

FIGURE 22.23 (a) Standard chisel-point drill indicating various features. The function of the pair of margins is to provide a bearing surface for the drill against walls of the hole as it penetrates into the workpiece; drills with four margins (double-margin) are available for improved drill guidance and accuracy. Drills with chip-breaker features are also available. (b) Crankshaft-point drill. (c) Various drill points and their manufacturers: 1. Four-facet split point, by Komet of America. 2. SE point, by Hertel. 3. New point, by Mitsubishi Materials. 4. Hosoi point, by OSG Tap and Die. 5. Helical point.

Drills are available with a **chip-breaker** feature ground along the cutting edges. This feature is important in drilling with automated machinery where disposal of long chips without operator assistance is necessary.

General drill geometry recommendations for various workpiece materials are given in Table 22.10. These angles are based on experience in drilling operations and are designed to produce accurate holes, minimize drilling forces and torque, and optimize drill life.

Drill Point Geometries. Small changes in drill geometry can have a significant effect on the drill's performance, particularly in the chisel-edge region, which accounts for about 50% of the thrust force in drilling. For example, too small a lip relief angle (Fig. 22.23a) increases the thrust force, generates excessive heat, and increases wear. Conversely, too large an angle can cause chipping or breaking of the cutting edge. Consequently, in addition to conventional point drills, several other drill-point geometries have been developed to improve drill performance and increase the penetration rate (Fig. 22.23c). Special grinding techniques and equipment are used to produce these geometries.

Other Types of Drills. Several types of drills are shown in Figs. 22.24. A *step drill* produces holes of two or more different diameters. A *core drill* is used to make an existing hole larger. *Counterboring* and *countersinking drills* produce depressions on the surface to

TARLE 22.10	General Recommendations for Dril	l Geometr	y for High-Speed	Twist Drills

Workpiece material	Point angle	Lip-relief angle	Chisel-edge angle	Helix angle	Point
	90–118	12–15	125-135	24-48	Standard
Aluminum alloys	70–118	12-15	120-135	30-45	Standard
Magnesium alloys	118	12-15	125-135	10-30	Standard
Copper alloys	118	10–15	125-135	24-32	Standard
Steels	118–135	7–10	125-135	24-32	Crankshaft
High-strength steels Stainless steels,	118	10–12	125–135	24–32	Standard
low strength Stainless steels,	118–135	7–10	120–130	24–32	Crankshaft
high strength	118-135	9–12	125-135	15-30	Crankshaft
High-temp. alloys	118	7–10	125-135	24-32	Standard
Refractory alloys	118–135	7–10	125-135	15-32	Crankshaft
Titanium alloys	118	8–12	125-135	24-32	Standard
Cast irons Plastics	60–90	7	120–135	29	Standard

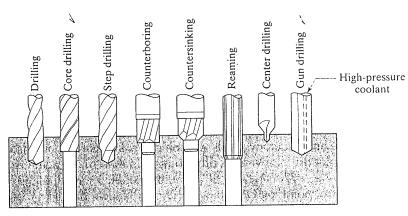


FIGURE 22.24 Various types of drilling and reaming operations.

accommodate the heads of screws and bolts. A *center drill* is short and is used to produce the hole at the end of a piece of stock so that it may be mounted between centers in a lathe (between the headstock and the tailstock, Fig. 22.2). A *spot drill* is used to spot (to start) a hole at the desired location on a surface.

Spade drills have removable tips or bits and are used to produce large and deep holes. They have the advantages of higher stiffness (because of the absence of flutes in the body of the drill), ease of grinding the cutting edges, and lower cost. Crankshaft drills (Fig. 22.23b) have good centering ability, and because chips tend to break up easily, these drills are suitable for producing deep holes.

Gun Drilling. Developed originally for drilling gun barrels, gun drilling is used for drilling deep holes and requires a special drill (Figs. 22.22e and 22.25a). The depth-to-diameter ratios of holes produced can be 300:1 or even higher. The thrust force (the radial force that tends to push the drill sideways) is balanced by bearing pads on the drill that slide along the inside surface of the hole (Fig. 22.25a). Therefore, a gun drill is self-centering, an important feature when drilling straight, deep holes.

Cutting speeds in gun drilling are usually high and feeds are low. The cutting fluid is forced under high pressure through a longitudinal hole in the body of the drill (Fig. 22.25b).

