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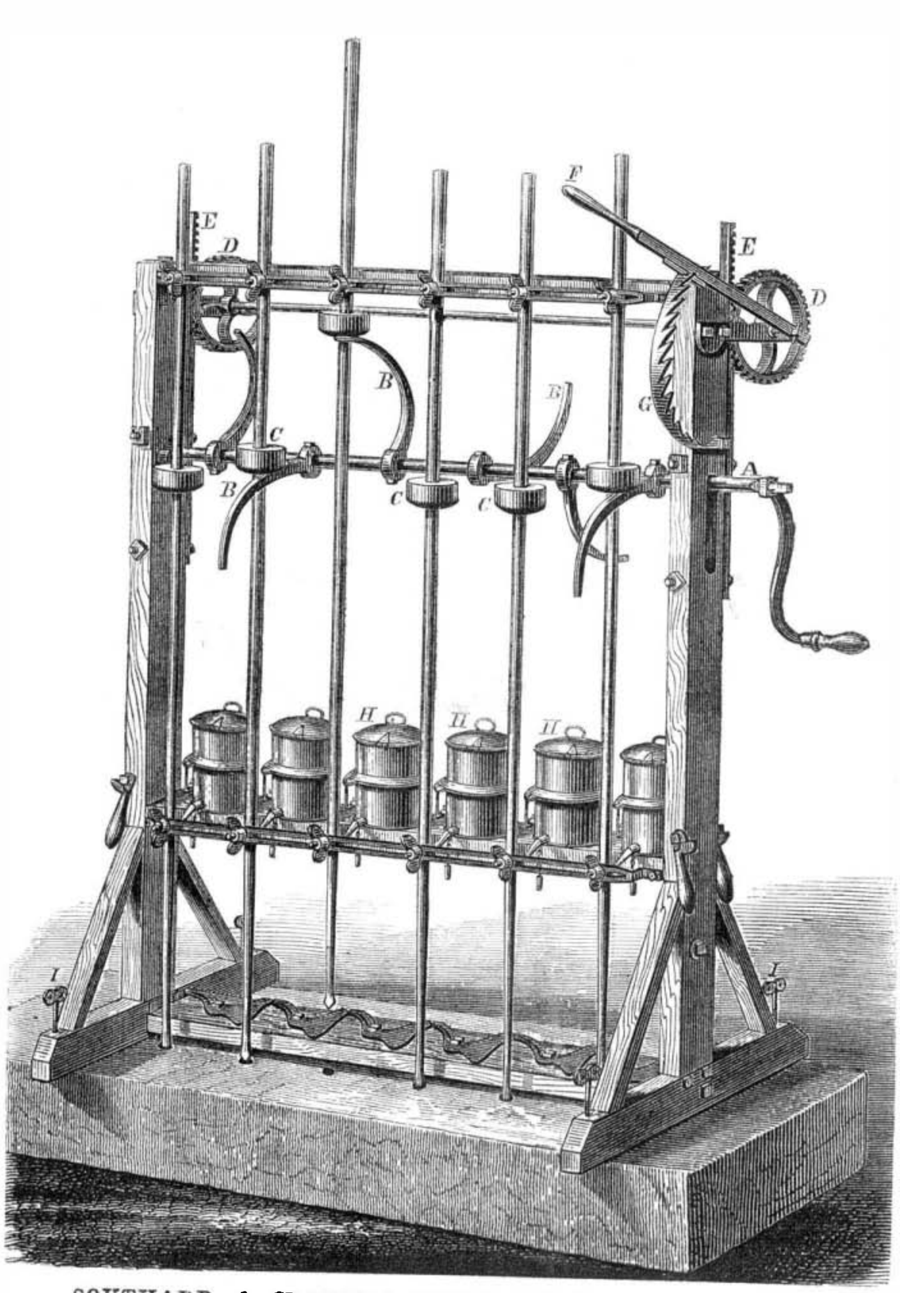
Improved Machine for Drilling Stone.

