

BY EDWARD SALMON.



GAS has become so universal an agent of illumination, and enters so considerably into the domestic economy of the world to-day, that it is somewhat surprising to remember the present year is the centenary of the discovery of the practicability of utilizing it for all sorts of purposes, from the lighting of the highway and the home, to the cooking of the dinner on a day when it is convenient to do without a coal fire.

Natural gas, which was spoken of as "spirit," and was more or less of a mystery, had been known for centuries, and is even said to have been used in China as an illuminant long before it was turned to account in Europe. In many places natural gas forced itself up through fissures in the earth, became ignited and burned incessantly, to the terror, no doubt, of some good people, who thought the flame came from Hades itself.

Some time towards the end of the seventeenth century a well in the neighbourhood of Warrington was found to contain inflammable air, and it is believed that the result of the application of a lighted candle to the mouth of this well suggested to the Rev. Dr. John Clayton the idea of making experiments in coal distillation, that is, in the heating of coal until the gas is forced out

of it. He placed some coal in an iron or brick receptacle called a retort, with an aperture through which the gas escaped when distillation, or carbonization, commenced. Dr. Clayton describes how at first there came steam, then a black oil, and then a spirit, the last of course being gas. He had no notion what to do with it, and was surprised to find that as it issued from the retort it caught fire on a light being applied to it. He filled some bladders with it, and when he wished to divert his friends, pricked a hole in one of these bladders, pressed the sides slightly and lighted the gas. Infinite amusement is said to have been derived from watching the "spirit" gradually burn itself out.

It is strange that, though Dr. Clayton thus came about the year 1690 so near to it, the discovery of gas in the form in which we know it to-day was not made for another century—till 1792, when William Murdoch, an engineer in Redruth, Cornwall, conceived the idea.

Certain impurities in the gas as it leaves the retort were the stumbling-block to progress. After some experimenting, Murdoch succeeded in removing them sufficiently to enable him to startle the Redruthians by lighting his own premises with gas before the close of 1792. Murdoch was one of the world's truly great men, and an excellent



DR. CLAYTON'S EXPERIMENT.

was told that on approaching the great man it was proper to wear a "top" hat. But he possessed no such thing. That, however, was a detail. He made a lathe, secured a block of wood, and turned a wooden hat out of it. Holding this strangest of head-gear in his hand, he respectfully solicited work, and the reason he was not shown the door as relentlessly as were most of the unfortunates who came on a similar errand, was that Mr. Boulton caught sight of the wooden

story is told of his knack from his earliest days of facing and overcoming difficulties. As a lad he is said to have applied to Mr. Boulton, of the firm of Boulton and Watt, for a job. Poor as he was, he could afford to leave nothing undone which might assist his chances of carrying his point. He

hat, and asked what it was. Young Murdoch's account of how he had made it, not unnaturally, straightway convinced Mr. Boulton that one who possessed such resolution was likely to do great things, and repay a hundredfold any help that might be given him. The lad was engaged, and lived



A PEEP AT THE GAS LIGHTS IN PALL-MALL.

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to become one of the scientists of his age.

Murdoch's successful utilization of gas caused no small sensation, and inspired both hopes and fears. When in the first or second year of the new century an exhibition was given of gas lighting, in Soho, one who was present declared the illumination to be of "the most extraordinary splendour," and no doubt, to eyes accustomed to the feeble oil lamp, it was so. At the same time many people saw in it all kinds of danger, among others, the probable loss of our naval supremacy. It was said that whale fishing would become extinct as an industry if oil were no longer burnt, and that as whale fishing was England's naval nursery, Britannia would soon find it impossible to rule the waves, owing to the want of training on the part of her sons. The story of the progress of gas lighting is long and interesting, but it must suffice here to mention that a corporation, the present Gas Light and Coke Company, was formed in 1810, that Westminster Bridge was first lighted with gas in 1813, Westminster itself in 1814, and the greater part of London in 1816.

