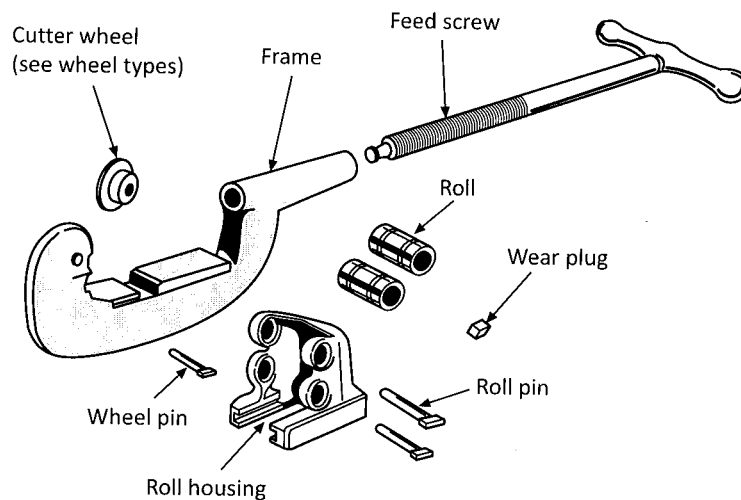


**Figure 2-23**  
**Parts of a standard wheel-and-roller pipe cutter**



Cutters may be classed as:

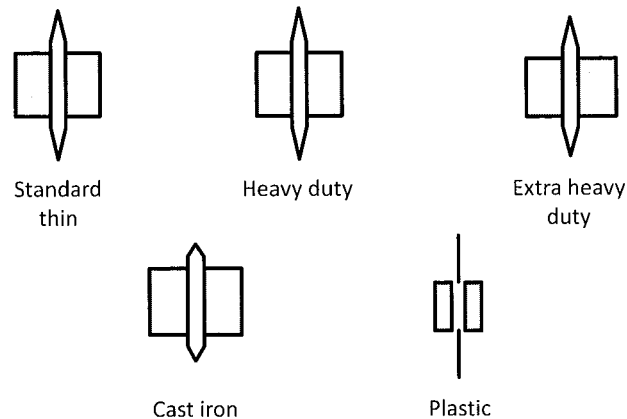
- standard wheel-and-roller cutters; and
- 3-wheel or 4-wheel cutters (these have no rollers, only cutter wheels).

### Cutter wheels

For a cutting operation, you must ensure that the cutter wheel is the right one for the cutter that you use and is suitable for the material that you cut. Figure 2-24 shows the main types of cutter wheels:

Type	Designed for...
Standard thin wheel	Cutting ordinary steel pipe.
Stronger wheels	Cutting heavier or cast-iron pipe.
Very thin wheel	Cutting plastic pipe.

**Figure 2-24**  
**Types of cutter wheels**

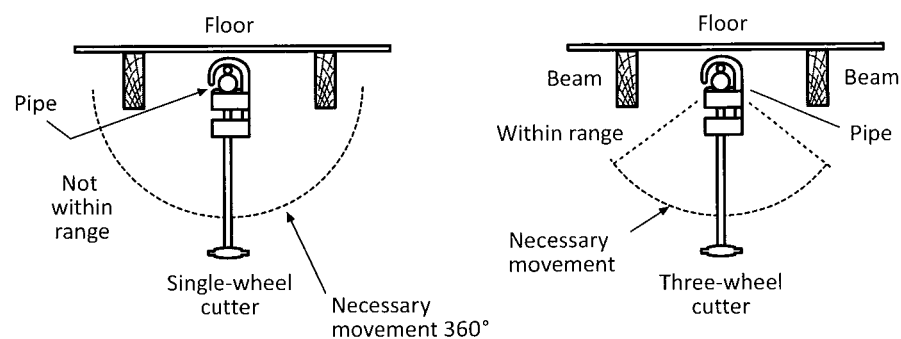


Before using a cutter wheel, always inspect it to make sure that it is not blunt or damaged. A blunt or dulled cutter tends to crush rather than cut the pipe.