The object of the machine represented in the engraving is to facilitate the drilling and quarrying of stone, the splitting of blocks, and the blasting of rocks. It is, in fact, the ordinary stone drill, improved and extended in arrangement and management. A light frame holds a series of drills of any number required, the drills being so arranged and connected that they may be instantly removed from the frame for transportation from place to place. The drills are all raised by one complete revolution of the lifting shaft, A, but only one at a time, so that the power, whether manual, horse, steam, or water, has the weight of but one to lift at once. The drills are turned as well as raised by the curved arms, B, which, impinging on the convex under side of the disks, C, give the drills a partial rotary motion as they are lifted, similar to that by the hand in the single ordinary stone drill. The drills can be set at any required distance, one from the other, by means of adjustable eyes, set in the parallel or slotted bars at the top and near the bottom of the frame. As the drills work down into stone, the shaft, A, is lowered by the cog wheels, D, on a shaft passing across the frame, working in the sliding racks, E, to which the lifting shaft boxes are attached, and is held in position by the catch lever, F, and curved rack, G.

The holes are moistened by the water cans, H, which have their spouts adjusted so that the water strikes the sides of the drills and runs down into the holes. The curved lifting arms are adjusted by set screws working in longitudinal grooves in the shaft on which they are fixed, and the water cans are secured at any distance apart by bolts passing through a slot in the cross bar on which they stand. The screws, I, through the feet of the frame are for leveling the frame when standing on rough or uneven surfaces.

The machine is portable, durable, and cheap. The inventor says that each drill will bore an inch a minute in very hard stone, working by man power at ordinary speed, and make a much smoother hole than can be made by hand. It is the subject of patents by A. M. Southard and W. J. Hobson, dated Sept. 3, 1867, and April 28, 1868.

All orders for machines and letters for further information should be addressed to Southard & Hobson, care of the Holske Machine Co., No. 528 Water street, New York city.



SOUTHARD & HOBSON'S STONE DRILLING MACHINE.

New Manganese Battery.

A battery, composed essentially of peroxide of manganese and a single liquid, chloride of ammonium, has been recently constructed by M. Leclanché, and, according to *Les Mondes*, has been already somewhat extensively adopted, or, at least, taken on trial by several telegraph companies on the Continent. It has been long known that peroxide of manganese possesses an electric conductivity similar to that of metals. The author only uses the natural crystalline peroxide of the purest quality. This is broken up and placed in a porous vessel, where it surrounds a carbon plate, forming the positive pole of the battery, the negative plate outside the porous vessel is simply a thick rod of zinc: the liquid which bathes both plates is a concentrated solution of sal-ammoniac. It appears to be a very constant form of battery, and exceedingly economical.

The Utilization of Town Sewage.

The sewage question is one which has lately attracted considerable attention in Paris; the problem, of course, has been to remove the polluted waters from the town in the most advantageous manner. The volume of these waters is now 100,000 cubic meters a day, soon it will be double this amount, and in a few years probably 500,000 to 600,000 cubic meters. We have three solutions of the difficulty. The first and most obvious is to carry the sewage into the Seine; this scheme has been well tested already, and the disadvantages seem generally more striking than the advantages. The advocates of a second plan would employ the sewage, which they would first raise by machinery to a considerable hight, in the irrigation of the fields. The fertilization of the sands at the mouth of the Thames by this means is cited in favor of the plan. The third scheme recommends itself as being the most scientific, and it is, perhaps, the best; experiments have been made with this scheme since the commencement of the spring. The sewage waters, collected in large basins, are mixed with a certain amount of sulphate of alumina—about one per cent to the cubic meter. Organic matters contained are rapidly precipitated, each cubic meter yielding about three klgrms. of solid manure. The decanted fluid, termed clear water, can be employed in the irrigation of soils, upon which it has a very fertilizing action; it contains, in fact, small quantities of mineral matters in suspension, a little nitrogenous and organic matter, and the whole of the alkaline salts. The deposit obtained in the clarification is abundant and compact; it contains the whole of the phosphoric acid and nine tenths of the nitrogenous and organic matter, and the mineral matters dissolved or in suspension; it constitutes an excellent manure, very fertilizing, and easily transportable. Towns would thus be considered as manure factories, and it is believed that the value of the manure may be made to defray the expense of supplying the town with pure water.

