THE CHEMISTRY OF COAL.

Number II.

DESTRUCTIVE DISTILLATION.

If water is heated to a temperature of 212° it passes into the form of gas or steam, and if the temperature of the steam is reduced below 212° it is restored to the liquid form. If water is boiled in a close vessel, and the steam is led off through a pipe and condensed so as to be collected in another vessel, the process is called distillation. By this process water may be separated from salt or any other non-volatile substance which it may hold in solution. The same process is also employed for separating alcohol from water. Alcohol is produced by fermentation, and the still is used merely to separate it from the water with which it is mixed. Alcohol boils at 173°, and consequently if the mixture is heated to this point the alcohol goes off as vapor into the worm, while the water remains behind. Neither water nor alcohol is decomposed by distillation. When in the form of vapor their atoms are composed of the same elementary atoms as when they are in the liquid form—water is still H O, and alcohol is C_2 H_3 O.

But there are other substances which, if heated sufficiently to evaporate or distil them, are decomposed. This is the case with coal. It cannot be evaporated and condensed again in the form of coal. The carbon, hydrogen, nitrogen, and oxygen, of which it is principally composed, are separated by distillation, and recombined to produce new substances. In such cases the process is called destructive distillation.

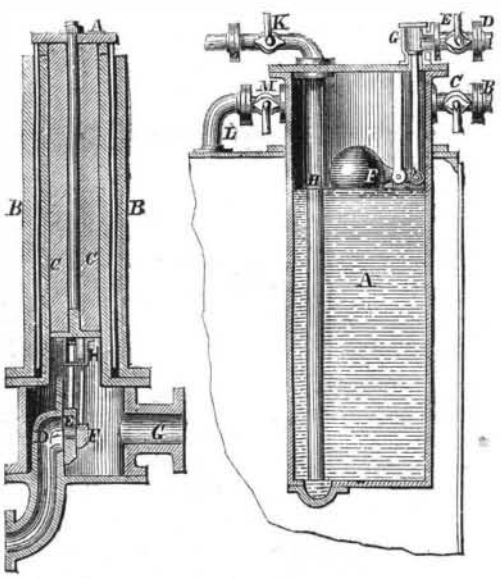
Anthracite coal cannot be distilled. It consists almost wholly of carbon and the inorganic elements, and these are neither volatile themselves, nor do they combine with each other to produce substances that are volatile. But bituminous coal contains a large quantity of oxygen, hydrogen and nitrogen, which combine with each other and with the carbon and inorganic elements of the ashes to produce a large number of volatile substances. The study of these products of the destructive distillation of coal will constitute the principal portion of our articles on this subject.

SURFACE CONDENSERS FOR STEAM ENGINES.

Number IV.

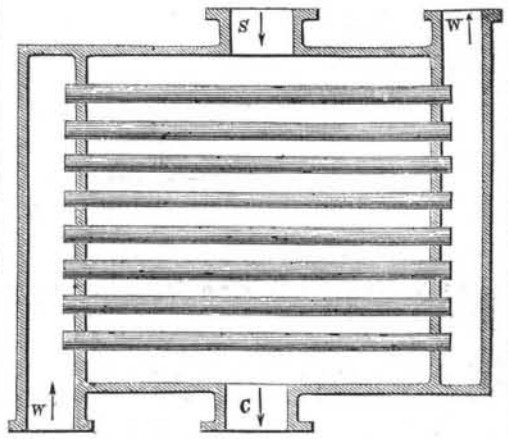
In the first condensers made by Mr. Hall, as illustrated in Fig. 5, the tubes were so secured in collars that provision was not made for the unequal expansion of the metal, consequently the tubes cracked. He then adopted the plan of securing only one end of the tube, and allowing the other end to work freely through a stuffing box, as shown by the tubes in diagrams 6 and 7. The apparatus on the right hand is to supply water lost through leakage. To regulate the supply of distilled water so as to maintain the water

Fig. 6 *Fig.* 7.