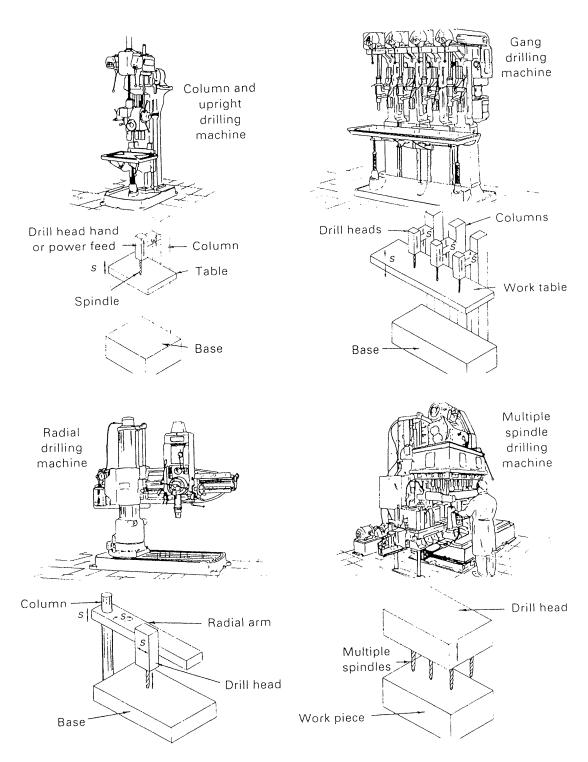


FIGURE 24-17 Four principal types of drilling machines. (From Manufacturing Producibility Handbook, courtesy of General Electric Company.)

CLEVELAND TWIST DRILL

P.O. Box 91839 • Cleveland, Ohio 44101 Customer Service: (216) 431-5050

MACHINE SCREW AND FRACTIONAL

TAP DRILL SIZES AND PERCENTAGE OF THREADS

FORMULA FOR OBTAINING TAP DRILL SIZES

Note: Select nearest commercial stock drill

PERCENTAGE OF FULL THREAD FOR OTHER DRILL SIZES

No. of Threads Outside Diam. of Thread — Selected Drill Diam.

NOM. SIZE T.P.I. DRILL EQUIV SIZE T.P.I. DRILL T.P.I.				of Thread er Inch	ıs X (-	Outside D	iam. of	.01299		Drill Diam		ercenta Full Th			
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1		T.P.I.			% OF THREAD		T.P.I.					T P.L	DRILL	EQUIV	% OF THREAD
1	0	80				1/4	28							.7969	72
To To To To To To To To	1	64				1/4	32				//8	14		.8125	84 67
2			53	.0595	67			F	.2570				13/16	.8125	. 77
2	1	72					1							.8281	72 72
2 64 50 0.7000 78 5716 32 9.732 2812 77 1 12 55/64 89. 3 48 56/64 0.781 77 0 0 .3160 73 1 12 55/64 9. 46 0.810 78 3/8 20 21/64 .3281 72 1 14 55/16 9.3 3 56 46 0.810 78 3/8 20 21/64 .3281 72 1 16 15/16 9.3 45 0.820 73 8	2	56				5/16	20			72				.8750	77
2	_		50	.0700	69			1		75			57/64	.8906	72
3	,					E/16	22				1	8		.8750	77
3	4	04			64					77	,	12		.8906 .9219	67 72
3	3	48	5/64	.0781	77	" "		0	.3160	73	,	1 12		.9375	58
3						2.0	1				1	14		.9219	84
4	3	56			78					79	١,	1,5		.9375	67 77
4 40 43 .0860 56 3/8 32 11/32 .3488 77 1-1/8 7 63/64 .98 4 48 42 .0935 57 7/16 14 U .3680 77 1-1/8 12 1-1/32 1.33 1.3664 1.98 5 40 39 .0935 68 7/16 20 W .3860 72 1-1/8 16 1-1/16 1.04 1.06 <t< td=""><td>,</td><td>30</td><td></td><td></td><td>73</td><td><i>"</i>"</td><td>1</td><td>R</td><td>.3390</td><td>67</td><td></td><td></td><td></td><td>.9531</td><td>72</td></t<>	,	30			73	<i>"</i> "	1	R	.3390	67				.9531	72
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