The progress of sanitation, with special reference to the sanitary condition of our Glasgow public schools / by W.P. Buchan.

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ON

THE PROGRESS OF SANITATION,

WITH SPECIAL REFERENCE TO THE

SANITARY CONDITION OF OUR GLASGOW PUBLIC SCHOOLS.

The Progress of Sanitation, with Special Reference to the Sanitary Condition of our Glasgow Public Schools. By W. P. BUCHAN, Sanitary Engineer, President of the Sanitary and Social Economy Section of the Society.

[Summary of Paper read before the Society, 18th February, 1891.]

MR. BUCHAN briefly alluded to the attention given to the subject of sanitation from the earliest times, and referred to the ravages made by some of the great plagues and epidemics of the middle ages,* more especially to that which swept over England in 1665. Passing on to what may be called modern sanitation, he spoke of the labours of Dr. Southwood Smith and Mr. Edwin Chadwick in the cause of sanitary reform. Progress had been slow, but an impulse had from time to time been given to it by great public calamities, such as cholera, the great loss of life through disease during the Crimean war, the death of the Prince Consort, and the threatened loss of the Prince of Wales. The author then proceeded to say:—In the Crimean war, 1854-55, the loss of the soldiers in actual battle was small in comparison with the large numbers carried off by sickness, largely resulting from insanitary conditions. Of the 22,000 men lost by the British army, only 4,000 died in battle, or of wounds—18,000, or more than four times as many, dying of disease. The French army, however, lost about 100,000 men—20,000 of these in battle, and 80,000 by disease. The Russians suffered still more, as they lost about 80,000 in battle, and about 500,000 from disease.

In the American war the Northern army lost 97,000 men by battle, and 184,000 from disease; while the Southern army lost about half-a-million men—the greater number of these from disease. All this immense loss from disease is truly appalling.

As showing the beneficent power of sanitation the author referred to what occurred when the news of the disastrous condition of the British army in the Crimea reached this country. In the spring of 1855 Mr. Robert Rawlinson, C.E., was sent out as engineering sanitary commissioner—Drs. John Sutherland and Hector Gavin being the medical commissioners. On their arrival at Balaclava

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* At this period science was scorned, but Nature, that has no respect for faith based upon ignorance, took a terrible revenge.

on 3rd April, the mortality was as high as 9·61 per cent. per month. By the end of June—or in three months' time—it was reduced to 1·01 per cent., or nearly ten times less. Previous to the appearance of the sanitary commissioners on the scene, the losses of some regiments rose as high as 70 per cent. It was at this time that the Government sent out a number of trained female nurses, headed by Miss Nightingale, to tend the sick and wounded soldiers, and their advent proved a great blessing.

The lesson taught in the Crimea was not lost, for while the loss of soldiers by death in the United Kingdom was 18 per 1,000 yearly before the Crimean war, in 1878 it was only about one-third of that, or 6·53 per 1,000.

Prisons, again, which were at one time pest-houses, are now among the healthiest places in the country.

As sanitation rests upon a physical basis, when the proper means are taken, sanitary progress follows as a natural consequence. As a proof of this we have only to look upon the history of our own city previous to the inauguration of the Loch Katrine water supply, and compare that with our condition and death-rate of to-day. Cholera and typhus fever have killed or permanently injured thousands of our citizens. They raised the death-rate in 1832 to fully 46 per 1,000. In 1837, with an epidemic of typhus, the death-rate was 40·6 per 1,000; but ten years after, from destitution and insanitary conditions, the death-rate rose much higher still—namely, to 52·5 per 1,000. In 1848-49 the city had a second visitation of cholera, the probable number of cases* being about 8,000, and the deaths about half that number. In 1853-54 there was a third visitation of cholera, the death-rate in the latter year being 42·4 per 1,000—the deaths from cholera being 3,885.

In October, 1859, Her Majesty the Queen turned on the water of Loch Katrine to the city, and when, about seven years after—in 1866—cholera invaded the city for the fourth time, Glasgow was so improved in its sanitary conditions that the deaths were only 53. Three years after this, however—namely, in 1869—there was an epidemic of typhus fever giving 970 deaths, which raised the death-rate to 34·09 per 1,000.

