

**THE MECHANICAL
PRODUCTION
OF COLD**

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The mechanical production of cold by Sir J. A. Ewing

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E THE MECHANICAL
PRODUCTION OF COLD

BY

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PREFACE

THIS book is a reprint of "Howard" Lectures on the Mechanical Production of Cold, delivered before the Society of Arts in 1897, with additions and corrections which show the advances of the past eleven years and bring the accounts of machines and processes into accord with the practice of the present day. In its main features the art of refrigeration has undergone little change in that time. But notable progress has been made in some directions, and this has required the introduction of a good deal of supplementary matter.

In the new portions the separation of oxygen from nitrogen in air, by condensation under extreme cold, is dealt with in some detail. This process, which is due for the most part to the genius of Linde, has become important in the commercial supply of oxygen and also as a step in the manufacture of nitrogenous manure. In the theoretical treatment of refrigerating machines the investigations of Dr Mollier have been specially fruitful. The Appendix will be found to contain an account of useful graphic processes with which he has enriched this branch of technical thermodynamics.

In expanding the book the original form of lectures has been retained, as being appropriate to the intended method of treatment. A general account of refrigeration is given, but it is chiefly on the thermodynamic aspect of the subject that stress is laid.

From this point of view a refrigerating machine is essentially a contrivance for pumping up heat from a place that is comparatively cold to a place that is comparatively warm, and the question of primary interest is how to do this pumping with the least expenditure of power. We are concerned with the theoretical

limits to the economy of power that hold in ideal refrigerating processes, and with considerations as to how nearly the actual conditions under which refrigeration is carried out will allow these limits to be approached when one or another type of real machine is employed. The lectures are in great part an attempt to make this side of the subject intelligible without unnecessary mathematics.

In preparing them I obtained much information from Dr Linde, Professor Schröter, Mr Windhausen, Mr Osenbrück, Mr Lightfoot, Mr Hesketh, Mr Sterne, Sir Alfred Haslam, Professor Sir James Dewar, and the late Sir Frederick Bramwell. To many of these gentlemen I am additionally indebted now, especially Dr Linde, Mr Lightfoot, Mr Hesketh and Sir James Dewar. Dr Mollier, Mr Murray of the British Oxygen Company, Sir William Ramsay, and Sir Philip Watts have also most kindly helped in various ways to make the work more complete.

I have also to thank the authorities of the Society of Arts for permission to use material which appeared in the *Journal* of the Society.

J. A. EWING.

August, 1908.

The changes in the Second Edition are mainly the correction of certain *errata* and the clearing up of points in which the original text was somewhat obscure.

J. A. E.

March, 1919.

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