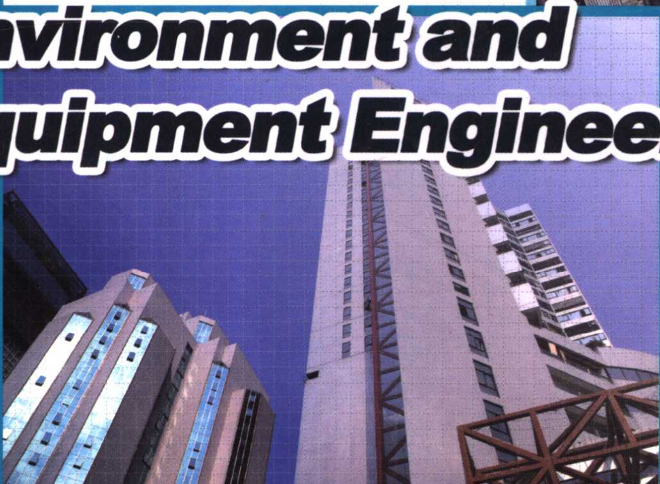
建筑与土木工程专业英语系列丛书

JIANZHU YU TUMU GONGCHENG ZHUANYE YINGYU XILIE CONGSHU

建筑环境与设备工程专业英语

王 革 主编　薛若军 顾璇 副主编

Professional English of Architectural Environment and Equipment Engineering



哈尔滨工程大学出版社

建筑环境与设备工程专业英语

Professional English for Architectural Environment and Equipment Engineering

王　革　主　编
薛若军　顾　璇　副主编

哈尔滨工程大学出版社

图书在版编目(CIP)数据

建筑环境与设备工程专业英语/王革主编.—哈尔滨:
哈尔滨工程大学出版社,2005
ISBN 7-81073-697-3

Ⅰ.建…　Ⅱ.王…　Ⅲ.①建筑工程-环境管理-
英语②房屋建筑设备-英语　Ⅳ.H31

中国版本图书馆 CIP 数据核字(2005)第 069550 号

内 容 简 介

本书共分十三个单元,包括建筑环境与设备工程专业及相关专业基础学科的原版教材节选。为帮助读者对本书内容的理解,每个单元后面都附有词汇表和整篇参考译文。本书力求少而精,按照由浅入深、循序渐进的原则选编,以便于读者在较短的时间内掌握建筑环境与设备工程专业及相关学科的基本专业词汇及专业英语的表述方法,从而提高专业英语的阅读能力。

本书可作为建筑环境与设备工程专业及相关专业大学生的专业英语教材,也可作为相关专业教师和工程技术人员学习专业英语的参考教材。

哈 尔 滨 工 程 大 学 出 版 社 出 版 发 行
哈 尔 滨 市 东 大 直 街 124 号
发行部电话:(0451)82519328　邮编:150001
新 华 书 店 经 销
哈 尔 滨 工 业 大 学 印 刷 厂 印 刷
*
开本 787mm×960mm　1/16　印张 13.25　字数 239 千字
2006 年 1 月第 1 版　　2006 年 1 月第 1 次印刷
印数:1—2 000 册
定价:16.00 元

总　　序

按照国家教育部1999年9月颁发的《大学英语教学大纲》(修订本)的规定,大学英语教学分为基础阶段和应用提高阶段。基础阶段的教学主要是公共英语,分为大学英语一至六级。应用提高阶段的教学要求包括专业英语和高级英语两部分。非英语专业的学生在完成基础阶段的学习任务,即通过国家四级、六级考试后,必须学习专业英语。《大学英语教学大纲》不仅强调学习专业英语的重要性,同时对专业英语的词汇和听、说、读、写、译的能力做出了明确的说明。

专业英语与公共英语有着相同的语言系统和语法规则,但也存在很大差别。在专业英语文章中不仅有大量专业词汇和专业术语,还有许多合成新词和缩略词,但两者的主要区别在于文体差异。专业英语主要是对客观事实和客观真理进行论述,逻辑性强,条理规范。另外专业英语的语法结构也有其自身的特性,如长句多、被动语态、非限定动词或非限定定语从句使用频率高等。由于专业英语与专业内容紧密配合,相互一致,懂专业的人用起来得心应手,不懂专业的人用起来则困难重重。因而必须具有一定的相关专业知识基础,才能正确地理解和运用专业英语。

