**The Noxious Gases Bill.**

# THE NOXIOUS GASES BILL.

AMONG the many measures which perished in the 'Massacre of the Innocents' of the past Session, it was perhaps hardly to be expected that the Noxious Gases Bill would not find a place. The Local Government Board has been of late apparently no favourite with the Cabinet, of which its existing chief is not a member. At all events, its most important Bills have either been introduced too late to reach maturity, or have been systematically 'shunted' to make room for legislative experiments more attractive in their character, though possibly of less practical utility. Yet the Bill itself, like many others that could be named, was worthy of a better fate. It was the outcome of a report of the Royal Commission appointed in 1876 to consider the working of the Alkali Act 1863, and the Alkali Amendment Act 1874. It had been prefaced by an inquiry before the Committee of the House of Lords in 1862, an address from the same House in 1876, and the collection of a body of evidence so full and so compendious that, were it not for the rapid extension of the trades affected by the ten enactments, further inquiry might have appeared to be premature. The deliberations of the Commission extended over two years. They had visited during that time the towns of Widnes, St. Helens, Runcorn, and the neighbourhood of Liverpool. They had explored the chemical works of Tyneside, the coke ovens of Durham, the copper-smelting districts of Swansea and South Wales. They had tested by experience the unsavoury odours of the Thames from Blackwall to Gravesend, and the scents of the Lambeth Potteries. They held numerous sittings in London, examined a large number of witnesses drawn from every section of society, and finally reported just before the close of the Session of 1878. Yet, with the Parliamentary recess at their disposal, the draftsmen of the Local Government Board were unable to frame a measure which had any chance of passing into law in the present year.

The failure is one which it is easier to explain than to justify. The Bill itself was of a milder type than the recommendations of the commissioners, inasmuch as the tests to be applied were sensibly less stringent. It was accepted, when first introduced, by the manufacturers as, upon the whole, an equitable settlement of the question. By degrees, however, as they began to perceive that time was on

their side, it was understood that their objections increased. Finally, it became apparent that an opposition had sprung up which must prove fatal at so late a period of the Session, and the Bill went the way of many others. Whether its opponents have been wise in their generation in administering to it so early a *coup de grâce* is a question which remains to be answered. We venture to think that a very brief recapitulation of the facts which have been elicited by the Commission will satisfy the public that the time has arrived at which 'something must be done.' If so, such a conviction is sure to bear fruit before long, and delay is not always in favour of those who may be supposed to have their reasons for desiring it. The evidence produced is in one respect satisfactory. The witnesses, with very few exceptions, deposed to the good effects which had been the swift result of recent legislation. Improved machinery, greater care in manufacture, better plant, and a more vigilant system of supervision had been all but universally adopted. It is needless to say that all this must mean a largely increased expenditure of capital, and give rise to apprehensions, which are not altogether unreasonable, of any further legislative restrictions upon the works. On the other hand, the improvements in the various methods of manufacture have been materially neutralised by the increase in the works. In the case of Widnes they would seem to have doubled within the last few years. Concentration, which was once looked to as a partial remedy for the evils complained of, is now rather a subject of dread. The volume of gas poured forth from many contiguous chimneys, all conforming strictly to the Act, may be as deleterious in its effects on vegetation, and as difficult to dilute, as the fumes belched forth from one notorious offender. The mischief is thus carried further afield, and blame is imputed to individuals for that for which the extension of our commerce is really responsible. It must be added that to the general rule of good conduct there are some flagrant exceptions. The really well-managed works complain with reason that inspection is not sufficiently stringent as yet to bring up the careless members of their body to the proper level, and that the whole trade suffers in the public estimation by the unprincipled and illegal conduct of a comparatively small minority. Large emissions of gas also take place from works not as yet subject to inspection—another grievance which finds a prominent place in the complaints of those who are trying to do their best.

