Supplementary material for

Charles Dickens and Fire Science

By John Gales PhD

Open access versions of two papers as they appeared in Charles Dickens’ Household words:

THE FIRE BRIGADE OF LONDON.

Earth, Air, and Water are necessary conditions of human life; but Fire is the first great element of civilisation. Fire, the first medium between the 'cooking animal' and the wild root and raw flesh-devouring savage; fire, the best, because the most useful of servants, and, according to the old proverb, the worst, because the most tyrannical of masters; fire, the chief friend of man in creations of nature and of industrial art, yet the most potent of all enemies in destruction; fire, the most brilliant and magnificent object on the earth, yet the most frightful and appalling when once it obtains dominion over man and man's abodes;—to subdue, and render docile to all needs, this devouring dragon, and bend his splendid crests, not only to 'boil the pot' but to lick the dust before the feet of Science, this is one of the greatest triumphs of mankind, the results of which are year by year more and more stupendous.

But, amidst all our mastery, we are never permitted to forget that this illustrious slave has neither abandoned nor abated one jot of his original nature. Of this we are but too constantly reminded. Not to speak of lightning and volcanic eruptions, the weekly record of colliery and other mine explosions, of steam-boat explosions, the burning of ships, and the dismal transformation to a heap of ashes of valuable warehouses, costly public edifices, or private houses, with 'dreadful loss of life,' need but the slightest mention to excite a thrill of alarm, or some passing thought of caution in the mind of every person holding the smallest stake in the social community.

To meet this sudden emergency, therefore, and to restore the balance of power, or, rather, to put down the mutiny of this powerful slave, and reduce him to his habitual subserviency, we have the Fire Brigade, divided into four sections, and having nineteen stations in the most central quarters of the metropolis. This includes two 'mighty engines' floating on the Thames.

'Of all the rallying words,' says a writer in Charles Knight's "London," 'whereby multitudes are gathered together, and their energies impelled forcibly to one point, that of "Fire!" is, perhaps, the most startling and the most irresistible. It levels all distinctions; it sets at nought sleep, and

meals, and occupations, and amusements; it turns night into day, and Sunday into a "working day;" it gives double strength to those who are blessed with any energy, and paralyses those who have none; it brings into prominent notice, and converts into objects of sympathy, those who were before little thought of, or who were, perhaps, despised; it gives to the dwellers in a whole huge neighbourhood the unity of one family.'

But even while we are trimming our midnight lamp to write this paper, the cry of 'Fire!' suddenly resounds from a distant street. The heavy boots of a policeman clatter along beneath our window. The cry is repeated by several voices, and more feet are heard hurrying along. The fire is in a squad court, leading into a mews which runs close to the backs of the houses of one side of a great square. We hastily struggle into an overcoat, snatch up a hat, and issue forth to follow the alarming cry.

The tumult sounds in the court; the cry of 'Fire! fire!' is wildly repeated by a woman's voice from one of the windows of the mews; now from another window—now from several. 'Fire! fire!'—cry voices of many passengers in streets, and away scamper the policemen to the nearest stations of the Fire Brigade, passing the word to other policemen as they run, till all the police force in the neighbourhood are clattering along the pavement, some towards the scene of the fire, but most of them either towards an engine-station, to one of the Fire-escapes of the Royal Society, or to pass the word to the policeman whose duty it will be to run to the engine-station next beyond. By this means of passing the word, somebody arrives at the gates of the Chief Office of the Fire Brigade, in Watling Street, and, seizing the handle of the night-bell, pulls away at it with the vigour which such events always call forth.

The fireman on duty for the night, immediately opens the gate, and receives the intelligence, cutting short all loquacity as much as possible, and eliciting the spot where the fire has broken out, and the extent to which it was raging when the person left. The fireman then runs to a bell-handle, which he pulls; and applying his ear to the mouth-piece of a pipe, hears a voice ask, 'What is it?' (The fireman hears his own voice sound as if at a great distance; while the voice actually re-
mote sounds close in the mouth-piece, with a strange preternatural effect.) The bell-wire reaches up to the Superintendent’s bedside; and the bell being rung, Mr. Braidwood raises himself on one elbow, and applying his mouth to the other end of the tube, answers, and gives orders. A few words of dialogue conducted in this way, suffice. Up jumps Mr. Braidwood—crosses the passage to his dressing-room (armoury, we ought rather to call it), and in three minutes is attired in the thick cloth frock-coat, boots, and helmet of the Fire Brigade, fixing buttons and straps as he descends the stairs.

Meanwhile all the men have been equally active below. No sooner has the fireman aroused Mr. Braidwood, than he rings the bell of the foreman, the engineer, and the singlemen’s bell—which means the bell of the division where the four unmarried men sleep. He then runs out to the stables, calling the charioteer by the way, and two other firemen lodging close by; after which he returns to assist in harnessing the horses.

Owing to this simultaneous action, each according to his special and general duties, by the time Mr. Braidwood reaches the bottom of the stairs, the engine has been got out, and put in working order. All its usual furniture, implements, and tools are placed within, or packed about it. Short scaling-ladders, made to fit into each other, are attached to the sides; six lengths of hose; branch-pipes, director-pipes, spare nozzle, suction-pipes, goose-neck, dogs’ tails (the first to deliver water into the engine; the second are iron wrenches), canvas sheet, with rope handles round the edge (to catch people who will boldly jump out of window), dam-board (to prevent water from plug flowing madly away), portable cistern, strips of sheep-skin (to mend bursting hose), balls of cord, flat rose, escape-chain, escape-ropes, mattock, saw, shovel, pole-axe, boat-hook, crow-bar (such a fellow) to burst through doors or walls, or break up pavement; instruments for opening fire-plugs, and keys for turning stop-cocks of water-mains, &c.

All being ready, the Superintendent mounts the engine to the right of the driver, and the engineer, foreman, and firemen mount also, and range themselves on each side of the long red chest at the top, which contains the multifarious articles just enumerated. Off they start—brisk trot—canter—gallop! A bright red gleam overspreads the sky to the westward. The Superintendent knows that the fire in the court has reached the stables, and the stables are in flames. Full gallop!

Along the midnight streets, which are now all alive with excited people—some having left the theatres, others wending homeward from supper at a friend’s, from dances, or perhaps late hours of business in various trades—all are running in the direction of the fire! As the engine thunders by them, the gas-lamps gleaming on the helmets of the firemen and the eager heads of the horses, the people send up a loud shout of ‘Fire!’ and follow yell in its wake.

Arriving at the mews, the Superintendent sees exactly all that has happened—all that must happen—all that may happen—and all that may be prevented. The court is doomed to utter ruin and ashes; so is the mews. Two of the larger stables are on fire, and the flames are now devouring a loft full of hay and straw. But in doing this, their luminous tongues stretch far beyond, seeking fresh food when this is gone. The wind too!—the fatal wind, sets in the direction of the square!

The flames are struggling, and leaping, and striving with all their might to reach the back premises of the houses on this side of the square; and reach it they will, if this wind continues!