In 1872 our Past-President, Dr. J. B. Russell, was appointed Medical Officer of Health for the City, and since then the death-

* See Dr. Glaister's paper, read before the Society on April 14th, 1886.

rate has only once reached 30 per 1,000—namely, in 1874, when, owing to an epidemic of scarlatina which caused 1,719 deaths, the death-rate rose to 31·4 per 1,000. It was about this time that Dr. Russell drew attention to the great danger arising from the contamination of the milk supply. In 1875-77 and in 1880 there were epidemics of enteric fever in the city, which Dr. Russell in each case traced to tainted milk brought from infected farms. For his work in this relation he deserves the sincerest thanks of the whole community. The average death-rate of the four years ending with 1889 was down to 23 per 1,000. For this great reduction in the death-rate—and long stride in the right direction—our thanks are largely due to the work of the Sanitary Department, and to the wise action of the City Councillors in rooting out a large number of crowded, old, and unhealthy buildings.

My remarks would be incomplete in this connection without going back a little to refer to the sanitary work of one of our former Presidents, whose experiments and investigations did so much to establish the view that sewer gases entering dwelling-houses produced disease, and that they often found an inlet there through their power of corroding and perforating lead pipes. I refer to the late Dr. Andrew Fergus.*

Following upon this, a great practical advance was made when improved systems of disconnecting the house drains from the public sewers were introduced, and also of properly trapping and ventilating said drains and the soil and waste pipes leading into them, and, further, when the system was invented of testing drains and soil pipes to detect leaks by means of smoke. The smoke test is now an established and recognised factor in sanitary work, acknowledged in our laws, and in constant use, while suitable mechanical contrivances for applying it have rendered it very easy and effective.†

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* He died 30th July, 1887. See his Memoir by Dr. Duncan, p. 245 of the Society's *Proceedings*, Vol. XIX.

† The first time I remember of applying the smoke in a drain was at the end of April, 1875, at 128 Renfield Street, Glasgow, when the old buildings were there. The first Buchan's intercepting drain trap—made hurriedly of metal—was put in there, and on its house side some smoke-producing stuff was burnt, so that the smoke went into and along the drain (which was under the floor of the house) and up the soil pipe, and out at the top of its air pipe above the middle of the roof. Leakage in the drain was indicated by the smoke appearing inside of the house. The smoke-machine testing for the drains was introduced by me shortly after this.

If sanitation is to progress we must continue to use the proper physical means for that purpose. Some of you will remember that when Lord Palmerston was asked to proclaim a national fast-day on account of a visitation of cholera, he declined to do so, telling the people that the fault lay with themselves, and that they were to set to work to whitewash their houses, and clear away the filth that lay about them. Charles Kingsley said:—"As a clergyman, I feel bound to express my gratitude to Lord Palmerston for having refused to allow a national fast-day on the occasion of the present reappearance of pestilence, and so having prevented fresh scandal to Christianity, fresh excuses for the selfishness, laziness, and ignorance, which produce pestilence, fresh turning men's minds away from the real causes of this present judgment to fanciful and superstitious ones. It was to be hoped that after the late discoveries of sanitary science, the clergy of all denominations would have felt it a sacred duty to go forth on a crusade against filth, and so to save the lives of thousands, not merely during the presence of cholera, but every year."

While the carrying-out of house drainage may be said to have now risen to the dignity of a science, there is still much to do before a satisfactory solution of the disposal of the sewage problem has been reached. In my opinion the East-End purification experiments should not have been undertaken, but now that they have been decided upon I think they ought to get a fair trial; while, to enable a proper judgment to be got of the condition of the effluent, I think the weir ought to be rebuilt. This would not only enable that to be better done, but also give better facilities for boating. The state of the river at the Green for years back has been very bad.

While great strides have been made in sanitary progress in many departments, there is one in which we have lagged behind very much. I allude to the ventilation of our buildings. Whether it be houses, churches, halls, or schools, we are still far from being up to the mark as regards this. Few houses have any systematic means for ventilation provided, while the condition of many churches must be very disagreeable to the worshippers, and in many cases not very creditable to them. Then, as to halls, few of them are properly ventilated. Our own City Hall has been again and again complained of in the public papers lately.