Having thus stated briefly the outlines of the question, we proceed to examine more closely the situation as disclosed by the report of the Commission. Noxious gases may be roughly divided for practical purposes into two classes—those which are injurious to animal or vegetable life, and those which are simply offensive to the smell. There are of course gases which are both, but many of which, like sulphuretted hydrogen, the public complain with

justice most loudly, belong properly to the latter. The prime agents in mischief to vegetation are muriatic, or, as it is more properly called, hydrochloric acid, nitrous, and sulphurous acids. Of these the last is probably the worst offender of all, and assuredly the most difficult with which to deal. It is not only to be found largely in all black smoke emitted from a chimney, but it is often, as in the case of dry copper works and glass works, emitted at so high a temperature, that science has not yet discovered a method of cooling it sufficiently to condense it. When there is any moisture in the atmosphere, it absorbs an equal part of its own bulk, and in the form of sulphuric acid gradually destroys all vegetation upon which it falls. It constitutes the chief destructive agent in the vicinity of copper works, coke ovens, glass works, salt works, and of many more of our national industries, and, even when itself not actually mischievous, it intensifies the damage done by other gases found in contiguity to it, and exercises a depressing effect upon the general health, beyond that which can be traced to its direct agencies. Muriatic acid, on the other hand, is mainly the result of the alkali manufacture in its various stages, of potteries in which a glaze is given by salt cake to the surface of the ware, and of cement works in which, the basis of manufacture being Medway mud, a vapour is given off in the process of drying by the sea salt contained in it. So far as alkali works are concerned, it is now generally admitted that by passing all the fumes into 'Glover' towers, in which the ascending gas is met by fluid trickling down through coke, condensation is practically complete, and a valuable article of commerce takes the place of a noxious gas. In potteries the temperature at which the gas is generated is so high that no remedy has yet been devised, while in cement works the attempts to deal with the evil are as yet but experimental. Of the effects of these gases upon vegetable life there can be no question. They are subject to considerable modification according to situation, locality, and the direction of the prevailing winds. Short chimneys are most destructive in their own immediate neighbourhood, tall stalks carry the vapour further afield. But no one can see the environs of Widnes and St. Helen's, Tyneside, the country round Durham, or the valley which leads down from Llandwr Junction to Swansea, without realising the extent and the serious character of the injury done. In the latter case it is fair to say that the population came to the works, not the works to the population. In Lancashire, Durham, and Northumberland, the same is true to a certain extent. But in the three latter counties there are large masses of the community who are gainers by the works only in a very indirect manner, but whose grievances against them are at once palpable and substantial. There are, indeed, some cases in which no redress can be given at all. Sir Richard Brooke, whose residence at Norton suffers from the fumes of Widnes and Runcorn, may find the value of his

land materially increased by its contiguity to these industrial centres, yet may regard it as a poor compensation for the ruin of an ancestral demesne which has belonged to his predecessors since the time of Henry the Eighth. There are losses which no mere money can compensate, and which can only be demanded of a man if some important public object is to be gained to which the conditions of the private loss inflicted upon himself must be subordinated.

It is not, however, so clear that the gases which are fatal to trees and hedges, which poison and deteriorate pastures, destroy corn, and denude the hillsides of grass, are equally poisonous to animal life. It seems to be established that stock may suffer from being pastured on infected grass—that cows fall off in milk, and bullocks and sheep in condition. It was asserted, but not without contradiction, that sheep occasionally died, and that cattle, fed under such conditions, developed a peculiar disease of the joints. But as regards danger to human life, the evidence broke down. Abundant proof was forthcoming as to the discontent and nausea produced by the cement works and manure factories of the Thames, the alkali and copper works generally, and, indeed, by most of the works confined within the scope of the inquiry. But the negative proofs on the other side were strong. The testimony on behalf of the good health of the operatives themselves was undeniable. Even in the neighbourhood where persons affected with special maladies, and new-comers, often suffered, nature itself, in the case of the latter, speedily established a certain 'tolerance,' under the influence of which they became acclimatised. Above all, the delicate tests of infant mortality, as applied by the local registrars and medical officers, disclosed no appreciable data. Life went on, possibly on a somewhat lower scale; certain constitutions suffered. But the zymotic diseases were neither more nor less prevalent in such districts than elsewhere, nor did, in fact, life in general appear to be subjected to any specially unfavourable conditions. Depressing and demoralising, to a certain extent, any offensive vapours must always be, and when these effects are intensified by the grimy incidents of coal-smoke and a darkened atmosphere, they are not without effect upon the moral condition of those exposed to them. But it is only fair to eliminate physical deterioration from the list of charges, already sufficiently long, which may be preferred against these industries which Mr. Sclater-Booth proposes to subject to the provisions of a Noxious Gases Bill.