Meanwhile, two of the Fire Brigade engines from stations nearer at hand than that of the Chief Office, are already here, and hard at work. A fourth engine arrives from the Chief Office close upon the wheels of the first—and now a fifth comes thundering up the mews. The Superintendent taking command of the whole, and having ascertained that all the inmates of the court and mews have been got out, gives orders for three of the engines to continue their efforts to overcome the fire, and at any rate to prevent it spreading to the houses in the square on each side of the one which is now so imminently threatened. He then directs his own engine and one other to be driven round to the front of the house in the square, so as to attack the enemy both in front and rear at the same time. The flames have just reached it—not a moment is to be lost! As he drives off, innumerable cries and exhortations seek to arrest his progress, and to make him alter his intentions. Several voices, louder and more excited than all the rest,— vociferating something about ‘saving her life!’—cause him to pause, and prepare to turn, till, amidst the confusion, he contrives to elicit the fact that a stable cat has been unable to escape, and has darted out upon the burning roof of a loft—and, also, that Mrs. Jesskin’s laundry—but he listens no further, and gallops his engine round to the front of the house in the square, followed by shouts of excitement and several yells.

The Fire-escape ladders of the Royal Society have already arrived here in front. All the inmates have been got out by the door—at least it is said that all are out, by those white figures with faces as white, who, looking round them, really see nothing distinctly—and know nothing as it is—having been awoke by the cries of ‘Fire,’ and not being quite sure if all this mad hubbub of people, flames, voices, and water-spouts, may not be some horrible nightmare vision.

The water-plugs have been drawn, and the gutters are all flooded. The gully-hole is covered—a dam-board arrests the stream and
The wind still blows strongly from the blazing stables—the flames are rapidly eating their way through the house from the back! The two upper stories are already on fire. A figure appears at one of the windows, and makes signs. All the inmates had not been got out! An aged woman—a very old and faithful servant of the family—had lingered behind, vainly endeavouring to pack up some of her dear young mistress’s clothes and trinkets.

A prolonged cry bursts from the crowd, followed with innumerable pieces of advice—bawled, hoarsely shouted, or rapidly screamed to the Superintendent, and the firemen directing the nozzle of the hose.

‘Point the nozzle up to the window!’

‘Up to the roof of that room!’

‘Smash the windows!’

‘The Fire-escape, Mr. Braidwood!’

‘Bring the ropes for her!—throw up the ropes to her!’

‘Don’t smash the windows; you’ll cut her!’

‘She’s gone to jump out at the back!’

‘She is lying on the floor!’

‘She’s enflamed, Mr. Braidwood!’

‘Send up the water, to bring her to her senses!’

‘She’s burnt to ashes, Mr. Braidwood—I see her lying all of a red tinder!’

Amidst these vociferations, the Superintendent, having a well-practised ear for such pieces of advice, has despatched two firemen to ascend the stairs (no fireman is allowed to enter a burning house alone) while two others enter below, and a lengthened hose is handed up to them with a boat-heap through the front drawing-room window, in order to combat the fire at close quarters, each one being accompanied by another fireman, in case of one falling from heat or smoke, and meantime to assist in getting out furniture from the rooms not yet touched by the flames.

The two foremost firemen have now ascended the stairs. One remains on the second-floor landing, to watch, and give notice if their retreat is likely to be cut off, while the other ascends to the upper room where the poor old servant had been last seen. The room is quite full of smoke. He therefore drops down directly with his face almost touching the floor (because, as the smoke ascends, he thus gets ten or twelve inches of clear space and air), and in this way creeps and drags himself along till he sees a bundle of something struggling about, which he at once recognises, seizes, and drags off as quickly as possible. Almost exhausted, he meets his comrade on the stairs, who instantly giving aid, they bring down a little white, smutty, huddled-up bundle, with a nightcap and arms to it; and as they emerge from the door, are greeted with shouts of applause, and roars and screams of ‘Bravo! Bravo! God bless’em! Bravo!’ from voices of men, and women, and boys.

The old woman presently comes to herself. She holds something in one hand, which she had never loosed throughout, though she really does not know what it is. ‘At all events,’ says she, ‘I’ve saved this!’

It is a hearth-broom.

The two firemen, each bearing a hose, have now got a position inside the house—one standing on the landing-place of the second-floor within ten or twelve feet of the flames, the other planted in the back drawing-room. The first directs his nozzle so that the water strikes with the utmost force upon the fire, almost in a straight line, dashing it out into black spots, and flaws, and steam, as much by the violence of the concussion as the antagonistic element. The other fireman directs his jet of water to oppose the advances of the flames from the rafters of the stables behind, and the wood-work of the back-premises.

Both the men are enveloped in a cloud of hot steam, so hot as scarcely to be endurable, and causing the perspiration to pour down their faces as fast as the water runs down the walls from the vigorous ‘playing of their pipes.’

But next door—to the right—a long succession of drawing-rooms, and dining-room chairs issue forth, varnished now and then with a dripping hamper of choice wine, and the sound of cracking bottles; now, with a
flattened cradle, now a tea-tray of richly-bound books; now, a turbot-kettle, and then more chairs!

In the door-way of the house on the left, there is a dreadful jam. An abominable, huge mahogany table has fixed one of its corners into the wall, on one side, and the brass castor of one leg into a broken plank of the flooring, on the other, just as a Broadwood horizontal grand was coming down the stairs in the most massive manner (like a piano conscious of Beethoven), with its five bearers. These five men with the piano-forte, receiving a check in the passage from three men bearing boxes and a large clothes-horse, who had themselves received a check by the jam of the huge mahogany and its eight or nine excited blockheads, the stoppage became perfect, and the confusion sheer madness. Some of the inmates of this house, who had been wildly helping and handing down all sorts of things, observing that a stoppage had occurred below, and believing they had no more time to spare before the flames would penetrate their walls, brought baskets to the window, and with great energy threw out a quantity of beautiful china, glass, and choice chimney ornaments down upon the stones below, to be taken care of; also an empty hat-box.

Above all the tumult, and adding in no small degree to the wilfulness and abrupt energies of the scene, a violent knocking at doors in the square is frequently heard, sometimes by policemen, at other times by excited relations, suddenly arriving, desperate to give their advice, and see it attended to. The bedroom windows, in rows on either side, are alive with heads, many of them in night-caps, while the upper windows of several, apparently 'the nurseries,' are crowded with white dolls, whose round white nobs are eagerly thrust forth. In the windows of the houses lights are seen to move about rapidly from room to room, and windows are continually thrown up; a figure looks out wildly—then suddenly disappears.

The two firemen who had gained positions inside the house, each with his long hose supplied from the engine below, had hitherto maintained their posts; the one on the second-floor landing having very successfully repelled the advance of the fire, the other in the back drawing-room having fairly obtained a mastery. But a strong gust of wind rising again, sets all their previous success at nought. The flames again advance; and all their work has to be done over again.