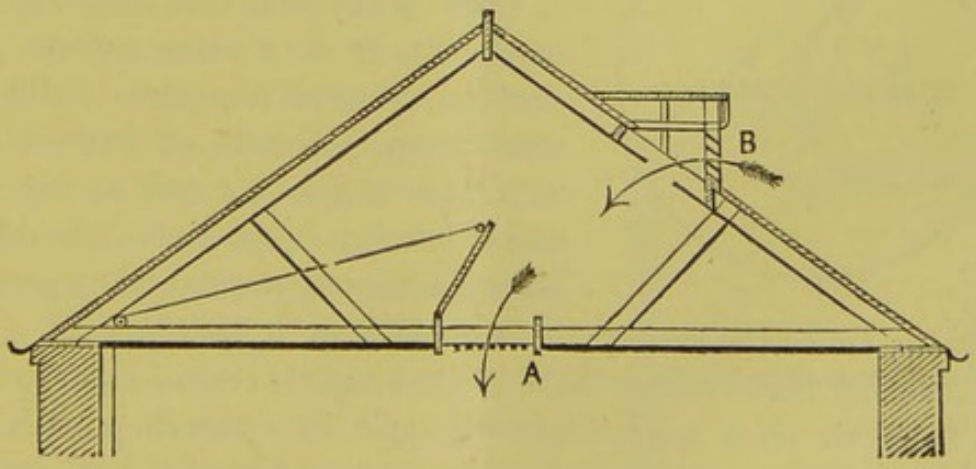
But I wish to speak more particularly to-night of the ventilation of our public schools. On 16th November last Sir John Neilson

Cuthbertson was chairman at a meeting held at the opening of the new School Board School in West Street, Calton, and in presence of the Right Honourable the Lord-Advocate, who was also there, he said :—" In Glasgow they had had no experience of the shoddy work which was alleged to have been passed off on other Boards. After seventeen years he could say that not one of the schools erected had proved anything but satisfactory."

Now, there is no doubt that, looking at many of the new Glasgow schools from the outside, they are palatial buildings, but I am not sure that they could stand a searching scrutiny in every particular.

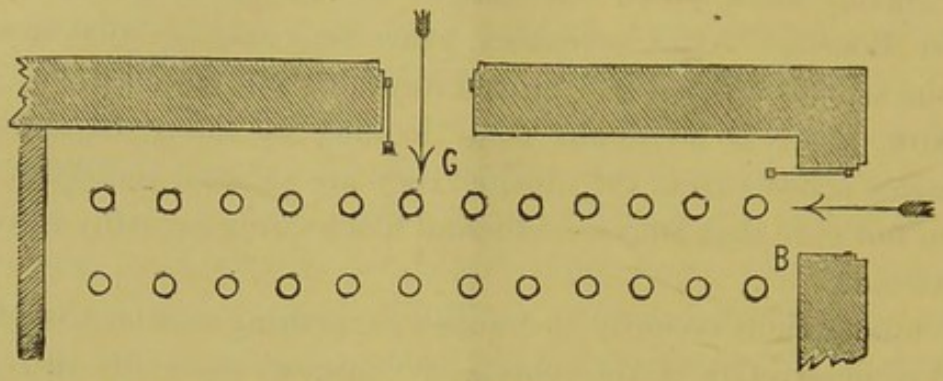
I was anxious recently to publish something commendatory as well as descriptive of the schools of Glasgow, especially in regard to their ventilation. For this purpose I visited a number of them. Some of these are under the management of Glasgow School Board and some are not. I have to thank the teachers of the schools for their courtesy on the occasion of my visits. A few of them were satisfied with the condition of the air in their school-rooms, but the great majority complained strongly of the imperfect ventilation.

In regard to the first one visited I found on more than one occasion in the afternoon that the air was close and disagreeable, and I learned that unpleasant results were experienced from down-draughts when the wind blew against the face of the ventilator. That it could not be otherwise will at once be evident from the diagram, where A, in the accompanying figure, shows the intended outlet in the ceiling, and B the " ventilator " on the roof.



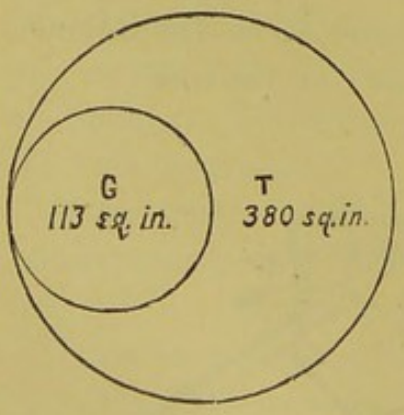
Taking another school, which I understand was erected by the Board nine years ago, the provision for its ventilation when I visited it in September, 1890, was, in my opinion, unsatisfactory. The

rooms on the ground floor had no pipes for carrying off the vitiated air from the ceilings, while the fresh air was admitted by gratings and windows, which latter hinged to open inwards, as shown at B and G in the diagram. The upstairs rooms, while having their



windows also hung in casement fashion, to open inwardly, have each a pipe off the ceiling, although said pipe is much too small, and especially for the larger room, which has only a 12-inch diameter outlet-pipe (equal to 113 square inches) for 110 children. This gives only about 1 square inch of outlet for each pupil.