The amount of rotation needed to cut pipe varies (Figure 2-25) as follows:

For a...	Rotation needed...
Single-wheel cutter (wheel-and-roller cutter)	360°
Three-wheel cutter	Just over 120°

**Figure 2-25**  
**Range of movement for single-wheel and three-wheel cutters**



## Heavy-duty cutters

The heavy-duty cutters shown in Figure 2-26 can function as single wheel-and-roller cutters for all-around work. For cutting in confined areas, replacing the two rollers with cutter wheels can convert these cutters to three-wheel cutters.

Type	Figure	Description
A	Figure 2-26a	Cuts pipe sizes ranging from 1/8 in to 1-1/4 in. Another model cuts pipe sizes NPS 1/8 to NPS 2.
B	Figure 2-26b	Has a second handle for leverage by two people. Cuts pipe sizes ranging from NPS 2 to NPS 6, depending on the model.

**Figure 2-26**  
**Heavy-duty pipe cutters**  
 Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



### Three-wheel cutters

Because of the smaller amount of rotation needed with the three-wheel cutter, it is useful in confined spaces. However, you must take more care when starting a cut with the three-wheel cutter to make sure the cut is straight. This cutter also leaves more of an outside burr. You must remove the burr on every cut to avoid trouble with damaged thread or pipe dies.

### Four-wheel cutters

The four-wheel cutter (Figure 2-27) facilitates work in areas where a complete turn is not possible.

Type	Description	Pipe Capacity
A	Has a short handle for extra-tight areas where only a 130° turn can be made.	NPS 3/4 to NPS 2
B	Has the second handle. Two people may use this for cutting large pipe sizes in confined areas.	NPS 2-1/2 to NPS 4

**Figure 2-27****Four-wheel cutters**

Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.

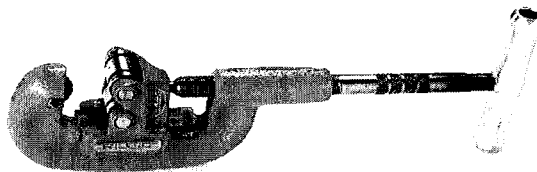


## Heavy-duty, wide-roll cutters

Gas technicians/fitters use the heavy-duty, wide-roll cutter (Figure 2-28) with power vises. The extra-wide rollers prevent the cutter from wobbling during the cutting operation; it has a longer body to rest on the machine while cutting. Pipe capacity is NPS 1/8 to NPS 2.

**Figure 2-28****Heavy-duty, wide-roll cutter**

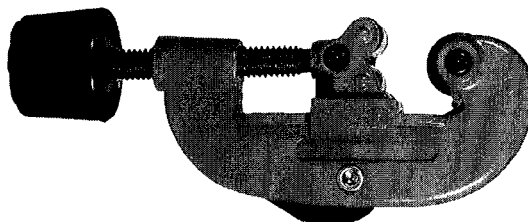
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



## Tubing cutters

Tubing cutters (Figure 2-29) helps make clean, square cuts on copper, brass, aluminum, and thin-walled conduit. These cutters commonly have a fold-away reamer attached to them.

**Caution!** It is extremely important that you do not use tubing cutters to cut pipe, as the cutting wheels will become totally useless.

**Figure 2-29**  
**Tubing cutter**

## Saws

### Crosscut saw

The function of a crosscut saw (the familiar handsaw shown in Figure 2-30) is to cut across the grain of wood. Do not use it on metal.

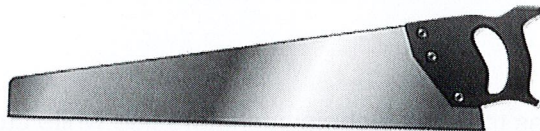
**Figure 2-30**  
**Crosscut saw (fine teeth)**



### Ripsaw

A rip saw (Figure 2-31) helps cut along the length of the grain of wood. Do not use it on metal. The rip saw has a coarser blade (fewer teeth/inch) than the crosscut saw.