It may now be proper to specify what these industries are.

In addition to the alkali works and copper works in which the dry process is employed, the Commission proposes to place upon the same footing as to inspection, works for the manufacture of sulphuric acid, chemical manures, sulphate of ammonia, and coke ovens. In a special category would be placed: 1. arsenic works; 2. cement works; 3. cobalt works; 4. dry copper works; 5. galvanising works; 6. glass

works; 7. lead works; 8. nickel works; 9. potteries, with certain exceptions; 10. salt works; 11. spelter works; 12. tin-plate works; 13. works for the manufacture of dyes from coal-tar derivatives. The latter class are recommended for a system of superficial inspection evidently with a view to legislation at some future period, when the conditions under which they can be successfully carried on have been more carefully ascertained. It will be obvious that such a list includes a large proportion of the staple trades of the kingdom, and that any legislation which it may be proposed to apply to them is not to be lightly or hastily undertaken.

With regard to the first division of the works enumerated, the task is comparatively easy. The mode of putting the law in force is now well understood. What the Commission seems to hint at is, that some increased vigour might be infused into the inspection, while the number of inspectors must clearly be increased. Dr. Angus Smith, who has now for many years filled the post of Chief Inspector, is a man of the highest scientific reputation, and evidently enjoys the full confidence of the Local Government Board. He has unquestionably shown great judgment in the manner in which he has rendered comparatively palatable the provisions of two successive enactments, which we can well believe have entailed upon those directly affected by them no small measure of trouble and expense. Mr. Brock, the managing partner of one of the largest of the Lancashire alkali works, puts the matter very fairly from this point of view. He gives statistics proving the heavy cost of a compliance with the requirements of the Act, and naturally deprecates continual meddling on the part of the Legislature. Still, we doubt whether Dr. Angus Smith has quite appreciated the gravity of the situation, or has fully grasped the fact, mentioned by more than one witness, that there are those who continually evade all regulations when they think that they can do so with safety, and that gas is often let off secretly at night which could be instantaneously detected by daylight. The time has clearly come now, whatever may have been the case when the Commission was first appointed three years ago, to insist upon the provisions of the Act being rigidly enforced, and for the adoption of a more decided and tentative policy than seems to have found favour, if we are to judge by his recorded opinion, in the eyes of Dr. Angus Smith. The case of coke ovens, to which it is recommended that the Act should in future apply, illustrates strikingly the course of action which seems requisite in the interests of the public. The mischief done by them may certainly be minimised by insisting that all works should be conducted on the best principles. The abandonment of the old 'beehive' ovens with their stumpy chimneys, and the adoption of those opening laterally into a horizontal flue, with one tall chimney at the end, render the effect of the sulphurous acid hardly perceptible. The commissioners recommend their adoption being insisted upon in

all new works, but give, somewhat unnecessarily, a period of three years to old works to make arrangements which will prevent their becoming a nuisance to all their neighbours. The principle is on all fours with the old legal maxim, which rightly holds that he who for his own pleasure or profit does that which injures his neighbour must be held decidedly responsible for the damage so done.

Before we pass on to the second class of works, it is right to observe that the Commission recommend that alkali 'waste' heaps should be placed in the same category as the works of which they form the residuum. The provision has not come a moment too early. The practical chemist who shall discover a profitable method of withdrawing the sulphur from these evil-smelling deposits will be on the high road to fortune. Mr. Mactear in Scotland, and M. Mond in Belgium, have attempted to do this more or less successfully. But no process of treatment has yet won its way to popular favour. The consequence is, that from the waste, often carelessly packed, distils in wet weather a horrible yellow liquor. When this finds its way, as it eventually does, into a stream into which acid refuse is permitted to flow, sulphuretted hydrogen, one of the most offensive gases, which can be recognised sometimes at six and seven miles distant, is immediately generated. Nor does the mischief end here. Much of the waste is employed to level ground which is eventually built upon. A large part of Liverpool stands upon such soil, and its unhealthiness is traced by some medical authorities more to this fact than to the effects of existing works. A sort of crust forms upon the surface, but if this is disturbed for drainage purposes, or the digging of a well, the noxious properties of the mass are revived. At present, vigilance is the only safeguard, and no question should arise as to the power of inspectors to regulate the treatment of alkali waste.