本套建筑与土木工程专业英语系列丛书包括:《建筑工程力学专业英语》、《土木工程专业英语》、《建筑环境与设备工程专业英语》、《给水排水工程专业英语》、《建筑学专业英语》。在选材上按照《大学英语教学大纲》要求,注重专业英语的文体特性,在强调专业性的同时,尽量保持内容的基础性和通用性,避免涉及过于深奥的专业理论,同时也不使其成为简单科普书籍。本套丛书80%左右为专业基本内容,20%左右为专业前沿性文献,基本上出自英语原文。通过学习,学生能够系统地掌握专业英语的文体特征和专业文献的阅读方法,熟练地进行英语资料的阅读、翻译以及英文摘要的写作。

谢礼立

2004年8月

谢礼立,1994年中国工程院首批院士,中国地震局工程力学研究所名誉所长,研究员;现任中国地震局科技委员会副主任,《中国地震学会》副理事长。

前言

PREFACE

目前随着社会经济的飞速发展,对于建筑环境与设备专业的要求也在不断提高。本教材根据新形势下,国家对高校的英语教学提出的更加重视实用能力培养的要求,在全面保持和突出以前教材的诸多的优点的基础上,进一步在更新观念、更新内容、更新体系、更新要求等方面做了许多积极的尝试。

本教材涉及到供热、空调、传热学、流体力学等相关知识。旨在使学生掌握基本的专业词汇,了解专业文献的写作形式,从而使学生巩固和运用已学过的英语知识进行专业英语训练,提高对专业文献的理解能力、阅读能力和运用能力,为学生毕业后在从事科学研究工作中能够顺利地阅读和翻译英文文献,为适应国际间的学术交流打下良好的英语基础。

本教材共分 13 个单元,其中第 4、6、7、8、9、11 单元由王革编写,第 2、5、10 单元由薛若军编写,第 1、3、、12、13 单元由顾璇编写。在编写过程中哈尔滨工程大学的宋天舒教授、朱卫兵教授、马景骏教授、部冶教授给予了大力的支持和指导,同时本书在编写过程中参考了其他作者的著作,在此一并向他们表示衷心的感谢。

由于编者者水平有限,书中难免存在不足与错误,敬请广大读者批评指正。

编　者

2006 年 1 月

目 录

CONTENTS

目 录

CONTENTS

目 录

CONTENTS

Unit One

1.1 Analysis of Thermodynamic Systems

Thermodynamics is invaluable in the analysis of any system involving energy transfers; the most common and practical uses of thermodynamics in engineering are in analysis of systems containing some sort of working substance, usually in a liquid or gaseous phase, which is flowing or circulating through the device. In this chapter we shall examine the characteristics of a number of thermodynamic systems, mostly of this variety, and, in addition, we shall look at the behavior of some more unusual devices which show promise of practical utility in the future. These characteristics may be predicted from a combination of thermodynamic analysis and experience with operating hardware. For the most part we shall consider systems sufficiently idealized that analysis of their performance is within the range of our studies thus far.

The systems of chief interest here are those which effect some sort of energy conversion. In power-generating systems we are interested in converting the internal energy of hydrocarbon fuel molecules, or the atomic energy of uranium or plutonium, into electric or mechanical energy. In refrigeration systems we are interested in keeping some area cool by continual removal of energy as heat from that area. Most such systems involve a working fluid, such as water or air, which is circulated through the system in a cycle. In steam power plants (Fig. 1.1) the cycle is usually closed. While in gas power systems, such as the turboprop engine (Fig. 1.2), the cycle is often open (closed by the atmosphere).

In addition, we now have the many consequences of the second law at our disposal and are in a position to employ them in discussing the performance of thermodynamic systems. The second law places strong limitations on the performance of thermal energy-conversion and thermal transfer systems, and we shall examine these in the following discussions.

