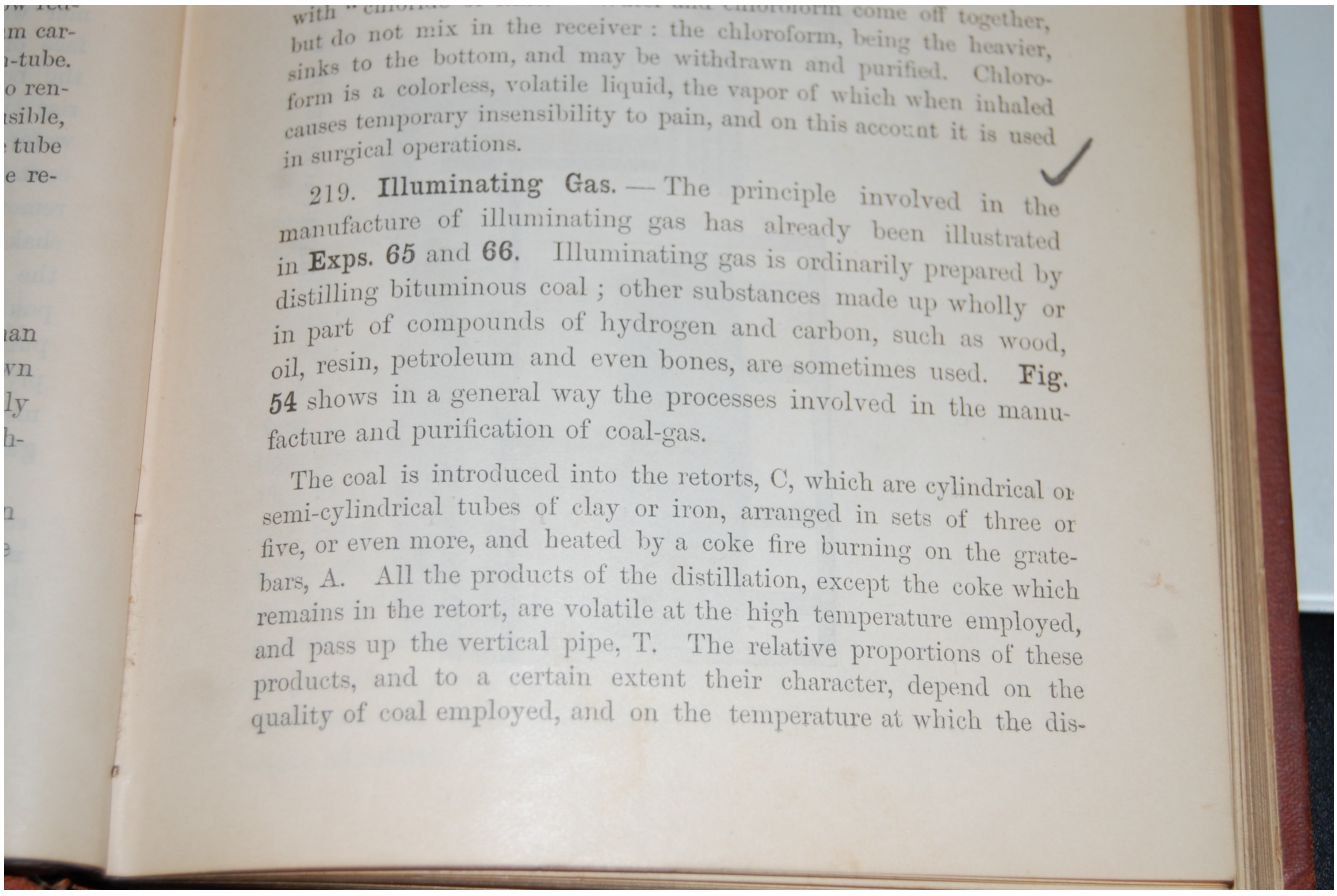
Illuminating Gas- From *An Elementary Manual of Chemistry* by WM. RIPLEY NICHOLS



with " chloric [illegible] and chloroform come off together, but do not mix in the receiver : the chloroform, being the heavier, sinks to the bottom, and may be withdrawn and purified. Chloroform is a colorless, volatile liquid, the vapor of which when inhaled causes temporary insensibility to pain, and on this account it is used in surgical operations.

219. **Illuminating Gas.** — The principle involved in the manufacture of illuminating gas has already been illustrated in **Exps. 65** and **66**. Illuminating gas is ordinarily prepared by distilling bituminous coal ; other substances made up wholly or in part of compounds of hydrogen and carbon, such as wood, oil, resin, petroleum and even bones, are sometimes used. **Fig. 54** shows in a general way the processes involved in the manufacture and purification of coal-gas.

The coal is introduced into the retorts, C, which are cylindrical or semi-cylindrical tubes of clay or iron, arranged in sets of three or five, or even more, and heated by a coke fire burning on the grate-bars, A. All the products of the distillation, except the coke which remains in the retort, are volatile at the high temperature employed, and pass up the vertical pipe, T. The relative proportions of these products, and to a certain extent their character, depend on the quality of coal employed, and on the temperature at which the dis-

tillation takes place : it may, however, be said in general terms that these products, when cooled to the ordinary temperature, are of three kinds, — solid, liquid and gaseous.

The *gases* obtained by the distillation of coal are marsh-gas, olefiant-gas (§ 259), carbon protoxide, carbonic acid, hydrogen, nitrogen, aqueous vapor and hydrogen sulphide ; the liquid portion of the distillate consists of an aqueous solution of ammonium carbonate, sulphide and sulphocyanide, certain liquid hydrocarbons, such as benzol, toluol etc., which will be considered hereafter (§ 264), and a semi-liquid or viscous *tar*. The solid product of the distillation of coal is the *coke* left in the retort.

In the production of gas, all the volatile products of the distillation go up the pipe, T, which is curved at its upper extremity, and dips into water in the "hydraulic main," B. In this water a portion of the tar and aqueous vapor is condensed, and the ammoniacal salts are, in part, dissolved. The gas then passes alternately up and down through the cooling pipes, D, called the "condensers," and suffers further condensation, the remaining tar and the liquid hydrocarbons being deposited. The gas is often further purified by passing through a tower, O, filled with fragments of coke, over which water trickles, the water absorbing the ammoniacal salts still present. The gas then passes through the purifier, M, where it comes in contact with slaked lime and is freed from hydrogen sulphide and most of its carbonic acid, and thence into the gas-holder, G. The lime in the purifiers is sometimes replaced wholly or in part by dry ferric hydrate, which retains the hydrogen sulphide.

220. After purification, the gas as delivered to the consumer consists mainly of marsh-gas, hydrogen and carbon protoxide, — the marsh-gas usually amounting to about one-third part of the whole gas. These non-luminous, or very feebly luminous gases, serve as carriers of the six or seven per cent of real light-producing ingredients which are contained in the gas. This mixture of light giving ingredients is exceedingly complex. The vapor of benzol, no doubt, plays a prominent part ; some of the higher members of the marsh-gas series lend their aid, and a hydrocarbon of composition C_2H_2, called acetylene, is important and very generally present. Sometimes a little olefiant gas (C_2H_4) is present, but the old view, that this substance constitutes the chief luminiferous ingredient of coal-gas, is no longer admitted.

The *coal-tar* obtained as a waste product in the gas manufacture is a very complex substance. Among other substances it contains *benzol*, used in the manufacture of aniline colors, and *aniline* itself in very small proportion; from it is obtained the *pitch* used as a roofing material and for sidewalks.