Correspondence.

Lieut.-Colonel Davidson.

Lieut.-Colonel A. E. DAVIDSON, R.E., hoped that the Author would be able to carry his experiments on radiators some steps further, and he suggested lines on which additional information would be desirable. In radiators Nos. 5 to 8 (*Figs. 11*) the tubes were staggered. More effective cooling might be obtained by placing the tubes in line, thus offering less resistance to the passage of air. The quantitative investigations as to the throttling effect of obstructions in and under the bonnet on the air-stream through the radiator would seem to indicate that for commercial vehicles, where a cheap and robust method was required of varying the cooling effect of the radiator, a movable shield or shutter inside the bonnet, not necessarily in proximity to the radiator, might in practice meet requirements as well as a louvered shutter. From the users' point of view, desirable points in a radiator for commercial working were cheapness, reasonable size, robustness, ease of repair, efficiency, and ability to retain efficiency year in and year out. Some of these requirements were antagonistic, and a compromise had to be made between efficiency and suitability for hard service. Whereas honeycomb-type radiators gave the best results with regard to cooling efficiency, vertical-tube radiators with top and bottom headers were preferable, as meeting the majority of the desiderata, especially when the vehicles had to operate in a dirty or dusty atmosphere, and when the quality of the water was doubtful. Experience had shown that under these conditions the vertical-tube types lost so much less of their original efficiency when both air-ways and water-ways were dirty that after a time they were as good as, if not better than, the honeycomb type. If the Author could make any further quantitative tests on these lines, they would be of great value to manufacturer and user alike. During the war certain American lorries used in France were fitted with honeycomb-type radiators of a very flimsy pattern. These had to be replaced with others of vertical-tube type. As the original radiator was on the small side, it had been feared that the new ones would be quite inadequate, but reports all went to show that the results in practice were as good, if not better, owing no doubt to the fact that the new radiators maintained their original efficiency.

Mr. Thomas.

Mr. H. KERR THOMAS remarked that the Paper illustrated a fact which he had often observed during the last 20 years, namely, that

it was extremely difficult to make comparisons between different radiators and to deduce empirical results therefrom. He did not for one moment offer any criticisms of the Author's experiments, but would point out the danger of accepting his conclusions as final. The Author's experiments shown in *Fig. 10* (p. 151) agreed with Mr. Thomas's in proving that the quantity of water flowing had only a small effect on the rate of heat-dissipation, which might be considered constant within practical limits. *Fig. 12* showed that the rate of heat-dissipation for radiator No. 3 (film type) was about 41 per cent. higher than that for No. 6 (vertical tubes with crinkled round fins). He had lately made a similar test between two radiators of these types, each having the same mask area of approximately 360 square inches. Both were made by well-known radiator manufacturers. The results of similar tests carried out on the two radiators showed that the tubular type dissipated about 22½ per cent. more heat than the film type—the reverse of the Author's results. Again, the radiator consisting of vertical plain tubes (No. 8, *Fig. 12*) dissipated exactly 50 per cent. of that fitted with gilled tubes. Mr. Thomas had made many experiments with ½-inch tubes with and without gills, and the results which he had obtained showed that the plain tube dissipated about 72 per cent. of that dissipated by the gilled tube. Equation (2) (p. 145), was mathematically indisputable, but he would certainly hesitate to accept the numerical value for air-velocity derived from it, at any rate so far as it might be applied to a vertical tube radiator in which all sorts of air-currents and eddies were set up round the gills, which necessarily made any figures of that kind unreliable. Mr. Thomas.

The AUTHOR, in reply, remarked that he was glad to have Colonel Davidson's valuable suggestions. It would certainly be possible to try the tubes spaced as he suggested. The Author was rather afraid, however, that no advantage to heat-transmission would be found, because one tube would shield another, and the efficiency of heat-transmission depended upon effective sweeping of the surface with air. Although he had not a radiator with tubes spaced as suggested, experiments were in progress to find the effect of shielding, by setting up in the wind-channel large tubes arranged one behind the other and with various degrees of shielding. Mr. Thomas stated that he had made similar tests on radiators of the types mentioned in the Paper with opposite results. The Author doubted whether, with the results stated, the tests had been similar in the strict sense. The conditions of similarity demanded similar scales, similar stream-line flow, and similar air-velocities calculated by the theory of similarity. He The Author.

The Author. believed that his experiments should agree absolutely with Mr. Thomas's if the conditions of the experiments were really similar in the strict sense. Some years ago, at the request of the Council of the Institution of Mechanical Engineers, he investigated the subject of heat-transmission, and in the course of that work examined about 460 Papers on the subject in different languages, aided by Mr. H. C. A. Thieme, Assoc. M. Inst. C.E. He then found that the difficulty of comparing results turned on the difficulty of comparing the conditions of the experiments. Reference could be made to the abstracts of these memoirs in the library of the Institution of Mechanical Engineers. Mr. Thomas's remarks showed the importance of that kind of work, and the extreme importance of securing similar conditions of experiment if the results were to be compared.