THE REYNOLDS AIR-TIGHT HEATER.

These engravings represent the mode of construction and some of the important features of a very popular heating apparatus that has, in Philadelphia and other portions of Pennsylvania, made a radical change in heaters for warming and ventilating dwellings, etc. We have been informed that its sales are large and very rapidly increasing on acconnt of its perfection, durability, simplicity, and economy. It is from well-established evidence the original air-tight heater, and from which the others have been taken.

Fig. 1.

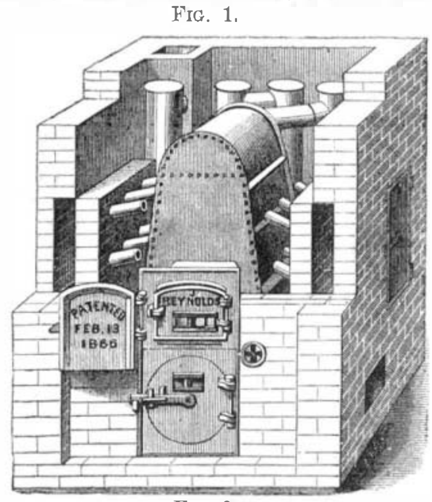


Fig. 2.

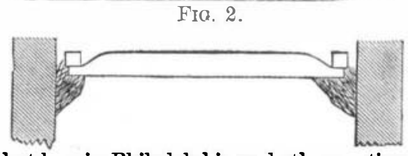
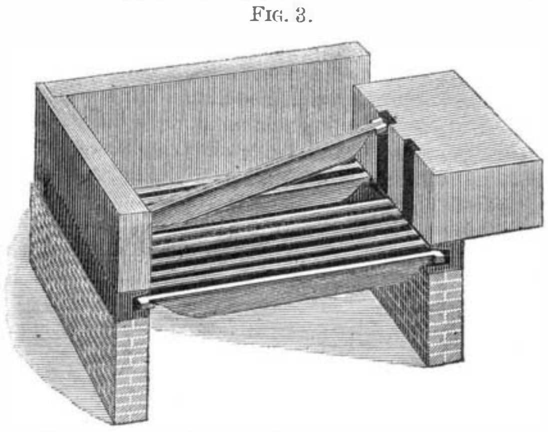


Fig. 1 represents the heater as set up in brickwork, with the top covering and a portion of the front wall removed. The pyramidal radiator is made of heavy plate iron, well riveted together, the same as a steam boiler, and bolted upon heavy wrought-iron side plates running down into the brick-work, preventing any possibility of the escape of gas or dust into the hot-air chamber. By the insertion of tubes in the hollow brick walls for the admission of cold air, and the keeping of the fire pot below and away from the sides of the radiator, it never becomes red hot, thereby diffusing a summer-like heated air through the apartments. Its most important feature are the air-tight draft door, the dust door or screen, the novel grate bar rests, and its perfect management without dampers of any kind. The draft door, it will be perceived, is circular in form, and is provided with a planed close-fitting brass slide, for regulating the heater. The edges of both the door and frame are beveled, turned, and ground, making a water-tight joint and preventing the risk of breaking the frame by expansion. The door of itself is a most important and valuable improvement. The dust screen for carrying off the ashes and dust made by raking, is simply a box-shaped door opened at the bottom, and placed on the left hand side of the feed door. It is long enough to entirely cover the upper and part of the lower doors. When the fire needs raking, the upper and lower doors are opened and this screen shut over their openings, making a flue from beneath the grate bars, up over the fire through the upper door, for the escape of the dust which is drawn into it by the draft of the chimney or smoke flue. The grate bar rests are the latest improvement, and a very important one. In all heaters, when separate bars are used to form the grate, the rests or bearing bars upon which they are placed are put within the fire pot as shown in Fig 2, causing the coals to lie on the ends of the bars unconsumed, and obstructing the thorough raking and cleaning necessary; but by this improvement the rests or bearing bars are put under the front and back lining or tile forming the fire pot, the grate bars are then inserted in a recess in the bearing bars as shown in Fig. 3. By this arrangement, the bars can be as readily removed and replaced as by the old method, while there is no obstruction to the draft reaching every portion of the fire pot, insuring as complete combustion of its contents as is possible, at the same time allowing of its thorough cleaning without difficulty. It would occupy much space to give all the advantages to be found in this celebrated heater, but any further information needed and pamphlets giving full descriptions may be obtained by addressing the patentees and sole manufacturers, J. Reynolds & Son, cor. 13th and Filbert streets, Philadelphia, Pa.