Especially important is the temperature-entropy plane; when matter undergoes a reversible process, the sequence of states through which it passes traces out a line on the T-s plane (Fig. 1.3). Since the process is reversible, the energy transferred as heat to a unit of mass of the substance is represented by the area under the curve on the T-s plane. If the substance undergoes a cyclic process, there will be no net change in its internal energy over a

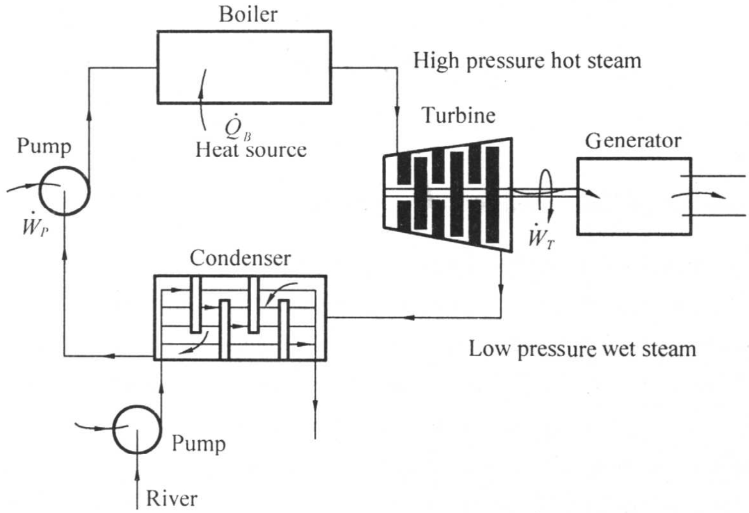


Fig. 1.1　schematic of a simple steam power plant

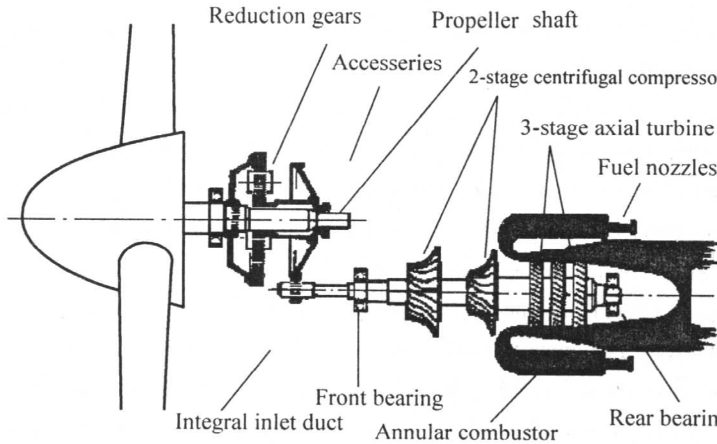


Fig. 1.2　details of a turboprop engine

cycle, and consequently the net energy transferred to a unit mass of the substance as heat during the cycle must equal the net energy transfer as work from the substance (work done), and both equal the area enclosed by the reversible path on the T-s plane (Fig. 1.4). The T-

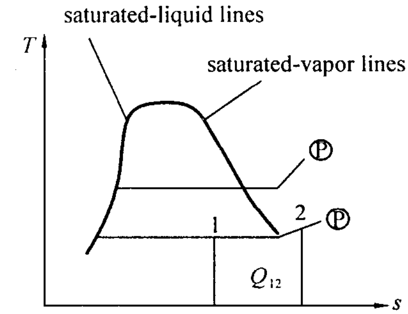


Fig. 1.3 the T-s plane is particularly useful in showing amounts of energy transfer as heat

s process representation can therefore be a very graphic aid in comparing and evaluating thermodynamic systems, and we shall make extensive use of it.

