used in preference to cement because it does not harden and can easily be removed. In those ducts into which cables have been drawn there is between the cables and the walls of the ducts more or less space which should be carefully filled with this clay.

During all the time that the splicer remains in the vault his helper on the surface sends down a supply of air from a rotary blower which is operated by a crank. This keeps the manhole ventilated and renders the work of splicing comparatively safe. Without the sealing up of the ducts all attempts at ventilation may prove useless, because if communication with neighboring manholes is allowed, a sudden draught of air might suck into the working chamber a volume of gas sufficient to smother the workman while his helper was contentedly turning the crank of the air pump on the surface above.

It is well to bear in mind that the treatment for asphyxia is similar in many respects to that used in resuscitation from drowning. If a workman should be overcome by gas, his life may depend on the way he is handled before the arrival of a physician. He should be brought into the fresh air at once. Efforts should be directed toward keeping up the heart's action and restoring the circulation, and for this purpose stimulants may be given. The foul gases should be expelled from his lungs and artificial respiration practiced if necessary.

Unless a general system of subway ventilation is carried out, this plan of sealing up the ducts should be extended to all the manholes whether there are men at work in them or not, otherwise a leak at one point might flood the entire system with gas. Under the latter condition an explosion at one place may be transmitted through the connecting ducts to a number of manholes, causing great destruction.

To detect the presence of gas is not an easy matter, especially in view of the fact that certain kinds of illuminating gas are inodorous. It has often been suggested that some chemically prepared paper, to be used after the manner of litmus paper, which is turned red by acids and blue by alkalies, might be devised for this purpose, but it hardly seems possible that anything of this kind will be produced, as it is necessary to know not only that gas is present, but also in what quantities. It is too much to expect that there ever could be devised an apparatus for the quantitative and qualitative analysis of gases simple enough to be operated by a subway laborer.

All ordinary underground cable-laying operations can be conducted without the use of a torch in the manholes, but there are cases where its use becomes necessary, and in those instances unusual precaution should be taken to make certain that an explosive mixture of gases is not present. The introduction of underground wires has brought with it new troubles, and it would seem for the interest of all that something should be done by the various companies toward securing uniformity of practice in dealing with this dangerous element, which threatens not only the lives of the cables, but also the lives of our workmen.—*Elec. Review.*

Why Fires Burn Brightly in Winter.

There are several reasons why a fire burns so brightly in frosty weather. First, the air being cold is denser, and the heated air and gases from the fire are comparatively more buoyant. Consequently there is a greater draught. Then the air, being denser, contains more oxygen in an equal volume, and that gas being quickly supplied, the combustion is fiercer and more perfect. In frosty weather, too, the atmosphere is comparatively free from moisture, which of course has a tendency to damp a fire.

SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

In some experiments described in a former article it was shown that hydrostatic pressure is equally distributed on all sides of the containing vessel. Fig. 1 illustrates an experiment in which are shown the effects of removing pressure from a portion of one side of the vessel, thus allowing the pressure to act upon the opposite side of the vessel in such a manner as to cause it to move. This experiment is arranged to show this action in two ways, one so as to propel the vessel forward, the other so as to cause it to turn.

The apparatus consists of a tall tin can—such as is used by fancy bakers for wafers or fine crackers—

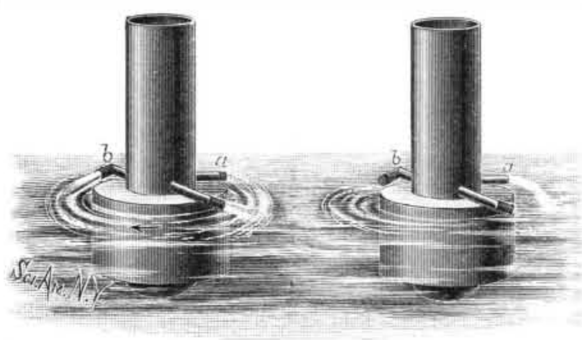

Fig. 1.—REACTIONARY APPARATUS.

mounted upon a wooden float provided with a lead ballast to keep it in an upright position. In one side of the can at the bottom is inserted a short tube, *a*, and in diametrically opposite sides of the can, also at the bottom, are inserted longer tubes, *b*, which reach over the wooden block and have their ends turned in opposite directions. All of the tubes are stopped, and the float is placed in a large vessel of water, when the can is filled with water and the stopper of the tube, *a*, is withdrawn, thereby allowing water to escape from the can, thus relieving the pressure over so much of the area of the can as is represented by the bore of the tube. This disturbs the equilibrium of the lateral pressure in the can, and allows the pressure on the side opposite the opening to preponderate and press the can forward, as shown in the right hand figure.

When the straight tube, *a*, remains closed, and the bent tubes, *b*, are opened, the relief of the pressure results in the rotary movement of the apparatus. In this case the bent tubes are virtually extensions of the containing vessel, and the relief of pressure at one side of one tube causes that tube to move forward, while the relief of pressure at the corresponding side of the other tube causes that tube to move rearward, the resultant of the two motions being a rotation of the two bent tubes, and the parts to which they are attached, around a vertical axis. The apparatus arranged in this way illustrates the principle of Barker's mill.

