THE SAFETY OF GAS FIRES IN REGARD TO CARBON MONOXIDE.

BY

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At times alarm has been expressed in connexion with the use of gas fires as to the probability of chronic poisoning arising from inhalation of carbon monoxide. In a pamphlet published recently by a medical officer of health of a large city, and circulated at the recent Smoke Abatement Conference, this view was put forward definitely, but without supporting evidence.

We thought it worth while, then, to carry out a few experiments to see whether we could put this fear at rest and remove any antagonism against the wider use of smokeless fuel which is necessary in order to secure freedom from smoke pollution of the air and an adequate supply of the health-giving ultra-violet rays. Carbon monoxide has no poisonous effect other than that of combining with haemoglobin and depriving the tissues of oxygen.

Blood taken and diluted to 1 in 200 parts of distilled water afforded a standard transparent solution of haemoglobin: when placed in the narrow test tube of the Gowers-Haldane haemoglobinometer and viewed against a white background by daylight, it appeared yellow-red as is characteristic for this dilution and width of containing tube. Saturated with carbon monoxide by shaking with coal gas the tint of the solution under the same conditions is carmine. Partial saturations vary from the yellow-red very slightly tinted with pink up to the full carmine colour.

Experiment 1.

A balloon was filled with a measured volume of air by means of a blower fan and meter, and enough coal gas introduced to give 1 in 1,000 parts of air. A sufficiency of the standard solution of haemoglobin was placed in a tube 6 inches long and 1 inch in diameter, which at each end was closed by a cork through which a narrow tube was inserted. The tube was held horizontally so that the solution of haemoglobin lay from end to end along its floor exposed in a shallow layer to air above which was drawn through the tube in a steady stream through the narrow tubes, one of which was connected to the balloon, while the other was suitably attached to a suction fan driven by an electric motor. During half an hour 670 litres of air from the balloon was drawn over the haemoglobin solution. On comparison with the control solution (kept in pure air) this solution gave a just perceptible change in tint, indicating a very slight formation of carbon monoxide haemoglobin.

Experiment 2.

Two parts of coal gas per 1,000 of air were then put into the balloon and the experiment repeated. After thirty minutes a slight but quite definite carmine tint was clearly seen on comparison with the control.

Experiment 3.

The experiment was now arranged so that air was drawn from the neighbourhood of a gas fire, a position being chosen where a person's face would be who sat down by the side of a fire in order to warm his legs. The gas fire 12 inches wide was of the modern type and properly flued, being built into a chimney, and was turned full on. During one hour 760 litres of air was drawn over the standard haemoglobin solution. No perceptible change in tint resulted.

The solution was reintroduced and the experiment continued for another eighty minutes. No change in tint resulted after 1,304 litres in all had been drawn over the blood. A resting man breathes on the average about 6 to 7 litres of air a minute, or the above amount in a little over three hours. More air was then drawn over in the two hours and twenty minutes' observation than a man would breathe.

Experiment 4.

An experiment was arranged so that air, in place of being drawn over, bubbled through the standard haemoglobin solution contained in a flask. In this case the rate of ventilation was about 150 litres an hour. The air was drawn from the neighbourhood of another gas fire in a different room, but of similar type and properly flued. No indication of carbon monoxide escaping into the room was found in this case.

Experiment 5.

This experiment was repeated on a windy day when possibly there might be some down draught in the flue. No evidence of carbon monoxide was obtained.

Experiment 6.

The experiment was repeated on a gas fire arranged in the grate of an ordinary open fireplace, the fumes from the fire escaping up the open chimney above the fire. No evidence of carbon monoxide escaping into the room was obtained.

Experiment 7.

The experiment was repeated with this variation, that a door adjoining the gas fire was set open to create a draught between door and window across the neighbourhood of the fire. The result was negative.

Experiment 8.

The experiment was repeated and varied by placing a small electric fan to blow across the gas fire to where the inlet to the sample tube lay. The fan blew across the warmed strata of air which lay in front of the fire, and this warm air was perceptible to the face when placed near the inlet tube and gave one at once a stuffy feeling. No evidence of carbon monoxide escaping into the room was found even in this extreme condition of artificial side draught, which might be expected to blow fumes into the air.

Experiment 9.

To make the conditions as severe as possible, four *flueless* gas stoves of various types were placed in a small room about 12,000 cubic feet in capacity, and the door and window closed. The stoves were lit and a mouse placed on the table in the room. After two hours the temperature of the air at head level was 100° F. dry bulb, and 87° F. wet bulb, and the room on entrance felt at once stuffy. The mouse's blood showed 16½ per cent. of carbon monoxide haemoglobin.

The difference between inside and outside temperatures set up enough natural ventilation through the crannies of door, window, and up the chimney to prevent very serious contamination of the air with carbon monoxide in this extreme case, showing how small is the amount of this gas arising from Bunsen flames burning in modern gas fires. The touch of heated air to the face on entering such a room is unpleasant, while the breathing of the heated air, which contains traces of sulphur acids, congests the nose and gives a stuffy feeling. At the same time cold feet may arise from the draught, cool air entering beneath the door. Gas fires should, then, always be properly flued.

No flueless gas burners or stoves should, of course, be used in *sealed-up* places where natural ventilation is almost *nil*. In such sealed-up places carbon monoxide may collect in dangerous amounts if cold surfaces are brought in contact with Bunsen gas flames so as to check combustion.

ROYAL COMMISSION ON LUNACY AND MENTAL DISORDER.

EVIDENCE OF THE MENTAL HOSPITALS ASSOCIATION.

On March 10th evidence was tendered to the Commission on behalf of the Mental Hospitals Association by Alderman J. C. Taggart, J.P., of Liverpool, and Alderman Sir William Hodgson, J.P., of Crewe.

Alderman Taggart said that his association desired to eliminate the pauperization element which at present entered into lunacy administration. Were it not for their illness, less than 5 per cent. of the persons afflicted with mental disorder would be pauperized. He urged that instead of sending cases of incipient insanity to a Poor Law institution, it ought to be possible to admit them to hospitals supported by the public health authority, in the same way as fever cases and cases of tuberculosis were admitted. Mental ailments should be dealt with as one of the classes of disorders for which public health authorities had to make provision in the same way as for tuberculosis or for the treatment of venereal diseases. He was sanguine that this would prevent a very large number of persons from going on to the asylum. Such clinics would be clearing houses, relieving the asylum population, and would receive out-patients as well as in-patients. In Liverpool he thought this provision could be made with very little extension of existing accommodation at the hospitals which were provided wholly or partly by the public authority, and, indeed, a scheme might be worked out for the whole of Lancashire, and perhaps for a group of counties. In each county—or, in the more sparsely populated parts of the country, each group of counties—there should be a central clinic to which the patient might be brought. Clinics at present under the control of the public health authorities were supported by grants from the State up to 50 per cent., the remainder being supplied by local taxation, and he took it that the grant would be made for mental clinics as well. In Lancashire 11 per cent. of the entire population of asylums was discharged annually, but of the cases admitted during a year 33 per cent. were discharged within twelve months of admission. He would have a modified form of provisional order, similar to that required for notification and removal in the case of infectious diseases. The witness caused some amusement by insisting on minimizing, although himself a justice, the value of the judicial functions in relation to insanity; he declared that the medical authority must be the governing one. He also put forward his views with regard to discharges. At present it was possible for three members of the visiting committee to discharge a patient even without the medical superintendent's consent. In Liverpool this arrangement had worked disastrously in one instance, where ten patients were discharged in this way by three members new to asylum work,