Fig. 3.



The Phenomena of Light.

A number of experiments, as illustrating the phenomena of light, were performed the other night in the Philadelphia Academy of Music, by Professor Henry Morton of that city. The following, among others, were specially interesting:

"The professor placed himself and apparatus on a platform secured to one of the stage traps, and then was raised to a great hight above the floor, at which elevation he burned in the compound blowpipe a piece of thick steel wire rope.

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The fountain of scintillating sparks and drops of melted steel —which, descending in a broad sheet some fifteen feet in hight, poured upon the stage and rolled in a torrent of fiery hail toward the foot lights—was a sight never to be forgotten. A wheel five feet in diameter, supporting electrical tubes, was rotated, while flashes of electric fire from the largest induction coil in the world, belonging to the University of Pennsylvania, were passed through, producing a dazzling star of constantly changing colored rays.

"The drop curtain, descending for a few moments, rose again, displaying a beautiful palace scene, illuminated by numerous lime lights, judiciously placed. There then marched in a great number of masked figures, in costumes representing the colors of the rainbow, and bearing banners with brilliant devices. These taking positions, formed a tableau equal in brilliancy and beauty of general effect to anything we have ever seen upon the stage. At a signal the white light was extinguished and its place supplied by pure yellow light, equally bright, when every trace of color disappeared, and the entire phalanx became a ghastly company of spectres bearing banners of white and black. The means for producing this yellow light is a device of Professor Morton's, entirely new and eminently efficient—in fact, the entire house was illuminated with it from the stage, so that the same wonderful change was manifest in the faces and costumes of the audience."

Vegetable Hairs.

Among the many objects of interest which the vegetable kingdom offers to the microscopist, one of the most varied and the most universally distributed is to be found in what are called hairs, which clothe the surface of the leaves and flowers of a vast number of plants and trees. These hairs are appendages of, and arising from, the skin or epidermis; and although their simplest form is that of a single projecting and elongated cell, they are more generally composed of a series of cells, often bearing at the extremity a glandular protuberance containing the essential oil of the plant; and the variety of shapes which they assume appears to be almost unlimited, while the characteristics of many of them are so definitely marked, that, in the vast majority of cases, it would be quite possible to determine, if not the actual species, at least the order or family to which any specimen belonged, from the observation of a single hair. The hair of the hop-plant, for instance, is so unlike most other vegetable hairs, that it would be impossible to mistake it.

The leaves and flowers of some plants possess two or three varieties of hairs, often in close proximity to each other. The flower of the snapdragon has single celled hairs, some terminating in a globular gland, others in a cone-shaped gland. The garden verbena has some hairs like a flattened rosette on the top of a tall stalk, and others breaking out on all sides of their entire length in curiously knotted excrescences. The hair of the marigold consists of a double layer of elongated cells, built up one upon another, and lying closely side by side. The base of the hair of the common stinging-nettle contains an irritating secretion, which flows through the straight tubular elongation until it reaches the little bulb-like swelling at the extremity of the hair. This is easily broken off when touched by any object, and the acrid fluid then escapes, and produces the well known sting.

