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(Illustrated articles are marked with an asterisk.)

To Advertisers.

The circulation of the SCIENTIFIC AMERICAN is from 25,000 to 30,000 copies per week larger than any other journal of the same class in the world. Indeed, there are but few papers whose weekly circulation equals that of the SCIENTIFIC AMERICAN, which establishes the fact now generally well known, that this journal is one of the very best advertising mediums in the country.

THE PROGRESS OF CHEMISTRY IN 1870.

Although there have been no startling discoveries since the 1st of January, 1870, still chemistry has held even pace with all other sciences; and we have been called upon from time to time to record numerous improvements in the methods of manufacture of various articles, and in the new application of well-known compounds.

The uses of oxygen gas have been greatly extended since its cheap manufacture, and we hear of it as an important remedy in disease, as a powerful agent in the production of great heat, as a source of light, and it can now be purchased the same as any common agent employed by chemists.

The recent improvment in the preparation of hydrogen bids fair to become an important step in the manufacture of illuminating gas, as it can be converted into carbureted hydrogen very cheaply, when it will burn with a highly illuminating flame, thus affording a cheaper and purer light than has hitherto been known. The simultaneous discovery of the cheap and ready preparation of oxygen and hydrogen opens the way to many uses of those gases hitherto considered impossible on account of the expense attending their manufacture; and the study and development of this new industry must be assigned to the first half of this year. Hitherto, in speaking of hydrogen, we have been in the habit of assigning very few uses to it. That it would lift balloons on account of its levity has long been known, but its application in medicine is a novelty of which, now that we are likely to have the gas in any quantity, we shall probably hear much more. When breathed in large quantities it proves fatal, but in proper proportions it acts as an hypnotic, and we may hear of it hereafter as a rival to the hydrate of chloral in cases of sleeplessness.

Further uses of hydrogen in conjunction with oxygen for the fusion of the most refractory metals is no novelty, and has long been anticipated as a probable and desirable consummation. The practical application of the condensation of gases for the production of cold is a result that has been attained this year more than in any other former period. The fact of the possible compression of gases into liquids was long ago ascertained by Faraday, and feeble attempts were made a few years since to apply it for the production of cold, but it was not until recently that these experiments proved successful. There now appears to be no doubt that the liquefaction of gases is the true method upon which to found the artificial production of ice on a commercial scale; and we shall be glad to record the success of any mechanical contrivance that shall accomplish all that science pronounces as entirely practicable in this direction. The chemistry of the question has been fully worked out, and what remains to be done is a similar solution of the mechanical part of the problem.

During the present year we have recorded unusual progress in the art of photography, especially in the rapidity of printing, and the permanency of the pictures. The Albertype offers a method by which a thousand prints can be taken in a day, with durable ink, and in colors according to the natural appearance of the objects, where these colors are such that they can be introduced with the ink. The Albertype and the Woodburytype are among the most important improvements of the present day, and offer encouragement that a rapid method for the production of photographic prints has now been attained. Photographing natural colors has made very little progress during the last six months, and it appears doubtful if we shall ever be able to accomplish this desirable result.

In the manufacture of glass we have to mention the use of salts of baryta, of fluor spar, of salts of thallium, for optical purposes, and in general a very satisfactory progress.

Platinized mirrors have been introduced, and appear to give satisfaction for various purposes; but the manufacture has hardly reached such proportions as to enable us to pronounce with absolute certainty upon the success of the method. Silver mirrors, which at one time were urgently pushed as a cheap and most desirable invention, have by no means displaced the quicksilver mirror so long in vogue; and there would appear to be some practical difficulties in the way of the universal substitution of silver for mercury. From a sanitary point of view it is a misfortune that silver cannot take the place of mercury, as the latter is exceedingly poisonous to the workmen; and it was chiefly from this humanitarian consideration that Liebig took up the investigation and devised cheap and ready methods for silvering glass.

The uses of manganese have largely increased during the present year, and new and important industries appear likely to be founded upon recent discoveries of the cheap preparation of the permanganates and the metal. It is now well known that Tessié du Motay's method for the manufacture of oxygen gas is founded upon the use of the oxide of manganese and soda.