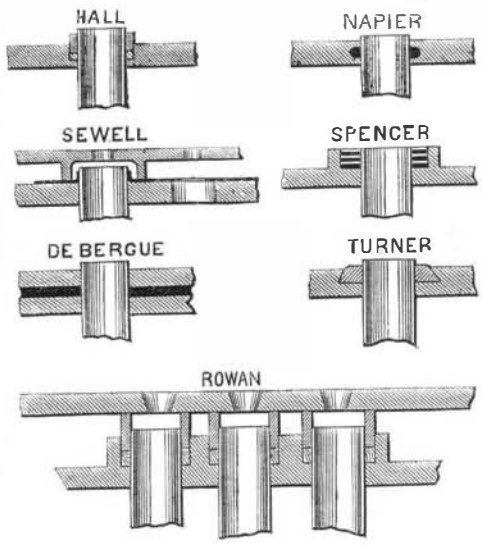
in the boiler at a proper hight a cock, C, is placed between the pipe, B, and the distilling vessel, A; by opening the cock, C, the steam from the distilling vessel is allowed to pass into the condenser, where it is condensed and passes, with the condensation water, into the boiler. When the proper level in the boiler is attained the cock, C, may be closed. The distilling vessel is connected with the cold-water cistern by the supply pipe, D, to which is fitted the cock, E, and the water is maintained at a proper hight in the distilling vessel during the distillation by means of the float, F, and valve, G. Any sediment may be blown off from the distilling vessel through the pipe, H, fitted with

Fig. 8.



the cock, K, by the pressure of the steam admitted through the pipe, L, and cock, M, thus, by shutting the cocks, C' and E, and opening K and M, the pressure of steam from the boiler, acting on the surface of the water in the distilling vessel, drives it out, with its impurities, through the pipe, H. The distilling vessel is let into the boiler, the steam in which supplies the required heat. Several plans have been used to effect this purpose, all acting more or less on this principle.

Fig. 9.



The left-hand figure of diagrams 6 and 7 represents Mr. Hall's steam saver, its office being to cause the steam which usually escapes at the safety valve to enter the condenser, so that the distilled water resulting from its condensation may be restored to the boiler by the action of the air pump, or any other suitable means. A is a cylindrical vessel closed at top, and the lower end plunged in mercury contained in a circular groove or cavity formed between two concentric cylinders, B B. These cylinders are supported upon a square box, which is closed at bottom and communicates with the boiler by the opening, C, and with the condenser by the bent pipe, D, to which latter is fitted a sliding valve, E, having a small aperture, over which slides a valve, F. The cylinder, A, is loaded by the weight suspended within it, to which is attached the frame, the stem of the valve, F, is attached to this frame, and the stem of the valve, E, works freely in a hole in the frame, and has a nut at the upper end, at a small distance above the lower bar of the frame.

Mr. David Napier, who was early in the field as an advocate of surface condensation, devised a plan which will be understood by referring to diagram 9. It consists of a number of horizontal tubes, in a wooden box open to the sea, and passing through a stuffing box in the tube plate, similar to that described as used by Hall, and at the other end forced through a ring of india rubber, previously inserted in a recess in the tube plate, as shown in diagram 9. In this instance the openings through the vessel's sides for supplying the condensing water were provided with flanges, so arranged that whichever way the vessel was moving a current of water was constantly flowing through the condenser. In this, which is a very simple and economical arrangement, we imagine the flow of condensing water would be hardly sufficient.

The plan adopted by Mr. Sewell, of New York, and introduced into England by Mr. Davison, has been extensively used in England with good results. It will be understood by referring to the same diagram, 8. It consists of a number of tubes placed horizontally, passing freely through holes in each tube plate, and projecting a short distance at each end over their ends, is passed a sheet of india rubber, punched with holes corresponding with the holes in the tube plate, and through the tubes are forced, thus forming an hydraulic cup joint. The india rubber is kept to the tube plates by a gland, which also serves to keep the tubes in place. The water is forced by means of a circulating pump, through the tubes in the direction of the arrows, W, diagram 8, and steam is admitted through the branch, S, the condensation water being drawn off through the branch, C. In this condenser the tubes are very easily withdrawn for cleaning or renewal, and it is a cheap and efficient condenser.

Mr. Spencer's condenser, which has been somewhat extensively used, and with good results, is similar to Sewell's, with the exception of the packing, which is shown in diagram, consisting of one or more india-rubber rings passed over the ends of the tubes, and driven firmly into recesses provided in the tube plate.

