By these means the excess of oxygen that is contained by the vegetable materials in presence of the vaporized hydrocarbons is transformed into carbonic oxide, and their azote into ammonia, in such wise that the metals under treatment are immersed in a gaseous medium, which is allowed to be the best for the purpose of converting them into fine steel.

Now, as it may occur that before this absolute conversion the productive source of the gas may be exhausted by distillation, they provide against this inconvenience by passing through the apparatus a current of carbonic acid or carbonic oxide mixed or not with azote. When they obtain this gaseous mixture from the products of the combustion of the furnace which serves to heat the apparatus, they separate from it its free oxygen, and change it to carbonic oxide by causing it to pass over carbonaceous matter heated to red heat before it is passed to the metals. In the Siemens, Ponsard, Muller, and other retorts, the principle of which consists in the gasification of combustibles, they give a mixture of the gases, which they employ equally to the heating of the apparatus as to the transformation of the metal to steel. The gas which escapes from these furnaces also serves for this double purpose. When, on the contrary, they obtain this gaseous medium by direct calcination of limestone, or the mixture of this with other carbons, the gaseous products (carbonic acid and carbonic oxide) are passed directly into the apparatus containing the layers of charcoal and metal. They obtain at the same time from the lime, which they may convert into pyrolignite of lime, the little pyroligneous acid which separates equally from the wood as from the hydrocarburetted peat during the heating to red heat, and which they take care to collect as is ordinarily done in the distillation of wood.

It will be understood that the mixed gases produced and composed in and that have passed through the apparatus may on their passage therefrom be collected in a gasometer to be again used for the same purpose, or passed under the furnace of the apparatus, where they will be utilized as combustibles. If the products prepared according to their process are melted, cast steel of the finest quality will be obtained, and by these means they may obtain without melting steel of the first quality for the manufacture of files and other articles from Bessemer metal, Martin metal, and generally from all metals which are obtained from castings, either by refining with the oxygen of the air, or by refining by reaction. In addition to the steel they obtain simultaneous and at will, from the lime, the ammonia, and the pyroligneous acid, tarry hydrocarbons, which they use over again, and wood or peat charcoal of denser quality than that used originally, not only fit for domestic purposes, but for use in metallurgy.

If cast iron particularly acted upon, and if this cast metal heated to red heat is exposed in a retort to a current of carbonic acid alone or mixed with air, it will be transformed into steel, and the gas will become carbonic oxide, which in passing into another retort charged with Bessemer metal at red heat will effect the conversion of this metal into fine steel, and will itself be converted into carbonic acid. Thus the carbonic acid (CO_2) raised to the casting its excess of carbon (C) is transformed into carbonic oxide (2CO); this passing over the iron of the Bessemer metal and the like will give up the carbon (C), and will return to the state of carbonic acid (CO_2). From this a given volume of carbonic acid gas being given enclosed in a gasometer they may, by passing this gas in the retorts heated to red heat and charged, the first with cast iron, the second with Bessemer metal, the third with cast iron, and the fourth with Bessemer metal, and thus in succession (provided that the series commencing with cast iron terminates with one or two retorts charged with Bessemer metal) transform the whole of the metal into steel, and on collecting the gas in a second gasometer the same operation may be recommenced, and so on indefinitely. If the passage of the gas takes place in a converter charged with melted cast iron, the transformation of the casting is more regularly and easily done, and with less loss of iron.

A FIRE ESCAPE ACCIDENT.

A distressing accident occurred at the Astor House, New York, just across the way from this office, recently, through the breaking of a fire escape while the owner and exhibitor of the same was endeavoring to lower himself from a lofty window. The apparatus known as the Kenyon Fire Escape consists of a wire rope $\frac{3}{16}$ inch in diameter, one end of which is secured within the room. The other end is wound on a drum, which is provided with brakes and arranged in connection with a stout belt, so that by regulating the brakes the wearer of the belt can cause the wire slowly to unwind and thus may lower himself in safety. The exhibitor, Mr. S. E. Hardman, of Providence, R. I., attempted to do this, but some part of the apparatus became inoperative; and in endeavoring to fix it, he brought some sudden strain on his rope so that it broke at the point where it turned over the sharp edge of the window sill, causing the unfortunate man to fall headlong to the pavement beneath, killing him instantly.