By this time the two men are nearly exhausted; two other firemen are, however, close at hand to relieve them. They take their places. As the flames advance, the engines below are worked with redoubled energy by the people, who also relieve each other; but no one will relinquish his place at the pump-lever, so long as he is able to stand, or have one heave up, or one bang down, more. Still the flames advance!—they enter the house!—the front drawing-room is suddenly illuminated!—a glare of light is reflected from a great looking-glass on one of the walls! A loud shout of excitement resounds from the crowd—while bang! bang! go the engine-pumps.

The fireman, who is surrounded by so strong a glare of light that he appears all on fire, is seen to retreat a few paces towards the door. He is presently joined by another fireman, who runs to the front drawing-room window, out of which he suspends an iron chain to secure their escape, in case of need, and then returns to his comrade. They rally, and each with his brass director-pipe advances again within half-a-dozen paces of the blazing walls. They are, foot by foot, driven back into the front drawing-room. The flames follow them, and soon are very close to the or-molu frame-work of the great looking-glass.

Bang! bang! go the engines.

'Save the glass!' shout numbers of voices.

'The ceiling! the ceiling's bursting down!'

cry others. -

Bang! bang! go the engines.

'Save the pieces!'

'The door-post's on fire!'

'Look behind you!'

'The glass!—the glass!'

'Save yourselves!'

Bang! bang! go the engines.

The Superintendent has sent orders to the firemen to give no more attention to the interior of this house, except with a view to prevent the fire spreading to the adjoining houses. Consequently, the streams of water are now directed to drenching the walls, and beating back the flames on either side. The great looking-glass, no longer an object of special protection, is presently reached by the flames; they coil and cluster round the framework, which, breaking out into jets of coloured fire, gives a splendid magnificence to the design of the carving. The crowd jump up and down to see, and also from excitement. The flames flap about, and point their long luminous tongues across the broad plate of the glass, which for a moment reflects every object in the room,—the falling ceiling—the firemen in their helmets—the blazing ruin around; and then, crack!—clash! clash!—the whole falls, a wreck of sharp angles.

Again a loud shout from the crowd below!—not so much of regret as a kind of wild purposeless joy, which causes them again to leap up and down, expecting and (without knowing it) hoping the same thing will happen to some other glass in the room. Melted lead from the roof now runs gleaming down—spurtling upon the helmet of one of the firemen, and then running in straggling lines down his thick coat; while a slate falling, as usual, edgeways, sticks across the centre-piece of his comrade's helmet. Now, with a rattling and loud rumble, falls the partition between the front and back drawing-rooms, and with it a great part of the
ceiling! A terrific shout of alarm bursts from the crowd. The two firemen are buried in the ruins. The whole space is filled with the dense smoke and with piles of lath and plaster, and brick and blazing wood.

But see—a helmet, white with mortar, rises from the floor near the window-sill—and now another! One after the other, the exhausted firemen descend the iron chain, and are caught in the arms of the Superintendent and two of their comrades below, while loud shouts and vociferations of applause burst from the crowd.

The stable, too, from the mews! See! she has crossed between the burning rafters, and leaped into the balcony of the next house, with smoking tail and ears.

The flames have been smothered for a time by this fall of the ceiling and partition-wall; the Superintendent has now got seven engines round to the front; he takes advantage of the fortunate accident; the wind, too, has shifted; the seven engines pour ten tons of water upon the smoking mass and against the walls, and thus continue till the most frightful of all enemies is thoroughly subdued and reduced to blackness and quietude. Most dismal is the scene of devastation; but the enemy is at all events laid prostrate and rendered incapable of further mischief.

Drenched to the skin with cold water, and reeking at the same time with perspiration, the gallant men of the Fire Brigade return to their several quarters. Two of them, however, remain on watch with an engine all night, a change of clothes and ‘a dram’ being sent them from the station.

The present efficient condition of fire-engines, as may easily be supposed, has only been the result of many years of skilful experiment and practical experience. Our ancestors (notwithstanding their wisdom) were by no means furnished with such means of extinguishing fire, although, from the great number of wooden buildings, and greater quantity of wooden materials employed, to say nothing of thatch, they had greater need of them. On the other hand, they had not so many scientific combustibles among them. Still, the want of a proper engine is manifest from what we know of their attempts in that way. They used squirts—actually nothing but squirts. Every alderman was obliged to provide one. It will be understood that the squirt was not of schoolboy dimensions, but so large as to require two men, holding it in their arms between them, like a sort of mummy, to dip its nose into a bucket, and then, raising it to the proper angle, discharge the contents at the building on fire.

The first construction of the fire-engine, properly so called, is attributable to a German named Hautsch, in 1657, which was afterwards improved by the brothers Van der Heyden, in 1672. But, though the merit of the invention confers all due honour on the engineering mind of Germans, it may be questioned whether the character of the people was ever of a kind to induce the working of them with promptitude or efficiency. So recently as a few years ago, when the writer was staying in the town of Bonn, intelligence was brought of a fire at Poppelsdorff, a village about a mile and a quarter distant. The town engine was got out by a couple of men, with pipes in their mouths, and the horse—one horse—being put to, it was trotted off in the most deliberate manner. Outside the town gates we overtook a number of students and other gentlemen, all leisurely sauntering with their pipes towards Poppelsdorff, never doubting but they would be in ample time before the engine had extinguished the fire. And so they were, for it was burning nearly half the day. Nevertheless, the Prussian Government have been the first to purchase the invention of the Steam Fire Engine. Their theories in the matter seem perfect; but to put out a fire with promptitude cannot be done even by a Steam Fire Engine without a little human activity.

The contrast of our vivacity in these matters is very striking, and in no case more so than when some mischievous idiot gives a false alarm (an atrocity which we believe is not often committed), or when some extraordinary meteorological phenomenon induces the mistake. We find two extraordinary instances of this recorded in Knight’s ‘London.’

‘On the first of these, twelve engines and seventy-four brigade men were kept in constant motion from eleven in the evening till six the next morning, in endeavouring to search out what appeared to be a large conflagration; some of the engines reached Hampstead, and others Kilburn, before it was found that the glare was the effect of the “northern lights.” On the other occasion, a crimson glare of light arose at the north-east part of the horizon, at about eight o’clock in the evening, seemingly caused by a fierce conflagration; and the resemblance was increased by what appeared to be clouds of smoke rising up after the glare, and breaking and rolling away beneath it. Thirteen engines and a large body of men went in search of the supposed fire, and did not detect their error till they had proceeded far to the north-east.’

The statistics of London fires are very interesting, and much may be learned from them, not only as matter of anxious information, but of salutary warning.

The total number of fires in London in the past year, was 838. Of these, 28 were utterly destructive fires; the number of lives lost being 26. Seriously damaged, 228; slightly damaged, 582.

Of chimneys on fire there were 89; and there were 76 false alarms—not mischievous, but from error or panic.

The number of calls on the fire-office and other aids amounted to 1003.