The hydraulic ram, a simple form of which is illustrated in Fig. 2, depends for its action on the momen-

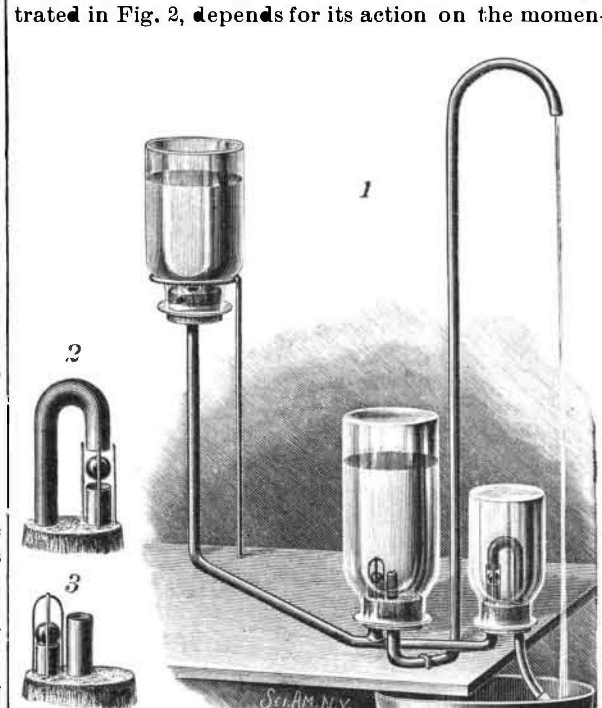

Fig. 2.—HYDRAULIC RAM.

tum of the water column and upon the elasticity of air. The reservoir in the present case consists of an inverted glass bottle having no bottom, and provided with a perforated stopper in which is inserted one end of a tube, preferably lead, on account of the facility with which it may be cut and bent. The other end of the tube is branched, one branch extending through a stopper inserted in an inverted bottle which serves as an air chamber. The other branch of the tube extends to the overflow valve. In the stopper of the air chamber is inserted a second tube, which is bent upward and curved over, forming the riser.

The smaller bottle, which serves as a valve chamber, is provided with a stopper which receives the branch of the supply tube and an overflow tube. The arrangement of these tubes is shown in detail at 2, the curved tube being the overflow, the straight one the inlet. To the inlet and overflow tubes is fitted a valve consisting of a metal ball or a marble. The fitting is accomplished by simply driving the ball against the end of each tube, so as to form valve seats. Four wires are inserted in the stopper around the inlet tube to prevent the escape of the valve. The distance which should separate these tubes as well as the weight of the ball valve is determined by experiment.

In the air chamber above the branch of the supply tube is confined a ball valve by a cage formed of wires inserted in the stopper as shown at 3. This valve is fitted in the manner already described.

The discharge tube extends above the level of the reservoir. The reservoir and the tubes are supported by wire loops and standards inserted in a base board.

Water flows from the reservoir through the valve chamber and out at the overflow. When the velocity of the flow is sufficient to carry the valve in the valve chamber up against the end of the curved overflow tube, the overflow is immediately checked and the momentum acquired by the water causes it to continue to flow for an instant into the air chamber, compressing the air in the chamber, and causing the water to rise in the discharge tube. As soon as equilibrium is established, the valve in the air chamber closes and the valve in the valve chamber falls away from its seat on the overflow tube, allowing the water to discharge again, and so on, this intermittent action continuing so long as there is water in the reservoir. The water discharged by the riser is only a fraction of that flowing out of the reservoir.

Emmensite.

The new explosive emmensite, which is now attracting considerable attention, is prepared, says *Engineering*, by dissolving at a moderate temperature an excess of picric acid in nitric acid of a density of from 50° to 60° Baume; an operation which can be performed without danger if the temperature is kept low. On evaporating the liquid afterward, fine rhombic crystals of a bright yellow color are first deposited, which are followed by others of a lighter hue, and finally by a precipitate of a light gray color, the whole of these three being probably isomers, though their composition has not as yet been determined with accuracy. It has, however, been recognized that they contain more hydrogen than picric acid, and a quantity of oxygen insufficient for complete combustion.

To provide this missing quantity, Dr. Emmens, the inventor of the explosive, employs ammonium nitrate, the mixture being effected by melting together five parts, by weight, of the above crystals with five parts of ammonium nitrate over a paraffine bath. When completely fused, six parts of picric acid are added and thoroughly incorporated, after which the whole is poured out into suitable moulds. These operations involve no danger if the temperature is kept below 200° Cent. Thus prepared, emmensite is an amorphous solid of a bright yellow color, completely odorless, but having a bitter taste. It has a spongy texture, and its specific gravity is 1·7. Microscopic examination tends to confirm the opinion that it is a chemical compound, and not a mere mixture. The explosive is made in several degrees of strength, some of the qualities resembling dynamite, while others can be used for firearms. It is but slightly sensitive to shock, and No. 1 emmensite can be heated without exploding, but Nos. 3 and 4 detonate slightly when raised to a high temperature.

The Fashionable Wood of the Season.

Oak finished antique will be as much used as ever in the manufacture of furniture next year. It is the most popular of all the woods, and the demand for it is steady, and no signs of a change in popular favor are apparent. Walnut is nowhere in the race with oak for popularity, and furniture of that richest of all materials, especially for the bedroom, boudoir, and dining room, remains in the warerooms uncalled for and in no demand. Mahogany is used now, as it always was and will be, for the finest goods, and cherry takes a high rank, but oak stands first in favor and will continue in the front rank for another year at least, and probably much longer, as there is nothing to take its place. For the cheaper grades of furniture, ash, maple, birch, and these woods, with various stains and finishes, continue, as they always will, in favor.

A Remarkable Meteor.

At Oswego, N. Y., on the night of January 26, a large and brilliant meteor was seen. It appeared in the southern sky about ten minutes past 9, 25 degrees above the horizon. It seemed about twice the brilliancy of Venus. It moved horizontally from west to east with the apparent speed of a rocket. It grew in size as it moved, and in the southwest broke into three balls, each larger than the whole when first seen. Just before breaking it showed a red tinge, and after separation each part showed vivid green like the characteristic flame of copper.