Contrast with this a new school at Galashiels, which has an outlet-pipe equal to about $3\frac{1}{2}$ square inches for each pupil, and with provision against down-draughts. At another school in Haddingtonshire the largest room, intended for 110 pupils, has an outlet-pipe 21 inches in diameter, or fully three times the area of that in the Glasgow school referred to. The subjoined diagram will give an idea of the relative sizes of the pipes, the *smaller* circle indicating the Glasgow allowance!

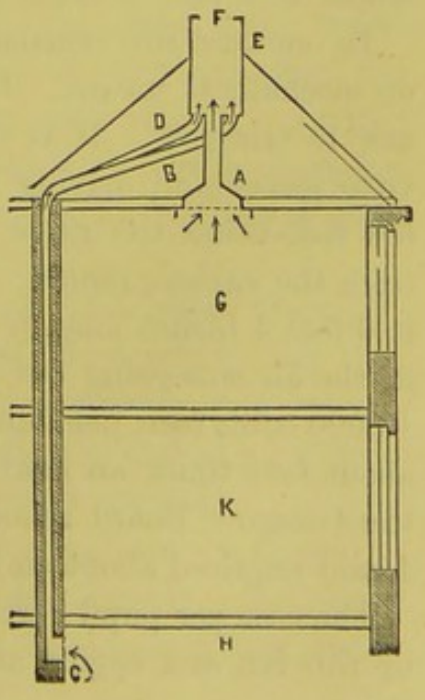


With great care and attention the teachers may do a little towards preventing some of the evils liable to ensue from this state of matters, but it is neither fair nor safe to lay this extra burden upon their shoulders. Health is the only capital many persons possess, hence the greater sin to cause them to lose it.

Another Board school that I visited had its provision for letting in fresh air on a much improved style in comparison with the last. The incoming air takes an upward direction, and can be heated. The provision for carrying off the vitiated air from the ceiling is very much too small, however, being only about $1\frac{1}{4}$ square inches for each pupil. A newer public school, one opened

last summer, was afterwards visited by me. The air in most of the rooms there was not what it should be, the provision for carrying off the vitiated air being both too meagre and badly arranged, so that in some of the rooms the windows were open from the top a considerable distance, allowing, as I considered, the cold winter air to blow down upon the children in a way to to be very uncomfortable and dangerous for them. When I shut the windows and tested the speed of the air up the outlet-pipes, which at the top are about 9 inches in diameter, it was very sluggish : for example, on October 17th, 1890, in the ground flat, north-east room, with three windows 5 inches down from the top, and which had two outlets in the room, the speed of the outgoing air was only 80 linear feet per minute. In the south-east room, one stair up, which had 84 pupils, and in which three of the windows were 9 inches open, the outlet speed at 18 inches by 12 inches outlet was only 70 linear feet per minute, but at the other outlet, 9 inches by 9 inches, it was 115 linear feet per minute. At the rate at which the air was going out from one of the rooms I calculated that it would take about an hour and a half to change the air—or rather to empty a roomful of it—once.

In three of the large new Board schools, opened in Glasgow last year, the style in which the provision for carrying off the vitiated air is carried out, is, in my opinion, not only very bad, but also far too meagre. A wind-acting exhaust ventilator is set up above the roof, and is made to do service for several rooms on different flats, and in some cases, as indicated in the sketch here shown, the largest branch pipe into the main pipe of the ventilator is from the room in the top flat near it; while the pipes from the rooms farther away are smaller and have one or more bends in them, so that often, and especially when there is little wind, the ventilator may get almost its whole supply from the larger pipe of the room in the top flat near it (especially if its windows are open), while scarcely any current is coming up from the rooms below. This happens all the more because the vertical shafts from the lower rooms (K and H) are rough



passages in the brick walls, while the shaft (A) from off the ceiling of the top-flat room (G) is a smooth galvanised iron or sheet zinc pipe.