The expansion of the tubes has been provided for in many other ways by different inventors. The plan recommended by De Bergue, represented in diagram, consists of two tube plates, with a sheet of india rubber between them, with holes corresponding with the holes in the tube poles. When the tubes are in their places the two plates are screwed together, thus expanding the india rubber latterly, and making a firm and tight joint.

Another plan, proposed and adopted with success by Mr. Turner, consists of melting into a recess around the tube tin or other soft metal, which is afterward caulked. It forms a tight joint, allowing the tube to expand, and can, if necessary, be very easily re-caulked.

Warlike Enterprise.

The Emperor Napoleon remarked at St. Helena:—"Generals are rarely found eager to give battle; they choose their positions, establish themselves, consider their combinations, but then commences their indecision; nothing is so difficult and at the same time so important as to know when to decide."

Wellington said:—"The fault with most commanders, however brave, is backwardness in taking the last step to bring on a battle, especially when armies are large; arising from deep moral anxieties, and after all, the uncertainties of the issue."

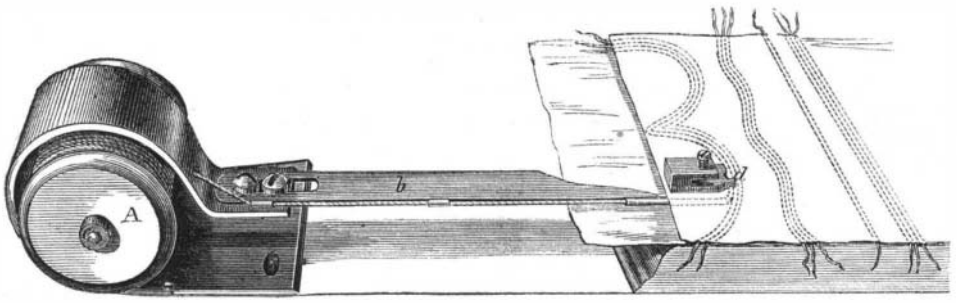
Washington, in a letter to Congress in 1780, expressly speaks of "our security depending on want of enterprise in the enemy," and says that "we have been indebted for our safety during a greater part of the war to their inactivity."

DIPHTHERIA.—We notice this insidious disease is becoming quite prevalent in some parts of the country. It is a malady that if not arrested at its very outset is almost certain to prove fatal. As soon as the first symptoms appear a physician should be instantly summoned. Meantime, until the doctor arrives, temporary relief can be afforded by gargling the throat every ten minutes with a strong decoction of common salt and water. Make it as strong as the patient can endure it without strangling, say, a teaspoon full of salt to two tablespoon's full of water. In many instances this simple remedy has been known to entirely check the disease without the aid of any further prescription.

NEW PROPELLER.—E. B. Ward, Esq., of Detroit, has a new boat in process of construction, which will be propelled on a principle unlike anything ever seen on the Western waters. She will be what is called a beam-geared propeller, with an engine working athwart ships, every stroke of which will produce two and a half revolutions of the wheel. The new boat will have 187 feet keel and 24 feet beam. The engine is being built at the Detroit Locomotive Works.

Corder for Sewing Machines.

The accompanying engraving represents a little attachment which may be applied to any sewing machine in use, in cording fabrics. The spool, A, containing the cord is slipped upon the axle, *c*, and the cord is led through the loops upon the spring blade, *b*, to the point, *d*, and through the groove in the toe piece of the shoe. It is here received between the two sheets of fabric, which pass under the shoe, and stitched without previous basting. The cord may be inserted in straight, curved or waving lines, and in such manner as to bring all the fullness produced by the cord on one side of the fabric, leaving the other side perfectly flat.



BRADY'S CORDER FOR SEWING MACHINES.

The right to use this invention has been sold to some of the leading sewing machine manufacturers, and the inventor is desirous of selling it to others. The patent was granted Dec. 27, 1859, and further information in relation to the matter may be had by addressing the inventor, O. G. Brady, at 440 Broadway, New York. See advertisement on another page.

Vulcanizing India Rubber—Influence of Occupation Upon Health.

