MACHINE-SHOP MATHEMATICS

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Machine-Shop Mathematics by George Wentworth & David Eugene Smith & Herbert Druery Harper

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WENTWORTH-SMITH MATHEMATICAL SERIES

MACHINE-SHOP MATHEMATICS

BY

GEORGE WENTWORTH

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DAVID EUGENE SMITH

AND

HERBERT DRUERY HARPER

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PREFACE

Purpose of the Work. This work has been prepared to meet the needs of students who expect to become machinists, either in the special line of automobile construction or in the more general lines of the machine shop. It is therefore strictly limited in scope to the needs of those who are entering upon this kind of work, and it treats only of such topics as experience has shown are demanded by the practical machinist who is determined to advance in his vocation.

Work Presupposed. The student is supposed to have covered the work laid down in the authors' "Fundamentals of Practical Mathematics," or its equivalent, and therefore to be familiar with the use of whole numbers, common fractions, decimals, per cents, proportion, and the common tables of measure as applied to practical problems. While it is not an absolute essential that the student should have mastered the slide rule or should be thoroughly acquainted with the elements of trigonometry and with the metric system, it is desirable that he should have at least a fair working knowledge of these subjects.

Topics Considered. A glance at the Contents will show the topics considered, the relative amount of attention given to each, and the sequence in which they are taken up. In general it may be said that the choice of topics and the time allotted to each are conditioned by the actual needs of the student, while the sequence is based chiefly upon the question of relative difficulty, although due attention has been given to the dependence of one topic upon another. The first thing that is needed is a knowledge of the measuring instruments actually used in the

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machine shop, since without this knowledge the rest of the work is meaningless; the second topic relates to speeds and feeds, this being the first thing that the student meets in the use of a machine; the third topic, tapers and taper turning, follows naturally, and so on throughout the book.

The authors believe that they have succeeded here, as in their earlier book in this field, in eliminating nonessentials, in emphasizing the great principles, and in presenting the matter in a new but perfectly natural form, with definite and valuable applications which initiate the student into the actual work of the shop. They hope that their efforts will meet with the approval of teachers and students alike.

Acknowledgment. The authors wish to express their thanks to the following manufacturers who have given permission to use the illustrations shown on the pages mentioned: South Bend Lathe Works, South Bend, Ind., p. 8; R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, p. 62; Cincinnati Milling Machine Co., Cincinnati, Ohio, p. 63; Brown and Sharpe Manufacturing Co., Providence, R. I., pp. 70, 81, 91, 99, 105, and 115; Meisel Press Manufacturing Co., Boston, Mass., pp. 97, 103, and 112; Niles-Bement-Pond Co., New York, N. Y., p. 110; Hoeffer Manufacturing Co., Freeport, Ill., p. 118; Ohio Machine Tool Co., Kenton, Ohio, p. 124; Lynd-Farquhar Co., Boston, Mass., p. 126; Garvin Machine Co., New York, N. Y., p. 128; and the Putnam Machine Works, Fitchburg, Mass., p. 132. Other well-known manufacturers supply similar machines of a high degree of precision, and they would, no doubt, have been equally willing to give permission to use their illustrations had it been requested.

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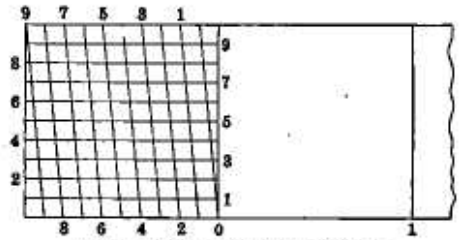
MACHINE-SHOP MATHEMATICS

CHAPTER I

MEASURING INSTRUMENTS

Measuring Lengths. In measuring short distances we take each distance with a pair of dividers, transfer it to a steel ruler, and then read off the length. Since, however, rulers are seldom graduated beyond $\frac{1}{64}''$, this method is not accurate enough for fine work.

For finer work a *diagonal scale*, which applies the principle of parallel lines to measuring lengths, is sometimes used by draftsmen. In the scale here shown the distance from the vertical line 1 to 0 is $1''$. From the vertical line 1 to the point where diagonal line 0 cuts horizontal line 8, the distance is $1.08''$; to the point where diagonal line 5 cuts horizontal line 6, the distance is $1.56''$; and so on, so that by this method we can readily measure to $0.01''$.



PART OF A DIAGONAL SCALE

For the work required of a skilled machinist, however, a higher degree of accuracy than is obtainable by either of the two methods given above is necessary. A method of obtaining this greater precision by the application of the principle of the screw thread is explained on page 2.