

That there is no marked difference in the blunter tool of varying cutting angles really does not affect the situation when we try the real cutting or sliding angles, which may be roughly stated to be efficient in proportion to their acuteness.

It is obvious that the least direct cutting stress for a given depth and feed would be obtained by a straight-edge tool, and one that would take a chip in which there is the least molecular change.

A flat top slope should have a straight cutting edge. The more the edge is rounded the greater the conflict of the metal crowding to the edge. The flow of metal on the top slope of the round nose does not move in one direction wholly, but tends to travel towards the centre of the curve. The conflict of currents of metal which approach the centre from various parts of the curved cutting edge increases the direct cutting stress.

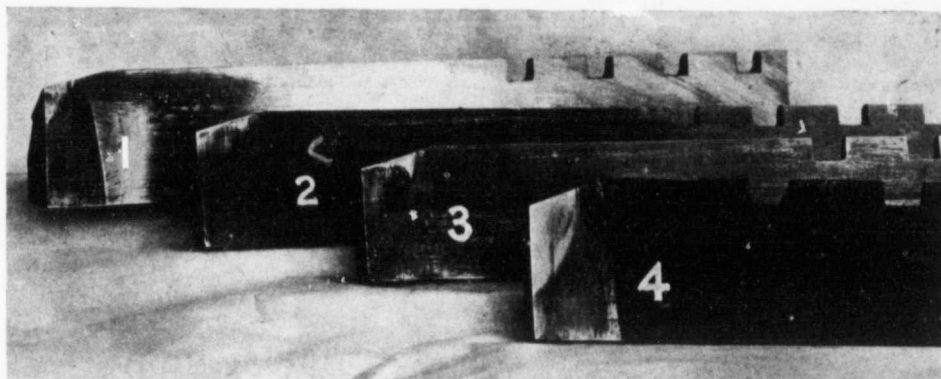


Fig. 5.—Reverse Side of Cutters Shown in Fig. 4. Illustrating the Rubbing Contact of the Tool Against the Shoulder of the Work. Each Tool Bears the Same Number in Both Cuts.

Crushing and partially or wholly shearing the chip into chunks which are three or four times the thickness of the feed undoubtedly increase the working stresses and heat.

The cuts accompanying Dr. Nicolson's discussion, page 33, vol. 28 of Transactions, clearly illustrate the great distortion that takes place even in cutting with an acute tool of 60 degrees and a straight edge. This tool does not have even the disturbing element of shearing

The crushing process of the present scheme of turning is due both to the bluntness of the cutting angle and the shape of the edge. A curved edge should have a curved top slope in order to remove the chip with the least distortion of the metal. The curved top slope for this purpose would make the shape of the cutting edge similar to the cutting edge of a carpenter's round-nosed chisel. This form of tool is not offered as a practical form, but is mentioned to emphasize the unnatural flow of the chip that must take place on the flat top slope of a round nose tool.

SEPARATING STRESS.

By separating stress we mean that stress which, in turning a shaft, forces the tool outward radially. Increasing this stress causes the work and tool to move apart, and results in variation in diameter, also in irregular and generally inaccurate product, particularly when the rough stock runs eccentric or irregular. Although this separating stress may be lessened by giving the tool more back slope, this is possible only in tools taking light depth cuts. A lathe tool, however, which takes a cut like a side tool, gives little or no tendency to separate radially.

With the side tool set at an angle of 90 degrees to the travel of the feed, the feeding stress does not tend to force the work and tool apart; in fact, this tool may be set so as to produce a slightly beveled shoulder either side of the 90 degrees, so as either to draw the work and tool together when making an overhanging shoulder or to force the work and tool apart when producing an external bevel.

QUIVERING STRESS.

The quivering stress due to the nature of the chip is affected by the cutting angle of the tool. The chunks which make up the parts of a chip are less firmly united in a chip taken by a tool of 70 degrees cutting angle than by a tool of 50 degrees, and of course the more firmly

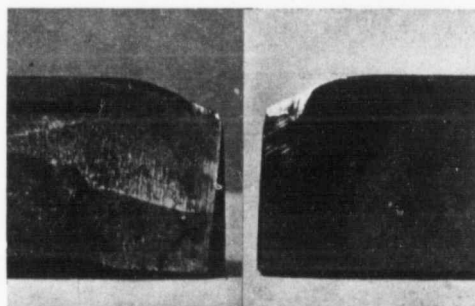


Fig. 6.—No-Clearance Tool, Full Size. Showing an Equal Abrasive Effect on Each Side of Edge. View at the Left Shows the Top Slope, the Angle of Which Was Increased by Chip Abrasion. View at the Right Shows the Abrasive Effect of the Shoulder of the Work Which Reduced the Cutting Angle, but Not as Much as the Abrasion of the Chip Increased It.

action at the edge of the chip, but the experiment shows the distortion of nearly every part of the chip. A tool having a round nose or a blunt edge would doubtless show still greater distortion.