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Machine Tools Handbook

Design and Operation

P. H. Joshi

MACHINE TOOLS HANDBOOK

DESIGN AND OPERATION

P H Joshi

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Institution of Engineers*

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To

My beloved mother

Late Kesarbai Joshi

Foreword

Few books on machine tools are available, as the subject domain warrants lengthy descriptions and hundreds of intricate illustrations.

Few technocrats venture into writing, many of those who do so, do not have flair or inclination for the lonesome vocation of writing. Consequently most of the technical books are penned by academicians with little field experience and often lack the pragmatic touch. In this present scenario Mr. Joshi's book *Machine Tools Handbook: Design and Operation* should be more than welcome.

Like Mr. Joshi's earlier books on tool design, this treatise too has brevity, clarity, flow and logical composition, which only a few other engineering texts can match. The in-depth coverage renders the book useful for practising professionals and the presentation is simple enough for students' comprehension.

Original contributions such as the graph for designing gears for wear and the thumb rules for designing gear boxes deserve special mention. Solved examples from *Machinery Handbook* enhance the worth of this work as they prove accuracy of the cited formulae.

Mr. Joshi deserves encouragement; I wish him success in his philanthropic mission.

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Preface

I have spent only a small fraction of my career in academic field. During my tenure as a lecturer in Fr. Agnel Technical College at Mumbai I taught 'machine tools' to production engineering students. I realized that none of the few contemporary books on machine tools was suitable for students. I had a tough time learning and teaching gear box design as no book, even the reference tomes, had guidelines or solved examples.

As a design consultant I found the existing reference tomes inadequate. None were helpful for an experienced designer while designing a new machine tool. All the books had sufficient information on various drives like belts, chains, gears but none compared them for speed range, capacity, and efficiency of transmission. There was ample information on hydraulic elements and drives but none on design of hydraulic systems: determining mundane details such as the specifications (sizes) of hydraulic valves and the piping, pump and tank.

A machine tool designer should have sufficient knowledge of electrical elements—the working and usage of contactors, time relays etc. Being a mechanical engineer, I learnt it the hard way—by listening, enquiring, attempting, and amending designs in light of discussions with fellow field experts. I have endeavoured to pass on the gist of the elementary circuit design to my readers.

In industry we aim at perfection. Errors can be very costly and blunders disastrous. We can neither rely totally on our subordinates nor redo everything the lesser one does to cross-check the correctness. We resort to broad approximations to see that the subordinate's submissions are more or less correct.

Splitting hair can be very costly in terms of time, which is more valuable than money. So we take 1 kg (force) = 10 Newtons (instead of 9.87) during rapid cross-checks. We round off figures to near values convenient for rapid calculations. Usually this does not make much difference to the ultimate result. In any case the calculated gear module or thread diameter must be adjusted to fit into the prevailing standards for economic manufacture.

I have often used such approximations in the solved examples in this book. Torque (kgm) is 1000/RPM (approx) of power in kW in some examples and 955/RPM of kW in others. I hope readers as well as teaching faculty will understand and condone these small anomalies.

A book addressed to students must aim at clarity sometimes even at cost of brevity. Reader must understand working of machine elements, their potential and parameters. Also he should be able to test his comprehension by way of exercises, and for these reference tables are necessary. Their range and number should be adequate for normal applications. Inclusion of all the prevailing standards would make the book unwieldy and more suitable

for consultants than students. So I had to strike a balance between the informative text and industrial standards. I have done away with data for very small (miniature) and very large (heavy duty) applications to save space. In any case practising professionals have enterprise to mine such data.

I hope readers would find my text easy to grasp and remember. Even industrial practitioners, and field consultants should find the treatise convenient as a reference for normal applications, and as a manual for training their subordinates.

I will be gratified if my book facilitates comprehension of machine tool working and simplifies design of machine elements. Nothing will please me more than industry and my fellow consultants using my book for reference and training.

P H JOSHI

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