Chapter 42—Electric Heating. New material was added describing types and features of various systems, including panel systems.

Chapter 44—Owning and Operating Costs. The chapter was rewritten for the purpose of indicating items to be considered in determining first cost as well as operating cost of present systems.

Chapter 45—Industrial Air Conditioning. A new section was added to illustrate methods of obtaining local relief for workers in hot humid environments.

Chapter 50—Residential Summer Air Conditioning. This is a new chapter describing current practice in this rapidly developing application of air conditioning.

Chapter 52—Codes and Standards. Several standards were added to the previous list. References to codes were added or changed where necessary to indicate latest editions. Addresses of sponsoring organizations were brought up to date.

In addition to the important changes enumerated, many others of a less extensive nature have been made to increase the value of the text, tables or illustrations.

A twenty-four-page comprehensive subject index of the Technical Data Section follows the Table of Contents. A Catalog Data Section showing products of 319 well-known manufacturers is included together with a detailed index for rapid reference to any desired type of equipment.

An *Edge Index* is a new feature enabling the users of THE GUIDE to open the book immediately at any desired chapter of text or any section of catalog data.

The annual revision of THE GUIDE is not only desirable but necessary in order to provide GUIDE users with the latest information on current practices in its field. A great number of suggestions received from readers are considered each year in order that new information may be added as soon as its usefulness and reliability can be ascertained. Members, other engineers, Society committees, associations, and various groups interested in heating, ventilating, cooling, and air conditioning review current GUIDE text continually, and frequently submit complete revisions of existing material, or propose improvements for consideration of the Guide Committee.

The Guide Committee expresses its appreciation to all of these sources for valuable assistance received in preparing this edition. A number of individual contributors who have been most active in preparing the 32nd Edition are given grateful recognition:

H. W. ALYEA
J. M. BLACK
A. D. BRANDT
T. C. BROWN
F. N. CALHOON
W. P. CHAPMAN
J. H. CLARKE
R. B. ENGDAHL
NATHAN FEDER
L. F. FLAGG
R. B. FOLEY
J. W. FRAZIER
W. F. FRIEND
H. T. GILKEY
R. A. GONZALEZ
C. A. GUSTAFSON
T. F. HATCH
W. O. HUEBNER
C. M. HUMPHREYS
J. M. KANE
G. E. KLAPPER
S. R. LEWIS
P. J. MARSCHALL
J. W. McELGIN
G. E. McELROY
L. A. MILES
L. G. MILLER
G. V. PARMELEE
F. J. REED
J. E. SEITER
LESLIE SILVERMAN
B. R. SMALL
T. H. SMOOT
J. P. STEWART
C. S. STOCK
G. L. TUVE
R. P. WARREN
E. F. WEHLAGE
W. N. WITHERIDGE

The Guide Committee takes pleasure in presenting THE GUIDE 1954, which it hopes will be a most valuable reference book for practicing engineers, manufacturers, teachers and students.

GUIDE COMMITTEE

W. S. HARRIS, *Chairman*

P. R. ACHENBACH
R. E. CHERNE
A. L. HESSELSCHWERDT, JR.
D. L. MILLS
A. B. NEWTON
F. J. NUNLIST, JR.
C. D. SHIELDS
W. M. WALLACE II
R. S. DILL, *Ex-Officio*

CARL H. FLINK, *Technical Secretary*

CONTENTS

PAGE

TITLE PAGE iii
PREFACE v
INDEX TO TECHNICAL DATA ix

SECTION I. FUNDAMENTALS

Chapter 1. Terminology 1
2. Abbreviations and Symbols 11
3. Thermodynamics 23
4. Fluid Flow 67
5. Heat Transfer 89

SECTION II. HUMAN REACTIONS

Chapter 6. Physiological Principles 111
7. Air Conditioning in the Prevention and Treatment of Disease 131
8. Air Contaminants 151

SECTION III. HEATING AND COOLING LOADS

Chapter 9. Heat Transmission Coefficients of Building Materials 167
10. Water Vapor and Condensation in Building Construction 201
11. Infiltration and Ventilation 217
12. Heating Load 239
13. Cooling Load 265

SECTION IV. COMBUSTION AND CONSUMPTION OF FUELS

Chapter 14. Fuels and Combustion 321
15. Automatic Fuel Burning Equipment 357
16. Heating Boilers, Furnaces, Space Heaters 385
17. Chimneys and Draft Calculations 411
18. Estimating Fuel Consumption for Space Heating 433

SECTION V. SYSTEMS AND EQUIPMENT

Chapter 19. Gravity Warm Air Systems 451
20. Forced Warm Air Systems 461
21. Steam Heating Systems 481
22. Hot Water Heating Systems 523
23. Radiators and Convectors 541
24. Panel Heating 553
25. Unit Heaters and Unit Ventilators 575
26. Unit Air Conditioners and Unit Air Coolers 591
27. Pipe, Fittings, Welding 605
28. Pipe Insulation 625
29. District Heating 641
30. Central Systems for Air Conditioning 653
31. Air Distribution 667
32. Air Duct Design 697
33. Fans 733
34. Air Cleaning 751
35. Spray Apparatus 773
36. Air Heating and Cooling Coils 799
37. Refrigeration 823
38. Dehumidification by Sorbent Materials 861
39. Automatic Control 871
40. Motors and Motor Controls 889
41. Sound Control 905
42. Electric Heating 927