The works which are, for the present, recommended to be placed under inspection only, and not to be subjected to the provisions of the existing enactments, are of two kinds. Under the first head may be placed dry copper works, glass works, and potteries. Science has hitherto failed to find any practicable method of cooling the gases emitted by these works sufficiently to permit of their condensation. In the case of copper works the Messrs. Vivian, of the well-known Hafod works at Swansea, are, we believe, the only manufacturers who have, as yet, made any attempts at all to minimise the mischief done by their works. They have gone to great expense for this purpose, without any very satisfactory results at present. But considering the very great strides which chemical science has made, and is still making, there can be no question of the benefits to be derived by keeping the subject incessantly before the public; and we know no better means of at once doing this, and of stimulating at the same time the efforts of scientific research, than by the annual reports of inspectors, noting at once the mischief done, and the success or

failure of any attempts to counteract it. Dr. Angus Smith expresses a confident opinion that not only in the case of these works, but even in that of the coal smoke emitted in so many industrial processes, a way will eventually be found of divesting it of the sulphurous acid which at present forms the most deleterious portion of its volume. But he confesses that the time is not yet arrived, and that we must look to the future for that better state of things which he hopes to see eventually brought about.

The other division of works to be simply brought under inspection is of a somewhat different class. They belong necessarily to the category of those industries the results of which are rather of an offensive than of a destructive character—bad smells rather than acid gases. The result of what is known as the 'Slaughter-houses Act' has been to drive these trades, especially in the case of the metropolis, just outside the boundary prescribed by the Act, to the infinite annoyance of those not only in their immediate vicinity, but also within reach of their influence. Thus Blackheath complains loudly of nuisances which arise from works carried on across the river, the pungent odour of chemical manures being clearly perceptible at a distance of several miles. It is quite possible, in passing down the river, if accompanied by an expert in such matters, to recognise by the peculiar smell the features of each individual manufactory. They have been known to cause not only nausea but actual illness to those inhaling them from the deck of a steamer, and cannot but be productive of the most serious annoyance to those perpetually subjected to their influence. Life may be rendered utterly miserable without being materially shortened. It is just here that an enactment enforcing the 'best practicable means' of abating a nuisance so intolerable comes in usefully. In the manufacture of most chemical manures the greater portion if not the whole of the evil odours may be effectually consumed in their passage through the chimney, if proper care is taken in the general arrangements. A system of constant and rigid inspection would ascertain at once whether such care was taken or not, while the great probability is that the very fact of liability to inspection would at once stimulate the flagging vigilance of the manufacturers. It is only fair to say that much of the evil complained of results from the carelessness of workmen, owing in a great measure to the want of adequate supervision. Some improvement may be hoped for in this respect from the employment of a more highly educated class of operatives. But the ultimate responsibility must, of course, be laid upon those who make a profit by the works. One of the chief existing difficulties is that complaints are rare, and information very difficult to obtain from those who live in the immediate vicinity of a manufactory and are dependent upon it for their daily bread. '*Non olet*' is a conclusion which they arrive at with comparative ease under the circumstances. Nor are instances