In its early days gas afforded the caricaturist many opportunities for most amusing sallies, of which the description to-day of an inflated speech as "gas" is no doubt a survival. George Cruikshank turned the discovery to excellent account, as may be seen in two reproductions which we are enabled to make from his pen. "The Good Effects of Carbonic Gas" appeared in 1813, and "The Introduction of Gas, or Throwing a New Light on the Subject," in 1815.

These were, however, not the first shafts launched at it, for in 1809 Rowlandson permitted his friends a very entertaining "Peep at the Gas Lights in Pall Mall," where, on the site of the Carlton Club, Winsor, the founder of the Gas Light and Coke Company, had premises. In 1807 he gave exhibitions of the new light, and in 1809 and 1810 the efforts to obtain a charter were assisted by keeping the light burning during the Parliamentary Session.

Strenuously opposed as gas lighting was at first, its advantages were too palpable to be withstood for long. Of the many companies in London alone to-day, the first started has attained such dimensions that its directors and officers are called on to deal with administrative matters equal to those



"The good Effects of CARBONIC GAS.!!!"

of a small state. The Gas Light and Coke Company's authorized capital is nearly £12,000,000; its revenue account shows an annual expenditure of £2,899,000, and income of £3,673,100, leaving about three-quarters of a million net profit; it employs 11,000 men; supplies gas to 220,000 private consumers, 682 churches and chapels, 530 railway stations and signal-boxes, 297 hotels, 261 Government and municipal offices, 260 banks and branches, 175 hospitals, and any number of prisons, barracks, theatres, palaces, clubs, markets, etc.; its street lamps number 50,351; its length of mains is, roughly speaking, 2,000 miles; and its district is about nine-tenths of London north of the Thames, and a considerable area south of it.

Its chief works are at Beckton, in Essex, where nearly half its gas is made. Beckton is capable of turning out $56\frac{1}{4}$ million cubic feet a day, has carbonized 31,000 tons of coal in a week, and can store 200,000 tons on its grounds. Here are the largest gas-works in the world, and Beckton is obviously the place to make for if we would see all there is to be seen of the process of gas manufacture.

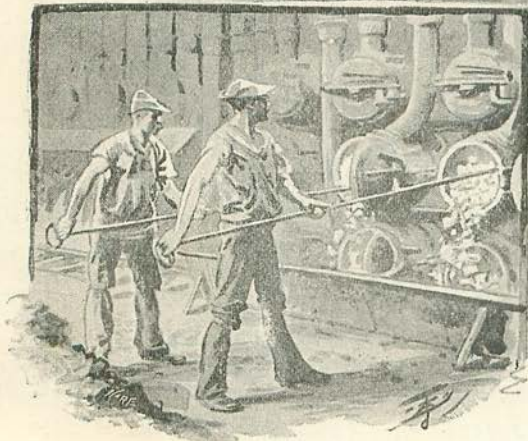
The first impression

at these works is one of bewilderment. Beckton looks a jumble of huge plain brick buildings, of gasholders, of pipes, of railways, and of heaps of coal, coke, and a dust known as breeze. For the concentrated essence of the ugly and unprepossessing, commend us to an extensive gas-works. However, we are here to seek not fine effects but information, and the initial question that we have to put to our kindly guide is inspired by the sight of a small engine, dragging a train of trucks on an elevated railway. It comes along snorting and puffing, and dives into one of the huge plain brick houses just mentioned, through a hole in the wall some 25ft. above the level of the ground.

A minute later another train moves along the rails at our feet, and we are peremptorily warned to look out. "Beware of the trains" is an inscription to be found on walls high



CHARGING THE RETORTS.



DRAWING THE RETORTS.

and low throughout the Beckton Works, and the injunction is not unneeded. The place is simply a network of rails, and trains at times pass over one's head and under one's feet with startling frequency. The former are bringing coal from the pier at the Thames side, and the latter are removing the coke which has recently been taken from the retorts. Let us go to the pier and follow the whole business throughout its various stages.

