GENERAL DISCUSSION.

Mr. C. F. Goodeve (*London*) said: If this paper covers the present position of the practical dissipation of fogs, one is led to the conclusion that very little progress has been made. There seem to be many important questions still unanswered, only a few of which are indicated below.

In the calculation of the amount of gas required to evaporate the liquid droplets, no mention is made of the necessary temperature increase of the air. What effect on the cost would this have? The burning of gas or organic fuels produce water vapour and perhaps will do more harm than good? If a fog is dissipated, there is an increased loss of heat by radiation. Has any estimation of this loss been made? Have any calculations of the economic aspects of using calcium chloride been made? Could not fountains be used to avoid the erection of dangerous apparatus? Could the calcium chloride solution be cooled to increase its efficiency? If it were caught in a trough system, could not a cyclical process be operated? There are now standard methods for the economic control of humidity in factories by using refrigerating plant. Could not these methods be considered for the removal of fog?

Dr. R. Lessing (*London*) said that from experience with a coal cleaning process employing calcium chloride on a very large scale he could confirm that there was no danger of corrosion. He anticipated, however, that calcium chloride spraying on aerodromes would not be permissible as this electrolyte would coagulate the clay in the soil and inhibit the growth of grass, thus making the surface unsuitable for traffic on the ground.

Mr. W. Barrett (*Gerrard's Cross*) said: Heat could be applied to remove fog from aerodromes by buried networks supplied with low voltage current, as already done in horticulture. It seems also worth considering whether a cloud of drops of the order of 60μ radius could be laid down on the windward edge of the belt to be cleared, so as to bring down the fog particles. The cloud particles should be colder than the fog to avoid evaporation and subsequent condensation on fresh nuclei.

Dr. B. W. Bradford (*Billingham*) said: Attention may be drawn to work carried out in America on the dissipation of clouds by spraying with electrified sand from an aeroplane, in which excellent results were claimed. The economics of the method have not been investigated—it is probably expensive—but it might be applicable to special cases such as the dissipation of fog over estuaries, or of smoke screens or toxic smokes in warfare.

Dr. R. Meldau (*Berlin*) said: The idea of settling fog by dropping electrically-charged sand from aircraft has already been tried, but with the opposite effect.[1] Indeed, in this way Veraart brought about the *formation* of clouds and mists. Probably the Americans used one polarity and the Dutch the other; both made use of sands containing different size particles. Süring does not consider the Dutch method to be very hopeful. The experiments do not appear to have been followed up.

Dr. N. Fuchs (*Moscow*) (*communicated*): Experiments on rain-precipitation from the clouds by spraying calcium chloride on them from an airplane were recently made in U.S.S.R. For the most part, only structural changes in the clouds were observed after this operation, namely a clearing along the path of the airplane, the tearing of the cloud into several parts, etc. But in some cases a rainfall was actually obtained. At first the rain-drops were small, and their calcium chloride content high, but later on the drop-size increased and the rain was pure water.

Professor D. Brunt (*London*), in reply, said: My paper was not meant to be encyclopædic, as Mr. Goodeve would appear to suppose. A number of points not mentioned in the paper, including those raised by Mr. Goodeve, were considered, and omitted from the paper as irrelevant to the main question. The necessary temperature increase of the air involved in the evaporation of the fog is allowed for in the estimate of heat required, and is shown in the first paragraph of section 4 of my paper to be $4\frac{1}{2}$ times the amount of heat required to evaporate the liquid water. The addition to the amount of water vapour present, involved in the use of liquid or gas fuel, is relatively small, and makes no essential difference to the estimates of cost which I gave. The increase in the loss of heat by radiation will not lead to any appreciable complication during an interval of time such as is aimed at in clearing fog. It has not been suggested that calcium chloride should be regarded at present as more than a suitable substance for experiments, and any calculations on the economic aspect of the choice of this particular compound appear a little previous. The suggestion of using fountains is quite impracticable. Drops of a size sufficiently small to present a reasonable amount of surface area to the air could not be sprayed up to heights such as are necessary for fog-clearing. The possibility of using a cyclical process such as Mr. Goodeve suggests might be considered at a later stage, but the first question is to decide whether the chemical method is at all feasible and effective. Methods involving the use of refrigerating plant, which may be effective in a closed vessel, or even inside a building, will not of necessity work in the open air.

[1] See A. Veraart, *Het kunstmatig verwekken van Regen*, N.V. Dr. Zuid-Holl. Boek-en Handelsdrukkerij, Gravenhage, 1930.

I now agree that I was mistaken in supposing that calcium chloride is corrosive, but this only removes one of several objections to the use of this substance.

Dr. Barrett's suggestion of using low voltage current to heat the air has never been tried, as far as I know. I cannot say how rapidly the heat from such a network would spread upward. A rapid diffusion of heat upward is not so necessary in horticulture, and the success of this method in horticulture does not of necessity mean that it would be effective in dissipating fog. Only an actual trial could determine the utility of the cloud of cold drops laid to windward of the area to be cleared.

The evidence as to the utility of electrified sand is so contradictory that it is impossible to assess its value.

The experiments described by Dr. Fuchs are puzzling, and it is far from obvious why the later stage of the experiments should give the precipitation of pure water.