FOG INVESTIGATIONS.

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MECHANICAL ENGINEERING, April. — The Wright Brothers lecture of the Institute of the Aeronautical Sciences was delivered by Dr. Sverre Petterssen of the Massachusetts Institute of Technology on December 17, 1940, and was published in the *Journal of the Aeronautical Sciences* for January, 1941, under the title "Recent Fog Investigations". Dr. Petterssen devoted the first part of his lecture to the physics of fog and a discussion of the meteorological conditions under which various types of fog may form. Included was a study of condensation, different types of air-borne nuclei of condensation, and the wide variance in their powers to attract moisture. Properties, characteristics, and sizes of various nuclei were described together with the condensation process and factors with control the colloidal stability of fog. The problem of dissipating fog by artificial means above limited areas, such as an airport runway, was outlined, and several methods which have thus far proved impracticable were described.

In the second part of his lecture, concerning the meteorological conditions for the formation of fog, Dr. Petterssen discussed the conditions necessary for the forming of frontal fogs, caused by rain falling into warmer air, and steam fog or arctic sea smoke, observed when cold air streams over much warmer water. He also discussed the factors governing the formation of commoner forms of radiation, advection, and upslope fogs. The behavior of fog over snow-covered ground was described and summarized classification of fog-producting and fog-dissipating processes; concluded the paper. In his discussion of the artificial dissipation of fog, a subject of interest in navigation both on the water and in the air, Dr. Petterssen said :

"Although many unsuccessful attempts to dispel fog have been made, the potential utility of a practical method is great enough to justify a brief discussion of the problem. In general, fog may be dispelled either by the evaporation of the drops or by physically removing the drops from the air. The requirements for the evaporation of the fog drops may be readily evaluated. To evaporate the drops, it is necessary to supply the latent heat of evaporation and also to reduce the relative humidity of the air (as by heating it) so that the additional water vapor can be accommodated. In order to insure a reasonable rate of evaporation, it is usually desirable to reduce the relative humidity by an amount which is considerably larger than the minimum set by the liquid water content of the fog. A reasonable value for the desired relative humidity is 90 per cent. If the initial air temperature were 20° C. and the liquid water content were 0.2 g. per sq. m.; the total heat required to dissipate the fog would be 320 cal. per sq. m., of which only one-fifth would be used to evaporate the fog drops, the remainder being required to reduce the relative humidity to 90 per cent. Since a certain amount of wind is usually present, fog must be dissipated continuously to maintain a clearing of suitable size. Assuming average fog conditions, Houghton and Radford found that the equivalent of 5,000 kw. would have to be supplied continuously to maintain a cleared volume approximately 40 m. wide × 10 m. high × 600 m. long in the direction of the wind. If this power could be supplied by burning oil, the cost would not be excessive, but the computations assume a uniform distribution of heat, and this would be extremely difficult to arrange for. In any event, it is apparent that it would be practical to clear large fog-bound areas such as harbors and air-ports. The evaporative dissipation of fog may also be accomplished if the relative humidity is reduced allowing finely divided hygroscopic particles to fall through it. This method has been worked out in detail by Houghton and Radford, and a number of successful full-scale demonstrations have been made. A clearing of the size already suggested (40 × 10 × 600 m.) was maintained in dense fogs with velocities as high as 16 m. p.h. by spraying 85 gal. of a saturated aqueous solution of calcium chloride per minute.

"Any field of force, which would cause the fog drops to coalesce into drops large enough to fall rapidly in the gravitional field, would represent an ideal means for the dispersal of fog. An intense sound field appears to be the only possibility in this direction, but computations indicate that it would not be practical in natural fog, although it has been used to precipiptate aerosols such as smoke on a laboratory scale. The fog may be precipitated by allowing a sufficient number of electrically charged (or uncharged) particles to fall through it. The falling particles collide with the fog drops and carry them to the ground. This method has been tried, using charged sand, with relatively unsatisfactory results. It is also possible to precipitate fog by passing it through a Cottrell-type electrostatic precipitator or through a baffle-like arrangement of fixed surfaces, but both of these methods require expensive and cumbersome apparatus. Many other fog-dissipation methods have been suggested, but all of the feasible ones are modifications of one of those already mentioned, and their relative merit can be judged in the same manner".