

THE CHEMISTRY OF COAL.

Number IV.

MECHANICAL MIXTURE AND CHEMICAL COMBINATION.

Coal tar is composed of a large number of substances, principally hydrocarbons, which are mechanically mixed together. And before going further let us get distinct ideas of the difference between mechanical mixture and chemical combination.

If one quart of oxygen is mixed with two quarts of hydrogen, the two gases mingle together but each retains its own properties. The hydrogen is light and combustible; the oxygen will not burn, but is the most efficient supporter of combustion and of respiration; and both are permanent gases which cannot be reduced to either the liquid or the solid state. Their atoms are held apart like the atoms of all gases, and their positions may be represented thus, the large Os standing for the atoms of hydrogen and the small os for the atoms of oxygen:—

O o O o O o
o o o O o o
O o O o O o
o o o O o o

This is a mechanical mixture. But if the mixture is heated to the temperature of flame, each atom of oxygen is instantly joined by the mysterious force of chemical affinity to an atom of hydrogen, the two forming an atom of water. Then their positions will be represented thus:—

Oo Oo Oo Oo Oo Oo
Oo Oo Oo Oo Oo Oo
Oo Oo Oo Oo Oo Oo
Oo Oo Oo Oo Oo Oo

They are now united in chemical combination; and their properties have undergone a most wonderful change. The compound is entirely unlike either of its elements. It is no longer a permanent gas, but becomes liquid at 212° Fah., and solid at 32°. It is not combustible, neither will it support combustion or respiration.

A portion of the hydrogen and carbon in coal tar is combined to form the substance known as benzole, in which 12 atoms of carbon combine with 6 atoms of hydrogen to form one atom of benzole, $C_{12}H_6$. Another portion forms toluol, in which 14 atoms of carbon combine with 8 atoms of hydrogen, $C_{14}H_8$. Other portions combine in other ways to form other substances, and then these several substances are mingled together mechanically to constitute coal tar. Next week we will examine some of the most interesting of these substances.

Uses of Camphor.

SPIRITS OF CAMPHOR.—The gum resin camphor readily dissolves in alcohol, forming spirits of camphor. About two ounces of the camphor is generally dissolved in about a pint of the spirits. It is used as an external application for sprains, local pains and stitches. It is applied by rubbing with the hand upon the painful part. To secure the full benefit of the application, the part should be afterward covered with a piece of flannel of suitable size, more or less wetted with the spirits, and the whole covered with oil silk for the purpose of restraining evaporation.

CAMPHORATED OIL.—This is another camphor liniment. The proportions are the same as in the preceding formula, substituting olive oil, for the alcohol, and exposing the materials to a moderate heat. As an external stimulant application it is even more powerful than the spirits, and to obtain its full influence, the part treated should be also covered with flannel and oil silk. It forms a valuable liniment in chronic rheumatism, and other painful affections, and is specially valuable as a counter irritant in sore or inflamed throats, and diseased bowels. Camphor constitutes the bases of a large number of valuable liniments. Thus in cases of whooping cough and some chronic bronchitic affections the following liniment may be advantageously rubbed into the chest and along the spine. Spirits of camphor two parts; laudanum half a part; spirits of turpentine one part; castile soap in powder a finely divided half an ounce; alcohol three parts. Digest the whole together for three days and strain through linen. This liniment should be gently warmed before using. A powerful liniment for old rheumatic pains, especially when affecting the loins, is the following:—Camphorated oil and spirits of turpentine, of each, two

parts; water of hartshorn one part; laudanum one part; to be well shaken together. Another very efficient liniment or embrocation, serviceable in chronic painful affections, may be conveniently and easily made as follows: Take of camphor one ounce; cayenne pepper in powder two teaspoonsful; alcohol a pint. The whole to be digested with moderate heat for ten days and filtered. It is an active rubefacient; and after a very slight friction with it it produces a grateful thrilling sensation of heat in the pained part, which is rapidly relieved.

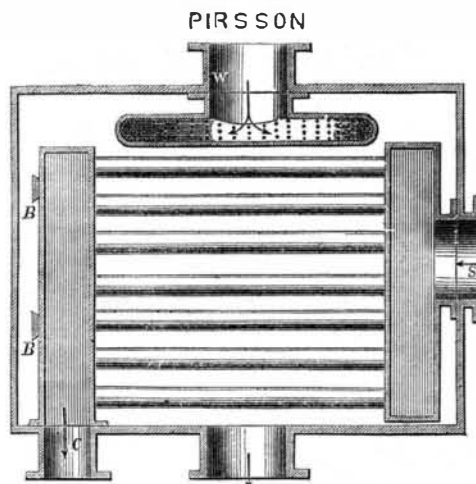
SURFACE CONDENSERS FOR STEAM ENGINES.

Number VII.

In continuing the papers on this useful subject Mr. Louth says:—

In the condensers hitherto described the condensation is effected by the circulation of a body of water, but other plans have been proposed, and, to some extent, used, in which the process is effected by the evaporation of the condensing water which is sprinkled upon instead of surrounding the tubes in a solid body. On this plan several have been made by Mr. Pirsson, of New York, as represented by Fig. 18.

