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Dedication

This book on grinding is dedicated to all those who are searching for a way to improve the productivity of man and machine.

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PREFACE

The latest information indicates that the United States now spends in excess of $150 billion annually to perform its metal removal tasks using conventional machining technology. That estimate is increased from $115 billion 5 years ago. It becomes clear that metal removal technology is a very important candidate for rigorous investigation looking toward improvement of productivity within the manufacturing system. To aid in that endeavor, an extensive program of research has developed within the industrial community with the express purpose of establishing a new scientific and applied base that will provide principles upon which new manufacturing decisions can be made.

One of the metal removal techniques that has the potential for great economic advantages is high-rate metal removal with related technologies. This text is concerned with the field of grinding as a subset of the general field of high-rate metal removal. Related processes (not covered in this text) include such topics as turning, drilling, and milling. In the final evaluation, the correct decision in the determination of a grinding process must necessarily include an understanding of the other methods of metal removal. The term grinding, as used herein, includes polishing, buffing, lapping, and honing as well as conventional definition: ". . . removing either metallic or other materials by the use of a solid grinding wheel."

The injection of new high-rate metal removal techniques into conventional production procedures, which have remained basically unchanged for a century, presents a formidable systems problem both technically and managerially. The proper solution requires a sophisticated, difficult process whereby management-worker relationships are reassessed, age-old machine designs reevaluated, and a new vista of product-process planning and design admitted. The key to maximum

productivity is a "systems approach," even though a significant improvement in process can be made with the piecemeal application of good solid practice. This text was structured with those concepts in mind. However, the reader should also consider complementing subjects, such as machine dynamics, factory flow/loading, management psychology/strategy, and manufacturing economics. The "bottom line" is to increase the overall effectiveness of the factory from whatever devise that is reasonable, that is, to obtain the greatest return on the dollar invested.

As an example, consider the technical problem of increasing the speed of the grinding wheel. To realize the benefits of that increase, the table or spindle feedrate must be increased. That in turn has an impact on the basic machine design and the response of the control system. As the various speeds are increased, new dynamic ranges are encountered that could induce undesirable resonances in the machine and part being fabricated, requiring dampening consideration. The proper incorporation of an optimum grinding process into the factory requires the integration of all of the above technical considerations plus many others—a difficult systems solution requiring professional attention.

Finally, when making any major change in factory operations, the reader should consider the managerial style used. Keep in mind that the processes suggested in this text could deviate considerably from those that may exist in any particular factory environment. The use of new techniques would be ill advised if the operating employees are not supportive for any reason. Employee involvement and understanding during process change is necessary for success, and fear of the unknown is unacceptable.

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