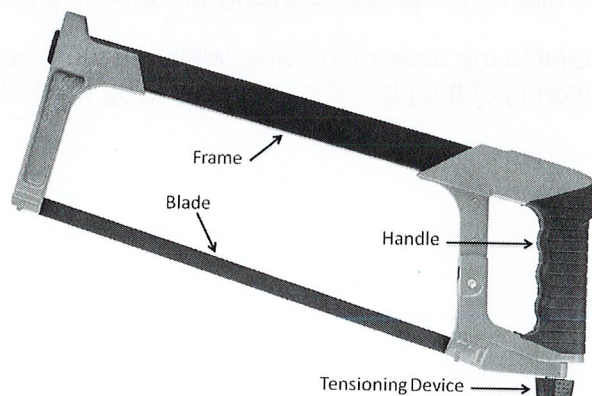
**Figure 2-31**  
**Ripsaw (coarse teeth)**



### Hacksaw

Gas technicians/fitters use a hand hacksaw (Figure 2-32) primarily to cut metal, as well as for cutting threaded rod and shaping such things as sheet metal and strap hangers.

**Figure 2-32**  
**Hand hacksaw**



Hacksaw frames may be fixed or adjustable. Fixed frames are more rigid, but adjustable frames enable the use of different blade lengths. Usually, you may orient the blade in line with the frame or at an angle 45° or 90° angle to it.

The blades are 10 in or 12 in (250 mm or 300 mm) and may be all-hard (rigid) or flexible:

Blade Type	Description
All-hard (rigid)	<p>Made of fully hardened steel.</p> <p>Used to cut tough materials such as alloy and tool steel.</p> <p>Are brittle and break easily.</p>
Flexible	<p>Are either carbon steel or bi-metal and do not break easily.</p> <p>Carbon steel blades are economical and are used to cut mild steel, copper, brass, and aluminum.</p> <p>Bi-metal blades are used to cut all types of metal.</p>

General blade information:

- The number of teeth per inch determines the coarseness of the blade.
- To cut thick materials, choose a coarse blade.
- For thin materials, choose a fine blade.
- At least two teeth should always be in contact with the cut material.

## Pipe vises

Pipe vises are holding devices that gas technicians/fitters use while cutting, reaming, and threading pipe. Some are attached to portable stands for use at the job site, while others are mounted on a workbench only.

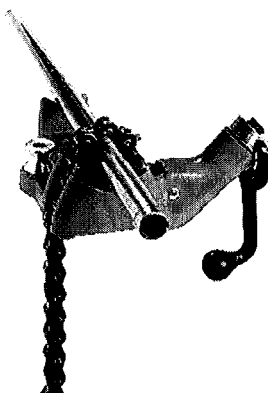
### Bench-mounted vises

#### Top-screw bench chain vise

The top-screw chain vise (Figure 2-33) is a popular bench-mounted type. Its main advantage lies with the holding chain, which distributes pressure evenly around the pipe.

The crank handle anchors itself to the base of the vise, while the toothless jaws have a special neoprene coating to avoid scoring of the pipe. Pipe capacity is up to NPS 8. There is also a bottom-screw chain vise.

**Figure 2-33**  
**Top-screw bench chain vise**  
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



## Portable pipe vises

### Tri-stand vises

The *tri-stand chain vise* (Figure 2-34) has a large base, legs, and a slotted tool tray, making it a complete, portable workbench. The gas industry particularly likes this type because the chain holds a pipe snugly, with uniform pressure. Pipe capacity is up to NPS 5.

**Figure 2-34****Tri-stand chain vise**

Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.