wanting in which a little judicious liberality has had its effect even upon neighbours who had no interest whatever in the offending works. Traces of such effective arguments being employed are to be found in the absence of any local complaints against the refinery of Messrs. Rothschild upon Tower Hill. It was not denied that considerable damage was occasionally done by it, but all claims on that score were generally settled with such promptitude and liberality that no one could be found ungrateful enough to prefer a formal complaint against the owners. Here again inspection would work wonders. If there is one thing more remarkable than another in the history of noxious gases, it is the manner in which science has responded to any judicious pressure exercised on the part of the legislature. It is only another proof of the truth of the axiom that 'necessity is the mother of invention,' applied to the practical incidents of everyday life. Selfishness is by no means confined to those engaged in the processes of manufacture which come within the scope of the inquiries of the Noxious Vapours Commission. But it has certainly been brought into strong prominence by the comparative ease and perfect success with which repressive legislation has been carried out. Mr. Brock's pathetic lament deserves consideration, because it proceeds from a man who is honestly endeavouring to do his best. But neither he nor any other of the leading trade-witnesses concealed the fact, that there were those among their body with whom the 'greed of gain' entirely overpowered any feelings of consideration for the public at large.

Not less important than the enactment of remedial measures is the machinery by which they are to be carried out. The two crying wants in this respect are the creation of some trustworthy agency which can act at once as a preventive and a repressive power, and the adoption in some form of the principle of collective responsibility. Both these objects are treated of in the report of the Commission, and both are embodied in the Bill recently introduced by the Local Government Board. It is needless to say that in approaching the core of the question we are treading on very delicate ground. There are plenty of people quite prepared to subscribe to the necessity of legislation in the abstract, who wince perceptibly when details come under discussion, and pressure is brought home to their own doors. The first question that arises is that of efficient inspection. There is a general agreement of testimony, that the existing staff must be strengthened. Nor are any serious objections made to the proposition that the inspectors themselves shall be men of high scientific training, and removed as far as possible from the grade of 'common reformers.' But while the manufacturers are unanimous in demanding that they should be Government officials in the strictest sense of the word, many of those interested in the suppression of nuisances would prefer the motive power being retained as far as possible in local

hands. The expense of inspection is another point of dispute. On the one hand, it is contended that a system intended for the protection of a limited class should be maintained, at all events in part, at the cost of those who are to benefit by it. On the other, it is argued that the protection thus extended is nothing more than that to which all subjects of her Majesty are entitled, and that no cause for special taxation can exist. It seems scarcely reasonable that duties of so delicate and difficult a character could properly be delegated to any but inspectors responsible to a public department. That there may be, occasionally, some want of that vigour which keen local watchfulness has a tendency to secure, is not to be denied. But, on the other hand, uniformity of pressure could hardly be secured in any other way, while the professional qualifications of the purely local inspector, and the efficiency of the superintendence which could be bestowed upon him, must be inferior to that which might be secured were the inspectors directly responsible to an official chief. The question of expense would seem to be met fairly enough by the provisions of this Bill. A certain portion would be defrayed by a rate levied upon the area which is to reap the benefit of the inspector's services, the remainder being borne by the Consolidated Fund. The Local Government Board would fix the standard of qualification, appoint the officer, and take care that he was adequately superintended by a chief inspector of eminent scientific acquirements. Upon the latter would devolve the onerous and responsible duty of tabulating all reports, summarising the conclusions to be drawn from them, and making such suggestions for future legislation as might from time to time occur to him. One of the greatest wants in this department of sanitary science is at present the dearth of collected data, which can only be accumulated in the course of time. Not only so, but the results of such data, when obtained, are not to be arrived at by a novice in the study of them, nor does it follow that the best practical investigators are always the most alive to the deductions to be drawn from the details which they have so carefully collected. There is, it seems, now no lack of qualified individuals able as well as willing to discharge the duties of inspectors or sub-inspectors. It is fortunate indeed that it should be so, for nothing is clearer than the fact that more of them are required, and that the existing salaries must be increased. But it is more than probable that the number of those who are competent for the post of chief inspector might be counted upon the fingers. Of these, too, several already hold posts of such importance that they could not be withdrawn from them without serious injury to the public service. Dr. Angus Smith, who at present occupies that post, is a man of the highest scientific attainments, and has done good service to the cause. But there are indications in the report that in the opinion of the commissioners the time has come for

a more decided move in advance. The policy of conciliation has been pursued quite long enough. All the best manufacturers have done their utmost, and in most cases, very successfully, to carry out the provisions of the Act in the spirit as well as in the letter. There are those, however, who have attempted to do neither, and to whose works attention needs to be called at a very early date. The inspectors of the future must be prepared not only to use persuasion and to tender advice, but to enforce, if necessary, by a machinery hereafter to be provided, with vigilance and rigour an obedience to the law. The duty will not always be a pleasant one, and will need to be impressed upon them by a chief thoroughly alive himself to the fact that 'prevention is better than cure.'