A ship is just in from Newcastle, and in both of her great holds eight or ten men are at work shovelling the coal into giant skips, which when full are hoisted by a steam crane over our heads and emptied into trucks. When a train of trucks is full, an engine is attached to it, and away it goes over a viaduct some hundred yards long into a retort-house. If not deposited there for use, the coal is carried through it, across a connecting viaduct, to another house, and so on through half-a-dozen houses if necessary. There are a dozen retort-houses at Beckton, to say nothing of one now building which is to be the largest in the world, and from every one of these, engines and a string of trucks pop in and out like serpents at hide and seek.

The floor of the retort-house is between the ground and the elevated railway. Underneath are the furnaces which heat the retorts. The latter are somewhat narrow, oval ovens, twenty feet long, opening at both ends. Each furnace heats nine retorts. These when shut are air-tight, so that the gas can escape only by the pipe provided for it. In some retort-houses, as, for instance, one at the South Metropolitan Works in the Old Kent Road, the doors of the retorts are not of the patent perfectly air-tight order. They have consequently to be luted or clayed over. At Beckton all the men have to do is to close and fasten the retort door to render any escape impossible.

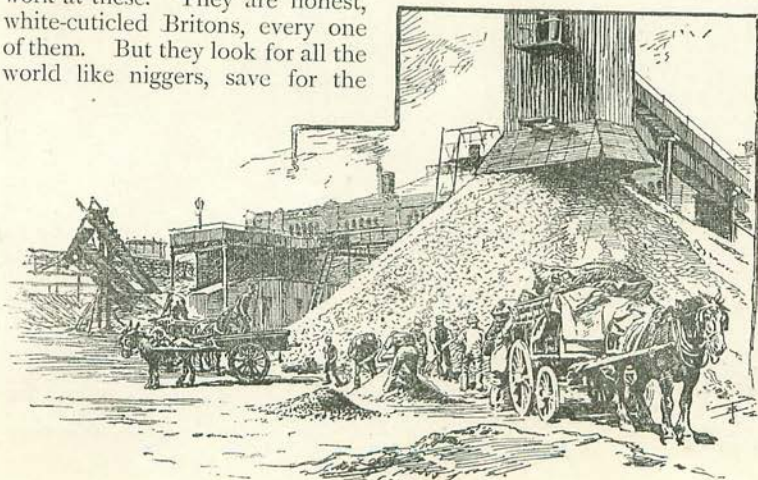
As we enter the retort-house three doors have just been opened and a tongue of flame shoots forth. Three men are at work at these. They are honest, white-cuticled Britons, every one of them. But they look for all the world like niggers, save for the



QUENCHING COKE.

absence of the curly hair and a certain coarseness of feature. Their skins are sable and their teeth gleam with a pearly whiteness almost worthy of the race of which Uncle Tom is so famous a member. Some of them wear only trousers, boots, and a skull-cap; others a ragged flannel jersey as well. If the attire seems scanty, it is soon shown to be more than adequate. Each man picks up a rake, that is, an iron rod ten feet long with some six inches turned at the end at right angles. To lift this rake by one end requires no simple effort, but experience is everything. Grasping the handle firmly with both hands, the stoker places the other end in the mouth of the retort, runs it a little way in, and withdraws a quantity of red-hot coke. This falls through an opening in the floor into trucks below, and is destined either to be used again for furnace purposes or to be sold

to outside consumers. To quench the red-hot coke, either a hose is turned on to it or it is placed on barrows, as at the South Metropolitan Works, and run under a quadrangular water-pipe, where it receives a shower bath, of which, to judge by the way it spits and hisses, it by no means approves. It is then carried along a viaduct and deposited on a tremendous heap in the coke-



THE COKE-YARD.

yard. Our illustration affords a realistic idea of this section of the South Metropolitan Works on a busy day.