In the above 838 fires, the number of insurances (ascertained) were 368; these
which insured on the building only, were 163; those which insured on the contents only, were 72; and the number of uninsured was 235.

Of the 26 lives lost, 13 were from the ignition of bed-furniture or wearing apparel; explosion of fire-works, 5; and 8 from inability to escape out of burning houses.

An examination of the statistics of fires in the Metropolis during sixteen years, i.e. from 1833 to 1848 (which document was obligingly laid before us by Mr. Braidwood), has put us in possession of a great mass of very curious and instructive information, from which we extract the following:

Apothecaries and dealers in drugs...... 36
Bakers...... 244
Book-sellers, binders, and stationers...... 137

Of these latter, 96 burnt gas; and the fires caused by gas amounted to 28.

Cabinet-makers...... 153
Carpenters and workers in wood...... 434
Churches...... 33

Of these last-named, 3 were totally destroyed, and 10 much damaged; the rest slightly, or mere alarms. Of the cause of the fires, 8 were from the stoves, flues, &c., and 2 from lightning.

Drapers, woollen and linen...... 254

Of these, 105 were much damaged; 239 burnt gas; and the cause of 140 of these fires was carelessness or accident with the gas.

Fire-Preventive Company...... 1

The cause of this was an experiment with some 'fire-proof plaster,' which ignited in a most unexpected and insubordinate manner, and caused great damage.

Fire-work Makers...... 49

The cause of these fires, all of which did great damage, was from the nature of the trade; from the smoking of tobacco; from boys playing with fire; and from the reckless trick of a lighted squib or cracker being thrown into the shop-window.

Gas-works...... 37

From the great care taken, and ready means of prevention, only 9 of these were much injured, and none totally destroyed.

Grocers...... 120

Of these, 109 burnt gas; and 26 of the fires are attributable to carelessness or accident with the gas.

Gunpowder-sellers...... 1

Notice the result of a full consciousness of the danger, and proportionate care. Only one fire!

Lodgings...... 868

Of the above number, 368 were found to have been caused by the taking fire of curtains, linen airing, &c. Some of the rest were caused by hunting insects, &c.

Lucifer-match-makers...... 101
Lunatic asylums...... 2

Observe the great care in these asylums. All the asylums for lunatics furnishing only two fires in sixteen years!

Printers and Engravers...... 72
Private houses...... 3882

Of the above, the immense number of 1392 were discovered to have been caused by the taking fire of curtains, dresses, airing linen, &c.

Sale-shops and offices...... 526

Of these, 379 burnt gas; and the fires caused by gas were 129.

Ships...... 82

Caused by stores, flues, cooking, igniting of cargo, smoking tobacco, &c.

Stables...... 192

Caused by candles, lucifers, smoking tobacco, intoxication, &c.

Tailors...... 81

Seventeen of the above were caused by gas; 13 by candles; and some by smoking tobacco.

Theatres...... 20

Of the above number, 8 were caused by gas; some others by smoking tobacco, and the taking fire of curtains, dresses, &c.

Tobacconists...... 43

Of the above, 6 were caused by gas; 6 by lucifer-matches; others by curtains, smoking tobacco, by a cat, and by rate. A word more of these incendiaries presently.

Victuallers...... 542

Of the above, there were 21 totally destroyed; 167 much damaged, and 354 slightly. Of the causes, 83 were from the flues; 73, curtains, dresses, &c.; 65, gas; 36, smoking tobacco; 35, a candle. The remainder comes under the various heads of lucifers, hotinders, intoxication, children playing with fire, a spark, and a monkey.

Besides this 'monkey,' we have had occasion to mention several other 'sparks,' concerning whom some passing explanation may be needed. Having noticed the word 'cat,' occurring several times in the list of annual causes of fire,—'Yes,' replied Mr. Braidwood, 'we often have a cat.' It appears that the cat sometimes upsets the clothes-horse with things airing; or, perhaps, in cropping under the clothes to get inside the fender, drags some of them with her on her back. The fire caused by the monkey was attributable to some break of his—meaning no harm, perhaps, but not much caring about that. The incendiaryism of the rats was undoubtedly effected innocently by their investigation of a box of lucifers, which included a trial if the matrices were good to eat. Their teeth exploded them—a feat very easily performed.

Of carelessness with gas in shops and warehouses, or with candles near bedroom
curtains, muslin dresses, or linen airing before the fire, we need not speak, as the dangers are too obvious by the results; nor of carelessness with lucifer-matches; nor the very common practice of taking out the fire at night from the grate (where it would be safe) down upon the hearth, and leaving the hot embers, which perhaps ignite by the air of the closing door, as the careful personretires to bed. Carelessness with a cigar or pipe is also an obvious cause. Working men often put their pipes, half-extinguished, or alive at the bottom of the bowl, into their jacket-pocket at night; and then hang up the jacket, and go to bed. Children, also, being left alone, near a fire, may generally be expected to play with fire, either because it is beautiful, or because the play is interdicted.

With respect to ‘sparks,’ that a house should take fire, had always been regarded by us with no small degree of scepticism. A gentleman of our acquaintance carried his disbelief much further. Sitting with a party of sporting friends round a winter’s fire, and these dangers being the subject of conversation, he offered to empty the whole contents of the grate on the carpet in the middle of the room.—he to pay all expenses if the house took fire; his opponent simply to pay for the carpet and the charred floor. They were all to sit round, and watch the result. It was agreed. ‘Now,’ said a friend, ‘I will bet you ten to one this house will take fire, provided we all go out of the room, lock the door, and leave the house.’ The other would not venture on this.

Mr. Braidwood’s speculation on the question of sparks, in reply to our doubts, is very curious and practical. He estimated the number of houses in London at 300,000. Allowing two domestic fires to each house, we have 600,000 in the day; and these multiplied by 7, give 4,200,000 in a week. That one spark, therefore, from 4,200,000 fires should fly out upon some materials easy to ignite, once in a week, is far from difficult to credit; and this would fully bear out the number on the list that are declared to have occurred from this cause.

The number of fires and alarms of fire that occurred in London during the fifteen years ending in 1847, present a continual increase. In 1833 they amounted to 458; in 1834, to 482; and so on, down to 1847, when they amounted to 836. This gives a total of 9662 fires during the fifteen years. The average of this is 644. We next find that in 1848 the number of fires amounted to 806; showing an increase beyond the previous year of 161. In 1849 the number amounted to 838, being an increase of 33 beyond the previous year.

How are we to reconcile this increase with the extraordinary efficiency of the Fire-Brigade, and the improvements in measures of precaution? Partly by the regular increase in the numbers of houses. But Mr. Braidwood frankly declares that this does not meet the increase of fires and alarms of fire that reach the Office. We can only account for it, therefore, by the great increase of scientific combustibles, not merely in our shops, but in our domestic arrangements—especially gas, and lucifer-matches—and yet more to the fact that, in former years, many slight fires caused no alarm to be given, while now the arrangements are so complete, that probably almost every slight alarm of fire that occurs is carried to the Office, and duly recorded.