The failure of the wire rope simply indicates that it must have been of poor quality. Had a single wire of steel or even iron been used, the tensile strength would have far exceeded any strain which one person descending could have put on it. As it is, probably deterioration of the metal, coupled with the abrasion by the sharp stone edge of the window sill, determined the break. The casualty only goes to show another source of danger which should be provided for by making lowering ropes not only abundantly strong but also by applying to them means of protect ing them from accidental injuries. In general, however, we do not think the portable fire escape problem is by any means solved yet. There is still an excellent opportunity for inventors to devise some system which shall be absolutely safe and certain in its action, and at the same time shall require nothing or nearly nothing to be performed by the presumably thoroughly frightened person whose life it is designed to protect.

Artificial Gems.

What we popularly call paste is technically known as strass; this is also the French word for the same substance (from M. Strass, its reputed inventor). Paste, then, is a material with which diamonds are imitated, and by mixing up with it metallic oxides of various kinds, colors in great variety are imparted to the paste, by which it serves as a representative of the various colored gems. Strass is prepared, according to the method of M. Donault, who has attained great proficiency in this art, from silica, potash, borax, and oxide of lead, and sometimes arsenic. Rock crystal and flint consist almost entirely of silica; but as flint generally contains a little iron, the silica obtained from it is liable to have a tinge of color, which is detrimental to the fidelity of the imitation; rock crystal is therefore employed.

The crucible in which the materials are melted claims particular attention, since, if the substance of which it is formed contains metallic particles, color would be imparted to the strass. Hard porcelain and Hessian clay are the best materials for this purpose. When the crucibles are supplied with the proper quantity of ingredients, they are placed in a porcelain furnace, where they are exposed to a steady heat for twenty-four hours, and then allowed to cool very slowly, so that a kind of annealing goes on. By this means is produced a strass, or paste, which, after passing through the hands of the lapidary, who gives it the form necessary for "setting," presents us with an imitation of the diamond.

Having once produced strass which imitates diamond, all the other gems may be imitated, by mixing with strass various metallic oxides and other substances, according to the color which it is desired to produce. Herein is manifested great diversity of opinions, different experimenters advocating different modes of procedure and different ingredients. One experimenter recommends the following ingredients: To imitate topaz, add glass of antimony, precipitate of Cassius, and oxide of iron, to the white strass; for ruby, add oxide of manganese; for emerald, oxides of copper, iron, and chromium, and acetate of copper; for sapphire, oxide of cobalt; for amethyst, oxides of manganese and cobalt, and precipitate of Cassius; for beryl, glass of antimony and oxide of cobalt; for garnet, glass of antimony, precipitate of Cassius, and oxide of manganese.

M. Donault has given directions somewhat different from the above; but we need not particularise them, as it would carry us into too minute details. We may, however, mention that he produces the imitative rubies by a particular treatment of the composition employed for topaz. This composition is 1,000 parts of strass to 40 of glass of antimony and 1 of purple of Cassius; at a certain stage of its preparation it affords an opaque mass, translucent at the edges, and affording thin laminæ of a red color. A part of this opaque topaz matter, added to 8 parts of strass melted in a Hessian crucible, and left 30 hours in a potter's furnace, affords a beautiful yellowish crystal. If this crystal be remelted by means of a blowpipe, it produces a strass nearly equal to the finest Oriental rubies. The art of producing imitative gems, ingenious as it is, is necessarily a confined one; for as soon as faithful copies of certain jewels are obtained, the object of the art is attained. The object is to deceive the eye; for, as M. Dumas remarks, "the most perfect description of strass, if it imitate no particular and identical gem, has no value, because it deceives nobody." There is a less perfect but a curious mode of producing artificial gems, with what are called doublets, by a process of cementation. The artificial gem consists, in this case, of two pieces of white transparent glass, or of crystal, which is cut into two pieces, conjointly so shaped that both together present the external form of the gem about to be imitated. A transparent cement is then formed of Venice turpentine and mastic melted up together in certain proportions, and to the mixture is added a portion of some coloring matter, according to the nature of the gem. Carmine, crimson lake, Prussian blue, verdigris, dragon's blood, Spanish annatto, etc., are employed, either separately or mixed one with another, until the required tint is imparted to the gummy mixture.—*British Trade Journal.*

The Manufacture of Mosaics.

The modern process of making mosaics now commonly followed at Rome is this: A plate, generally of metal, of the required size is first surrounded by a margin rising about three quarters of an inch from the surface. A mastic cement, composed of powdered stone, lime, and linseed oil, is then spread over as a coating, perhaps a quarter of an inch in thickness. When set, this is again covered with plaster of Paris rising to a level with the margin; upon which is traced a very careful outline of the picture to be copied, and just so much as will admit of the insertion of the small pieces of smalto or glass is removed from time to time with a fine chisel. The workman then selects from the trays, in which are kept thousands of varieties of color, a piece of the tint which he wants and carefully brings it to the necessary shape. The piece is then moistened with a little cement and bedded in its proper situation: the process being repeated until the picture is finished; when the whole, being ground down to an even face and polished, becomes an imperishable work of art. The process is the same for making the small mosaics so much employed at the present day for boxes, covers, or articles of jewelry; and this work is sometimes upon almost a microscopic scale.

