board boxes on the market, although they are somewhat wider, which cost thirty cents.

The advantage of the open back and top is to remove any limit to the size of the reprints filed. The shelf dimensions with such a box constitute the only limit. The width of the box is its best feature. It is broad enough to stand alone and to permit labeling on the outside which is easily read with the box on the shelf. (Dennison No. 205 labels can be pasted on the outside.) On the other hand, the box is so narrow that it is very little work for one to go through all the reprints in a single box. For this reason it is not necessary in returning a reprint to the box to remove the other reprints and place the particular one with respect to the others. It is enough for one to know that the reprint is in a given box in order to find it quickly.

The small box also allows readily for the expansion of the series at any point, and for the collection of small groups of papers on a given subject or by a given author into a single repository appropriately labeled.

At present I have about 1,800 reprints filed by author in 210 of these boxes. With this distribution the boxes are not full and there is room for considerable expansion without the introduction of new boxes.

EDWIN G. BORING

HARVARD UNIVERSITY

THE PROFESSOR AND HIS WAGES

UNDER this caption appears an article in SCIENCE for August 24 that well illustrates the danger of theorizing without that judgment and knowledge of "how much" that only experience in the field dealt with teaches.

In the first place, the profits assumed for the merchant are much beyond the average, the orderly progress of success rarely exists and the incident worries and troubles and resourcefulness necessary to turn corners are hardly suggested. The risk of capital is quite lightly dismissed. Professor Slosson would doubtless be much surprised to learn that an insurance company, which attempted to underwrite this risk for all those starting in business for themselves, for a 50 per cent. premium, would inevitably bankrupt itself. Yet such is the case.

Of those who attempt business for themselves, even though they have more initiative and self-reliance than the average, fully 90 per cent. are failures and forced to drop out, generally with their capital completely used up. Men, therefore, who succeed in business for themselves, belong to the most severely selected class in the world and certainly not one professor in ten could stick in it. Apply the same severity of selection and the great majority of professors, lawyers, doctors, etc., would drop out, as the majority of business men have. The average professor, then, should not be compared with the successful business man but rather with the latter's employees.

There are, rarely, professors with a genius for teaching—for imparting knowledge—that do work of value hard to estimate and all too little appreciated, and other rare research professors whose work is of inestimable value. These, unhappily, must needs be ill rewarded, largely because but few can appreciate their work or appreciate it during the life-time of the men. Unless a bit sensational, it makes small appeal to the public. But as for the majority, like the great majority of other classes, they get all they are worth to the community. But few of these audible books benefit the community as much as average clerks because their efforts are not directed and coordinated from outside as are those of the clerks.

FRANCIS RALSTON WELSH

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SCIENTIFIC BOOKS

Eighth Report[1] *of the Committee for the Investigation of Atmospheric Pollution. Reports on Observations for the year ending March 31, 1922.* London, 1923.

THE people of London and its environs wash their clothes on Tuesday and themselves on Saturday night. Thus the veil of domestic privacy is ruthlessly torn aside and the secrets of home life no longer held *in camera*. Which is characteristic of this age, for nothing now is hidden. Even the secrets of the structure of matter are pried into, electrons being knocked about by inquisitive physicists; and snug little constituencies known as atoms completely upset and disturbed by some high speed atomic nucleus.

We can prove that the good people of dear old London take their weekly tubbing on Saturday night, because there is a suspicious increase in the number of smoke particles in the air over London at this hour; and these undoubtedly come from domestic fires, lighted or kept going for the purpose of providing sufficient hot water. The Advisory Committee on Atmospheric Pollution have traced such inequalities in the load of suspended impurities to various sources and find that the common dwelling house chimney is the chief offender; even in cities regarded as manufacturing centers. It is not to be wondered at either, for *en masse* these little smokers pour out a vast volume of products of imperfect combustion.

This Eighth Report is the most ambitious effort yet made and shows that the Committee is getting into its stride and obtaining results of great value. The work differs from most pieces of experimental work in

[1] Previous reports have been reviewed in SCIENCE, June 2, 1922, April 22, 1921, and November 28, 1919.

chemistry or physics, in that it is carried on, not in a university laboratory, but in the larger laboratory of out-of-doors and the results therefore are applicable without regard to scale and other uncertainties.