With respect to Fire-Escapes; precautions against fire, that should be adopted in houses; arrangements to meet the accident; and the best means of extinguishing fires (particularly with reference to Mr. Phillips’ Fire-Ammunator, which possesses an undoubted power over flames), we cannot now afford the space their importance merits; but we shall bear them in mind for a future number.

POETRY IN THE BYE-WAYS.

Every book-hunter, whose connection with paper and print has more of individuality than of fashion in it—must in his time have met with scores of small volumes of rhyme forced out with a care and pains of which the heart aches to think, prefaced with the bad taste of immoderate depreciation on the part of the author,—or with the worse appeal of extravagant commendation on the part of the patron—none of which shall merit a place on the shelf by the side of Crabbe, or Wordsworth, or Burns—none of which can be denied the possession of some sparks and breathings of true poetry.

Sometimes, however, it must be owned, that the difficulties under which the rhymster has laboured, are the best—may the sole evidences of his genius. In the verses of Phillis Wheatly, the negro girl, for instance, there is not a line that is not the stalest of the stale—not an image that is not the most second-hand of the second-hand. Yet, that sixty years since, a woman of her condemned colour and oppressed race—in America, low—should find spirits to sing, and power to attract an audience,—in that fact was a poem of no common order.

Years ago, there passed through the writer’s hand a small collection of verse—if verse it might be called—in quality, the most dreary and antipathetic, possible—sectarian hymns, full of phrases, the intimate sense of which can never have pierced to the mind of their maker. This was a poor creature in a hospital, who had been found on a harsh January night, frozen into the kennel where she had fallen, and who paid for that night’s lodging with a lingering death of cruelly long duration. Her vital powers gradually retired one by one. For many years she was unable to move a limb; latterly could scarcely speak audibly, or take barely sufficient food
damp and ruinous—its walls covered with greenness and crawling insects. It was a great lurking-place of Sir Roger when on the watch for poachers.

The line of the Rockvilles was evidently running fast out. It had reached the extremity of imbecility and contempt—it must soon reach its close.

Sir Roger used to make his regular annual visit to town; but of late, when there, he had wandered restlessly about the streets, peeping into the shop-windows; and if it rained, standing under entries for hours together, till it was gone over. The habit of lurking and peering about, was upon him; and his feet bore him instinctively into those narrow and crowded alleys where swarmed the poachers of the city—the trespassers and anglers in the game preserves and streams of humanity. He had lost all pleasure in his club; the most exciting themes of political life retained no piquancy for him. His old friends ceased to find any pleasure in him. He was become the dregs of all dry wells. Poachers, and anglers, and Methodists, haunted the wretched purlissus of his fast fading-out mind, and he resolved to go to town no more. His whole nature was centred in his woods. He was for ever on the watch; and when at Rockville again, if he heard a door clasp when in bed, he thought it a gun in his woods, and started up, and was out with his keepers.

Of what value was that magnificent estate to him?—those superb woods; those finely-hanging cliffs; that clear and riant river coming travelling on, and taking a noble sweep below his windows,—that glorious expanse of neat verdant meadows stretching almost to Stockington, and enlivened by numerous herds of the most beautiful cattle—those old farms and shady lanes overgrown with hazel and wild rose; the glittering brook, and the songs of woodland birds—what were they to that worn-out old man, that victim of the delusive doctrine of blood, of the man-trap of an hereditary name?

There the poet could come, and feel the presence of divinity in that noble scene, and hear sublime whispers in the trees, and create new heavens and earths from the glorious chaos of nature around him, and in one short hour live an empyrean of celestial life and love.

There could come the very humblest children of the plebeian town, and feel a thrill of exquisitely delightful pervade their bosoms at the sight of the very flowers on the sod, and see heaven in the infinite blue above them. And poor Sir Roger, the holder, but not the possessor of all, walked only in that region of sterility, with no sublier ideas than poachers and trespassers—no more rational enjoyment than the brute indulgence of hunting like a ferret, and seizing his fellowmen like a bulldog. He was a specimen of human nature degenerated, retrograded from the divine to the bestial, through the long-operating influences of false notions and institutions, continued beyond their time. He had only the soul of a keeper. Had he been only a keeper, he had been a much happier man.

His time was at hand. The severity which he had long dealt out towards all sorts of offenders made him the object of the deepest vengeance. In a lonely hollow of his woods, watching at midnight with two of his men, there came a sturdy knot of poachers. An affray ensued. The men perceived that their old enemy, Sir Roger, was there; and the blow of a hedge-stake stretched him on the earth. His keepers fled—and thus ignominiously terminated the long line of the Rockvilles. Sir Roger was the last of his line, but not of his class. There is a feudal art of sinking, which requires no study; and the Rockvilles are but one family amongst thousands who have perished in its practice.

### THE CHEMISTRY OF A CANDLE.

The Wilkinsons were having a small party,—it consisted of themselves and Uncle Bagges—at which the younger members of the family, home for the holidays, had been just admitted to assist after dinner. Uncle Bagges was a gentleman from whom his affectionate relatives cherished expectations of a testamentary nature. Hence the greatest attention was paid by them to the wishes of Mr. Bagges, as well as to every observation which he might be pleased to make.

"Eh! what? you sir," said Mr. Bagges, facetiously addressing himself to his eldest nephew, Harry,—"Eh! what? I am glad to hear, sir, that you are doing well at school. Now—eh? now, are you clever enough to tell me where was Moses when he put the candle out?"

"That depends, uncle," answered the young gentleman, "on whether he had lighted the candle to see with at night, or by daylight, to seal a letter?"

"Eh! Very good, now! 'Dun my word, very good," exclaimed Uncle Bagges. "You must be Lord Chancellor, sir—Lord Chancellor, one of these days."

"And now, uncle," asked Harry, who was a favourite with the old gentleman, "can you tell me what you do when you put a candle out?"

"Clap an extinguisher on it, you young rogue, to be sure."

"Oh! but I mean, you cut off its supply of oxygen," said Master Harry.

"Cut off its ox—eh? what? I shall cut off your nose, you young dog, one of these five days."

"He means something he heard at the Royal Institution," observed Mrs. Wilkinson.

"He reads a great deal about chemistry, and he attended Professor Faraday's lectures there on the chemical history of a candle, and has been full of it ever since."

"Now, you sir," said Uncle Bagges, "come
you here to me, and tell me what you have to say about this chemical, eh—or comical; which?—this comical chemical history of a candle."

"He'll bore you, Bagges," said Mr. Wilkinson. "Harry, don't be troublesome to your uncle."

"Troublesome! Oh, not at all. He amuses me. I like to hear him. So let him teach his old uncle the comicality and chemicality of a farthing rushlight."

"A wax candle will be nicer and cleaner, uncle, and answer the same purpose. There's one on the mantel-shelf. Let me light it."

"Take care you don't burn your fingers, or set anything on fire," said Mrs. Wilkinson.