The point which is likely to be the most hotly contested in Mr. Sclater-Booth's proposed measure is the question of joint and several liability. Yet it is one the carrying of which in some form is of vital importance. As the law now stands, the complainant, however patent may be the injury which he has suffered, is practically compelled to bring the offence home to an individual culprit before he can obtain any redress. In the case of isolated works this, of course, may be done. But where, as at Widnes, Runcorn, St. Helens, and on Tyneside, there is a conglomeration of works, such a task is a simple impossibility. The existing acts, being of a highly penal character, are very properly construed strictly. The result has been a series of failures to bring home such offences to individual members of a class some one or more of whom are unquestionably responsible for the mischief which has been done. The necessity, accordingly, of singling out the delinquent is a real hardship upon the sufferer for which some remedy should be provided by law. The scheme suggested in the Bill, and which also found favour in the eyes of the Commission, is ingenious. It is proposed to group works emitting noxious gases, and to make any penalties recoverable against the body of manufacturers to be assessed rateably among them. It is assumed, with justice, that the real offenders are rarely unknown among the trade, and that such a measure would cause an indirect pressure upon them stronger in all probability than any which could be exerted by the direct action of the Legislature. To bring up the worst managed works to the level of the best should be the object of future legislation. To do more might be seriously to affect the position of our national industries. To do less is to wink at evasions of the law, prompted by the most selfish instincts of personal gain at the expense of others. The principle is in some respects a new one, and as such will meet with opposition. But it seems to be equitable in itself; and if it be so, the means of carrying it out ought to be only a matter of detail.

The whole question has now reached a stage at which things cannot remain as they are. Had it not been for the commercial depression of the last few years, much more would have been heard

of it than has been done of late. That depression, especially in the coke-oven districts, has been of so serious a character that not one-third of the deleterious vapours has recently been emitted which were poured forth over the country, say five years ago. But with a revival of trade will come an increase of the old nuisance, and it is important accordingly 'not only to be wise, but to be wise in time.' The experience of the working of the two Acts which have already been passed is also of an eminently satisfactory character. We are gradually approximating to a knowledge of the conditions which lie at the root of the question. We have learned that restrictions once deemed impracticable may be enforced not only without injury to the manufacturer, but sometimes to his direct advantage. We find that where pressure has been applied with judgment and moderation, science has responded to the touch, and has discovered how the noxious elements of destruction may be converted into profitable commodities. We know indeed that there are certain trades, and certain processes of manufacture, which we can never hope to render absolutely innocuous. But we know also that even those evils which cannot be absolutely cured may be divested of most of their virulence by care and by contrivance. It is probable that under no conceivable circumstances can one of our great industrial centres be rendered agreeable for what is known as a 'residential locality.' But there seems to be no reason why life in such a neighbourhood should be rendered intolerable either by acid gases or by foul stenches—why nature should be robbed of her beauty, or the population of all that makes existence agreeable, by the presence of those establishments which afford the means of subsistence to the masses. Much, indeed, of the mischief that has been done can never be undone. We cannot pull down, for instance, those portions of Liverpool which have been erected, in defiance of all sanitary considerations, upon soil composed mainly of old alkali waste heaps. We cannot, at all events for a generation, hope to give back to Norton or to Bishop Auckland the woods which have perished under the withering influences of acid vapours. We cannot reclothe with verdure the scored hillsides of the valleys around Swansea. But we can to a great extent repair an error which our forefathers, had they possessed our means of light and knowledge, would never have committed, and take care that for the future effectual 'metes and bounds' be set to the recklessness and carelessness of manufacturing enterprise. And this may be done without ignoring in any way the importance, we may say the indespensability, of such a spirit of enterprise to the material prosperity of the nation. It is not surprising that in certain quarters there should be a tendency to overlook this latter consideration. But the statesman would deserve ill of his country who could shut his eyes to the narrowness of the margin which enables England to face successfully the fierce foreign competition by which she is menaced

