

**THE VENTILATION HAND BOOK; THE  
PRINCIPLES AND PRACTICE OF VENTILATION  
AS APPLIED TO FURNACE HEATING;  
DUCTS, FLUES AND DAMPERS FOR GRAVITY  
HEATING; FANS AND FAN WORK FOR  
VENTILATION AND HOT BLAST HEATING**

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The ventilation hand book; the principles and practice of ventilation as applied to furnace heating; ducts, flues and dampers for gravity heating; fans and fan work for ventilation and hot blast heating by Charles L. Hubbard

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**CHARLES L. HUBBARD**

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# The Ventilation Hand Book

The Principles and Practice of Ventilation as  
Applied to Furnace Heating; Ducts, Flues and  
Dampers for Gravity Heating; Fans and Fan  
Work for Ventilation and Hot Blast Heating

BY CHARLES L. HUBBARD

A Series of Questions,  
Answers and Descriptions,  
Illustrated by One Hundred  
and Thirty-seven Engravings

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## P R E F A C E

The material contained in the following pages has been arranged from a series of articles prepared by the author for publication in SHEET METAL.

As indicated by the title, the object of the volume is to place in convenient form, for ready reference, the underlying principles of warm-air heating and ventilation, together with simple methods for computing the sizes of the various parts of a system of this kind.

Special care has been taken to keep all descriptions and mathematical work well within the understanding of the student and beginner.

The original form of questions and answers has been retained, as it tends to hold the interest of the reader more closely than the usual method of employing topics or headings.

After one has developed definite or fixed habits of study, the usual text-book arrangement may be followed without difficulty. When the reader has become thoroughly familiar with the contents of the handbook it will be advisable to make up a pocket note book based on data contained in the former, and covering the special line of work of the student. The general arrangement and method of condensing the data

should be carried out according to the ideas of the individual, and will prove of much value in fixing the information clearly in mind, as well as placing it in convenient form for quick reference upon the job. Furthermore, the reader is advised not to end his study with the present volume, but to broaden his knowledge by consulting freely the advanced works along the same line.

## CHAPTER I.

### GENERAL DEFINITIONS, HEATING AND VENTILATING REQUIREMENTS, HUMIDITY

#### **What is meant by the term "Ventilation"?**

Ventilation means the supplying of fresh air to a room or building for the purpose of improving its condition as regards the comfort and healthfulness of its occupants, and a system of ventilation comprises any arrangement of special apparatus for bringing about this result. Furnace heating, indirect steam and water heating, steam blast heating, etc., illustrate different types of ventilating systems, which should be properly designed and installed.

The removal of air from a building by means of vent flues or exhaust fans constitutes another form of ventilation. Natural ventilation, so called, is produced by the movement of fresh air through a room by means of open doors or windows.

#### **How does the necessity for air compare with that for food and water?**

It is possible for a man to live three weeks without food, three days without water, and three minutes without air; hence an abundance of fresh air is a matter of great importance in all rooms which are to be continuously occupied.

#### **What is the effect of poor or vitiated air upon the occupants of a room?**

Vitiated atmosphere lowers the vitality, and there-