The ready way of making the manganate of soda has suggested the use of that salt for many purposes, and by degrees the permanganate has been introduced and applied as a disinfectant and for bleaching; it is for the latter purpose that the permanganates of lime and potash appear destined to become conspicuous. Disinfecting and bleaching are essentially founded on the same chemical process; for the former only small quantities of material are required, while for the latter the demand was much beyond the possibility of the supply. It has now been proved that the permanganates are among the best bleaching agents we have, and the past few months have shown the possibility of supplying them cheaply and in any quantity. No chemical progress of recent date is of more importance than this application of permanganic acid as a disinfecting and bleaching agent.

We have also to note the use of metallic manganese in combination with copper. Cupro-manganese is a white alloy closely resembling German silver, and possessing many of the valuable properties of the older alloy. It can be substituted for German silver in plated ware, and is now manufactured and successfully applied in Connecticut. There was formerly an insurmountable obstacle in the way of the use of manganese, and that was the production of the necessary heat to fuse it. This difficulty has now been overcome by the use of Siemen's furnace, and the alloy of copper and manganese is readily accomplished. We shall probably hear of its introduction as a substitute for the much more expensive alloy of nickel, and can now anticipate the manufacture of manganese steel more largely than ever before.

The progress in the economical use of products that were formerly wasted, has been satisfactory during the past six months. Earth closets have become better known, and by degrees we shall not only avoid the waste attending upon the old system, but also the frequent diseases and discomfort that custom has fastened upon us. The waste of coal-tar products is fast disappearing, and as we have recently had occasion to remark, so great has been the progress of discovery in the new application of the liquid and solid products of the distillation of coal that we may expect to see retorts erected for the purpose of producing them, rather than for the manufacture of gas. Gas will become an incidental product, while the object sought will be the tar from which to make aniline colors, and anthracene from which to manufacture alizarine and artificial madder dyes.

The manufacture and use of the hydrate of chloral, although not started this year, may be properly said to belong to it, as it has received its chief development within the last six months. This medicine may be pronounced the most valuable contribution of chemistry to *materia medica* that has been made for a long time.

The progress made in the uses of glycerin is worthy of note, and in nothing was it more unexpected than in the preparation of elastic sponge. By this recent improvement we have refuse sponge rendered available for mattresses, cushions, and other purposes. The use of glycerin in wine and beer, and for the preservation of animal substances from decay, and in medicine, is also worthy of note.

We cannot enumerate in detail each particular discovery, but have said enough to show that the recent progress of chemistry has been entirely satisfactory, and quite up to the precedents of the past few years.

STEAM ROAD ROLLING.

This method of consolidating roads, which, as our reader, are well aware, has been for the last two years under trial, both abroad and in America, seems to be entirely successful. So far as its results can be ascertained here they seem to warrant the belief that this system is destined not only to be adopted in cities but also upon rural highways, turnpikes, etc.

From abroad, we gather most encouraging accounts of the progress and results of the system in various cities of France and England. From the *Building News* we learn that Mr. Heaton, of Birmingham, calculates that an annual saving of $28,500 to that town would be effected by the use of the steam roller; the present annual expenditure for road material alone amounting to as much as $65,000. Though hesitating to assign a precise figure to the amount of saving effected by road rolling, Mr. Newlands, the Liverpool borough engineer, wrote in October, 1867, with regard to Messrs. Aveling and Porter's 30-tun roller: Our roads are in much better order, and easier kept clean, than before its use, and our bills for macadam are not so heavy."

Mr. Newlands expects, however, that "the saving in macadam by every coating being at once consolidated will be very great, though he cannot at present put a value upon it." During the last two years, Mr. Samuel F. Holmes, the borough surveyor of Sheffield, has "used a steam road roller made by Messrs. Aveling and Porter." He finds "the saving in the cost of macadamized roads to be even greater than when rolled with a horse-roller," but he is "not yet in a position to give exact figures." He has no doubt it will increase the saving "at least 40 per cent over unrolled roads." Mr. Edward Buckham, the borough surveyor of Maidstone, writes as to the steam rolling carried out there in March, 1868, with a 15-tun Aveling and Porter roller, that "the results obtained from using the roller are economy, durability, comfort, and uniformity of section of road." Mr. Buckham considers that the constant use of a steam road roller would effect an economy in road maintenance of "at least" 20 per cent.

