GAS A SUBSTITUTE FOR SOLID FUEL.

BY M. H. STRONG.

Improvement in methods of producing and applying heat is rational and businesslike economy, and is to be sought in comparatively few directions. First, the combustible employed must be intrinsically cheap. Second, it must admit of greater ease of handling and rapidity in attaining the maximum temperature than have heretofore been secured. Third, it must possess the capability of cheaper storage and transportation to the point of combustion without waste. Fourth, it must have the susceptibility of more perfect combustion than has yet been attained in the everyday use of ordinary fuel. Any one of the advantages named can scarcely be overrated, and all of them may be secured by the use of water gas as made by recently improved methods.

No well-informed person who gives the subject any thought will claim that the combustion of a given volume of gas, the product of the decomposition of steam by the agency of incandescent carbon, can by any possibility evolve more heat than that generated by the perfect direct combustion of an equal weight of the same carbon. Theoretically there can be no gain whatever by the exchange, and just here the mere theorist would pronounce the matter unworthy of further investigation. The subject, however, is a practical one, and demands an inquiry into the comparative fitness of the two forms of fuel for the various uses to which heat is applied.

It is manifest that the transformation of a crude to a gaseous form of fuel by employing it for the decomposition of steam, permits a wider, more varied, and perfect application of its potential heat energy, and that the measure of its economy is the cost of such transformation. Let us in a general way inquire into this question of cost.

No sooner had the discovery been made that water is composed of oxygen and hydrogen gases, than it became a pet theory (and would have remained a theory to this day had not fact taken its place) that it would sooner or later afford a practical source of cheap heat and light. Many thousands of dollars and much thought and labor have been devoted to attempts at its rapid and economical decomposition, but so persistently did the solution of the problem elude experimenters, that at one time the term water gas became a synonym for hallucination. Chemical reagents and the electric current were in turn faithfully tried and abandoned, as entirely impracticable on the score of economy.

Advantage was then taken of the well known affinity of the oxygen of water for carbon at high temperatures, but unlooked for and apparently insurmountable difficulties of a technical nature interposed to prevent a decided success in that direction, some of which we will mention. The carbon employed, whether of coal, coke, or charcoal, was placed in retorts of clay or iron, set in a furnace and brought to a high temperature by a fire beneath, as in the ordinary distillation of gas coal. Steam was then admitted to the retorts, whereupon the well understood decomposition and recomposition ensued with an evolution of what is termed water gas, composed mostly of hydrogen, carbonic oxide, and carbonic acid gases, the rapidity of the operation being of course in direct proportion to the quantity of carbon and heat employed. This general description will cover nearly all the attempts at water gas manufacture by the agency of carbon up to quite a recent date. In short, experimenters seem to have confined themselves to the system of external heating of retorts. Now let us examine into the defects of the system as heretofore employed, or at least of its indifferent success.

It should be borne in mind that we are not speaking of water gas as a diluent or vehicle to convey rich hydrocarbon gases to the burner for lighting purposes, but solely as a fuel.

First, to impart the necessary heat to the carbon it must be transmitted through a retort, usually made of clay (a decidedly bad conductor), and since the external surface of this retort is small compared with the internal surface of the furnace in which it is placed, but a small fraction of the heat evolved was applied to the carbon itself; add to this loss by conduction through the walls of the furnace the enormous loss of heat due to the imperfect combustion of the fuel, and we recognize the first item of cost.

Second, to maintain the necessary temperature of the carbon for decomposition involved a serious wear and tear of both furnace and retorts.

Third, since speed of manufacture is an element of economy, and since direct contact of the oxygen of the steam with the carbon is absolutely essential to decomposition, we see another item of loss in the fact that although at first the evolution of gas was rapid it soon ceased because contact ceased. This will be explained by stating that the process of decomposition forms a coating of ash over each individual lump or piece of carbon, which soon becomes so protected by the oxidation that much of the steam escapes decomposition, while constantly absorbing useful heat to no useful purpose.

Another and by no means the least item of cost is found in the large volume of carbonic dioxide formed, especially in the lower ranges of temperature. With no method devised for conversion to CO, its action was not simply a diluent, but a directly antagonistic one to the calorific power of the combustible portion. To be sure, this impurity could be removed by lime or other alkaline reagents, involving, however, an expense almost prohibitory. Last, but not least, was the cost of labor in the charging and discharging of retorts and the stoking of fires.

