

CONGRESS AT GLASGOW.

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CONFERENCE OF MUNICIPAL REPRESENTATIVES.

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THE SMOKE PROBLEM.

Introductory Remarks

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*The Hon. the Lord Provost of Glasgow.*

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IT is eight years ago (1896) since, at a Congress of somewhat similar magnitude, the problem of smoke pollution and its remedies was brought forward and discussed. It was keenly and brilliantly touched upon by the President of the Chemical and Engineering Section in his opening address on the subject of "Light and its Influences." I remember well how we all sat in the Bute Hall, like people entranced, drinking in the illuminating periods which fell from Professor, now Sir William Ramsay. Sir William has travelled far in the regions of science since then. As a discoverer in the sphere of luminosity and radio-activity he stands now among the foremost, and to-day he has reached the inner recesses of nature's mysteries, where radium and helium combine to point the way to an unthought-of solution of the making and unmaking of worlds. We had also a most instructive paper from Mr. Alfred F. Fletcher, H.M. late Chief Inspector under the Alkali Acts, in which he fully surveyed the ground from the engineering and technical standpoint.

Doubtless these two addresses did much to attract public attention to smoke pollution and its dire effects; and we have also travelled, during the eight intervening years, considerably nearer towards a final solution of the problem. Still, much of what these two gentlemen told us at that time is equally true now: eight years is as but a moment in the distance of time we have yet to go before all our manufactories and all our domestic

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NOTE.—The Proceedings of the Conference commenced with an Address by COUNCILLOR W. F. ANDERSON, J.P. (*see page 291*).

fires cease to be the "enemies of cleanliness and the supporters of disease."

Not being a chemical and physical scientist, nor an engineering expert, all I can do to advance the good cause is to reiterate, in the best manner I can, the great lessons then taught, and to indicate the position of the problem to-day, and the steps which all authorities might reasonably take to bring home to the minds of the general population of this kingdom the importance of the subject. Having done this, I may safely leave the matter for discussion in your hands, as there must be many before me whose experience and expert knowledge will make complete what I imperfectly fulfil or leave undone.

Sir William Ramsay, in the address I have alluded to, referred to one point in connection with smoke production which cannot be known too widely. He said: "Smoke condenses atmospheric vapour, causing fog and rain, renders our climate colder, and makes our lives more or less unhappy and uncomfortable. It shuts out sunlight, and thus increases the growth and tends towards the multiplication of bacteria, many of which are of a dangerous character."

Thus, as he stated, "we have, to some extent, the very rainfall under our control." Now, gentlemen, that is a very comforting suggestion. There are certain places in the world, notably Australia, where the ingenuity of man is invoked to cause rain; where the brazen heavens have been attacked by bombs and explosive air-ships, in order to wring out a life-giving shower from the arid air. I sincerely wish that some one would invent a method whereby Glasgow, Sheffield, Birmingham, and some other of our darker communities could despatch to such districts our rain-compelling smoke. We would not ask any financial return for our export. Even in the summer-time in Glasgow we have, taking averages, rain on two days out of every three, and our sunshine is all too scanty. When we see the clouds rolling over us, making the sun invisible and soaking us with moisture, we are apt to blame those mysterious visitors called cyclones, V-shaped or otherwise, forgetting that these are but moving centres of atmospheric depression, which render the air incapable of sustaining the moisture it contains. But we know from the valuable experiments of Mr. John Aitken, of Falkirk, that before this moisture can form into rain-drops it must be supplied with particulate matter in the form of dust, either as smoke, fine dirt or sand, bacteria, or concentrated salt from the sea-spray. Round about these minute particles the moisture condenses and falls to earth as rain.

Thus, in a certain measure, every community that loads its atmosphere

with smoke is preparing, either for itself or for other people, those multitudinous condensers, without which the moisture in the atmosphere could only come to us as "the gentle dew."

But even more important from the public health point of view is the formation of fogs, which make all those who dwell in cities, and can afford it, flee therefrom to the country, or, at any rate, far enough into the environs to escape from that yellow, all-enshrouding quality of fog which is so utterly disagreeable and dangerous. We are all well aware, from the abnormal rise of the death-rate of towns during a continuance of fogs, how they act as aggravators of disease conditions—how bronchial and phthisical subjects especially suffer; but now we know that the intensification of fogs by the admixture of smoke emissions directly incites disease, by absorbing from the rays of the sun the blue, violet, and ultra-violet light, which has been discovered to be fatal to all bacterial life. Thus, directly, as well as indirectly, the public health is deteriorated by our present methods of coal combustion, and we cannot doubt that, to a considerable extent, through scientific investigation, public lecturing, the comments of the public press, and official action, backed up by legislative sanction, much has been done in recent years to lessen the evil. Still, as sanitarians, we cannot rest content so long as we find our city air so contaminated, and, in turn, so contaminating, in comparison with that of the country.