These are only specimens of like testimony received from London and many other places in England, and from Paris in France. The New York Central Park Commissioners have used a heavy steam roller of Aveling and Porter's make, imported for the purpose, with great success.

On Fourth avenue, Brooklyn, a most beautiful drive has been made by this process.

While the results named are highly satisfactory, we are constrained to say that in our opinion *the* steam road roller which shall be beyond question adapted to universal use on all sorts of road beds is not built. Perhaps the different nature of the materials used in road making will render it impossible to construct a roller which shall be equally adapted to all. We think this highly probable; but if so there is certainly room for the profitable employment of inventive talent in the construction of this class of machines. It has been only within a week that the proprietor of a valuable patent paving material has made inquiry at our office for something lighter, more rapid and portable than anything of the kind now in market.

We believe that the system might be extended to American country roads with great profit, provided some inventor would hit upon the right thing to do the work.

GAS AS FUEL.

It is scarcely necessary to preface what we are about to say with any remarks about the numerous family of gas-stoves for the consumption of and generation of heat from the combustion of ordinary illuminating gas. Those already introduced into market are answering a good purpose, and are both economical and convenient for many domestic purposes. We should, however, certainly fail in judgment and sagacity did we not fully comprehend the fact that the use of gas as fuel is in its infancy, and that it is destined to a far more extended application than at present obtains.

When, however, we use the term gas, we mean much more than illuminating gas; we mean all gases which by their chemical combination are capable of developing intense heat.

The old idea of separating water into its elements to reunite them and employ them as heat producing agents is perhaps no chimera. It is true that the heat thus developed will only be the equivalent of the force employed to effect the separation; and unless some natural force be by future discovery rendered available by conversion to produce the separation, no gain will result.

But recent advances in chemical discovery indicate that hydrogen as well as oxygen will eventually be obtained at so cheap a cost that they may find extensive application for heating as well as for illuminating purposes.

Be this as it may, its further discussion is foreign to the purpose of the present article, which is to institute some comparison between the relative economy of common illuminating gas and coal as combustibles for ordinary domestic purposes.

The comparison of the relative values of these materials as heat-producing agents would become extremely complicated were we to consider, in making it, all the compounds which enter into their composition. We shall find it, however, sufficiently accurate for our purpose, to consider the chief constituents of illuminating gas. These are carbon and hydrogen. To determine approximately the proportions of these elements contained in the best quality of illuminating gas, we shall take the results of the experiments of Peclet, who gives as the mean result of investigations upon the composition of coal the following:

In one thousand parts, carbon, 812 parts; hydrogen, 48 parts; oxygen, 54 parts; nitrogen and sulphur, 31 parts; ashes, 55 parts. From an analysis of eight kinds of coals, by Dr. Fyfe, we find an average of coke after distillation to be 1,254 lbs. per tun.

From Peclet's analysis we find there are on an average 1,624 lbs. of carbon in a tun of 2,000 lbs. and 96 lbs. of hydrogen. The coke (carbon), on the average being 1,254 lbs. after distillation, leaves an average of 370 lbs. of carbon converted into gas, which, added to the weight of hydrogen, makes 466 lbs. of gas as an average yield from 2,000 lbs. of coal; 27 lbs. more than an average of the weight of gas obtained from seven kinds of cannel coals by Wright. The heating power of 466 lbs. of gas, composed as above, is according to Dulong.

Carbon.....370 × 12,906 =	4,775,220	Heat Units.
Hydrogen.... 96 × 62,535 =	6,003,360	Heat Units.
Totals.... 466 lbs.	10,778,580.	Heat Units.

This is all the heat that can be obtained from the gas pro

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