

meet our customers' needs for a variety of tubes." Trepanning also allows manufacturers to reuse inventory by changing the I.D. of a tube or collar that has already been trepanned.

While companies are trying to keep inventory low and cash available, steel mills are still requiring minimum orders of 8-10,000 pounds. This is out of the question for many companies, especially smaller tool manufacturers and some independent contractors.

"An individual company can face a couple of problems," Elder explains. "If they go ahead and order the volume of material steel mill require, they could get stuck with it if the market drops. It's easy to tie up \$200,000 on just one order; money that could be sitting on a warehouse floor indefinitely. If they don't order the material and a job comes in they could be waiting three months or more for the stock to arrive. If it's a rush

job, the customer may not have the time or desire to wait."

Because Boring serves the whole marketplace, they do not face this risk if the market goes down. "I look at the requirements of all my customers and build an inventory to meet those needs. Then I utilize each end-user to move the inventory," Elder said. Although Boring Specialties works with a variety of metals, including special alloys, Elder inventories only drill collar blank material—4145 H modified heat treated alloy bars.

"Drilling contractors used to keep extra collars on stock," said Hacker. "They just can't afford the luxury of spares anymore." Because Boring Specialties has the material in inventory, the contractor can get the needed tools without sacrificing additional time or money.

The API has developed new guide-

lines regulating how raw materials must be handled. It is necessary for service companies to keep up-to-date with API regulations and to provide proper documentation so that the tool manufacturers and contractors do not have to worry about liability.

"Since we are licensed to use the API monogram, our source of supply also has to be in tune with these requirements," Hacker said.

Large tool manufacturers and government-owned drilling companies may be able to afford long lead times of up to several months and minimum orders of thousands of pounds occasionally, but smaller companies and independent contractors simply cannot. Competition and budgetary requirements won't allow it. Service companies such as Boring Specialties allow these companies to remain competitive in price, lead time, and in customer service.

THE PROCESS OF TREPANNING

Trepanning is the process of boring a hole through a solid metal workpiece by cutting an annular groove and removing a solid core. The essentials of a trepanning system are cutter design, proper alignment, application of coolant, feed per revolution and rigid support of the boring bar and workpiece. The tool, workpiece, or both may be rotated.

The setup of the workpiece and accurate positioning of the cutting tool are essential for a proper bore. Once properly aligned and fed, however, the equipment is self-piloting. It can cut a straight hole for any distance.

The trepanning machine consists of an internal chip removal head and a variable feed mechanism in which a cylindrical workpiece usually rotates. One end of the workpiece is held by a three or four jaw chuck. The other end is held in a roller-type steady rest with approximately six-inch diameter adjustable rolls. A relatively long workpiece may require an additional steady rest.

The chucked end of the workpiece must be placed at right angles to the spindle centerline. The cut provides a flat surface for the coolant seal on the

guide/starter busing and eliminates possible run-out.

The tailstock of the boring bar mounts in a headstock on the lathe carriage, clamped into position with a bearing cap and clamping nuts.

A steady rest placed directly behind the fluid transfer unit serves as a vibrant dampener. The dampeners are the same construction as the boring bar headstock, except that a two-piece bronze or nylon bushing is used to increase vibration dampening and to allow the boring bar to slide.

Cutting oil passes between the outside of the boring bar and the inside diameter of the hole being machined. Then, a coolant fluid enters the induction barrel, under pressure, behind the starter bushing and flows into the annular space around the boring bar. Next, it flows to the cut between the bushing and the trepan head, picking up chips and flushing them through the head between the outside diameter of the core and the inside diameter of the boring drill bar.

Several advantages result from the trepanning process. Because the chips are prevented from contacting and

marring the bore's inner-finished surface, secondary finishing methods are usually unnecessary. Additionally, there is less vibration in the tool support bar because the workpiece is confined by the high pressure of oil flowing between the bar and the workpiece bore. It also minimizes chattering vibrations because the trepan head is aligned centrally in the bore. Faster cutting speeds and higher feed pressures can be utilized because the tubular tool bar can withstand torsional and longitudinal stresses better than the support bars for external chip disposal tubes.

Steel wear pads with brazed carbide wear surfaces maintain a balance of cutting forces and eliminate the problem of inaccurate cutting. One pad is placed 90 degrees behind the cutter edge to steady the head against the bore and balance the cutting force. The other pad, 180 degrees behind the cutter edge, controls the size of the bore.

These factors all combine to form a process of holemaking which is 12-15 times faster than conventional gun and spade drilling methods and more efficient than buying processed tube. ■