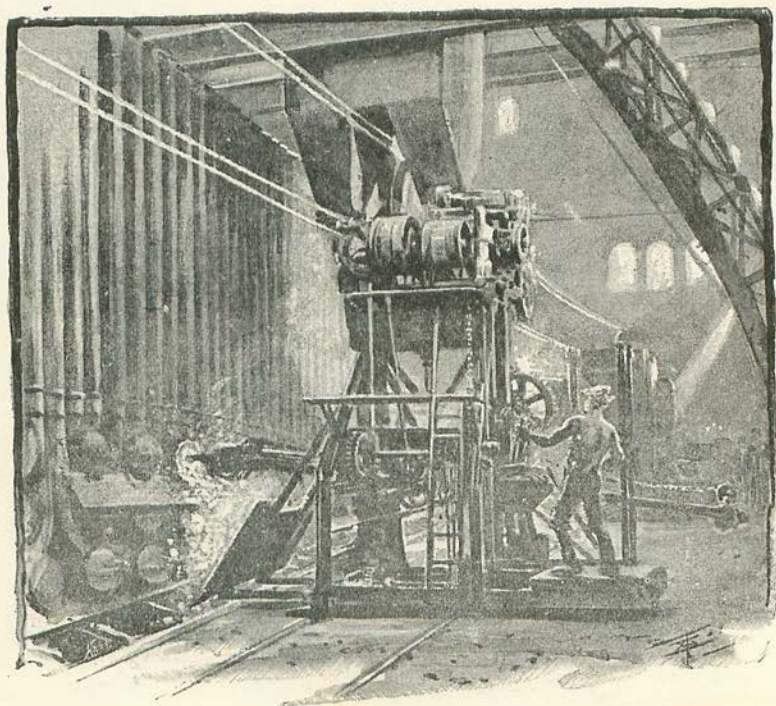
But to return to the retorts at Beckton. In a few minutes the greater portion of the charge has been withdrawn, and one can look—always at a respectful distance—along the retort. The men's work has grown hotter and hotter the farther the rake has been shoved into the retort, and great streams of perspiration run down their faces and backs. In the midst of it all comes along our artist. He is armed with the camera, and suggests that the men should stand still for a while in the act of withdrawing, in order to let him take a shot at them. The proposal strikes one as cool even in this hot house, but the men seem perfectly willing to be roasted alive in order to give him an opportunity of conveying to the British public a truthful impression of the way "it is done." They would make capital martyrs these men, and our artist would make a very daring army general. Fire has no terror for him when he is safely out of its way, and he stands, for what seems to his less exacting colleague an interminable time, counting by his watch the seconds necessary to obtain the negative he wants. But at last he says, "Thank you; that will do!" and the men finish drawing the coke from the retorts.

Then, without the loss of a minute, they prepare to re-charge them. On the ground is a heap of coal running the length of the house, deposited by one of the trains running above, and from this two scoops ten feet in length, containing one hundredweight each, have been filled. One man takes the handle, hoists it slightly, the other two place a bent bar, called a bridle, underneath and about the middle of the scoop, it is lifted to the height required, the nose is thrust into the

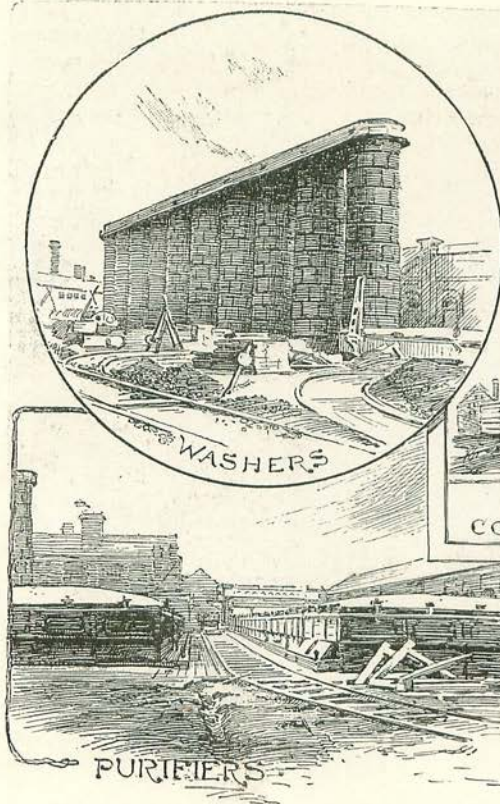
mouth of the retort with a dexterity which comes of daily practice, the two men with the bridle find themselves perilously near the flame which bursts forth from the retort, the man at the handle rams the scoop well home, turns it upside down and rushes back with it; the next scoop is treated in the same manner, both scoops are refilled and emptied, and a few shovelfuls of coal thrown in complete the charge.