Some hairs are forked or branched, like those of the dandelion and the plane tree; others consist of a single elongated cell, like that of the cabbage. In the hair of the marvel of Peru the elongation is formed by a chain of cells placed end to end, and connected by slender threads. In the thistle and the groundsel, the last cell of the hair is lengthened out to a bristle-like extremity. On the leaves of some geraniums may be found two kinds of hairs, the one formed of a series of three elongated cells, the other a flattened disk-like form terminating a short stem of three or four cells. The branched hairs of the lavender are also intermingled with others terminating in a glandular appendage which contains the essential oil that gives to this plant its peculiar odor. On the petal of the heartsease may be found three varieties of hairs. The hairs or spires of some of the cactus tribe are like a series of spear heads placed one upon another. The southernwood hair is composed of a chain of cells, of which the three lower form the stem of the hair while the two upper are lengthened into lateral branches. The leaves of chrysanthemum and the wallflower also bear T-shaped hairs, the former springing from a series of cells that decrease in size from the root to the extremity. The hair of the tobacco plant has a two-celled gland at the extremity, containing the narcotic secretion. The hair of the lobelia is like a knotted club; others assume a star-like appearance, like those of the hollyhock and the ivy. In the geum we have another example of a club-shaped two-celled hair; while that of the bean has a crook-shaped appearance. The flower of the dead-nettle bears two-celled hairs, remarkable for the number of knobs scattered over the surface; a similar appearance is presented by the hairs of the wallflower and chrysanthemum.

Many connecting links present themselves between hairs and scales, such as the stellate hairs of the *Deutzia scabra*, which a good deal resemble those within the air-chambers of the yellow water lily. The cuticle of the iceplant is covered with hairs that have the appearance of frozen dew-drops, and consist of very large oval-shaped cells, which lie detached from one another upon the surface of the cuticle.

As we have probably said enough to draw the attention of young microscopists to this interesting branch of research, we need only add that vegetable hairs are easily preserved in weak spirit, while some retain their natural appearance very fairly in Canada Balsam.—*Hardwicke's Science Gossip.*

As an experiment, several streets in the city of Edinburgh are being illuminated at night by means of the lime light.

Science Familiarly Illustrated.

Glass—Its Material and Manufacture.

A great number of earths, and other mineral bodies, after being fused, do not resume their original character, upon cooling, but pass into a dense, hard, shining, and brittle state, having the character of glass; and are thus said to be vitrified. Most of these substances do not immediately become hard, upon the reduction of their temperature, but go through an intermediate, or ductile, state, in which a combination of of softness with tenacity, enables them to be wrought into articles of use and ornament. Of these, common glass is the most important, while enamels, artificial gems, etc., belong to the same species of manufacture.

Glass is a compound substance, artificially produced, by the combination of silicious earth with alkalies, and, in some cases, with other metallic oxides. These substances, being melted together at a high temperature, unite, lose their opacity, and are fused into a homogeneous mass, which, on cooling, has the properties of hardness, transparency, and brittleness.

The most important ingredient, and, in fact, the basis, of transparent glass, is silica, or oxide of silicium. This earth, nearly in a state of purity, is found in the sand of certain situations, and also in common flint, and quartz pebbles. Sand has the advantage of being already in a state of minute division, not requiring to be pulverized. Pure silicious sand, proper for the glass furnace, is found in many localities. A great portion of that used in the United States is taken from the banks of the Delaware. When flints, or quartz, are employed, they must be first reduced to powder, which is done by heating them red hot, and plunging them in cold water. This causes them to whiten and fall to pieces; after which, they are ground and sifted, before they are ready for the furnace.

An alkaline substance, either potash or soda, is the second ingredient in glass. For the finer kinds of glass, pure pearlash is used, or soda, procured by decomposing sea salt; but, for the inferior sorts, impure alkalies, and even wood ashes, are made to answer the purpose. Lime is often employed, in small quantities; also borax, a salt which facilitates the fusion of the silica.