on every side. No fact stands out more prominently in history than the difficulty of resuscitating any industry which has once been driven away, no matter how, from any particular locality. Many of the towns or populous villages which suffer most from noxious gases are the creation of the works which emit them, and have sprung up around the centres which supply them with the means of existence. It is argued with some plausibility that if the choice lies between two evils, life in the midst of a leafless waste and under the depressing influence of a murky atmosphere is still, in every sense of the word, preferable to starvation or even to penury. The fallacy, of course, lies in the assumption that these are the only alternatives, and in ignoring the possibility of ameliorating the conditions of existence, simply because they cannot be rendered perfect. The only safe test which can be applied to the matter is that of an educated experience, and that is being every day supplied through the medium of the enactments which have already passed into law. Ten years ago the question was scarcely ripe for legislation at all. Five years ago we hardly knew how far we could venture with prudence. Now we are in a position to take a bolder line, because we are more sure of our ground, we have better sources of information, and we are above all in possession of a staff of trained explorers to whom we may look with confidence for future achievements in the field of scientific discovery.

There is, indeed, a wide field still open for the research of experimental chemists, in which their labour, if successful, will also prove profitable in more than one sense of the word. Dr. Angus Smith himself believes, as we have said, that the time will come when science will succeed in divesting black smoke of those sulphurous particles which are the most noxious portion of its constituents. The man who discovers how effectually to condense sulphurous acid, or to cool those gases which are now generated at too intense a heat to be scientifically treated, will have deserved well of his country. A profitable method of withdrawing the sulphur from alkali waste is, as has been already stated, yet to be discovered. When it is so, a valuable chemical product will be the result, and the invention will have its money value, as well as having effected the solution of a knotty sanitary problem. There is actually a process at work which diminishes by half the consumption of fuel in the manufacture of salt, and entails a corresponding decrease in the emission of black smoke. Its expense appears to be the only drawback, and to lessen this, while increasing the general efficiency of the method, is surely a worthy aim for the practical engineer. Mr. Vivian's gallant attempt to grapple with the forces of copper smoke has not, as yet, been crowned with the success that it deserved. But something has already been accomplished, and more, it may be hoped, will be done, in proportion as public attention is attracted to the

magnitude of the evil. It is quite a moot-point whether direct encouragement should not be given by the Government, in the shape of a handsome bonus, to successful experimentalists in this and the kindred branches of scientific inquiry. Much has undoubtedly been accomplished without such a stimulus. But much more remains to be done, and it can hardly be expected that any very tangible rewards will be held out by manufacturers for inventions, the main object of which is rather to improve the process than to diminish the cost of manufacture. It is to the latter point that the attention of scientific inquirers has been mainly directed, for the very obvious reason that it pays best. The time would seem to have come when inducements may fairly be held out for the encouragement of research in the former direction, nor is it likely that the labour thus employed would be thrown away. Several patents appear to have been brought to the notice of the Commission, all more or less valuable, and all steps in the right direction. Copper, alkali, salt, and cement works have all been the subjects of such experimental attempts. In each case there have been 'guesses at truth,' more or less close to the mark. In each we seem to be upon the threshold of success, and any assistance that can be given which may enable us to cross it will lead to results which it would be taking a very narrow view of the subject to regard as of a merely local interest.