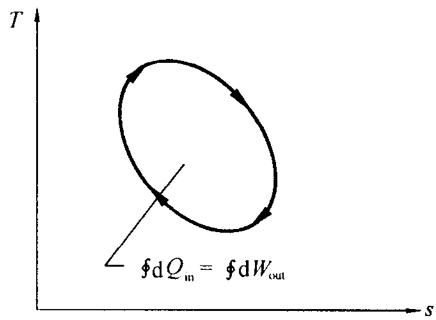


Fig. 1.4 the cyclic integral of T－s represents the net energy transfer as heat to the substance

词　汇

thermodynamic　*adj*.热力的
system　*n*.系统
working substance　工质
circulate　*v*.循环,流动

operating hardware	计算机,操作设备(装置)
idealized	*adj*.理想化的
performance	*n*.特性,性能
energy conversion	能量转换
power-generating	*adj*.产生动力的
uranium	*n*.铀
plutonium	*n*.钚
working fluid	(液态)工质
cycle	*n*.循环
steam power plant	蒸汽动力厂
boiler	*n*.锅炉
heat resource	热源
condenser	*n*.冷凝器
pump	*n*.泵
turbine	*n*.涡轮机,(汽、燃气、水)轮机
generator	*n*.发电机
gas power system	气体动力系统
turboprop engine	涡轮螺旋桨发动机
integral inlet duct	进气道总成
reduction gears	减速器
accessories	*n*.附件
propeller shaft	螺旋桨轴
front bearings	前轴承
2-stage centrifugal compressor	2 级离心式压缩机
3-stage axial turbine	3 级轴向涡轮机
fuel nozzle	燃料喷嘴
rear bearings	后轴承
annular chamber	环状燃烧室
temperature-entropy plane	温熵平面,温熵图
reversible	*adj*.可逆的
area	*n*.面积
net	*adj*.净的
work	*n*.功

enclosed	*adj*.封闭的
graphic aid	形象地帮助

译 文

1.1 热力系统的分析

在分析任何涉及能量传递的系统时,热力学是非常有价值的。热力学在工程中最普遍和最实际的应用是分析包含某种工质的系统,该工质通常是在装置内流动循环的液体或气体。在本章中,我们将研究一些热力系统的特性,它们多数属于这种类型。此外,我们将考虑某些不常用的装置,它们在将来是有可能付诸实用的。这些特性可由热力学分析结合运用计算机实践来预测。我们将对大部分系统予以理想化,使对其特性的分析在我们所学过的范围之内。

在这里我们感兴趣的主要是实现某种能量转换的系统。在产生动力的系统中,我们感兴趣的是将烃燃料分子的内能或者将铀或钚的核能转变为电能或机械能。在制冷系统中,我们感兴趣的是用连续从冷区中取出热量以保持该区中的低温。大多数这种系统包含有工质,例如水或空气,它以循环的方式在系统中环流。在蒸汽动力厂中(图 1.1),循环通常是封闭的,而在气体动力系统中,例如涡轮螺旋桨发动机中(图 1.2),循环经常是开口的(由大气封闭之)。

此外,我们现已有许多可资利用的第二定律的推论,在讨论热力系统的特性时能够使用它们。第二定律给出了热能转换和热传递系统的某些严格的限制,我们将在下面的讨论中研究这些内容。

特别重要的是温熵图。当物质经过一可逆过程时,它所经历的状态连续变化在 T-s 图上可描绘出一条线(图 1.3)。由于过程是可逆的,以热的方式传给单位质量的能量可以用 T-s 图上这条线下面的面积来表示。如果物质经历一个循环过程,那么,对于整个循环来说它的内能就不会有净的变化,因此在循环中以热的方式传给单位质量物质的净能量必定等于物质以功的方式向外界传出的净能量(所作的功),二者都等于在 T-s 图上可逆过程线所包围的面积(图 1.4)。因此 T-s 过程图可以形象地帮助我们比较和计算热力系统,我们将广泛使用它。

1.2 The Carnot Cycle

The Carnot cycle is the reversible cycle defined by two isothermal processes and two isentropic processes (Fig. 1.5). Since a reversible isentropic process is adiabatic, the only energy transfer as heat to a piece of substance undergoing a Carnot cycle occurs during the