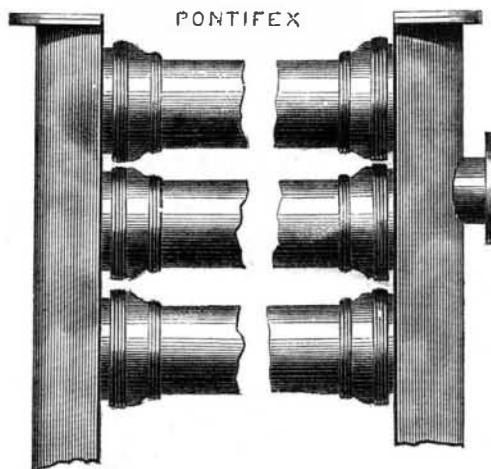
Fig. 18.



The tubes through which the steam passes are fixed into these copper tube plates, and water allowed to fall or trickle over them from a perforated pipe or rose. The waste water and air are withdrawn by the lower branch, W. In these condensers a communication is made between the exterior and interior of the tubes by means of the orifices, B.

By this contrivance the pressure is equalized and all strain on the tubes and plates removed, but the arrangement involves the loss of upwards of 25 per cent of the condensation water. I am also informed that these condensers, at least in some cases, wear out quickly, those placed on board *The State of Georgia*, an American vessel, having been renewed three times in six years. Whether this is owing to evaporating the water on the surface of the tubes, or what other cause, I am not informed. This system has the following advantage, that should the condenser get out of order by removing the tubes, it is converted into an injection condenser.

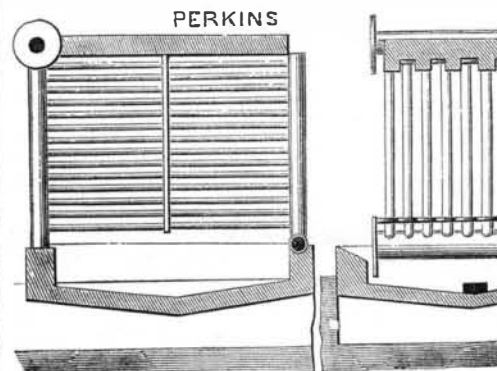
Fig. 19.



Condensers of this class have the advantage of being lighter than those which I have before described, owing to their not having so great a body of water in them.

Messrs. Pontifex make condensers, as shown in Fig. 19. Copper tubes of large diameter are fixed at each end into a cast-iron box, allowance being made at one end for expansion by a collar of india-rubber attached to the tube, and also to the socket, as shown. The condensing water is made to fall on them in the form of a shower, and is rapidly evaporated.

Fig. 20.



Many of these condensers are in use in London producing good results, but they are only adapted for land engines and to be fixed to the exterior of the enginehouse. I am also informed that they are subject to rapid corrosion.

Mr. Perkins has a very successful condenser, represented in Fig. 20. It is composed of a number of horizontal iron tubes of small diameter, screwed into vertical tubes of 3 inches diameter, $\frac{3}{8}$ inches thick connected with the exhaust steam pipe on the one side, and the condensation water pipe on the other. The small horizontal pipes are, after being screwed into the 3-inch pipes, caulked up, thus making a secure joint, and, from their length and small diameter, bend when unequal expansion takes place. The steam passes through the tubes, the condensing water falling on the exterior surface. This condenser produces good results. On one which I had an opportunity of seeing at work, and which had been successfully used for some time, I observed a small deposit of scale which was, however, at that time not sufficiently thick to cause any practical inconvenience.

I also observed that on one set of tubes which had, by way of experiment, been galvanized, the scale was not nearly so thick as on the others. Mr. Perkins proposes, in some instances, to inclose this condenser in a case, and from thence form a communication with the furnace or chimney of the boiler, which, by the rapid current of air passing through, would, no doubt, increase its efficiency.

Dangerous Character of Benzine.

The following is from the *Philadelphia Insurance Journal*:—

A recent review of fires in this city since the 24th of October, by the Fire Marshal, Mr. A. W. Blackburn, refers to benzine in connexion with two or three disastrous fires originating through its use. The Fire Marshal has been convinced that haversacks and knapsacks, made of duck or muslin, or any kind of linen or cotton fabric, when coated with paint, composed of lampblack and linsed oil, hastily and carelessly mixed, and then glazed with varnish, in which benzine is an ingredient, when packed tightly in boxes for transportation, or closely piled in heaps in manufacturing establishments, are constantly liable to take fire from spontaneous combustion. Benzine is a component part of petroleum or coal oil in its crude state, as it comes from the earth. In refining coal oil for burning or lighting purposes, the benzine, which is highly explosive, is got rid of by the process of distillation. From being, as it was first considered, a refuse substance, it is now fast becoming an important article of trade. In various manufacturing and mechanical arts, it has been found an admirable substitute for turpentine, and owing to the scarcity and high price of the latter article, since the blockade of the North Carolina ports, benzine from its comparative cheapness—and, indeed, from the almost absolute necessity of the case—is fast taking its place. It makes a handsome and durable paint, and on wood and other solid surfaces, is harmless; but as an ingredient in the coating on vegetable textile material, it is at all times, more or less dangerous. It is very volatile, and at a certain temperature rapidly assumes a gaseous form. Where articles, such as knapsacks, haversacks, &c., freshly glazed with varnish made with it, are undergoing the process of drying, especially by the heat of boilers or steam pipes, the whole surrounding atmosphere becomes filled with benzine gas, and let combustion ensue from any cause whatever, at such a time, the apartment will be enveloped in flames, with the rapidity of lightning. These facts are well worth the attentive consideration of Underwriters.

The benzine so termed is the light spirituous oil which passes over first at a low heat in distilling petroleum, not coal oil.

The total import of cotton from Europe from the 1st to the 8th of February was 3,510 bales.