Preface to third edition

During the period that has elapsed since I wrote the last preface, the progress I commented upon at that time has continued unabated. Production engineering is now recognised as an important element in our national existence and well-being; so much so that its encouragement constitutes the chief activity of a government department. This outlook, and the activities associated with it, are leading to profound changes in the practices of manufacture.

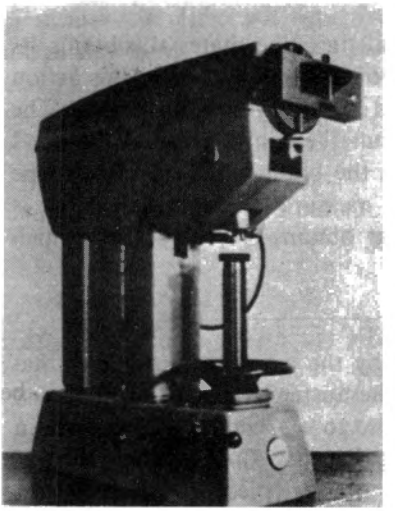
In revising the book for a third edition I have kept in mind the changes taking place. Fundamentals, of course, do not change, but their applications are being pursued in a more sophisticated manner accompanied by the use of scientific principles not hitherto associated with present-day usage.

In its revised form I hope the book will portray the present state of affairs and will continue to serve the purpose for which it originally appeared. Since the book was first written, the character of technical education has changed a great deal, with production engineering appearing on the calendars of polytechnics and universities. The book should be a useful source of knowledge for students on such courses and for those in the more advanced stages of City and Guilds and TEC courses. I always hope that it may also serve as a useful source of information for those who have long since ceased to be interested in examinations.

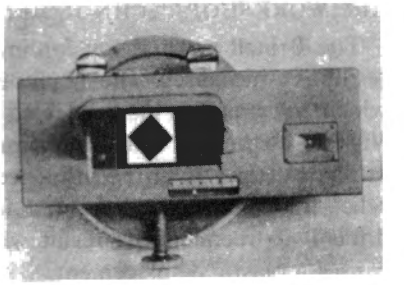
As on previous occasions I am indebted to a wide circle of firms and colleagues for help with information, and the supply of material for diagrams. In particular, I owe the new last chapter to Mr S. J. Martin, C.Eng., F.I.Mech.E., F.I.Prod.E., and my indebtedness to the many firms is signified at the foot of the diagrams they have made available. I thank them all and hope that as the result of such generous cooperation the book will continue to serve students not only in this country but in many other parts of the world.

W.A.J.C.

Hatfield 1975



(a)



Avery Denison Ltd

(b)

Fig. 7 (a) Vickers or Brinell hardness testing machine. (b) Magnified image of Vickers impression as seen through microscope (vertical lines are edges of the measuring shutters)

then applied and, after its removal, the measuring device on the machine records the depth of penetration in terms of the Rockwell number.

The Shore scleroscope consists essentially of a graduated glass tube inside which a small diamond-pointed hammer may move freely. The hammer, having a mass of 2·37 grams, is allowed to fall from a height of 254 mm onto the surface to be tested, and the height of the first rebound is taken as the index of the hardness. This method is useful for large articles which cannot conveniently be placed under one of the other testing machines since, if necessary, the scleroscope may be carried to, and rested on the article to be tested.

Hardness equivalents

There are available tables showing the approximate relationships between various hardness numbers. The information given in such tables should not be accepted with too much confidence as it should be realised that there can be no absolute parity between results obtained by methods employing different principles and, in fact, testing different properties of the material. Furthermore, not much reliance can be placed on the result of a steel-ball indentation for hardness numbers over 400, and in this region it is general to standardise on a diamond-indentation method, e.g. the Vickers test.

The chief purposes of the transverse impact test are as follows:

1. it gives a guide to the resistance of the material against stress concentration at a change in section;

2. it indicates the resistance of a material to the spread of a crack after it has once formed. A low Izod value indicates that in service there will be a greater chance of failure before the initial crack is discovered.

The use of this test to indicate the resistance of a material against impact is not now considered to be reliable, since the speed at which fracture takes place is too low. Heat-treatment and tempering are very influential on the Izod value for steel, as Table 3 shows.

Table 3. Effect of various tempers on the Izod value for a carbon steel. C 0·43–0·50%, Mn 0·60–0·90% (steel previously hardened)

Tempering temperature (°C)	Izod value (joules)	Brinell hardness
320	20	311
430	31	277
480	41	262
540	52	241
600	65	223
650	81	207
700	95	196

The effect of grain direction introduced by rolling causes a higher Izod value to be given when the test is made across the grain than when the specimen is fractured parallel to the grain direction.

Tests on sheet metal

Material in the form of sheet and strip is used extensively for making into components, particularly in press-tool work. In connection with such processes, the material is often subjected to bending and drawing operations, and the following tests are used for examining its suitability for these purposes.

Bend tests (BS 1639: 1964)

The tests in the BS specification are classified under (*a*) single-bend tests, where the test piece is submitted to appreciable deformation by a single