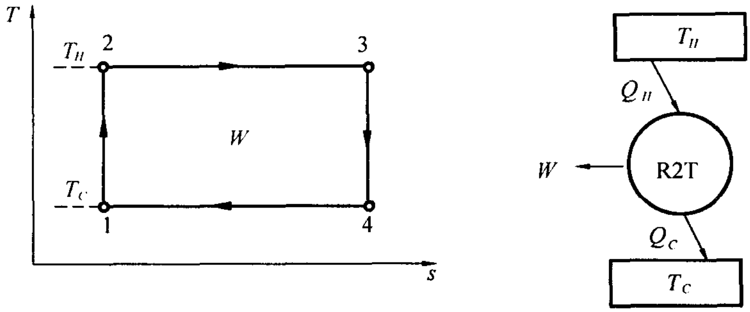


Fig. 1.5 the Carnot engine

isothermal processes. The Carnot cycle constitutes a reversible 2T engine, and consequently the ratios of the energy transfers as heat defined in Fig. 1.5 are given by

$$\frac{Q_H}{Q_C} = \frac{T_H}{T_C}$$

Its energy-conversion efficiency is therefore

$$\eta = \frac{W}{Q_H} = \frac{Q_H - Q_C}{Q_H} = 1 - \frac{T_C}{T_H} \tag{1}$$

The highest efficiencies will be obtained when the ratio T_C/T_H is as small as possible. One would like to add the energy as heat at as high a temperature as possible and reject energy as heat at the lowest possible temperature.

The Carnot cycle operates as a refrigerator when reversed (Fig. 1.6). The area enclosed

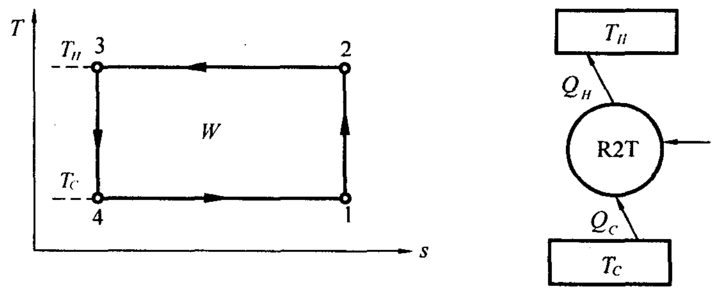


Fig. 1.6 the Carnot refrigerator

by its T-s process path would represent the work required per cycle of operation, and we should like this to be as small as possible. This suggests that this relation can easily be derived at will from $dQ_{rev} = Tds$, since

$$\frac{Q_H}{Q_C} = \frac{T_H(s_3 - s_2)}{T_C(s_4 - s_1)} = \frac{T_H}{T_C}$$

having T_H as close as possible to T_C is most desirable. A refrigeration cycle is rated in terms of its cop (coefficient of performance):

$$\text{cop}_{\text{refrig}} = \frac{Q_C}{W} \tag{2}$$

For the Carnot refrigerator,

$$\text{cop} = \frac{Q_C}{Q_H - Q_C} = \frac{T_C}{T_H - T_C} \tag{3}$$

Unlike the efficiency, the cop can range from zero to infinity. For a Carnot refrigerator extracting energy as heat from a cold space at 0 °F and transferring energy as heat to an environment at 60 °F,

$$\text{cop} = \frac{460}{520 - 460} = 7.7$$

Real refrigeration systems operating between the same two temperatures have cop values of the order of 2 to 3.

An interesting use of the refrigerator is a heat pump. Here the objective is not to keep a region cool but instead to keep a region (such as a house) warm. The energy transfer to the hot space is then of prime interest, and it is customary to define the cop as

$$\text{cop}_{\text{heat-pump}} = \frac{Q_H}{W} \tag{4}$$

Then, for a Carnot heat pump,

$$\text{cop} = \frac{Q_H}{Q_H - Q_C} = \frac{T_H}{T_H - T_C} \tag{5}$$

For example, a Carnot heat pump taking energy from the outdoors at −10 ℃ and transferring energy into a house at 20 ℃ has a cop of

$$\text{cop} = \frac{293}{293 - 263} = 9.7$$

This means that the homeowner would be getting energy into the house equal to almost 10 times the electric energy showing up on his utility bill. A practical heat pump may have a cop of 3 to 4, but even this makes a heat pump far superior to direct electric-resistance heating from the point of view of utility costs.

The Carnot cycle is very useful in estimating limits of efficiency for given operating