"An Improved Process for Combining the Production of Synthetic Ammonia with the Working of a Coal Gas or Coke Producing Plant."

Devised by

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It is, of course, well known that in the carbonisation of coal there is produced an average of from 250 to 300 cubic metres of gas per ton of coal, the gas so obtained containing about 50 per cent. of hydrogen. The carbonisation process therefore constitutes an important source of hydrogen for the extraction of which from the mixed gases several different processes can be employed. A new and important process for the utilisation of the hydrogen thus produced, in installations of relatively small size, has been devised by the well-known French company, L'Air Liquide Societe Anonyme Pour L'Etude et L'Exploitation des Procedes Georges Claude, who make use of their patented hyper-pressure processes (see for example British Patent No. 130086) for the manufacture of synthetic ammonia for disposing of the hydrogen obtained in carbonisation processes. The new process permits of the adaptation to this new application, under relatively simple conditions, of existing coking installations and gas-works.

In the first place the gas resulting from the carbonisation of the coal is treated by processes for obtaining hydrogen which consist in taking advantage of the very low degree of solubility of the hydrogen in certain solvents (see for example the processes described in British Patents Nos. 130092, 130358 and 131091). On thus separating the hydrogen a gas is simultaneously obtained consisting almost exclusively of methane and consequently of exceptional calorific power. In practice only a little nitrogen escapes solution, but this presents no drawback in connection with the process under consideration. Matters are found to be much improved in practice, when, as is most often the case, the installations of coke ovens and gas works are provided with the necessary purifying apparatus and when, consequently, gases are produced which it is very easy to treat.

It must be remarked that not only carbon monoxide but also carbon dioxide are only present in a small proportion in the gases in question, and that, consequently, the process which furnishes the hydrogen cannot at the same time supply carbon dioxide. If, however, this carbon dioxide is required, it will be necessary, for example, to find it in the gases of combustion.

In the second place the extraction of the hydrogen as referred to above deprives the coke or gas works of the greater part of its gases, as it is necessary to use a fairly considerable portion thereof for compressing the gaseous mixture to the desired pressure (50 or 100 atmospheres for example); if all the gas produced by the furnaces were used, this is the case in gas works properly so-called or in well-combined metallurgical establishments, it would not be possible to replace the part of the gas necessary for the manufacture of the hydrogen except by using new furnaces to an extent corresponding to the deficit or else by heating the furnaces with the aid of air gas for example.

A better means which obviates any such necessity consists in profiting by the fact that, in almost all existing installations the coke on leaving the furnaces, and especially metallurgical coke furnaces, at a temperature exceeding 1,000 degrees Centigrade is quenched by means of water, and by the fact that there is thus lost without benefit an enormous quantity of heat of the order of that which would produce the combustion of 40 kilogrammes of coke per ton. Now it is easy to avoid this loss by producing in the furnaces themselves, without great expenditure for additional plant, by the aid of this heat and of a very small quantity of coke, a considerable quantity of water gas which can be added to the gas supplied by the coke furnaces and will thus permit of the—so to speak, gratuitous—extraction of the hydrogen existing in a much larger quantity of gas.

When the distillation in a furnace is terminated it suffices to introduce therein towards one of its ends A, as illustrated in the accompanying diagram, a current of steam produced and superheated by the gases themselves which result from the operation, as will be seen from what follows. This steam becomes progressively decomposed in the course of its transit in contact with the incandescent mass, so that at the other end of the furnace, where a very high temperature will prevail up to the end, a mixture of carbon monoxide and hydrogen will pass out at B. This mixture enters at the top of a vertical group of pipes immersed at their lower part in the water of the steam generator G, and produces steam and effects its superheating. When passing this steam into the furnace, the necessary precautions must be taken to prevent damage to the refractory lining of the latter; for example, the steam may be introduced through a long pipe T of suitable metal having a series of holes pierced towards its end, in order to distribute the steam which is highly superheated. The fact of introducing this steam superheated to 300 or 400 degrees Centigrade limits to that temperature the cooling of the parts of the furnace which are in the most unfavourable conditions, and prevents the drawbacks which might result from the too rapid or too complete cooling of the furnace both from the point of view of its solidity as well as of the further carbonisation. Even with this restricted use of the heat of the coke the production of water gas remains very appreciable and may exceed 30 per cent. of the normal gaseous output of the oven.