The following extracts on this important subject, are from the Paris correspondent of the London *Lancet*:—

None of the most arduous callings in life can be exercised without a measure of wear and tear in the human machine. In no way can the destructibility of the working material with which we men are provided be better seen than by a consideration of the special diseases which the exercise of particular professions entails upon their adepts. The statesman, clergyman and lawyer have their especial sore throat, the doctor his dissecting wound, the knife-grinder his phthisis, the painter his colic, the lucifer-match maker his necrosis, the chimney-sweeper his cancer; and so on through a long chapter of accidents, ending only, it would appear, with the last item on the catalogue of professions. In presence of this almost daily increase of morbific causes, it behooves medical science, as the sentinel of civilization, to be more than ever on the alert, to check the hurtful progress of new diseases Such is the object of a paper read at the Paris Academy of Medicine, by M. Delpech. Some few years back, this writer, in a communication to the Academy, first drew notice to the baneful effects produced by the sulphuret of carbon upon the workmen employed in the preparation of vulcanized India-rubber. The process termed "vulcanizing" is effected by the exposure of caoutchouc to the action of a mixture of sulphuret of carbon with chloride or bromide of sulphur; and, according to M. Delpech, the respiration of air charged with the vapor given off during the operation produces, in a large proportion of the workmen so engaged, symptoms not unlike those resulting from the inhalation of ether, chloroform, or other anæsthetic agent, with the difference that in the former case the effects are more gradually developed. The particular branch of the India-rubber manufacture whence the author has gleaned his most prominent facts, is that in which the caoutchouc is blown into bags or bladders for medical and other purposes; and here he has divided the symptoms of intoxication into two stages. In the first are ranged headache, giddiness, cutaneous hyperæsthesis, with feelings of creeping or pricking, and muscular pains. A certain degree of excitement and agitation also is not uncommon, together with a tendency to laugh or cry without reason; and with these half-hysterical symptoms may coexist sleeplessness, night-mare, and great irritability of temper, sometimes ending in confirmed mental alienation as a climax. In other cases the stimulus has affected the muscular system, in the way of spasm or stiffness; or, again, the digestive or respiratory organs, by the production of bulimy, nausea, cough and oppression; and, lastly, the heart and circulation, in the way of fever and palpitation. In the second stage, the poison would seem almost exclusively to have impaired the functions of the nervous system, as exhibited by decline of the intellectual powers, melancholy, indifference, loss of memory, defective vision, deafness and insensibility of the skin, together with loss of sexual power, atrophy of the seminal glands, general muscular debility, going on to paraplegia, wasting and cachexia. By means of experiments on animals, M. Delpech has ascertained that rabbits, for example, although easily affected by the vapors of the vulcanizing mixture, or by those of the sulphuret of carbon alone, passed several days with impunity in an atmosphere charged with chloride of sulphur, and he therefore argues, with much apparent fairness, that the former ingredient alone is responsible for the baneful effects resulting from the process. By way of practical deduction, he infers that if the workpeople could be so placed, when manipulating these poisonous materials, that a glass screen should intervene between them and the caoutchouc under preparation, their arms being passed through apertures properly stuffed in order to prevent the entry of vapor, much benefit would accrue, in a hygienic point of view, to the employees in this branch of trade.

HEARING TRUMPETS.

Hearing trumpets formed of vulcanized india rubber and made to fasten on a suitable cap, as represented in the annexed figure, might be used by military scouts for the purpose of detecting distant sounds unappreciable by the naked ear. It is of great importance to detect military movements made during night; hence soldiers who are quick in hearing should always be chosen to perform picket duty during hours of darkness, when sudden attacks or secret movements of the foe are expected. It is well known that some animals, such as dogs, can hear distant sounds when the human ear is at fault; it was therefore customary for Roman soldiers on guard in an enemy's country, to use a watch dog that was quick of ear so as to give warning when a foe was approaching with stealthy footsteps. It does not appear unreasonable that art may enable men to rival the most sensitive-hearing creature by such a device as is here represented.

CHLORINE AS A DISINFECTANT.

Of that class of disinfectants which remove odors by destroying them by far the most powerful is chlorine. Nearly all the offensive odors that we encounter are organic compounds, generally containing hydrogen. Chlorine has a very strong affinity for hydrogen; so strong that when chlorine comes in contact with a compound of hydrogen, nitrogen, carbon or oxygen, the hydrogen leaves the other elements and combines with the chlorine; and the compound is thus broken up.