These disadvantages and drawbacks incident to, in fact inherent in, the system of external heating always have worked and always will work its defeat, if economy be the object sought.

On the principle, however, that with perseverance defeat leads to success, the money, time, and labor have been well spent. By the new system water gas is produced at a cost which guarantees a gratifying improvement over the present wasteful method of generating heat, not alone in the arts and manufactures, but in domestic use.

Reserving for another article the attempt to show the great advantage to be derived in the use of gaseous fuel over the solid form, we will content ourselves in this by endeavoring to point out in a general way, without referring to details of construction, wherein the new method of producing water gas avoids the difficulties encountered in the old.

First, it abandons the external for the internal system of heating, thus effecting a great saving of fuel. Second, it employs the very cheapest form of carbon, that of dust or slack, the use of which is impracticable in the old. Third, the products of imperfect combustion are utilized for the heating of steam, whereas in the old system they were wasted. Fourth, the oxygen of the steam being thus intensely superheated is applied to the carbon in a state of minute subdivision and while in suspension, thereby securing direct and intimate contact of these elements, and as a result astonishingly rapid and thorough decomposition. Fifth, the CO_2 portion of the gas formed by this contact is thoroughly converted to CO by passing through a bed of incandescent carbon before its exit from the generator, by which two very important advantages are gained, to wit, avoiding the labor and cost of purification, and an exchange of one volume of the non-combustible CO_2 for two volumes of the highly combustible CO. Sixth, the great saving in labor and wear and tear.

It must be admitted that these differences are radical, and that they indicate improvement in a wide field of operations.

Ventilation of Bedrooms.

The ventilation of bedrooms, a very important matter, is, as a rule, much neglected. The circulation of the blood is not nearly so active during sleep as when awake. The *Lancet* has some important notes on this subject. The sleeper is entirely dependent upon the atmosphere supplied to him for the means of carrying on the chemical purification and nutrition of his body. He must breathe the air that surrounds him, and he does this for a lengthy portion of each period of twenty-four hours, although it is probable that in a large majority of cases the atmosphere has become so deteriorated by the expiration of carbon and the emanations from the body generally, that if the senses were on the alert some change would be sought as a mere matter of preference.

When a person places himself in a condition to take in all air, without being able to exercise any control over its delivery, he ought to make sure that the supply will be adequate, not merely for the maintenance of life, but for the preservation of health. If a man were to deliberately shut himself for some six or eight hours daily in a close room, with closed doors and windows (the doors not being opened even to change the air during the period of incarceration), and were then to complain of headache and debility, he would be justly told that his own want of intelligent foresight was the cause of his suffering. Nevertheless, this is what the great mass of people do every night of their lives with no thought of their imprudence. There are few bedrooms in which it is perfectly safe to pass the night without something more than ordinary precautions to secure an inflow of fresh air. Every sleeping apartment should, of course, have a fireplace with an open chimney, and in cold weather it is well if the grate contains a small fire, at least enough to create an upcast current and carry off the vitiated air of the room. In all such cases, however, when a fire is used, it is necessary to see that the air drawn into the room comes from the outside of the house. By a facile mistake it is possible to place the occupant of a bedroom with a fire in a closed house in a direct current of foul air drawn from all parts of the establishment. Summer and winter, with or without the use of fires, it is well to have a pure ingress for pure air. This should be the ventilator's first concern. Foul air will find an exit if pure air is admitted in sufficient quantity, but it is not certain pure air will be drawn in if the impure is drawn away. So far as sleeping rooms are concerned, it is wise to let in air from without. The aim must be to accomplish the object without causing a great fall of temperature or a draught. The windows may be drawn down an inch or two at the top with advantage, and a fold of muslin will form a "ventilator" to take off the feeling of draught. This, with an open fireplace, will generally suffice, and produce no unpleasant consequences even when the weather is cold. It is, however, essential that the air outside should be pure. Little is likely to be gained by letting in a fog or even a town mist.

The Filtration of Drinking Water.

Dr. A. B. Prescott remarks, in the Michigan *Medical News:* It seems to me more attention might well be given to the purification of rain water, river water, etc., by that simple means, everywhere and at once cheap and available, the use of a portable filter with a good bed of pulverized charcoal in layers with gravel. I do not disparage filters set in cisterns or reservoirs. If made on right principles they may do the work expected of them. They have an advantage of permanence and uniform supply without daily attention, but they are much more liable to failure from neglect of the true conditions of filtration than the simple movable filters manufactured for sale.