It is earnestly to be hoped that another Session will not be permitted to pass away without a strenuous attempt being made to carry a comprehensive measure upon the subject. There is an impression abroad, well or ill founded, that unless the chief of a department be a Cabinet Minister, the Bills which proceed from it do not get a fair chance in the struggle for precedence. The experience of last Session does not, to say the least, negative such a conclusion. Yet it teaches also the impossibility of carrying such a measure, treading as it must do upon the toes of so many different people, unless it is introduced at the commencement of the Session, and pushed forward at every available opportunity. Few voices were raised against the Noxious Gases Bill at the outset. It was admitted by the manufacturers themselves that it was an honest attempt to settle a difficult question, conceived in a spirit of fairness and of impartiality. It was certain that the chemical tests to be applied were in many respects far less rigorous than those recommended by the Royal Commission, and that the Bill was otherwise less stringent, and therefore less favourable to the public at large, and more so, presumably, to the trade, than the recommendations, moderate as they were, of the Commission. Yet, as the Session dragged on, and its opponents became aware that time was every day more upon their side, their objections increased in volume and in urgency, until the measure, like so many others, perished by the wayside. We trust that no opportunity may be given for the repetition of so questionable a strategy. The clause of collective

liability, to which exception was specially taken, is vital to the interests of the public. Unless the principle embodied in it be carried out in some shape, the weak will always be at the mercy of the strong, the small farmer of the wealthy manufacturer. Of course, every possible precaution must be taken to prevent the putting forward of 'bogus claims,' but this may and ought to be done without depriving the public at large of a redress to which they are fairly entitled. It cannot be too often repeated that the sole reason which can justify the exercise of forbearance towards a company or an individual engaged in a lucrative undertaking, if that undertaking be injurious to others, is the paramount consideration of the importance of the trade of the country. But an exemption from the ordinary responsibilities, which attach to all alike, is based upon purely public grounds, and must have its limits. 'Sic utere tuo, ut alienum non lædas' is sound law as well as good morality.

We must not, indeed, impose restrictions so stringent or so unreasonable as to run the risk of driving trade abroad. But, short of this, we are bound to do all in our power to compel those who carry on a profitable business, not to do so on purely selfish principles. Private interests must undoubtedly be subordinated to the public good. Even the beauties of nature must give way if their preservation intact militates against undertakings which will even indirectly benefit mankind. But by a parity of reasoning one class cannot be permitted to monopolise gifts which were intended for all. The question, be it remembered, is essentially a poor man's question. For one landowner who has to lament over the decay of his ancestral oaks, or over a once fair prospect marred by tall chimneys and volumes of smoke, a thousand toilers suffer under the gradual withdrawal from their daily life of all that makes life pleasant, it may be of all that can render it tolerable. The owner of the soil has generally consolation in the increased value of his property. Its occupier can, if the nuisance becomes serious enough, seek another farm elsewhere. But the great mass of our operative population *must* live near the place of their daily employment, and dare not complain, while it is possible to avoid doing so, of any shortcomings upon the part of those to whom they look for their daily bread. In many cases, indeed, they are so imperfectly acquainted with the true laws of sanitary science that they could not complain, even if on other grounds they deemed it expedient to do so. Perhaps the greatest sufferers of all are those inhabitants of populous districts, unconnected with the trades in question, who derive no benefit from them, but who are very gradually, from the extension of some particular industry, being brought within the range of the gases generated by it. That they are not absolutely without a remedy is true. But the forms of procedure are at present so cumbrous, and so difficult to master, success is so problematical, and a large expenditure is so certain, that no one can be found with

courage to 'bell the cat.' We want an easy method of obtaining a judicial decision which will protect the manufacturer from vexatious suits, while it will secure to his neighbours full compensation and a certain remedy for every wrong that they may suffer. More than one scheme for attaining this desirable object has been sketched out by competent authorities. The public will not and ought not to be satisfied until one or other of them be adopted. Justice to the trades already under the Alkali Acts demands that other not less frequent or flagrant offenders should be subjected to similar control. Justice to those manufacturers who have done their best to conform to the spirit of the law demands that those who have done otherwise should be compelled to amend their ways. Justice to the owners and occupiers of the soil demands that the process of recouping themselves for proved injuries should not be needlessly cumbrous or expensive. Above all, justice to the public at large, of which so large a portion is too poor or too ignorant to protect itself, demands that the noxious agencies which tend to deteriorate the vital force, to detract from the rational enjoyment of life, or to injure its *morale*, should be reduced, so far as human legislation can reduce them, to a minimum.

MIDLETON.