## Letters to the Editor.

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### Distribution of Sizes among Rain-drops.

COL. GOLD'S article in NATURE of April 30, p. 654, has prompted us to communicate the results of some observations which we have made of the size of rain-drops. The work has had to be discontinued for the moment, but possibly the results, incomplete as they are, may be useful to other workers in this field.

The accompanying diagram (Fig. 1) shows the distribution of sizes among 3026 rain-drops observed between Oct. 1924 and June 1925. The method of measurement was that described by us in the *Proc. of the Royal Dublin Society*, vol. 17, p. 1, 1922. The rain-drops measured by Defant (*Akad. Wiss. Wien, Sitzungsber.*, **114**, 2a, p. 585, 1905) are for the most

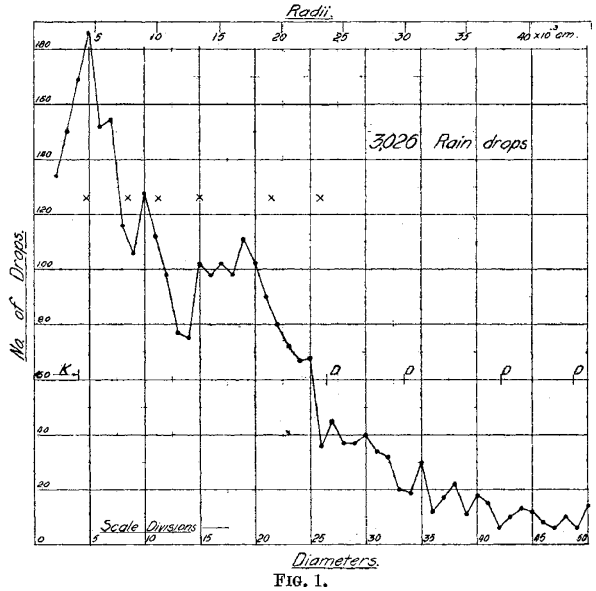


FIG. 1.

part larger than those observed by us. For the range in which our observations overlap, we have marked the sizes which Defant found of most frequent occurrence (*D*, *D*). The range of Kohler's observations on mist particles ("Geofysiske Publikationer," vol. 2, No. 6, Kristiania, 1922) is also indicated on the left of the diagram (*K*).

It was suggested to us that the peaks on our curve of sizes might be due to the tendency, in measurements of this kind, for the readings to group themselves round the fives and tens of the scale employed. We therefore undertook a further series of measurements with a magnification about 1·8 times that previously employed. Observations on 909 drops gave a curve on which only one peak out of many coincided with a multiple of 5 scale divisions. Apart from the maximum at radius $4 \times 10^{-3}$ cm., the general correspondence of the curves was not very satisfactory. The positions of the principal peaks on the second curve are indicated (*X*, *X*). It is evident that a great number of observations must be accumulated before definite conclusions can be arrived at.

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### The Supposed Law of Flame Speeds.

ON behalf of my colleagues and myself, I desire to submit the following observations upon the letter from Dr. Payman and Prof. Wheeler on p. 779 of NATURE of May 28 about our recent experimental examination (*Proc. Roy. Soc.*, A, **114**, pp. 404-449) of their supposed 'law of flame-speeds.'

It is true that in a paper entitled "The Interpretation of the Law of Speeds" (*Trans. Chem. Soc.*, **123**, pp. 412-420; 1923) Dr. Payman had explained that "the fact that the rate of reaction must also depend on the concentrations of the reacting gases results in small divergences from the law when the oxygen is in deficit," and that "the correction necessary to allow for this cannot be correctly estimated, but the general effect of this factor is to make the speeds of the uniform movement of flame in complex mixtures rather slower than the speeds calculated from the law of speeds." Such qualification—which was fully quoted and set forth in our Royal Society paper (*loc. cit.* p. 421)—implied only *small* divergences from the 'law,' that is, *rather slower* flame speeds than it would predict; but by no stretch of language can it be held to cover deviations of such magnitude as were discovered during the flame-speed tests described in our recent papers.

The statement that the principal hydrocarbon mixtures chosen for our blending tests were of acetylene or ethylene with oxygen, and that the choice was made *because* such mixtures are 'so sensitive' is incorrect, as will be seen from the following catalogue of the different pairs of primary mixtures (*A* and *B*) actually used in our blending tests:

| | *A* | | *B* | Flame speeds, cm. per sec. |
|---|---|---|---|---|
| (1) | 64·4 $C_2H_2$/35·4 $O_2$ | and | 83·1 $H_2$/15·4 $O_2$ | 1400 |
| (2) | 12·35 $C_2H_4$/87·5 $O_2$ | and | 38·7 $H_2$/61·2 $O_2$ | 2190 |
| (3) | 49·9 $C_2H_4$/49·9 $O_2$ | and | 92·5 $H_2$/7·4 $O_2$ | 180 |
| (4) | 55·45 $C_2H_4$/44·35 $O_2$ | and | 93·45 $H_2$/6·45 $O_2$ | 75 |
| (5) | 53·2 $CH_4$/46·5 $O_2$ | and | 92·9 $H_2$/7·0 $O_2$ | 115 |
| (6) | 11·05 $CH_4$/88·95 Air | and | 71·9 $H_2$/28·1 Air | 64 |
| (7) | 11·5 $CH_4$/88·5 Air | and | 72·6 $H_2$/27·4 Air | 51 |

Of these seven pairs of primary mixtures, only (1) and (2) can be regarded as in any way 'sensitive'; the remaining five (which, be it noted, showed the greatest deviations from the 'law') were certainly not so, as their quite moderate flame speeds indicate. Also, in the last three series of blending tests the hydrocarbon used was neither acetylene nor ethylene but methane; and in the last two the supporter of combustion was not oxygen but air. Indeed, the last three series of blending tests were made because Payman and Wheeler had declared that such complex methane-hydrogen-oxygen (or -air) mixtures obey the 'law.'

Readers of NATURE who may be specially interested in the subject will doubtless study for themselves the evidence contained in our paper, and we will leave them to form their own conclusions upon it. For those who have not time to do so, we need only say that, although the test applied to the 'law' in our experiments was the one prescribed by its authors, in not a single instance was the 'law' obeyed. Indeed, in all but one case (and that with the rather 'sensitive' acetylene-hydrogen-oxygen blendings), it broke down utterly.

Our conclusion against the general validity of the 'law' was chiefly based upon the following facts, which are in direct contradiction to it, namely:

(1) That when an acetylene-hydrogen-oxygen mixture of the composition $C_2H_2 + 2H_2 + O_2$ is exploded, neither carbon is deposited nor any appreciable