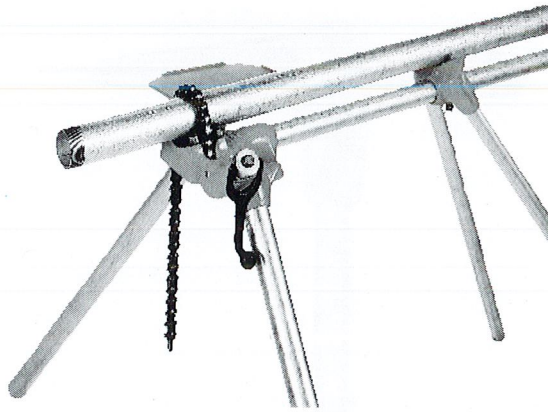
**Top-screw, stand chain vise**

A pipe connects two pairs of legs that make the top-screw, stand chain vise (Figure 2-35) handy for working on long lengths of pipe that require support.

Manufacturers must often tailor each of the legs and connecting pipe for each job because suppliers do not provide these parts along with the vise. The vise will hold a maximum pipe capacity of NPS 5.



**Figure 2-35**  
**Top-screw, stand chain vise**  
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



## Reaming and threading tools

### Pipe reamers

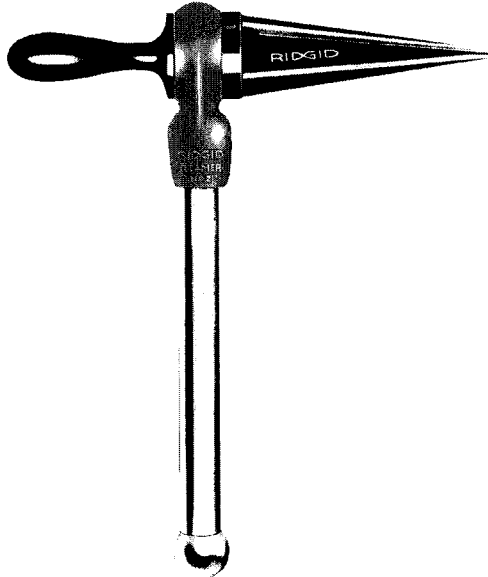
Reamers help remove the burr from the inside surface of a pipe after you cut the pipe with cutters. The objective is a smooth finish no smaller than the inside diameter of the pipe for unrestricted fluid and gas flow. You can do reaming by hand, but certain types of reamers specifically function for power vises. Reaming always comes before threading to avoid deforming the threaded end.

### Straight, fluted, ratchet reamer

This reamer works fast and clean with light pressure. It works for either hand or power reaming. Of the three tools, it is the only one that is safe for power equipment.

Two models of the straight ratchet reamer (Figure 2-36) are available. One has a pipe capacity of NPS 1/8 to NPS 2. The other has a pipe capacity of NPS 3/8 to NPS 3.

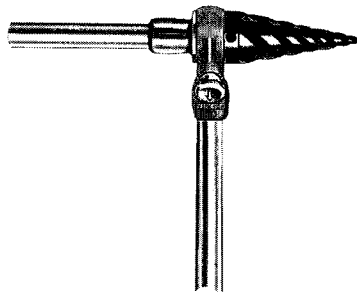
**Figure 2-36**  
**Straight, fluted, ratchet reamer**  
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



#### **Spiral ratchet reamer**

The function of spiral ratchet reamer (Figure 2-37) is for hand use only. It is unsafe to use with a power vise. Such reamers can handle a pipe capacity up to NPS 4.

**Figure 2-37**  
**Spiral ratchet reamer**  
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



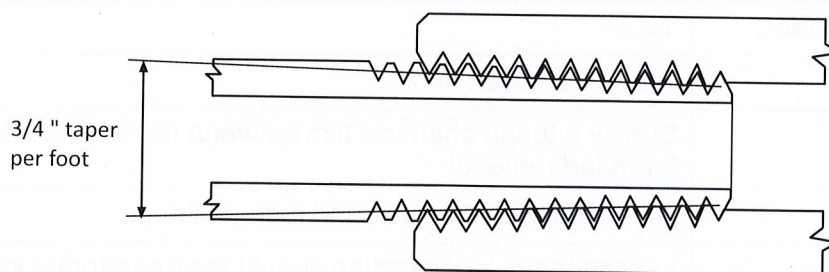
You should not use hand spiral reamers with power vises, as the reamer may bind in the pipe and pull away from your hand, possibly causing injury.