It is common experience that, in the country, our houses, furniture, clothing, and persons continue for days to preserve a cleanliness quite impossible to secure under city conditions. After a holiday, and on returning to town life and struggle, we all know how our noses at once perceive the change from the fresh to the stale; from the dust-free to the dust-laden; from the invigorating ozone to the depressing and biting sulphur. We have been so long accustomed to accept this state of matters as one of the penalties of city existence, and to regard it as of the nature of the inevitable, that, after the first feeling of uneasiness and resentment is over, we settle down into a dull state of resignation, and partially forget all about it. It is not till a prolonged fog again envelops us in its asphyxiating embrace that we cry out in our distress for the removal of the "smoke fiend." How is this?

I much fear it is because that great touchstone, the public conscience, has not yet thoroughly gripped the fact that smoke is in reality a sapper of health, and not merely a necessary inconvenience, a penalty to be paid for the benefit of dwelling in an industrial community. I believe that once the mass of our city dwellers come to realise the disease-bearing

properties that lurk in the smoke-pall which enshrouds them day after day, we may expect the inertia, which now retards progress, to disappear, and instead receive from them the momentum which will insure a sweeping reform.

It is with this object in view that I have ventured to open the discussion to-day upon this subject. I am not able to find in the records of civic sanitary progress that scientific attention has been universally applied to an elucidation of the problem, and the effects of a smoky air on our towns.

There is no want of attention to the observation and careful tabulation of towns' death-rates, both general, special and infantile, for comparative purposes. Great attention has in recent years been paid to sewage treatment and disposal, and quite recently a Special Commission was appointed by Parliament to make an exhaustive enquiry into, and a report upon, this important question. I find scattered throughout the journals dealing with questions of public health, scientific data on the treatment of sewage, and the quality of the resultant effluents in various parts of the kingdom. I observe that the problem of the housing of our poorer classes, both in towns and in rural districts, has been receiving increasing notice, and that social reformers, medical men, architects, and even statesmen have been devoting themselves to its solution, and writing and speaking voluminously upon it. I rejoice to see that the condition of the operatives in all workshops and workplaces has in recent years been engrossing the attention of our Government, and particularly that of the Home Office. The question of shop employees and their hours of labour is also kept well to the front, and there are several Bills now under consideration for the amelioration of their condition. All along the line of sanitation, and particularly in that dealing with the health and well-being of our industrial population, I seem to note the march of progress, and to hear the sound of warfare against present evils; only on the state of the air, which the people are compelled to breathe, I fail to find any reliable data, or to hear of any serious or responsible movement being attempted to secure amendment.

We can obtain reliable information all over the country as to the rainfall, and the temperature is duly recorded day by day in every important centre of population. On the smut-fall statistics are silent. Why should this be?

It cannot be because of the comparative unimportance of a clean atmosphere as against a clean river or stream. It cannot be that it is more important to note and tabulate the effects of certain diseases among the population than to make records as to the causes of these effects. It cannot be that the careful marking of the inches of local rainfalls is

considered more essential than a careful analysis of the solid constituents that the rain washes from the air into the rain-gauges.

I cannot answer my own question. All I know is that among the multitudinous array of facts and figures continually laid before us, both in official and non-official documents, I have no acquaintance with any which would enable us to know the quality of the air of London as against that of Liverpool, or the smut-fall of Manchester in comparison with that of our own city. In the absence of any facts bearing on this question, it is little wonder that the public as a body are somewhat apathetic with regard to it. We are accustomed to hear of Glasgow, Sheffield, Manchester, Wigan, and other towns being dubbed centres of smoke and dirt. We have no proof that these are in reality worse than their neighbours, because it does not appear to have been considered essential to make any experimental research.

Now it does seem to me that a problem of the magnitude and importance of the smoke problem, and one which affects in such a material manner the comfort, cleanliness, and health conditions of all who must dwell in cities, ought to be treated on the most scientific lines; that each town of any pretensions should have connected with its sanitary department some means whereby the amount of dust and smuts in its air could be gauged and analysed.