The door of the retort is closed and fastened, the process of gas making has begun, and for the next six hours the coal will undergo distillation. The men have been about forty minutes over their work, and some twenty minutes will elapse before the time to clear another set of retorts is up. They retire to a room, where are many lockers containing their clothes and belongings, and the interval is spent in rest, in gossip, or in snatching refreshment.

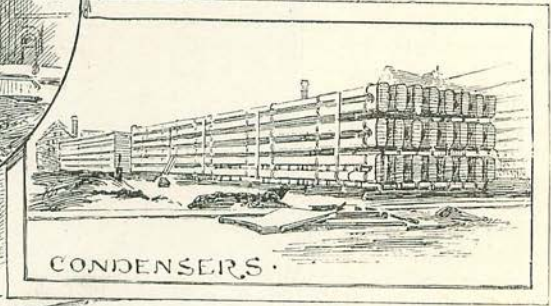
The men work in eight-hour shifts, earn good money (the average being £2 a week), and, wearing as their occupation seems to be, enjoy excellent health and opportunities of improving their position. It will generally be found that the foremen in immediate responsibility over the men have risen from the ranks. Two instances of success may be cited. The first is that of a head



CHARGING RETORTS BY MACHINERY.



and down the retort-house, one of which is made to perform the operation of raking out the coke, whilst the other contains a supply of coal from which the scoop is filled. The coal is deposited in the retort-house, is carried in elevator buckets to a hopper overhead, from which it is dropped into the charging machine. A couple of men with very little

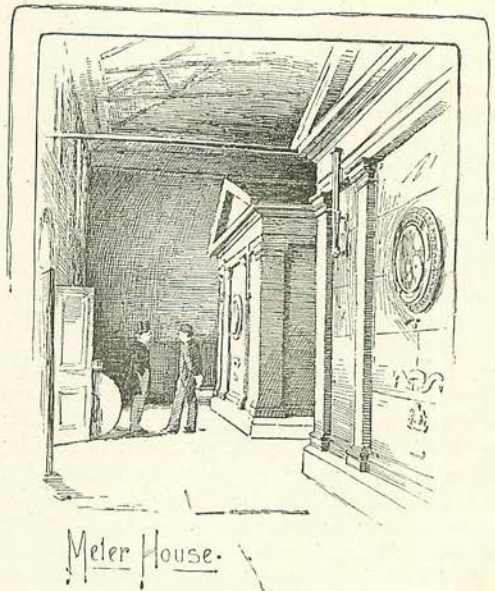


experience can with these machines do the work of several expert stokers.

As the gas leaves the retort it is very hot and very impure. Its temperature has therefore to be reduced and its impurities have to be removed. It passes into a pipe known as the "hydraulic main," the air in which is exhausted by means of engines, which may be seen at work in the engine-house. The main contains water through which the gas is forced. From the hydraulic main it enters the condensers, which are pipes running back-

foreman, now receiving a good salary and enjoying the entire confidence of his employers, who, a few years ago, was an ordinary scoop-driver. The second case is that of a man who, some fifteen or sixteen years since, obtained a job at a provincial gas-works. He was in absolute want, and had walked the roads for many a weary day in search of work. He addressed the casual inquiry, which most pedestrians have heard, to a passing stranger: "Do you know of anyone who could give a man something to do?" He, fortunately, happened to be speaking to an employé of the gas-works, who secured him a post as stoker. He proved himself an efficient and reliable servant, and was ultimately promoted to be head foreman with a salary of £150 a year. He is now the proud possessor of several houses, and is credibly reported to have accumulated, by judicious investment of his savings, as much as £2,000.