## **Threads**

Gas technicians/fitters use internal and external threads in combination to make mechanically sound and leak proof connections. They may be cut straight or tapered.

Type	Description
Straight threads	Called parallel because the peaks of the threads all have the same diameter. Bolts usually have straight threads. Piping connections that need not be leak proof often use straight threads.
Tapered threads	Tapered threads, both internal and external, mesh together when tightened securely, producing a leak proof joint. Standard piping threads have a taper of 3/4 in per foot (Figure 2-38).

**Figure 2-38**  
**Tapered pipe thread**



General thread information:

- Some threads are right-hand, which means the fitting is screwed onto the threaded pipe in a clockwise motion.
- Other threads are left-hand, in which case the fitting is screwed onto the threaded pipe with a counter-clockwise motion.
- A thread is assumed to be right-hand unless designated otherwise.
- The size of thread varies for different sizes of pipe; the larger the pipe size, the larger the size of the thread.

**Table 2-1**  
**Number of threads per inch for each pipe size**

NPS Pipe	Threads/Inch
1/8	27
1/4, 3/8	18
1/2, 3/4	14
1 to 2	11-1/2
2-1/2 to 12	8

When you screw a pipe to a fitting, 7 to 8 threads are engaged (a little more for pipe sizes larger than NPS 1-1/4). Therefore, you can measure or calculate the approximate thread engagement

for the various sizes of pipe. This is useful in determining the length of pipe to cut when you know the center-to-centre measurement.

## Thread cutting oil

Thread cutting oil helps produce accurate work and a smooth finish, during a threading operation.

The oil covers the pipe and the die to:

- reduce friction;
- cool both the tool and the pipe; and
- flush away metal chips.

Thread cutting oils are either clear or dark and produce the same result when working with either power-driven or hand tools. The ingredients include:

Ingredients include...	To...
Fatty oil	Provide an even film.
Sulphur/chlorine	Supply a tough chemical film between the cutting edges and the threaded material.
Anti-foam agent	Reduce surface tension and foam buildup.
Germicide	Lessen the risk of infection should the operator be injured.

General thread oil information:

- Thread cutting oil lubricates and cools the threads during the threading operation. A dirty or poor-grade of cutting oil can result in poor thread quality.
- Clean metal shavings and other debris from the chip tray of the oiler. Check the level and quality of the thread cutting oil. Replace or add oil if necessary.
- You should not confuse thread cutting oils with the oils used to maintain the condition of tools. They are not, in that sense, a lubricant.

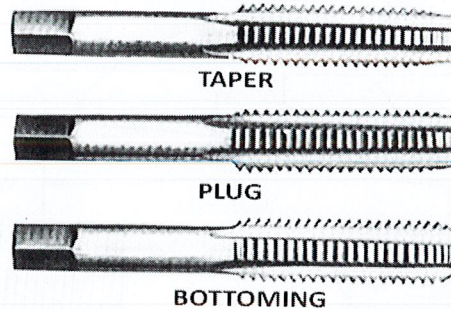
## Pipe taps

Pipe taps help cut or repair internal pipe threads. The process is called tapping and is usually done by hand using a special wrench to hold and turn the tap. Before attempting to tap new threads in a plain hole, you should taper the hole with a taper pipe reamer to properly shape the hole.

Figure 2-39 shows some pipe taps. Sizes range from NPS 1/8 to NPS 2. Manufacturers usually stamp the diameter and pitch (the number of threads per inch) on the shank of the tap. The flutes on a tap provide a space between the cutting edges to catch metal chips. The square end of the tap provides a sturdy grip for the tap wrench.