We would then be able to ascertain how the air of each town compared with that of all the others; and, as one town seeks to emulate the other in the matter of a lessening death-rate, so the periodical publication of town smut-rates would, in like manner, arouse a healthy stimulus in the matter of a clean atmosphere.

I was led into this train of thought by a lecture which was delivered last winter by our Sanitary Inspector, in which he showed how various parts of Glasgow stood with reference to atmospheric pollution. I requested him to be good enough to extend these observations in the city, so that I might be in a position, from the presentment of actual facts, to illustrate to you to-day the bearing of my remarks. Thereupon the city was divided into 25 districts for purposes of experiment. As a matter of fact, the electoral divisions or wards were selected as suitable centres, and in each ward a wooden water-tight gauge, 12 inches square, was placed on the roofs of buildings at a height of between 30 and 40 feet from the ground-level. They were placed in position on the 1st of March and left for 100 days, or until the 8th of June. They were then carefully removed and placed in the hands of the Corporation Chemist for analysis. The first four columns of the tabular diagram (page 679) show you the

result. You will observe the analyst has divided the solid constituents found in each box or gauge into three parts, the mineral or indestructible matter, the oily or greasy matter, and the organic or volatile matter. The second and third columns exhibit the substances which may be said to be derived almost purely from smoke emissions, while the first column may contain a certain proportion of minute mineral gritty or dusty particles, which are cast into the air of any town by the operation of industrial processes, or lifted by the winds from road surfaces.

It will be noted that Wards 10 and 13 are not represented in the table, as it was found in both cases that an accident had occurred to the gauges, but I think that the results shown are amply sufficient to warrant us in concluding that they indicate a correct average for this city.

It is not my purpose to weary you by any analysis of the differences of one ward from another. Speaking generally, they show, notwithstanding singular divergences here and there, that the heavier smut-rates are found in our more industrial and crowded areas; while the outlying and more sparsely populated districts show less air pollution. The great purpose which they serve is to illustrate what I mean by a city smut-rate, for a specified period, during the year.

Here we find that during 100 days in spring the deposit of dust and smuts from the air of Glasgow averages 109 grains upon each square foot.  $63\frac{1}{2}$  grains of this are mineral, or found to be unburnable;  $3\frac{1}{2}$  grains are composed of grease, or the oily extract obtained from the soot; and 42 grains are the smuts or other organic substances, easily consumed by fire.

The second row of columns exhibits, in a corresponding manner, the deductions arrived at from the first row. It has been assumed in each case that, if a certain number of grains have fallen on one square foot within a particular ward in 100 days, a proportionate amount has fallen on each acre of that ward during 365 days. On this fairly legitimate assumption, we arrive at the conclusion that the smut-rate of Glasgow is 22·119 hundredweights on each acre per annum; further that 13 cwts. of this is mineral matter, 7·22 cwts. grease or oily matter, and  $8\frac{1}{2}$  cwts. is volatile or organic matter.

If these observations had been conducted over the whole period of a year (as for strictly comparative purposes with other cities they ought to be), we should be in a position to see at a glance how our air stands, as regards dust pollution, in comparison with that of the chief towns of the United Kingdom. It is regrettable that no information of this kind seems to be obtainable from them, and it is to be hoped that in the near future

each important sanitary authority will make an effort to obtain this very important information relative to the atmosphere of the district.

Meantime, Glasgow has a standard to go upon. As years proceed, and the existing law against smoke emissions continues to be administered, we shall be in a position to compare each future year with this one, and so be able, in a scientific way, to mark progress. If no progress is observable, it is a fair inference that the law against smoke, or its administration, is defective. I say this because I have become quite convinced that mechanical science, in its application to the proper combustion of fuel, whether the fuel be coal or the gas obtained from it, is now quite capable of relieving us from this nuisance. Further, that this much-needed relief may be obtained in a manner quite consistent with economy, so far as steam production is concerned. In my own works, I have been able to prove this, as, whereas in former years I admit having contributed my share to the air pollution of the city, I now rejoice in a clear chimney-top from morning till night. I do not intend to reiterate, what must be well known to most of you, all the ways and means which may be adopted to this end. All manufacturers know that steam-boiler furnaces continue to issue volumes of smoke from various causes. What I contend for, is that there is no cause of smoke to-day which is undiscoverable, and is not removable, if suitable means are employed.

I would at this point, however, say this for manufacturers (many of whom have willingly adopted the best structural means they know of), that, notwithstanding their expenditures and endeavours, these have been rendered abortive by the absolute carelessness of their firemen. I have consulted our Sanitary Inspector, who has charge of the matter here, and he informs me that a very large proportion of our smoke emissions is alone due to this cause.

