

TC 9-524

FUNDAMENTALS OF MACHINE TOOLS

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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Preface

The purpose of this training circular is to provide a better understanding of power-driven machine tools. It also supplements technical manuals in the 9-3400-series covering power-driven machine tools.

One of the main objectives is for this publication is to be clear and understandable. Illustrations throughout this publication show the step-by-step process of many machine shop operations. The tables, charts, formulas, weights, and measurements in this publication can be a ready reference for selecting the proper tooling and math formulas for machining different materials.

The proponent of this publication is HQ TRADOC. Send comments and recommendations on DA Form 2028 directly to the Department of the Army, Training Directorate, ATTN: ATCL-AO, 801 Lee Avenue, Fort Lee, Virginia 23801-1713.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Drilling Deep Holes

If the depth of the hole being drilled is greater than four times the diameter of the drill, remove the drill from the workpiece at frequent intervals to clean the chips from the flutes of the drill and the hole being drilled. A slight increasing speed and decrease in feed is often used to give the chips a greater freedom of movement. In deep hole drilling, the flutes of the smaller drills will clog up very quickly and cause the drill to drag in the hole, causing the diameter of the hole to become larger than the drill diameter. The larger drills have larger flutes which carry away chips easier.

When the depth of the hole being drilled is four times the diameter of the drill itself, remove the drill at frequent intervals and clean the chips from the flutes of the drill and from the hole being drilled.

Drilling a Pilot Hole

As the drill size increases, both the size of the web and the width of the chisel edge increase (Figure 4-34). The chisel edge of drill does not have a sharp cutting action, scraping rather than cutting occurs. In larger drills, this creates a considerable strain on the machine. To eliminate this strain when drilling a large hole, a pilot hole is drilled first (Figure 4-34) and then followed with the larger drill. A drill whose diameter is wider than the web thickness of the large drill is used for the pilot hole. This hole should be drilled accurately as the larger drill will follow the small hole.

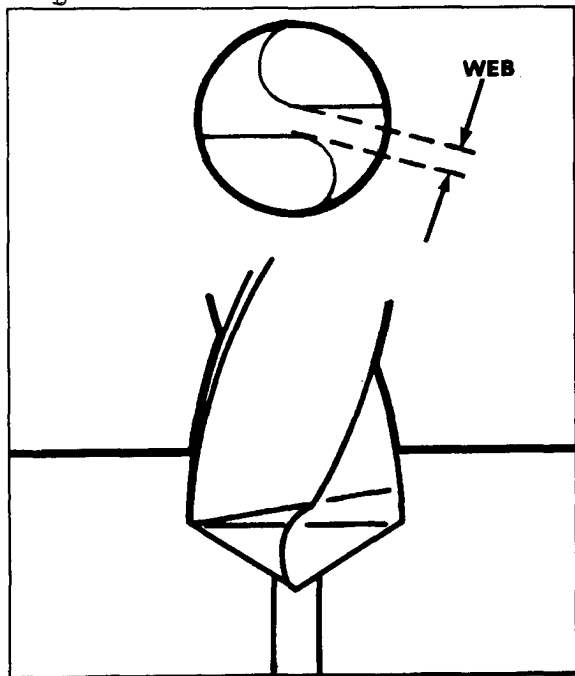


Figure 4-34. Using a pilot drill.

A pilot drill can also be used when average-sized holes are to be drilled on small drilling machines. The small machine may not have enough power to drive the larger drill through the metal. Avoid making the pilot drilled hole much wider than the web of the larger drill. Too wide of a pilot drilled hole may cause the larger drill cutting lips to grab and snag which may cause excessive chatter or an out-of-round hole.

Drilling Thin Material

When drilling thin workpieces, such as sheet metal, place another piece of metal or wood under the workpiece to provide support and prevent bending the workpiece or ruining the hole due to the upthrust created when the drill breaks through.

If thin metal must be drilled and a support cannot be rigged under the thin metal, then a drill designed for thin metal, such as a low helix drill with zero rake angle, commonly called a sheet metal drill, must be used.

Using a Depth Stop

The depth stop mechanism on the drilling machine (Figure 4-35) should be used whenever drilling to a desired depth, and to prevent the twist drill from traveling too far after cutting through the workpiece. The depth stop is designed to be used whenever a number of holes of the same depth are to be drilled, or when drilling holes deep into the workpiece (blind holes). Make sure that drills are chucked tightly to avoid slipping and changing the depth setting. Most depth stops have away to measure the distance that the drill travels. Some may have a fractional gage on the depth stop rod, and some may have a micrometer dial located on the depth stop for very precise measurements.

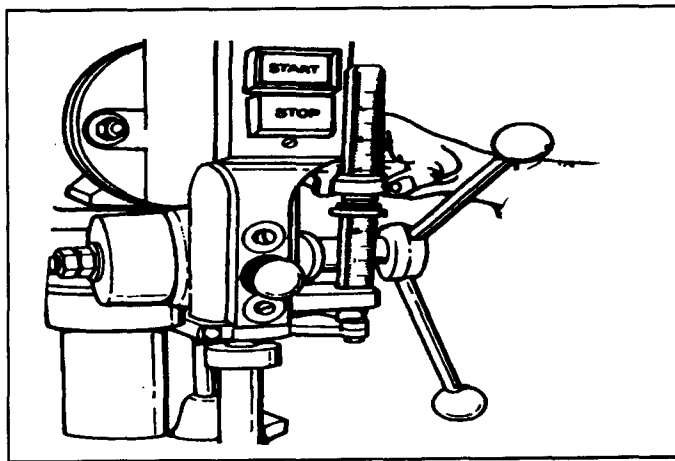


Figure 4-35. Depth stop mechanism.