**Figure 2-39**  
**Pipe taps**



## Pipe dies

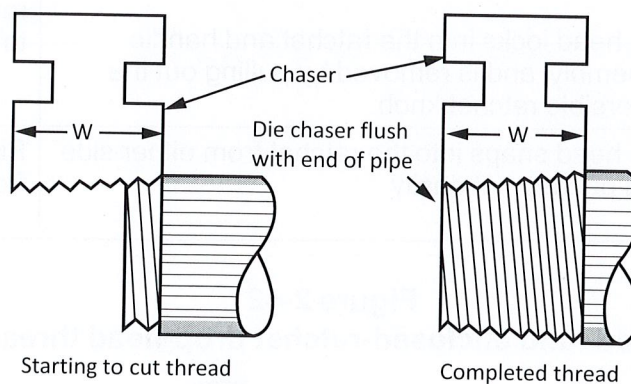
Gas technicians/fitters use dies to cut the external threads on pipe fitting—a process known as threading. A die head holds the cutting dies in place. Mounted on the die head is a handle of suitable length for turning often with a ratchet assembly for convenience and ease of operation.

Dies have flutes or spaces between the cutting edges to provide space for metal chips to escape during the threading operation. There are two main types of dies: full-width and receding.

### Full-width dies

In full-width dies (Figure 2-40), the width of the dies is equal to the length of the thread to be cut. The die moves along the pipe as it cuts the thread, and when the outer edge of the die is flush with the end of the pipe, the thread is complete. This applies to taper threads only. Full-width dies facilitates threading of smaller pipe sizes, where less effort is required.

**Figure 2-40**  
**Full-width die**

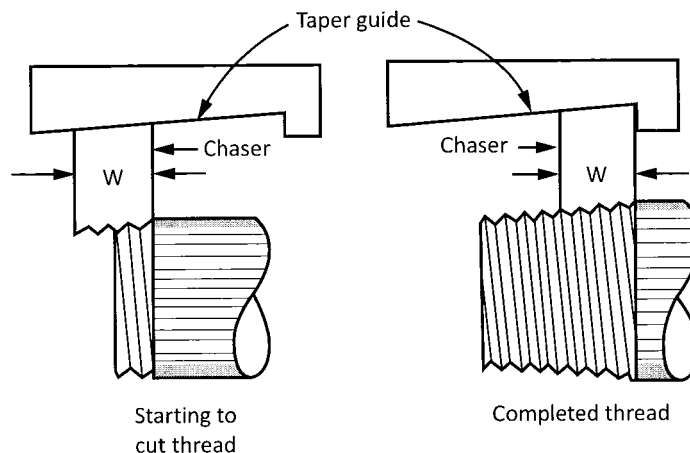


### Receding dies

In receding dies (Figure 2-41), the width of the dies is considerably less than the length of the thread to be cut. The die must travel along the pipe to cut the thread, and as the die moves along the pipe, it must recede from the centre line of the pipe in order to cut a tapered thread.

Receding dies usually help thread larger pipe where there is considerable surface area to cut.

**Figure 2-41**  
**Receding die**



## Hand threaders

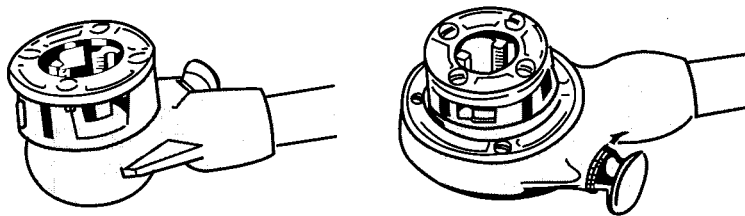
The gas industry prefers the ratchet type of threader to other hand methods because the body weight can help turn the full-width dies while standing to one side of the pipe.