I remember, at a great meeting of gentlemen, deeply interested in smoke abatement, which was held in the city many years ago, the then Lord Provost, Dr. John Ure, told us how he had permanently cured the evil in his own case by adding one shilling per week to his fireman's wages, on the explicit understanding that, if his firm was in future fined for smoke emissions he (the fireman) would pay the fine. The firm was never again summoned to the Court. The cure was complete. I am not sure, however, that firemen should be bribed to do their duty. It appears to me that the penalty should, in these cases, fall upon the actual transgressor. This is the case under the Alkali Acts, in which there is a provision that where the manufacturer can satisfy the inspector that his plant and appliances are complete, and free from the flaws which tend to

permit the escape of noxious fumes into the atmosphere, the workman found responsible may be summoned to the Court and answer personally for his ignorance or carelessness. So it should be in regard to smoke pollution. Given a steam boiler or boilers, with flues and chimney, and ratio of consumption of coal compatible with a smokeless furnace, the prosecuting authority should be empowered to proceed against the fireman, or otherwise show to the satisfaction of the Court that, on account of some defect inherent in the plant, or the fuel, or because of overpressing for steam, the manufacturer was responsible. The odium of having to appear in the Court and being convicted of an offence should, in all fairness, be laid on the offending party.

I will now in a closing word refer to the domestic fire, which is by no means free from blame. I need not enter upon any argument as to the causes of our household smoke. We all know it well. The diagnosis of the disease is, as in many medical cases, much simpler than advising as to the cure.

Sir William Ramsay in 1896 proposed to demolish domestic smoke by the extensive use of coke. He alluded to the fact that at each of our large corporation gas works an enormous amount of coke or gas breeze was made, and referred to the difficulty then of disposing of the coke, on account of its weak power of ignition. Since that time, however, we know that a great demand has arisen for this material, and that a very ready sale is obtained for it all over the city. I do not wish you to infer from that, that the citizens of Glasgow could not, if they desired to do so, utilise this fuel in their grates and stoves as they do in Paris and other French cities. Those who have had the pleasant experience of residence in the French capital know how clear and brilliant the air of that city is, compared with the atmospheres of many of our cities, and that this is entirely due, as was pointed out by Sir William Ramsay eight years ago, to the nature of the fuel burned. This, he admitted, was the only plan, so far as he could see, which would lead us towards a bright and clean city, "without trampling more than need be on those very sensitive excrescences, the corns of sentiment."

On the other hand, Mr. Fletcher appeared to think that the use of closed stoves on the American system would be preferable. He spoke of his experience of the hot-air stove in the basement of his house giving a genial and general warmth throughout the whole of it, while gas fires in some of the rooms supplemented the stove, as might be required. All the cooking, he said, was done by gas, adding: "As there was a copious supply of warm air sent into the house, all draughts were outwards, so that fogs



and dust from the outside were excluded. Such an arrangement as this is an effective cure for domestic smoke, and could it be generally adopted a great change for the better would be made in the atmosphere of our towns."

I do not know that at this present day we have advanced much beyond those two views. It is true that the manufacture of gas and its utilisation, both in connection with cooking and the heating of apartments, has made very great strides during the last seven or eight years; and my opinion is that for cooking purposes alone, gas is able to hold its own, from the economic point of view, with the coal fire. It has also the further advantage of being much cleaner, and I am not aware that the fumes which arise from the gas in the process of cooking have any deleterious effect whatever upon the meat or food subjected to their influences.

With reference to the heating of our houses, or the apartments therein, during the winter season, the problem is somewhat more difficult. The British citizen likes to see his roaring fire, and takes a calm delight in poking it up every now and again, in order to make it brighter and cheerier; and, as Mr. Fletcher stated at the end of his paper, he would be "a bold man who would try to persuade a Briton to give up his open fire."

Still, the progress of sanitary and mechanical sciences, combined with the growing necessities of public health, and the keener appreciation we have, as time proceeds, of the hurtfulness of many things which aforetime were looked upon as necessary evils, leads me to the conclusion that the period may not be far distant when the gas-fire shall supersede the burning of raw coal in our grates. Its superior cleanliness alone should, one would imagine, attract every tidy housewife, were its cost so reduced that, when burning constantly for 10 or 12 hours, it would, all things considered, compare favourably with the coal fire.

