rated. The main asset of both the aeroplane and the airship is speed, and here the importance of long distances will be evident on little consideration. In a country like England, with well-organised railway trunk lines and journeys of the order of 500 miles, the saving of time in the carriage of mails is small, particularly since the mail trains travel by night, whereas aeroplanes wait for the dawn before commencing the journey.

Where the route includes a sea passage the advantages are much greater, and the enterprise of our two leading transport companies has shown the possibility of a remarkable degree of certainty in the service between London and Paris. It is, however, on much longer journeys than these that the saving of time by aerial transport presents its most attractive possibilities.

On the other hand, the initial outlay and running expenses are roughly proportional to the length of journey, and the inception therefore represents a formidable undertaking. The returns are problematical, and from the nature of the case it will be obvious that until the special facilities have existed for some time no estimate of value can be made as to the charges which will prove remunerative to an operating company and sufficiently attractive to the users of the new form of transport.

Civil aerial transport is therefore still in its infancy as an addition to our industrial life.

THE LIQUEFACTION OF GASES.

By Prof. C. H. Lees, F.R.S.

IN 1869, when the first number of NATURE appeared, Andrews had just completed his experiments on carbonic acid, and established the fact that for each gas there is a critical temperature above which it is impossible to liquefy the gas by pressure. Faraday, by using low temperatures and considerable pressures, had liquefied chlorine, sulphurous and hydrochloric acids, cyanogen, and ammonia in 1823, by 1844 had added eight other gases to the list, and had solidified sulphuretted hydrogen, ammonia, and nitrous oxide. Cailletet, in 1878, by suddenly reducing the pressure on oxygen, nitrogen, and carbonic oxide compressed to 300 atmospheres, obtained mists which he ascribed to fine drops of the liquefied gas. Pictet, about the same time, by employing greater pressures and cooling his apparatus with other liquefied gases, succeeded in obtaining a small quantity of liquid oxygen which was of a slightly blue colour.

In 1883, at Cracow, Wroblewski and Olszewski succeeded in obtaining small quantities of liquid oxygen, nitrogen, and air, which evaporated in a few seconds. By 1887 Olszewski could obtain a few c.c., and by 1900 100 c.c., of liquid oxygen before an audience of his students. Dewar had been able to produce quantities exceeding 20 c.c. since 1886, and had already made determinations of the properties of substances at the low temperatures thus attainable. In 1892 he introduced the double-walled vacuum vessels with a little mercury within to convert the internal surfaces into mirrors, now known as Dewar flasks. These reduced the rate of evaporation of a liquid gas stored in them to about a thirtieth of the rate for ordinary vessels. The utilisation of the Joule-Kelvin cooling effect by Linde and by Hampson in 1895 enabled each to produce a machine capable of liquefying air, oxygen, and nitrogen on a commercial scale. In 1898 Dewar produced for the first time liquid hydrogen, using the Joule-Kelvin effect in the gas pre-cooled to 68° A. by a bath of liquid air evaporating *in vacuo*. Next year he solidified it, and determined its melting point to be 14° A. In 1908, at Leyden, Kamerlingh Onnes liquefied helium and determined its boiling point to be 4° A. In the meantime, Olszewski had liquefied and solidified argon in 1895, and Râmsay and Travers had by 1900 liquefied krypton and xenon.

The commercial production of liquefied gases gave facilities for the examination of the physical properties of substances at low temperatures, and in this work Dewar and Kamerlingh Onnes and his pupils have played prominent parts. It is to the Leyden professor we owe the discovery of the disappearance of the electrical resistances of many metals at temperatures a few degrees above absolute zero attained by the use of liquid helium.

PROGRESS OF METEOROLOGY.

By W. H. Dines, F.R.S

THE progress of meteorology during the last fifty years has been very marked, as may be seen by a casual reference to the current meteorological literature of the period 1865–75; to a great extent, it resembles the emergence of astronomy as an exact science from the old astrology, but it must be confessed that the Newton of meteorology has not yet appeared.

Fifty years back the student of meteorology spent much of his time in a vain hunt for weather