Some of the compounds of chlorine are even more powerful as disinfectants than the element alone. One of these is hypochlorous acid, which is a compound of one equivalent of chlorine with one of oxygen, Cl. O. The substance popularly but improperly known as the chloride of lime is in fact the hypochlorite of lime; being formed by the combination of hypochlorous acid and lime. This is one of the most powerful disinfectants known. It generally destroys odors by oxydizing them, giving up its own oxygen to the organic compound and burning the latter up. Chlorine is exceedingly injurious to the lungs, and therefore should never be used in inhabited apartments.

The Naumkeag Mill, in Salem, is about importing a load of cotton from India, to supply the place of American cotton sold.

Suggestions How to Prevent Fires.

The Philadelpia *Ledger* publishes a number of suggestions in regard to the prevention of fires, which we commend to the attention of housekeepers, tradesmen, manufacturers and others. They are as follows:—Keep matches in metal boxes, and out of the reach of children. Wax matches are partiularly dangerous, and should be kept out of the way of rats or mice. Be careful in making fires with shavings and other light kindling. Do not deposit coal or wood ashes in a wooden vessel, and be sure burning cinders are extinguished before they are deposited. Never put fire wood upon the stove to dry. Never put ashes or a light under a staircase. Fill fluid or camphene lamps only by daylight, and never near a fire or light. Do not leave a candle burning upon the steps of a stairway. Never leave a candle burning on a bureau or a chest. Alway be cautious in extinguishing matches and other lighters before throwing them away.—Never throw a cigar stump upon the floor or into a spit box containing sawdust or trash, without being certain that it contains no fire. After blowing out a candle, never put it away on a shelf or anywhere else, until sure that the snuff has gone entirely out.

A lighted candle ought not to be stuck up against a frame wall, or placed upon any portion of the wood work in a stable, manufactory, shop, or any other place. Never enter a barn or a stable at night, with an uncovered light. Ostlers should never smoke about stables. Never take an open light to examine a gas meter. Do not put gas or other lights near curtains. Never take a light into a closet. Do not read in bed either by candle or lamp light. Place glass shades over gas lights in show windows, and do not crowd goods too close to them. No smoking should ever be permitted in warehouses, especially where goods are packed or cotton is stored The principal register of a furnace should always be fastened open. Stovepipes should be at least four inches from wood work and well guarded by tin. Rags ought never to be stuffed into stovepipe holes. Openings in chimney-flues for stovepipes which are not used, ought always to be securely protected by metallic coverings. Never close up a place of business in the evening without looking well to the extinguishment of lights and the proper security of the fires. When retiring to bed at night, always see that there is no danger from your fires, and be sure that the lights are safe. This is the season of the year when fires are indispensable everywhere, and when the short days and long nights render it necessary to burn lights for many bours. The above suggestions, if carefully followed, may be the means of preventing numerous fires, and thereby saving thousands of dollars' worth of property, as well as preserving many valuable lives.

Those who Live in Glass Houses Should not Throw Stones.

We find in the *Irish Agricultural Review* the following communication from Capt. Norton, the well-known inventor of war projectiles:—

Captain Rodman, of the United States Navy, casts cannon ready boxed by the act of casting in the same manner as my patented process; he, however, cools his cannon from within. This is an improvement on my patent. The Scientific American of a late date describes the construction of the *Ericsson*, a steel-clad floating battery for the defence of the harbor of New York. The sides of this battery could not be pierced by shot fired by a cannon in our service; but a shot fired from the 15-inch bore guns cast on the Rodman principle would crush in the sides of our steel-clad *Warrior* when fired at the distance that Nelson loved to pour in his broadsides. How would Brighton, with its princely buildings, look after a few rounds of Rodman's shells, having my concussion-fuzes fixed in them, were thrown into it from a distance of three or four miles? Dublin is in the same danger, as well as many towns on the coast of England, Ireland, and Scotland. Shells can now be charged with liquid fire (phosphorus dissolved in bisulphite of carbon), the most "rarefragious" fire stuff ever invented by the ingenuity of man. Captain Halsted, R. N., one of our very best authorities on naval armaments, has clearly stated that one shell, charged with liquid fire, is sufficient to destroy the largest line-of-battle ship. Is it good play, then, for the *Times* newspaper to taunt the Northern Americans with the Bull's Run reverse when these Americans can retort the historical quotation, "Why did you run at Fontenoy, ye scoundrel grenadiers?"

Animal and vegetable life exists in the sea at a depth of 2,500 yards.