

One has only to glance at column 6 of the preceding table to see how closely the figures correspond. The figures are the average amounts in grms. of CO<sub>2</sub> (moist) excreted per kilo: per hour by the various experimenters who had worn all the four types of rescue apparatus. The maximum is 1.5, the minimum 0.87 grms. Out of 11 cases no less than 9 are between 1.5 and 1.1 grms. In corroboration of the figures in column 6, we may take the averages of the amounts of CO<sub>2</sub> excreted by eleven of the observers in each of the instruments in turn thus:

In the Fleuss 1.25, in the Meco 1.28, in the Weg 0.96, in the Drager 1.14 grms. CO<sub>2</sub> (moist) per kilo: of body-weight per hour.

The probable physiological inference from this is, that although the intensity of the oxidation of carbon is affected in both directions by a number of external and internal conditions, yet by hard work and maximal supply of oxygen, an intensity can be attained as a result of which the CO<sub>2</sub> excreted per unit of tissue is within very narrow limits the same for everyone under the same vigorous external conditions.

#### VII. *The Effects of Heat Generated in the Apparatus.*

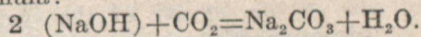
Towards the end of a test the temperature of the regenerators in the Drager, Meco and Weg and of the bag of the Fleuss tended to rise to a degree distinctly uncomfortable to the wearer. This tendency is, of course, particularly well marked when the test has been conducted in a hot atmosphere. The heat complained of is liberated by the union of aqueous vapor and CO<sub>2</sub> with the alkali of the regenerators. Whilst this heat of chemical origin is rapidly lost by radiation in atmospheres not above 70 degrees F., it is lost with increasing slowness as the temperature rises towards 90 degrees F. The heat from the "cartridges" on several occasions became so intense as to burn the skin of the back of the experimenter even through a flannel shirt. Thus on June 21st, 1910, C, wearing a Drager for 76 minutes, had his back badly burned; the temperature of the cartridges was over 200 degrees F. Subsequent observations showed temperatures as high as 201 degrees F. on the outside of the cartridge. After wearing a

Meco at the end of a test of 53 minutes' duration, J. had his back pretty seriously scorched. In both these cases the irritation to the skin lasted a couple of weeks. At the end of the test (120 minutes), on November 15th, 1910, B. had his back burned: he had not been doing work, but merely recording temperatures. On many occasions the discomfort from hot cartridges was considerable, although no permanent reddening of the skin had been produced. Complaints also were constantly being made towards the end of a test of the heat caused by the bag of the Fleuss.

Besides suffering from burns of the skin, the experimenter towards the close of a test frequently complained of the excessive heat of the air returning to his throat from the regenerators.

During the test on June 7th, 1910, D., while wearing a Fleuss, had his throat badly scorched; the temperature of the abdominal aspect of the canvas bag being 135 degrees F. when he came out of the mine after 147 minutes. On this occasion the dry bulb readings were very high, viz.: 103 degree, 106 degrees, 106 degrees F., at 12.10, 12.30 and 1.30 respectively: the atmosphere of the mine was full of smoke and irrespirable.

On November 15th, C. had a disagreeable condition of his throat after wearing a Fleuss apparatus for only one hour; but minor degrees of pharyngeal catarrh were being constantly reported. It seems that the cause of this distressing sensation of heat in the throat is due to the excessively moist condition of the air returning to the experimenter during the later stages of a test. The circulating, constantly re-breathed air must tend to become saturated with moisture in these apparatuses, for not only is aqueous vapor from the lungs being in diminishing amount absorbed by the alkali—and the expired air is always saturated—but the union of CO<sub>2</sub> with the NaOH forms water according to the formula:



A physical factor comes into play after a short time, for the moisture soon "cakes" the adherent sticks of NaOH and thus reduces their absorbing surface with the result that less and less water vapor is retained by the alkali and more and