"Now, uncle," commenced Harry, having drawn his chair to the side of Mr. Bagges, "we have got our candle burning. What do you see?"

"Let me put on my spectacles," answered the uncle.

"Look down on the top of the candle around the wick. See, it is a little cup full of melted wax. The heat of the flame has melted the wax just round the wick. The cold air keeps the outside of it hard, so as to make the rim of it. The melted wax in the little cup goes up through the wick to be burnt, just as oil does in the wick of a lamp. What do you think makes it go up, uncle?"

"Why—why, the flame draws it up, doesn't it?"

"Not exactly, uncle. It goes up through little tiny passages in the cotton wick, because very, very small channels, or pipes, or pores, have the power in themselves of sucking up liquids. What they do it by is called cap—something."

"Capillary attraction, Harry," suggested Mr. Wilkinson.

"Yes, that's it; just as a sponge sucks up water, or a bit of lump-sugar the little drop of tea or coffee left in the bottom of a cup. But I can't say much more about this, or else you will tell me I am doing something very much like teaching my grandmother to—you know what."

"Your grandmother, eh, young sharpshirsey?"

"No—I mean my uncle. Now, I'll blow the candle out, like Moses; not to be in the dark, though, but to see into what it is. Look at the smoke rising from the wick. I'll hold a bit of lighted paper in the smoke, so as not to touch the wick. But see, for all that, the candle lights again. So this shows that the melted wax sucked up through the wick is turned into vapour; and the vapour burns. The heat of the burning vapour keeps on melting more wax, and that is sucked up too within the flame, and turned into vapour, and burnt, and so on till the wax is all used up, and the candle is gone. So the flame, uncle, you see, is the last of the candle, and the candle seems to go through the flame into nothing—although it doesn't, but goes into several things, and isn't it curious, as Professor Faraday said, that the candle should look so splendid and glorious in going away?"

"How well he remembers, doesn't he?" observed Mrs. Wilkinson.

"I dare say," proceeded Harry, "that the flame of the candle looks flat to you; but if we were to put a lamp glass over it, so as to shelter it from the draught, you would see it is round, round sideways, and running up to a peak. It is drawn up by the hot air; you know that hot air always rises, and that is the way smoke is taken up the chimney. What should you think was in the middle of the flame?"

"I should say, fire," replied Uncle Bagges. "Oh, no! The flame is hollow. The bright flame we see is something no thicker than a thin peel, or skin; and it doesn't touch the wick. Inside of it is the vapour I told you of just now. If you put one end of a bent pipe into the middle of the flame, and let the other end of the pipe dip into a bottle, the vapour or gas from the candle will mix with the air there; and if you set fire to the mixture of gas from the candle and air in the bottle, it would go off with a bang."

"I wish you'd do that, Harry," said Master Tom, the younger brother of the juvenile lecturer.

"I want the proper things," answered Harry. "Well, uncle, the flame of the candle is a little shining case, with gas in the inside of it, and air on the outside, so that the case of flame is between the air and the gas. The gas keeps going into the flame to burn, and when the candle burns properly, none of it ever passes out through the flame; and none of the air ever gets in through the flame to the gas. The greatest heat of the candle is in this skin, or peel, or case of flame."

"Case of flame!" repeated Mr. Bagges. "Live and learn. I should have thought a candle-flame was as thick as my poor old noddle."

"I can show you the contrary," said Harry. "I take this piece of white paper, look, and hold it a second or two down upon the candle-flame, keeping the flame very steady. Now I'll rub off the back of the smoke, and—there—you find that the paper is scorched in the shape of a ring; but inside the ring it is only dirtied, and not singed at all."

"Seeing is believing," remarked the uncle. "But," proceeded Harry, "there is more in the candle-flame than the gas that comes out of the candle. You know a candle won't burn without air. There must be always air around the gas, and touching it like, to make it burn. If a candle hasn't got enough air, it goes out, or burns badly, so that some of the vapour inside of the flame comes out through it in the form of smoke, and this is the reason of a candle smoking. So now you know why a great clumsy dip smokes more than a neat wax candle; it is because the thick wick of the dip makes too much fuel in proportion to the air that can get to it."
"Dear me! Well, I suppose there is a reason for everything," exclaimed the young philosopher's mamma.

"What should you say, now," continued Harry, "if I told you that the smoke that comes out of a candle is the very thing that makes a candle light? Yes; a candle shines by consuming its own smoke. The smoke of a candle is a cloud of small dust, and the little grains of the dust are bits of charcoal, or carbon, as chemists call it. They are made in the flame, and burnt in the flame, and, while burning, make the flame bright. They are burnt the moment they are made, but the flame goes on making more of them at first as it burns them, and that is how it keeps bright. The place they are made in, is the case of flame itself, where the strongest heat is. The great heat separates them from the gas which comes from the melted wax, and, as soon as they touch the air on the outside of the thin case of flame, they burn.

"Can you tell how it is that the little bits of carbon cause the brightness of the flame?" asked Mr. Wilkinson.

"Because they are pieces of solid matter," answered Harry. "To make a flame shine, there must always be some solid—or at least liquid—matter in it."

"Very good," said Mr. Bagges,—"solid stuff necessary to brightness."

"Some gases and other things," resumed Harry, "that burn with a flame, you can hardly see, burn splendidly when something solid is put into them. Oxygen and hydrogen—tell me if you use too hard words, uncle—oxygen and hydrogen gases, if mixed together and blown through a pipe, burn with plenty of heat but with very little light. But if their flame is blown upon a piece of quick-lime, it gets so bright as to be quite dazzling. Make the smoke of oil of turpentine pass through the same flame, and it gives the flame a beautiful brightness directly."

"I wonder," observed Uncle Bagges, "what has made you such a bright youth."

"Taking after uncle, perhaps," retorted his nephew. "Don't put my candle and me out. Well, carbon or charcoal is what causes the brightness of all lamps, and candles, and other common lights; so, of course, there is carbon in what they are all made of."

"So carbon is smoke, eh? and light is owing to your giving. Giving light out of smoke, eh? as they say in the classics," observed Mr. Bagges.

"But what becomes of the candle," pursued Harry, "as it burns away? where does it go?"

"Nowhere," said his mamma, "I should think. It burns to nothing."

"Oh, dear, no!" said Harry, "everything—everybody goes somewhere."

"Eh—rather an important consideration that," Mr. Bagges moralised.

"You can see it goes into smoke, which makes soot for one thing," pursued Harry. "There are other things it goes into, not to be seen by only looking, but you can get to see them by taking the right means,—just put your hand over the candle, uncle."

"Thank you, young gentleman, I had rather be excused."