The work done during the year falls under eight sections, namely, (1) the monthly amounts obtained by standard gages, tabulated and analyzed; (2) new type of gage; (3) influence of a Nipher wind shield on the amount collected; (4) the Rochdale deposits; (5) the automatic filter; (6) a jet apparatus for the isolation and examination of atmospheric dust; (7) researches on obscurity and visibility; (8) relations with other organizations.

Thirty-one gages were operated during the year, of which 8 were in London. Data are now available for five years, in many cases, and so comparisons can be made with a view of getting monthly or seasonal departures from mean conditions.

The old unit for amount of deposited matter, namely, the metric ton per square kilometer, has been altered to simplify printing. The amounts heretofore given to two decimal places have been multiplied by 100 and can be read as metric tons per hundred square kilometers and the same figures express the weight in grams over 100 square meters. The gram per square dekameter, $gm/(10m.)^2$, seems to be a practical and economical unit.

The year was one of exceptionally fine, clear weather; and also there was a coal strike from April 1 to July 4. The amounts of pollution are below the average and the influence of the coal strike can be clearly traced.

An interesting point brought out by the Rochdale experimental records, is that the impurity of the air is not particularly due to an influx from neighboring polluted areas. By means of twin gages, one collecting material brought by east winds and the other by west winds, it is shown that the high deposit at this place is not due to impurities carried into town by the west wind.

Again during the stoppage of coal and the closing down of factories, duplicate gages made it plain that factory smoke was responsible only for about 66 per cent. of the pollution.

A rough estimate is

Dust 15 per cent.
Factory smoke 66 per cent.
House smoke et al. 19 per cent.

Many interesting graphs are given showing conditions on foggy and non-foggy days.

There is a detailed description of the new jet apparatus dust counter of Dr. J. S. Owens, an instrument which is within reach of the laity.

Near the end of the Report there is a handy bibliography of dust investigations.

ALEXANDER MCADIE

SPECIAL ARTICLES

THE INFLUENCE OF THE TEMPERATURE OF THE SOIL ON THE RELATION OF ROOTS TO OXYGEN

THE rate of root growth of land plants, under normal conditions of aeration, is known to be influenced by the temperature of the substratum in such manner that there are three well defined temperatures of growth, namely, the highest at which growth is possible, the temperature at which growth is most active, and the temperature below which growth ceases. Under conditions of a diminished supply of oxygen, however, these cardinal temperatures of growth appear to be greatly modified. This feature has physiological and ecological bearing of some interest.

In *Potentilla anserina,* which occurs in swampy ground, with the roots in 1.2 per cent. oxygen and the balance nitrogen, the growth of the roots is various. Thus at 27° and 30° C. growth does not take place, but at 18° it is about one fourth normal for that temperature. When given experimental atmosphere containing 2 per cent. oxygen the growth rate is about one fourth normal at 30°, one third normal at 27° and normal at 18° C.

In a garden variety of corn with roots in 3 per cent. oxygen the effect on the rate of growth is quite as striking as in the case of Potentilla. For example, at 30° it is about one sixteenth normal, 20° it is about one fifth normal and at 18° it is about one third normal. When the percentage of oxygen is increased to 3.6 the rate of growth is much increased. For example, at 30° the rate is about one third the expected rate under normal aeration conditions, while at 18° it is about two thirds normal. While in 10 per cent. oxygen the rate at 30° is about nine tenths normal and at 18° it is normal.

In the two species referred to, and the same is true of several species studied, the relative rate of root growth, that is, the rate under given oxygen conditions as compared to the expected rate in normal conditions of aeration, decreases with the increase in the temperature of the soil. It can be seen, therefore, that there comes a point in the diminution of the oxygen content of the soil atmosphere when the growth of the root ceases because it is no longer sufficient to supply the demands for energy correlated with physiological activities of higher temperatures. The diminution of the oxygen supply of a consequence becomes a factor limiting the growth of the root, and which, as the above citations indicate, may have specific value.

Some observations on modifications of the cardinal temperatures for root growth resulting from deficiency of oxygen indicate that the conclusion as stated in the preceding paragraph may in some manner in-