I understand that its production on the Mond system has made such rapid strides that it is now coming into use in some of our large iron and steel works, where it is intended to utilise it not only for the purpose of raising steam, but also for the purpose of heating and re-heating the steel in the furnaces. The value of the by-products, viz., the ammonia and the tar separated in the process, is so great as to admit of a great reduction in the cost of the gas itself. This being the case, it seems that in all cities only one consideration stands in the way of its immediate adoption by the citizens in connection both with cooking and heating, viz., the distribution of it. It is obvious that the cost of laying new large gas mains for producing gas throughout a city would be quite prohibitive, but it appears that the resources of gas engineers are by no means exhausted,

and recently we have been learning that, by the issue of coal gas in small pipes, under a pressure of 60 or 70 lbs. on the square inch, the cost of distribution will not only be very materially reduced, but the citizens may be able to obtain, at a comparatively low rate, a sufficient supply of gaseous fuel at a reduced pressure for all domestic purposes.

Possibly during the discussion which is to follow there may be gentlemen here who can throw some technical light upon this part of the great problem of smoke production and its abatement.

In 1896 my friend Sir James Bell, then Lord Provost of the City, at the close of his Presidential Address to the Congress, said that in Glasgow the impurity of the river and of the air was the "heaviest indictment Dr. Russell had to lay against it." To-day the former of these impurities has, at great labour and cost, been so far successfully dealt with, and we have now entered upon the last phase of that gigantic undertaking, which in a few more years will finally remove a long-standing reproach from the Clyde. The trend of mechanical and chemical science, backed up by public opinion, is now in the direction of a determined attack against the other impurity. Probably it is the greater of the two, as certainly it is the more difficult to be dealt with.

It is my ardent hope that the outcome of the deliberations of this Conference upon it will do much to hasten on the time when, with a purified air, as well as a purified river, our city may proceed to attack the minor evils which still hinder her advancement towards that ideal of all sanitarians, Hygeia, the City of Health.

I should also say that we as a Corporation in Glasgow are doing very much in a quiet way to reduce smoke production and the smoke nuisance. We have some notable citizens who are co-operating with the city authorities. For instance, the Beardmore forges, out in the east end of the city, which used to be a menace and a disgrace, environed as they were by an ever-present pall of dense black smoke, display an improvement. The public spirited proprietor of those works has, for one-half of the works, already erected a gas installation for the making of electricity to provide the motive power. The other half of the works will be similarly treated within a year, and the district in which smoke was produced equal to the production by many towns of 20,000 inhabitants, will soon have a clear and pure atmosphere. But he does not do it from a solely philanthropic idea, nor altogether from the point of view of the good citizen. These qualities may be present, but that proprietor does it because it is economically sound, and because he will make money out of it. I believe in that direction a great deal more can be done.

Now, I do not like to preach without endeavouring to practice what I preach, and in connection with my own works during the last six months we have been investigating with the Thompson patent furnaces that have given results that are absolutely astonishing. One of our boilers being overpowered, was continuously emitting volumes of black smoke that made me ashamed of my calling and ashamed of my citizenship. We had tried several methods, which did not prove effective, but by putting in Thompson's furnaces we have absolutely annihilated the smoke. What is far better, I have had the statistics taken out for some time, and I may tell you that in the economical aspect, in addition to the elimination of the smoke, the installation has resulted in an increased output of 50 per cent. and an economy of fuel of 17 per cent. per pound of water evaporated. Now, that patent furnace has a future, I have no doubt, along with many others, but I do contend that what we need most is a thorough awakening of the public conscience to the evil of black smoke. We know well how the pioneers of sanitation have had to fight an uphill battle. They had to fight in a way of which we know nothing to-day. In their days the country was absolutely indifferent to the call for reform, but as men with souls, men who would have hereafter to give an account, they laboured on in the face of difficulty and in the face of opposition, and they had to do this without appreciation or even recognition. What is the result to-day? Bridge over a period of forty years, and you see the sanitary condition of the country at large raised from a slough of despair and set upon a hill. It will be the same in the end with the smoke nuisance. Progress will necessarily be slow, there will be failures attending our efforts, but I hope that from every failure we shall rise to fresh effort in a new battle. I trust the day is not far distant when our otherwise beautiful city (for Glasgow is a beautiful and stately city) will be able to eliminate smoke and fog and grime, and that it will with greater justification be described, alike in commercial progress, alike in endeavouring to bear its part worthily among the civic institution, as the Second City of the Empire.