Owing to causes in which we need not enter here, it has been found expedient in recent years to replace manual labour to a considerable extent by machinery in charging and drawing retorts. Two carriages work up

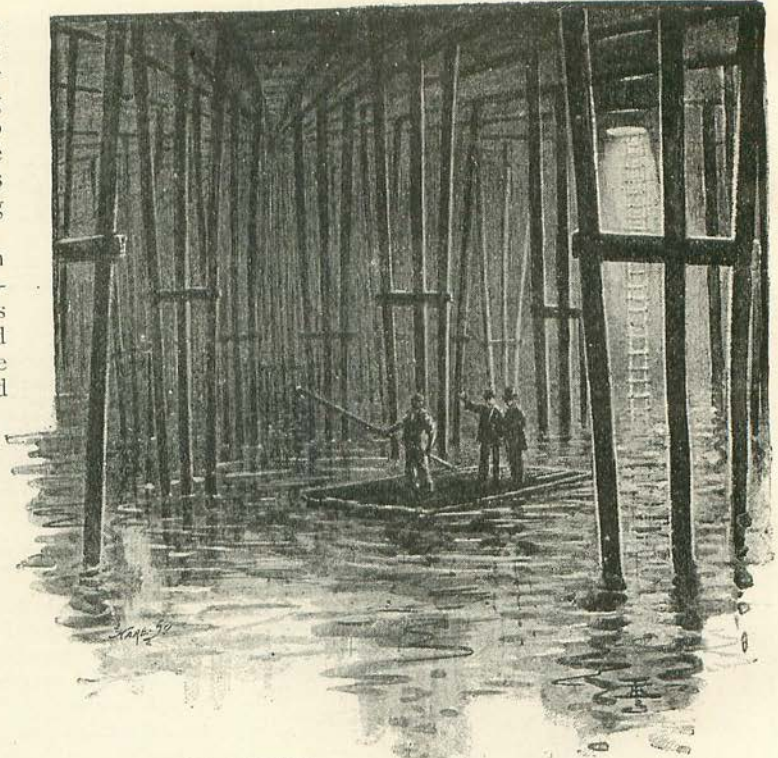


wards and forwards one above another in the outer air, or lying under water, the object being to keep them cool, so that the gas may be gradually robbed of its heat as it passes along them.

In its passage through the main and the condenser the gas deposits ammoniacal liquor and tar, both of which are drained off, and utilized in various ways.

The gas next enters the washer and scrubber. It is brought constantly in contact with water, which assimilates ammonia; and in the scrubber, a tower of considerable height, it is passed through a quantity of coke, shavings, and other materials saturated with water, so that it is really scrubbed as it progresses. From the scrubber it goes to the purifiers, huge square boxes containing layers of grids well covered with lime and oxide of iron. After this, all that has to be done is to measure it and store it. We who have occasion to know only our own domestic meter, do not instantly recognise its big brothers in the two station meters, which have been aptly likened to mausoleums.

Their size affords an idea of the volume of gas which has sometimes to be made and measured. Some of the gas will be sent along miles of mains to London, there to be placed in holders; some will be stored in holders on the spot. We are fortunate in finding a holder in the course of construction at Beckton. To the passer-by it is complete, but a walk over its top discovers a hole a yard square, down which we gaze cautiously. Thirty feet below is a body of water, and we see that the entire structure is supported by scaffold poles. A man on a raft is pulling himself from point to point by means of a hooked stick. Comparatively few people, even among gas-workers, have been inside a gasholder, and it at once strikes us that a novel experience may be had if we choose to



INSIDE A GAS-HOLDER.

risk the consequences of a climb down the swaying rope ladder. The information that a man was recently drowned in such a place only makes us screw our courage more up to the sticking point, and another minute sees us on the ladder. Friendly hands below do what they can to steady it, but only a monkey or an acrobat would make a respectable show on such a contrivance. Landed safely on the raft, the man in charge, whom we immediately dub our gondolier, pulls us round about through a perfect maze of scaffolding which runs from the bottom to the top like a monster umbrella frame. By-and-by the water will be continued right up to the roof, and it will surprise some people to learn that the gas, when it enters the holder, rests on the water and forces the holder up, so that when the holder is full its top is on a level with that of the upright girders which guide its actions, and its bottom only a foot or so beneath the surface of the water, the latter being in a giant stone tank. Water, it should be understood, is an absolute seal for gas, and it is a practical impossibility that a gasholder could, as many imagine, blow up. Such a disaster has certainly never been known.