which allows the gage to stand upright. The movable jaw of this particular make of gage has a projection which extends beyond the base and is convenient for testing the height of a button attached to a jig plate (as the illustration indicates) and for similar work. The end of this extension is beveled to a sharp edge for scribing lines. The gage is graduated to read to thousandths, by means of a vernier scale on the sliding jaw. There are graduations on both sides, giving readings on one side for outside measurements and on the other side for inside measurements. This particular gage can be used for heights up to 8 inches.

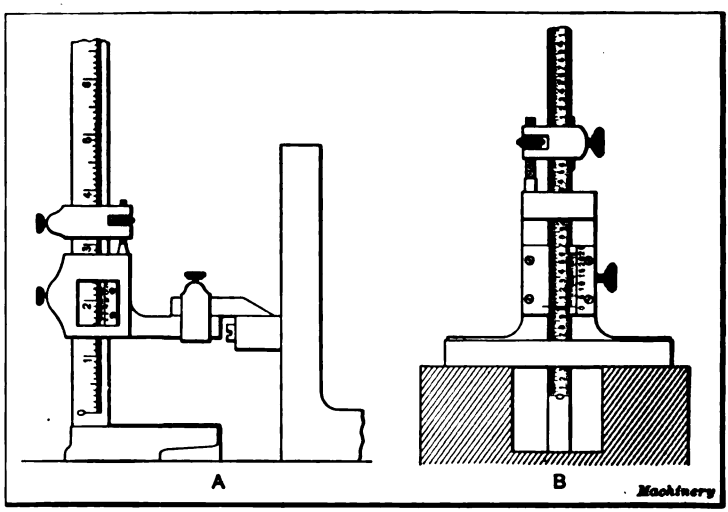

Fig. 21. (A) Vernier Height Gage. (B) Vernier Depth Gage

Illustration *B*, Fig. 21, shows a depth gage for measuring the depths of holes, recesses in dies, etc. The vertical blade or scale is graduated and by means of a vernier gives readings to thousandths of an inch. Height and depth gages are also made on the micrometer principle; that is, instead of having a scale and vernier, the adjustments are effected by a micrometer screw, graduated to read to thousandths.

Center Indicator. — The center indicator is used to set any point or punch mark in line with the axis of a lathe spindle preparatory to boring a hole. The plan view, Fig. 22, shows how the indicator is used. It has a pointer *A*, the end of which is

conical and enters the punch mark to be centered. This pointer is held by shank *B* which is fastened in the toolpost of the lathe. The joint *C*, by means of which the pointer is held to the shank, is universal; that is, it allows the pointer to move in any direction. When the part being tested is rotated by running the lathe, if the center punch mark is not in line with the axis of the lathe spindle, obviously, the outer end of pointer *A* will vibrate, and as the joint *C* is quite close to the inner end, a very slight error in the location of the center punch mark will cause a perceptible movement of the outer end, as indicated by the dotted lines. Obviously, when the work has been adjusted until the pointer

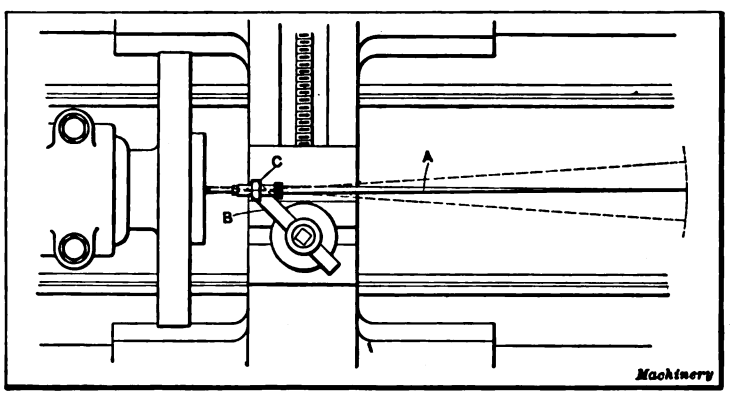

Fig. 22. Plan View Illustrating Use of Center Indicator

remains practically stationary, the punch mark is in line with the axis of the lathe spindle. When two holes are being bored to a given center-to-center distance, by first laying out the centers and then indicating them true in this way, the accuracy depends largely upon the location of the center punch marks.

Test Indicators. — The test indicator is extensively used in connection with the erection of machinery, for detecting any lack of parallelism between surfaces, in inspection departments, and for testing the accuracy of rotating parts such as spindles or arbors. Fig. 23 shows how a dial indicator is used to test the concentricity of the outer race of a roller bearing. The assembled bearing is mounted upon an accurately running arbor, held between centers, and the contact point *A* of the indicator bears

MODERN TOOLMAKING METHODS

A TREATISE ON PRECISION DIVIDING AND LOCATING METHODS, LAPPING, MAKING FORMING TOOLS, ACCURATE THREADING, BENCH LATHE PRACTICE, TOOLS FOR PRECISION MEASUREMENTS, AND GENERAL TOOLMAKING PRACTICE

COMPILED AND EDITED
BY
FRANKLIN D. JONES
ASSOCIATE EDITOR OF MACHINERY
AUTHOR OF "TURNING AND BORING" AND "PLANING AND MILLING"

FIRST EDITION

NEW YORK
THE INDUSTRIAL PRESS
LONDON: THE MACHINERY PUBLISHING CO., LTD.
1915