The Florentine mosaic, which is chiefly used for the decoration of altars and tombs, or for cabinets, tops of tables, coffers and the like, is composed of precious materials in small slices or veneers; and by taking advantage of the natural tints and shades which characterize the marble, the agate or the jasper, very admirable effects may be produced in imitation of fruit, flowers, or ornaments. The use of this kind of mosaic is extremely restricted, on account of the great value and expense not only of the materials, but of the labor which is spent upon them. None but the hardest stones are used; every separate piece must be backed by thicker slices of slate or marble to obtain additional strength; and every minute portion must be ground until it exactly corresponds with the pattern previously cut.

Formic Acid as an Antiseptic.

The number of antiseptics is now so considerable that it seems almost hazardous to wish to increase it. Each new antiseptic that appears is extolled as the only saviour, and page after page of testimonials proves its excellence and infallibility. As the people may easily be distracted if every "discoverer" pours forth the abundance of his paternal joy over his offspring, which is frequently far from ripe, it is easy to see that the series of experiments made without prejudice by disinterested persons are of great value. In these experiments, made and published recently by Bidwell and others, they overlook, says G. Feyerabendt, one substance which for certain purposes cannot be replaced by any other, namely, formic acid. He does not lay claim to priority, for Dammer, in his excellent dictionary, mentions its antiseptic properties, nor is he a manufacturer of the article; so he does not speak in his own interest, but in that of the subject.

In acid solutions, formic acid far surpasses carbolic acid, and is especially adapted to the preservation of fruit syrups. Experiments made by Feyerabendt in his own household for two years have, without exception, been crowned with success. He has two jars of pickles made with vinegar and sugar from the year 1875, that have only been covered with a loose glass cover, yet they have preserved their freshness and show no trace of mould or decay. The taste of formic acid is pure, acid, and pleasant, the price low, and its use very simple. He has employed from $\frac{1}{4}$ to $\frac{1}{2}$ per cent of it in vinegar, fruit juice, glue, ink, etc., and is convinced that even smaller quantities will answer the purpose.

He especially seeks to excite the attention of housekeepers, and feels confident that they will be satisfied with the results and introduce formic acid as a good and true friend in pantry and kitchen.

Ordinary formic acid is made by heating together to 110° C. equal parts of dry oxalic acid and glycerin, until no carbonic acid is evolved. The pure concentrated acid is obtained by decomposing the formate of lead by sulphuretted hydrogen, and might contain lead.

The Oregon Silver Mud.

Professor Silliman of New Haven informs us that the alleged argentiferous mud of Wasco county, Oregon, an account of which we recently copied from the *San Francisco Examiner*, is a fraudulent production. As regards the form in which the silver was added, Professor Silliman says that the metal in the sample analyzed by him was spongy, in a gray powder, and generally in the condition in which silver appears when reduced by zinc. An authentic example from the locality, obtained by a trustworthy correspondent of Professor Silliman, yielded no silver whatever.

Coloring Zinc Roofs.

Among recent German inventions is a simple process, depending on the use of acetate of lead, by which every kind of color is applicable to sheets of zinc. By mixing black lead, for instance, with the salt, a very agreeable light brown hue is obtained. It is by this process that the cupola of the synagogue at Nuremberg has been painted. A sufficient length of time has already elapsed, it is said, to show that the atmosphere has had no influence on the zinc sheeting of the roof, thus showing the practical value of the process in such cases. By the addition of other coloring matters, light or dark shades of yellow or gray may be produced.

A Large Steam Pump.

Messrs. Cramp and Sons have now completed, with the exception of the boilers, the immense steam pumping engine which is intended for the Frankford Water Works, Philadelphia. The entire machinery will be ready to go into operation by October 1. This engine was built at the contract price of $46,000, and has a pumping capacity of 10,000,000 gallons per day. It is a double cylinder engine, the smaller cylinder being 40 inches and the other 60 inches in diameter. The pumps are 21 inches in diameter, and five feet stroke. The Frankford reservoir has a capacity of 36,000,000 gallons, to which have been run a 30 inch pumping main and 20 inch distributing main. There will be three boilers, two of which will furnish steam for 500 horse power. The third boiler will be held in reserve for emergencies.