When I experimented in Washington Street new School the outlet in a top-flat room indicated about 450 lineal feet per minute, but when I went down to one of the lower rooms, I had great difficulty to get an indication of as much as 40 feet per minute. I pointed out this most unsatisfactory state of matters lately to the School Board officials.

I also examined the new schools in Napiershall Street and the one in West Street, Calton. The provision for carrying off the vitiated air from both is much too little, and in a number of the rooms is done on the principle I have sketched above, and which, in my opinion, is very defective. The style of the fresh air inlets is also open to improvement.

It is likewise right to point out that in a number of cases the intended wind-acting exhaust ventilators are actually set up *below* the ridge, so that when they are on the lee side of the roof the wind cannot get at them to help them to work, while, when they are on the windward side, the tendency is for them to allow down-draughts very readily.

I have been speaking principally about the schools under the Glasgow School Board and some not so, all which are nominally ventilated by natural or automatic means; but there are a few schools in Glasgow, however, not under the Glasgow School Board, which I ought to refer to before closing, as their ventilation in whole or in part is much better than those I have been describing.

In one case the ventilation is aided or carried out by artificial or mechanical means. In my opinion this is the best school I saw in Glasgow. It is ventilated by means of a 2-horse power Otto gas-engine, driving a 48-inch diameter Aland's fan, placed a few feet below the ridge of the roof. The fan extracts the air from the various rooms. The main outlet at the ridge of the roof is 6 feet 4 inches long by 2 feet 6 inches wide, and, when I tested it, the air was going out at a speed of fully 1,000 lineal feet, or 16,000 cubic feet, per minute—the air being changed in the rooms about four times an hour, which is six times oftener than that of the Glasgow Board school-room, automatically ventilated, which I said required about an hour and a half to change the air once.

The cost per pupil for a whole year of the expense of keeping up this fan and engine at this three-flatted school (of, say, 1,000

pupils) is only about fourpence each. The school being at Hillhead is under the Govan Board.

A country school of only one flat may be well ventilated automatically quite easily, but this is not the case with large three-flatted schools, like many of those in Glasgow. The ventilation of the new part of the Allan Glen Technical School is effected by means of a large chimney stalk into which shafts or flues from the various rooms are joined. The chemical class-room has two flues along its ceiling leading into the chimney, one fully 30 feet long, and the other, square in section, about 80 feet long. Each flue has a number of inlets into it. The results of tests I made with these have been rather interesting. For example, the speed at which the air passed into the end opening of the 30-feet flue was 700 lineal feet per minute, but the speed at the far end of the 80-feet flue was only 30 feet per minute; at the third opening from the far end, 140 feet; at seventh opening, 370 feet; at ninth, 570 feet, the nearer the chimney, the quicker. This backs up my condemnation of the joining of pipes from the lower flats of a school into the same wind-acting ventilator that serves for the top-flat room, and especially when the pipes farthest away are the smallest.

In a South-Side school, lately ventilated by motive power, when I examined it, the air from a large room near the fan was going out at the rate of 1,200 lineal feet per minute, which kept the room air pretty good, but when I entered a larger room which had the same size of piping from it, the air was very bad. The reason was, that not only were there more pupils in this room than in the other, but the air, owing to the room being much farther from the fan, was only going out at 600 lineal feet per minute, or half that of the smaller room near the fan. In this case the piping, instead of being only about 9 inches diameter, should have been, at least, 14 inches diameter for the larger room farthest from the fan.

With regard to the character of the air in schools, Professor Carnelley wrote me, a few months before his death, to say that he intended to test the air in the Glasgow schools, but he was suddenly cut off before he could accomplish it, and so a brilliant career was closed, to the great loss of sanitary science.

In conclusion, I have to say that this subject of improved ventilation must be kept before our School Boards. No doubt they have been animated by a desire to do the best they could,

according to their lights, for the health and comfort of the children entrusted to their charge, and it is with regret that I have found it necessary to point out serious defects in their buildings, especially in this matter of ventilation. It is to be hoped, however, that as more attention has been given to this matter of late, and improved ways of doing the work are being introduced, that our own School Board will yet look carefully into this highly important subject, and for the sake of all concerned, do what is necessary to improve the atmosphere of the schools. When that is done I shall have much pleasure, in some future address or publication, to give expression to my heartiest commendations.