"Not close enough down to burn you, uncle; higher up. There—you feel a stream of hot air; so something seems to rise from the candle. Suppose you were to put a very long slender gas-burner over the flame, and let the flame burn just within the end of it, as if it were a chimney,—some of the hot steam would go up and come out at the top, but a sort of dew would be left behind in the glass chimney, if the chimney was cold enough when you put it on. There are ways of collecting this sort of dew, and when it is collected it turns out to be really water. I am not joking, uncle. Water is one of the things which the candle turns into, in burning,—water coming out of fire. A jet of oil gives above a pint of water in burning. In some lighthouses they burn, Professor Faraday says, up to two gallons of oil in a night, and if the windows are cold the steam from the oil clouds the inside of the windows, and, in frosty weather, freezes into ice."

"Water out of a candle, eh?" exclaimed Mr. Bagges. "As hard to get, I should have thought, as blood out of a post. Where does it come from?"

"Part from the wax, and part from the air, and yet not a drop of it comes either from the air or the wax. What do you make of that, uncle?"

"Eh? Oh! I'm no hand at riddles. Give it up."

"No riddle at all, uncle. The part that comes from the wax isn't water, and the part that comes from the air isn't water, but when put together they become water. Water is a mixture of two things, then. This can be shown. Put some iron wire or turnings into a gun-barrel open at both ends. Heat the middle of the barrel red-hot in a little furnace. Keep the heat up, and send the steam of boiling water through the red-hot gun-barrel. What will come out at the other end of the barrel won't be steam; it will be gas, which doesn't turn to water again when it gets cold, and which burns if you put a light to it. Take the turnings out of the gun-barrel, and you will find them changed to rust, and heavier than when they were put in. Part of the water is the gas that comes out of the barrel, the other part is what mixes with the iron turnings, and changes them to rust, and makes them heavier. You can fill a bladder with the gas that comes out of the gun-barrel, or you can pass bubbles of it up into a jar of water turned upside down in a trough, and, as I said, you can make this part of the water burn."

"Eh?" cried Mr. Bagges. "Upon my word! One of these days, we shall have you setting the Thames on fire."

"Nothing more easy," said Harry, "than
Collect the bubbles from both wires in a tube, and fire them, and they turn to water again; and this water is exactly the same weight as the quantity that has been changed into the two gases. Now then, uncle, what should you think water was composed of?

"Oh! well—I suppose of those very identical two gases, young gentleman."

"Right, uncle. Recollect that the gas from one of the wires was hydrogen, the one-ninth of water. What should you guess the gas from the other wire to be?"

"Stop—eh!—wait a bit—eh!—oh!—why, the other eight-ninths, to be sure."

"Good again, uncle. Now this gas that is eight-ninths of water is the gas called oxygen that I mentioned just now. This is a very curious gas. It won't burn in air at all itself, like gas from a lamp, but it has a wonderful power of making things burn that are lighted and put into it. If you fill a jar with it—"

"How do you manage that?" Mr. Bagges inquired.

"You fill the jar with water," answered Harry, "and you stand it upside down in a vessel full of water too. Then you let bubbles of the gas up into the jar and they turn out the water and take its place. Put a stopper in the neck of the jar, or hold a glass plate against the mouth of it, and you can take it out of the water and so have bottled oxygen. A lighted candle put into a jar of oxygen blows up directly and is consumed before you can say Jack Robinson. Charcoal burns away in it as fast, with beautiful bright sparks—phosphorus with a light that dazzles you to look at—and a piece of iron or steel just made red-hot at the end first, is burnt in oxygen quicker than a stick would be in common air. The experiment of burning things in oxygen beats any fire-works."

"Oh, how jolly!" exclaimed Tom.

"Now we see, uncle," Harry continued, "that water is hydrogen and oxygen united together, that water is got wherever hydrogen is burnt in common air, that a candle won't burn without air, and that when a candle burns there is hydrogen in it burning, and forming water. Now, then, where does the hydrogen of the candle get the oxygen from, to turn into water with it?"

"From the air, eh?"

"Just so. I can't stop to tell you of the other things which there is oxygen in, and the many beautiful and amusing ways of getting it. But as there is oxygen in the air, and as oxygen makes things burn at such a rate, perhaps you wonder why air does not make things burn as fast as oxygen. The reason is, that there is something else in the air that mixes with the oxygen and weakens it."

"Makes a sort of gaseous grog of it, eh?" said Mr. Bagges. "But how is that proved?"

"Why, there is a gas, called nitrous gas, which, if you mix it with oxygen, takes all the
oxygen into itself, and the mixture of the nitrous gas and oxygen, if you put water with it, goes into the water. Mix nitrous gas and air together in a jar over water, and the nitrous gas takes away the oxygen, and then the water sucks up the mixed oxygen and nitrous gas, and that part of the air which weakens the oxygen is left behind. Burning phosphorus in confined air will also take all the oxygen from it, and there are other ways of doing the same thing. The portion of the air left behind is called nitrogen. You wouldn’t know it from common air by the look; it has no colour, taste, or smell, and it won’t burn. But things won’t burn in it, either; and anything on fire put into it goes out directly. It isn’t fit to breathe,—and a mouse, or any animal, shut up in it, dies. It isn’t poisonous, though; creatures only die in it for want of oxygen. We breathe it with oxygen, and then it does no harm, but good; for if we breathed pure oxygen, we should breathe away so violently, that we should soon breathe our life out. In the same way, if the air were nothing but oxygen, a candle would not last above a minute.

“What a tallow-chandler’s bill we should have!” remarked Mrs. Wilkinson.

“If a house were on fire in oxygen,” as Professor Faraday said, “every iron bar, or rafter, or pillar, every nail and iron tool, and the fire-place itself; all the zinc and copper roofs, and leaden coverings, and gutters, and pipes, would consume and burn, increasing the combustion.”

“That would be, indeed, burning ‘like a house on fire,’” observed Mr. Bagsie.

“Think!” said Harry, continuing his quotation, “of the Houses of Parliament, or a steam-engine manufactory. Think of an iron-proof chest—no proof against oxygen. Think of a locomotive and its train,—every engine, every carriage, and even every rail would beset on fire and burn up.” So now, uncle, I think you see what use of nitrogen is, and especially how it prevents a candle from burning out too fast.

“Eh?” said Mr. Bagsie. “Well, I will say I do think we are under considerable obligations to nitrogen.”

“I have explained to you, uncle,” pursued Harry, “how a candle, in burning, turns into water. But it turns into something else besides that; there is a stream of hot air going up from it that won’t condense into dew; some of that is the nitrogen of the air which the candle has taken all the oxygen from. But there is more in it than nitrogen. Hold a long glass tube over a candle, so that the stream of hot air from it may go up through the tube. Hold a jar over the end of the tube to collect some of the stream of hot air. Put some lime-water, which looks quite clear, into the jar; stop the jar, and shake it up. The lime-water, which was quite clear before, turns milky. Then there is something made by the burning of the candle that changes the colour of the lime-water. That is a gas, too, and you can collect it, and examine it. It is to be got from several things, and is a part of all chalk, marble, and the shells of eggs or of shell-fish. The easiest way to make it is by pouring muriatic or sulphuric acid on chalk or marble. The marble or chalk begins to hiss or bubble, and you can collect the bubbles in the same way that you can oxygen. The gas made by the candle in burning, and which also is got out of the chalk and marble, is called carbonic acid. It puts out a light in a moment; it kills any animal that breathes it, and it is really poisonous to breathe, because it destroys life even when mixed with a pretty large quantity of common air. The bubbles made by beer when it ferments, are carbonic acid, so is the air that fizzes out of soda-water,—and it is good to swallow though it is deadly to breathe. It is got from chalk by burning the chalk as well as by putting acid to it, and burning the carbonic acid out of chalk makes the chalk lime. This is why people are killed sometimes by getting in the way of the wind that blows from lime-kilns.”