Some of the definitions and conditions of a good water filter may be given as follows:

1. It must be more than a strainer, and remove more than suspended matters. A brick partition (of bricks mortared edge to edge) in the cistern or reservoir makes a good strainer, removing undissolved matters, but not much else.

2. It must remove from the water the dissolved colloids—the organic matters. The power of a bed of powdered charcoal, especially bone charcoal, to withdraw coloring and other colloid matters, is familiar in manufacturing operations.

3. The good water filter, instead of becoming filled with the organic matters it removes, causes their prompt oxidation. To do this it must have air. A filter constantly submerged under water can act only with the attenuated oxygen dissolved by the water, and cannot effect half the oxidation it would if exposed to the air for the greater part of the time. Without oxidation of its gatherings, a filter can render only a brief service.

How to get rid of Ants.

During a recent visit to Mr. Humann, in Ostheim, I had an opportunity of becoming acquainted with a very successful method of speedily getting rid of ants, which are so troublesome in the apiary.

One takes small bottles, fills them half full of sirup or sweetened water, and puts them in the places where the ants have their passage ways, in such manner that the necks of the bottles lean against a wall or board, in order that the ants may easily fall into the trap and drown.

By means of camphor, ants may be driven from rooms where honey is stored.

In gardens, lime dust operates very destructively upon them. Their hills, after being scratched open, are sprinkled with lime dust, and then hot water is poured on them.

To render jars of honey or preserved fruit inaccessible to these insects, place the jars in chests whose bottoms have been previously covered with ashes or pulverized chalk.—*Bienenzuchter.*

The Texas "Screw Worm."

Samuel Myers is now lying bedfast at his home in this place, afflicted with that terrible malady, the screw worm, It appears that Mr. Myers has been sick, of late, with fever, and that recently, while resting in bed, one of the flies alighted near his nostrils, where there were some few drops of blood. It requires but a few moments for one of these flies to deposit hundreds of eggs, which are hatched and grown inside of an hour, many of them as much as one half an inch in length. Mr. Myers, upon awakening, felt a slight tickling in the nose, and it was not until his eyes and face had become fearfully swollen, that the physician discovered the presence of the worms. The only known remedy was applied—calomel and carbolic acid—by injection into the nostrils. At first a few would drop their hold and force themselves out. Application after application was made with like results up to the time of our report, when 152 was the number passed. The patient is in a critical condition, with but slight hopes of his recovery. The fly is much dreaded by our stock men, and is represented as a dark colored and fuzzy insect, which generally attacks cattle or any other animal that is unfortunate enough to have blood upon which it can alight.—*Dallas Intelligencer.*

The Science of Milling.

The problem of milling is to separate in as simple and cheap a manner as possible the interior of the grain from the outer rind, the beard, and the germ; to thoroughly grind the cells of which the grain is composed, and by setting free the glair substances and starch grains from the outer integument in which they are inclosed, to facilitate a quicker and more intimate contact of the nourishing qualities contained in the wheat with the human stomach.

The Austro-Hungarian high milling, with its nicely exact elimination of even the smallest modicum of bran, and its fine and careful grinding, of all other methods approximates the nearest to this ideal, and the bread made of flour so treated is consequently the most nourishing and the easiest of digestion of any bread in the world.

According to this theory, if we would answer the practical question, "How much pure flour can be got out of the grain?" the above named experiment will enable us to do it in the following figures: Pure flour—wheat, 78 to 82 per cent; rye, 75 to 80 per cent. Waste and fodder—wheat, 18 to 22 per cent; rye, 20 to 25 per cent.—*G. Pappenheim.*

Cellulose as a Material for Washers.

The *Pharmaceut. Centralhalle* says that, for the purpose of packing joints which are to be hermetically sealed, such as retort connections, couplings, etc., where vulcanized rubber has usually been employed, cellulose appears to be even a better material. It has the advantage of cheapness, it readily absorbs water at first, thereby becoming pliable, and adapts itself more accurately to the surfaces which it is intended to render tight. If a joint is exposed to steam, and is to be frequently opened, the cellulose should be soaked in oil.