HANDBOOK OF PRECISION ENGINEERING

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HANDBOOK OF PRECISION ENGINEERING

Edited by A. Davidson

Volume 7 Electrical Design Applications

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Foreword

During the last twenty or thirty years precision engineering, albeit not a separate field such as, say, naval architecture or aeronautics, has nevertheless emerged as a technology in its own right, involving methods and concepts different from those of conventional engineering.

No clear definition of what is meant by precision engineering can be given. The view that this covers all those sectors of technical activity in which artificial aids are employed as extensions of the senses can no longer be upheld.

The question of what is to be regarded as a precision mechanism can best be settled by summarizing a number of devices which qualify for this description. Generally, they are small devices ranging from the unique to the mass produced.

The term precision mechanism may well be a misnomer as applied, say, to a watch, since an ordinary watch, although small, is a relatively crudely toleranced instrument, whereas the drive of an observatory telescope, a massive piece of equipment, is constructed to operate with the utmost precision. Examples of precision engineering in the sense in which the term is employed in this handbook are: telecommunications equipment; optical apparatus such as cameras, projectors, but also such instruments as microscopes, comparators, etc.; office machines such as typewriters, accounting machines, calculating machines, etc.; technical construction kits, marketed as toys, in view of the often ingenious constructions and highly sophisticated tool designs employed; electric shavers, electronic equipment for use in the home, etc. Many other examples could be added to this list.

Both in the precision engineering industry and in education, there is a need for a handbook providing ready access to all the different subjects involved in this branch of engineering. Although in most cases these subjects are not new in themselves, there is much to be gained from a review of them which places special emphasis on those aspects which have a specific bearing on precision mechanisms and which provides information of possible use to designers, manufacturers and users of products in this category.

The authors, specialists in their field, do not claim either to have covered every aspect of the subject dealt with in their chapter, or to have included all the details in the limited space available. What they have tried to do is to describe the essentials as thoroughly as possible, whilst providing an extensive list of references to the international literature as a source of detail.

The handbook has been divided into twelve parts. Volume 1 deals with the general principles upon which the design of a product should be based, whilst Volume 2 discusses the materials required. They contain both theory

and practical information of interest to the designer and the engineer. Methods and technical processes of production are discussed in Volumes 3, 4, 5, 8, 9 and 10 inclusive. Here, production engineers will find full information on production methods and the machines involved.

Volumes 6, 7, 11 and 12 inclusive cover the construction of precision engineering products and equipment, together with components for same. Designers, manufacturers and users will all find useful data in them.

This handbook is published as a sequel to the first two volumes of the *Handbook of Precision Engineering*, produced as long ago as 1957 by the Cosmos Publishing Company.

The authors take this opportunity to thank all those who have assisted in the production of this handbook.

A. Davidson

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Introduction

The constructional elements were described in detail in Vol. 6 of this handbook. Certain applications of these elements were also given—mainly those occurring in mechanical systems.

Volume 7 is concerned with the assembly of electrical components and equipment. Since electrical and electronic equipment is largely based on precision-engineering techniques, full attention must be paid to the constructional aspect. Production managers in the field of electrical equipment will find a mine of information about electrical and electronic components and systems incorporating them in this volume.

Our description aims at giving an insight into the purpose of the components and apparatus mentioned, without going into details about all the possible types and combinations in each case. It would be impossible to mention all standards, dimensions, etc., in this field, as each manufacturer has his own system of standards.

In the chapter on the construction of electrical equipment, we mainly deal with those systems which may be found in electronic equipment. However, examples from other types of equipment, e.g. small electric motors, are also dealt with.

The chapter on electrical engineering and electronics in precision engineering deals mainly with the electrical problems likely to confront the precision engineer. The measurement of electrical quantities, and of mechanical quantities by electrical methods, is the main topic in this chapter.

Other applications of electrical equipment are also mentioned. This chapter too is far from exhaustive, as the number of applications in this field is countless.

Since the recording of measured data in graphical form is of great importance for the precision engineer, a chapter is devoted to this topic. Interesting constructional details of the equipment involved are also discussed in full.

This handbook would not be complete without a chapter about the background and aims of industrial design.

Since design considerations are of great importance in precision engineering, and in particular in the field of electrical equipment, this chapter was deliberately placed in Vol. 7. Design considerations are discussed for electrical equipment in mass production and series production, together with a few cases of one-off production. It is impossible to formulate precise rules in this field, all that can be done is to describe the aims involved, and how these are achieved in practice.

The units and symbols used in this volume are those of the International System of Units (I.S.O.), as explained in Vol. 1, Chapter 1.

A. Davidson