Instead of the common alkalies, the sulphate of soda may be employed in glass making. But, in this case, it is necessary to liberate the alkali by decomposing the sulphuric acid of the salt. This may be done by charcoal, or, in flint glass, by metallic lead. Lime is also used with this salt.

Of the metallic oxides, which are added in different cases, the deutoxide of lead (red lead) is the most common. This substance renders flint glass more fusible, heavy, and tough, and more easy to be ground and cut. At the same time, it imparts to it a greater brilliancy, and refractive power. Black oxide of manganese, in small quantities, has the effect of cleansing the glass, or of rendering it more colorless and transparent. This effect it seems to produce by imparting oxygen to the carbonaceous impurities, thus forming with them carbonic acid, which subsequently escapes. Common niter produces a similar effect. If too much manganese be added, it communicates a purple tinge to the glass, which, however, may be destroyed by a little charcoal or wood. Arsenious acid (white arsenic) in small quantities, promotes the clearness of glass; but, if too much be used, it communicates a milky whiteness. Its use, in drinking vessels, is not free from danger, when the glass contains so much alkali as to render any part of it soluble in acids.

Glass is of various kinds, which are named, not only from the character of their ingredients, but from the mode in which they are wrought. The name of crown glass is given to the best kind of window glass, that which is hardest, and most free from color. It is made almost entirely of sand and alkali, and a little lime, without lead, or any other metallic oxide, except a minute quantity of manganese, and sometimes of cobalt, which are added to counteract the effect of any impurities, in giving color to the glass. Crown glass requires a greater heat to melt its ingredients, than those kinds which contain a larger quantity of metallic oxide, especially of lead.

After the materials have been intimately mixed, they are subjected to the operation called fritting. This consists in exposing them to a dull, red heat, which is not sufficient to produce their fusion. The use of this process is to drive off the carbonic acid, and other gaseous and volatile matters, which would otherwise prove troublesome, by causing the materials to swell up in the glass pots. The heat is gradually increased, and the materials constantly stirred for some hours until they unite into a soft, adhesive mass; the alkali having gradually combined with the silicious earth. The reason why the fritting is conducted at a low heat is that, if a high temperature were applied at once, the alkali would be driven off, before it had time to combine with the silica.

The homogeneous mass, or frit, is next transferred to the glass pots of the melting furnace. These are crucibles, made of the most refractory clays and sand. A quantity of old glass is commonly placed upon the top of the frit, and the heat of the furnace is raised to its greatest hight, at which state it is continued for thirty or forty hours. During this time the materials become perfectly united, and form a transparent, uniform mass, free from specks and bubbles. The whole is then suffered to cool a little by slackening the heat of the furnace until it acquires sufficient tenacity to be wrought.

The formation of window glass is effected by blowing the melted matter, or metal, as it is called, into hollow spheres, which are afterward made to expand into circular sheets. The workman is provided with a long, iron tube, one end of which he thrusts into the melted glass, turning it round until a certain quantity, sufficient for the purpose, is gathered or adheres to the extremity. The tube is then withdrawn from the furnace, the lump of glass which adheres is rolled upon a smooth iron table, and the workman blows strongly with his mouth through the tube. The glass, in consequence of its ductility, is gradually inflated like a bladder, and is prevented from falling off by a rotary motion constantly communicated to the tube. The inflation is assisted by the heat, which causes the air and moisture of the breath to expand with great power. Whenever the glass becomes so stiff, from cooling, as to render the inflation difficult, it is again held over the fire to soften it, and the blowing is repeated, until the globe is expanded to the requisite thinness. It is then received by another workman upon an iron rod, while the blowing iron is detached. It is now opened at its extremity, and, by means of the centrifugal force, acquired from its rapid whirling, it spreads into a smooth, uniform sheet of equal thickness throughout, excepting a prominence at the center where the iron rod was attached.

