

PREFACE

1. Frederick Winslow Taylor began the first systematic research in the field of Machinability and Metal Cutting. Early in this century (1907) he reported that the heat generated during the machining of Metals played an important part in the wear of cutting tools. Taylor's findings gave great impetus to research on better tool materials and led to the discovery of High Speed Steels (7)*. Others followed Taylor, and consequently, the knowledge of machinability grew. Yet, it cannot be said that the subject has been put on a fully scientific basis.

2. Many factors have a bearing on the subject of Machinability and Metal Cutting. The machine tool, the cutting tool, the material to be machined and the cutting conditions employed - all affect machinability. For a given machine tool, cutting tool and the material to be cut, an important determinant is the temperature-rise in the cutting tool. Considerable amount of work has been done on the temperature rise in metal cutting and much useful knowledge has thus been built up. However, the knowledge is still meagre and inadequate.

3. The research recorded in this thesis is mainly devoted to the study of 'cutting tool temperatures' in metal cutting. It is felt that any contribution to the knowledge of metal cutting will substantially aid the current problem of increasing productivity in metal cutting industries. The research planned, therefore, was initially to cover only the study of cutting temperatures, but in the course of the investigations a number of interesting problems arose like, High Speed Machining, and Refrigeration in place of normal cutting fluids. These were duly investigated, yielding fruitful results.

* Figures in parenthesis refer to Bibliography at the end.

4. All the experiments were done on cast iron using High Speed Steel cutting tool.

5. The research was largely experimental. It can, generally, be described as 'extensive' though an important aspect of machinability, namely, the cutting tool temperature, was intensively studied. The vital aspects of machinability, namely, cutting temperatures and cutting forces were investigated. On cutting temperatures, useful data were obtained, resulting in the preparation of a co-relating chart which co-relates cutting tool temperature against the cutting conditions.

6. The work incorporated in this thesis has been divided into four sections :

- 1) Measuring Cutting Temperatures.
- 2) Some Studies of Temperatures in Machining.
- 3) Some Steps to Raise Productivity in Machining.
- 4) Miscellaneous Studies.

The experimental data obtained have been recorded in appendices given at the end. The work has been largely illustrated with suitable diagrams and photographs.

7. Research in Machinability and Metal Cutting so far attempted in India, appears to be negligible. Almost all the data available are of foreign origin. One of the difficulties of research in Machinability has been the weakness in the area of instrumentation. For this research, various devices other than standard tools and equipment were locally designed and fabricated. Moreover, cutting temperature data were obtained with different techniques of instrumentation.

8. In course of this research, other main items of investigation related to the following :

- a) Influence of Diameter of Work on Cutting Temperatures.
- b) Chip Temperature.
- c) Refrigeration in Machining.
- d) High Speed Milling.
- e) Qualitative Analysis of Cutting Forces.