“Of which it is advisable carefully to keep to the windward,” Mr. Wilkinson observed.

“The most curious thing about carbonic acid gas,” proceeded Harry, “is its weight. Although it is only a sort of air, it is so heavy that you can pour it from one vessel into another. You may dip a cup of it and pour it down upon a candle, and it will put the candle out, which would astonish an ignorant person; because carbonic acid gas is as invisible as the air, and the candle seems to be put out by nothing. A soap-bubble or common air floats on it like wood on water. Its weight is what makes it collect in brewers’ vats; and also in wells, where it is produced naturally; and owing to its collecting in such places it causes the deaths we so often hear about of those who go down into them without proper care. It is found in many springs of water, more or less; and a great deal of it comes out of the earth in some places. Carbonic acid gas is what stultifies the dogs in the Grotto del Cane. Well, but how is carbonic acid gas made by the candle?”

“I hope with your candle you’ll throw some light upon the subject,” said Uncle Bagsie.

“I hope so,” answered Harry. “Recollect it is the burning of the smoke, or soot, or carbon of the candle that makes the candle-flame bright. Also that the candle won’t burn without air. Likewise that it will not burn in nitrogen, or air that has been deprived of oxygen. So the carbon of the candle mingles with oxygen, in burning, to make carbonic acid gas, just as the hydrogen does to form water. Carbonic acid gas, then, is carbon or charcoal dissolved in oxygen. Here is black soot getting invisible and changing into air; and this seems strange, uncle, doesn’t it?”

“Ahem! Strange, if true,” answered Mr
Bagges. "Eh?—well! I suppose it's all right."

"Quite so, uncle. Burn carbon or charcoal either in the air or in oxygen, and it is sure always to make carbonic acid, and nothing else, if it is dry. No dew or mist gathers in a cold glass jar if you burn dry charcoal in it. The charcoal goes entirely into carbonic acid gas, and leaves nothing behind but ashes, which are only earthy stuff that was in the charcoal, but not part of the charcoal itself. And now, shall I tell you something about carbon?"

"With all my heart," assented Mr. Bagges.

"I said that there was carbon or charcoal in all common lights,—so there is in every common kind of fuel. If you heat coal or wood away from the air, some gas comes away, and leaves behind coke from coal, and charcoal from wood; both carbon, though not pure. Heat carbon as much as you will in a closed vessel, and it does not change in the least, but let the air get to it, and then it burns and flies off in carbonic acid gas. This makes carbon so convenient for fuel. But it is ornamental as well as useful, uncle. The diamond is nothing else than carbon."

"The diamond, ch? You mean the black diamond."

"No; the diamond, really and truly. The diamond is only carbon in the shape of a crystal."

"Eh? and can't some of your clever chemists crystallise a little bit of carbon, and make a Koh-i-noor?"

"Ah, uncle, perhaps we shall, some day. In the meantime I suppose we must be content with making carbon so brilliant as it is in the flame of a candle. Well; now you see that a candle-flame is vapour burning, and the vapour, in burning, turns into water and carbonic acid gas. The oxygen of both the carbonic acid gas and the water comes from the air, and the hydrogen and carbon together are the vapour. They are distilled out of the melted wax by the heat. But, you know, carbon alone can't be distilled by any heat. It can be distilled, though, when it is joined with hydrogen, as it is in the wax, and then the mixed hydrogen and carbon rise in gas of the same kind as the gas in the streets, and that also is distilled by heat from coal. So a candle is a little gas manufactory in itself, that burns the gas as fast as it makes it."

"Haven't you pretty nearly come to your candle's end?" said Mr. Wilkinson.

"Nearly. I only want to tell uncle, that the burning of a candle is almost exactly like our breathing. Breathing is consuming oxygen, only not so fast as burning. In breathing we throw out water in vapour and carbonic acid from our lungs, and take oxygen in. Oxygen is as necessary to support the life of the body, as it is to keep up the flame of a candle."

"So," said Mr. Bagges, "man is a candle, ch? and Shakespeare knew that, I suppose, (as he did most things,) when he wrote—"

"Out, out, brief candle!"

"Well, well; we old ones are moulds, and you young squires are dips and rushlights, eh? Any more to tell us about the candle?"

"I could tell you a great deal more about oxygen and hydrogen, and carbon, and water, and breathing, that Professor Faraday said, if I had time; but you should go and hear him yourself, uncle."

"Eh? well! I think I will. Some of us seniors may learn something from a juvenile lecture, at any rate, if given by a Faraday. And now, my boy, I will tell you what," added Mr. Bagges, "I am very glad to find you so fond of study and science: and you deserve to be encouraged; and so I'll give you a what-d'ye-call-it—a Galvanic Battery on your next birthday; and so much for your teaching your old uncle the chemistry of a candle."

**AN OLD HAUNT.**

The rippling water, with its drowsy tone,—
The tall elms, towering in their stately pride,—
And—sorrow's type—the willow sad and lone.

Kissing in graceful woe the murmuring tide;—
The grey church-tower,—and dimly seen beyond,
The faint hills gilded by the parting sun,—
All were the same, and seemed with greeting fond,
To welcome me as they of old had done.

And for a while I stood as in a trance,
On that loved spot, forgetting toil and pain—
Buoyant my limbs, and keen and bright my glance,
For that brief space I was a boy again!

Again with giddy mates I careless play'd,
Or plied the quir'ring oar on conquest bent;
Again, beneath the tall elms' silent shade,
I wo'd the fair, and won the sweet consent.

But briefer, alas! the spell,—for suddenly
Peal'd from the tower the old familiar chimes,
And with their clear, heart-thrilling melody,
Awaked the spectral forms of darker times.

And I remember'd all that years had wrought—
How bow'd my care-worn frame, how dimm'd my eye,
How poor the gauds by Youth so keenly sought,
How quench'd and dull Youth's aspirations high!

And in half mournful, half upbraiding host,
Duties neglected—high resolves unkept—
And many a heart by death or falsehood lost,
In lightning current o'er my bosom swept.

Then bow'd the stubborn knave, so backward sped
The self-saucing thoughts in dread array,
And slowly, from their long-congenial bed,
Forced the remorseful tears their silent way.

Bitter, yet healing drops! in mercy sent,
Like soft dews falling on a thirsty plain,—
And 'ere those chimes their last short notes had spent,
Strengthen'd and calm'd, I stood erect again.