After the glass has received the shape which it is to retain, it is transferred to a hot chamber, or annealing furnace, in which its temperature is gradually reduced, until it becomes cold. This process is indispensable to the durability of glass; for, if it is cooled too suddenly, it becomes extremely brittle, and flies to pieces upon the slightest touch of any hard substance. This effect is shown in the substances called Rupert's drops, which are made by suddenly cooling drops of green glass by letting them fall into cold water. These drops fly to pieces with an explosion whenever their smaller extremity is broken off. The Bologna phials, and some other vessels of unannealed glass, break into a thousand pieces if a flint, or other hard and angular substance is dropped into them. This phenomenon seems to depend upon some permanent and strong inequality of pressure; for when these drops are heated so red as to be soft, and left to cool gradually, the property of bursting is lost, and the specific gravity of the drop is increased.

Broad glass is a coarser kind of window glass, and is made from sand, with kelp and soap boilers' waste. It is blown into hollow cones, about a foot in diameter, and these, while hot, are touched on one side with a cold iron, dipped in water. This produces a crack, which runs through the length of the cone, nearly in a right line. The glass then expands into a sheet, in its form resembling somewhat the shape of a fan. This appears to have been one of the oldest methods of manufacturing glass.

Flint glass, so called from its having been originally made of pulverized flints, differs from window glass in containing a large quantity of the red oxide of lead. The proportions of its materials differ; but, in round numbers, it consists of about three parts of fine sand, two of red lead, and one of pearlash, with small quantities of niter, arsenic, and manganese. It fuses at a lower temperature than crown glass, has a beautiful transparency, a great refractive power, and a comparative softness which enables it to be cut and polished with ease. On this account it is much used for glass vessels of every description, as especially those which are intended to be ornamented by cutting. It is also employed for lenses and other optical glasses. Flint glass is worked by blowing, molding, pressing, and grinding. Articles of complex form, such as lamps and wine glasses, are formed in pieces, which are afterward joined by simple contact, while the glass is hot. It appears that the red lead used in the manufacture of flint glass gives up a part of its oxygen and passes to the state of a protoxide.

Common green glass, of which bottles are made, is the cheapest kind, and formed of the most ordinary materials. It is composed of sand, with lime, and sometimes clay, and alkaline ashes of any kind, such as kelp, barilla, or even wood ashes. The green color is owing to the impurities in the ashes, but chiefly to oxide of iron. This glass is hard, strong, and well vitrified. It is less subject to corrosion by strong acids than flint glass, and is superior to any cheap material for the purposes to which it is ordinarily applied.

The plates of crown glass which are obtained in the common manner, by blowing them in circular plates, afford the common material for window glass, being cut into squares by first marking the surface deeply with a diamond and then breaking the glass in the same directions, the crack always following the exact course of the incision made by the diamond. But there is always a loss or waste in cutting squares from a circular plate, besides which they can never be very large, owing to the protuberance, or *bull's eye*, which fills the center of the plate, so that a square can never be larger than can be described within less than half the circle. To remedy this disadvantage, plates for looking glasses, and others of large size, are executed in a different way, either by blowing them in cylinders or by casting them in plates at first.

Cylinder glass is blown at first in spheres, like window glass. These are elongated into spheroids by a swinging motion which the workman gives to his rod. The ends of this spheroid are successively perforated, thus converting it into an irregular cylinder. One side of this cylinder is cut through with shears, and the glass is laid upon a flat surface, where it expands into a uniform plate, without any protuberance. It is then annealed, by diminishing the heat, in the common way. When the plates are intended for looking glasses, the finest materials are used, and the heat kept at its greatest hight for a long time, to dissipate all impurities and remove any specks or bubbles.

Looking-glass plates may be blown in cylinders, when they do not exceed about four feet in length. But they cannot well be blown of a larger size than this, from such a quantity of glass as the rod will take up, without becoming too thin to bear polishing. Plates, however, may be made of more than double this size by another process, which is called *casting*, the only mode by which very large plates are produced.

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