### Ratchet, drop-head, hand threaders

Drop-head threaders are quick and easy to use for small jobs or in close quarters. The dies are interchangeable. In both the exposed and enclosed models (Figure 2-42), you can reverse the dies for close-to-the-wall threading. You can also use drop-head threaders with power vises.

Type	Description	Pipe size capacity
Exposed-ratchet, drop-head threader	More widely used than the enclosed type. Die head locks into the ratchet and handle assembly, and is removed by pulling out the reversible ratchet knob.	Designed for pipe sizes ranging from NPS 1/8 to NPS 1.
Enclosed-ratchet drop-head threader	Die head snaps into the ratchet from either side and pushes out easily.	Pipe size capacity is from NPS 1/8 to NPS 2.

**Figure 2-42**  
**Exposed- and enclosed-ratchet drop-head threaders**



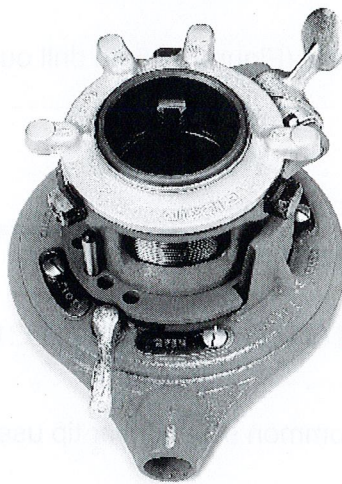
General ratchet drop-head threader information:

- Inspect the threader before use.
- Replace dies or any other part that shows damage or wear.

### Jam-proof ratchet threader

The jam-proof ratchet threader (Figure 2-43) uses receding dies and is useful and quick for threading pipe between NPS 1 to NPS 2 size. It uses one set of dies to thread different pipe sizes. After the thread is completely cut, its jam-proof action kicks out automatically to prevent damage caused by dies receding past their limit.

**Figure 2-43**  
**Geared pipe threader**  
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



### Quick-opening threader

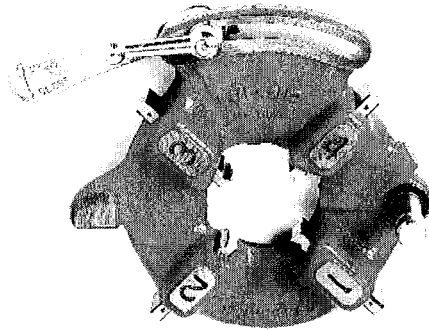
The quick-opening threader (Figure 2-44) is designed for use on power equipment such as a power threading machine.

After you cut the thread to the required length, the die head has a lever to release the dies from the pipe, eliminating the need to stop and back off after the thread has been cut.

The die head can have two styles:

Type	Description
Mono-die head	Threads just one size of pipe.
Universal-die head	Adjustable—can use the same set of dies to thread NPS 1 to NPS 2 pipe or fit two other die sets to thread NPS 1/2 to NPS 3/4 pipe or NPS 1/4 to NPS 3/8 pipe.

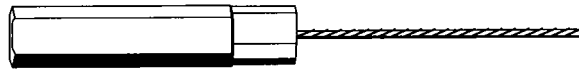
**Figure 2-44**  
**Quick-opening threader**



### **Thumb drills**

Gas technicians/fitters use Thumb drills (Figure 2-45) to drill out orifices.

**Figure 2-45**  
**Thumb drill**



## **Assignment Questions – Chapter 2**

- 1) Which of the following is not a common screwdriver tip used by a gas technician/fitter?
  - a) Straight blade
  - b) Philips
  - c) Robertson
  - d) Tri-wing
- 2) Why are sheet metal snips not suitable for cutting wire?
  - a) Can cause arcing
  - b) Can nick the blades of the snips
  - c) Can destroy the insulation
- 3) Which type of wrench has both an open end and a box end?
  - a) Combination wrench
  - b) Crescent wrench
  - c) Channel locks
  - d) Pipe wrench