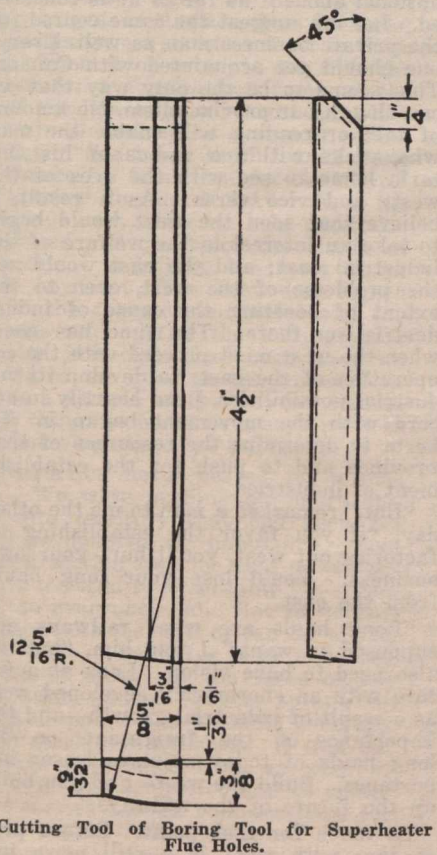
lar is clamped to the body of the tool by another set screw. A short drill is then inserted in the end of the tool and it is ready for use. This short drill first drills a pilot hole, and then acts as a guide for the cutters.

As the cutting tools wear, all that is necessary to keep the tool in good working order is to loosen the 4 set screws holding them, loosen the binding screw, and turn the adjusting collar the proper amount. When the various screws have been tightened, the tool is again ready for use. Reference to the threading will show that this adjusting may be continued until the cutting tools are practically used up.



Cutting Tool of Boring Tool for Superheater Flue Holes.

The principal advantages of this tool, in addition to its ability to quickly cut a large hole in a comparatively thin sheet, are that it forms a means of using up drills which have become too short for any other use, and also saves the breakage of long drills, which is sure to occur in drilling holes through sheets no thicker than flue sheets.

Promoting Milling Machine Practice in Railway Shops.

From a general view point it does not appear that milling machine practice in some railway shops has been given the attention or consideration that this particular method of machining would merit, for while there are some progressive shop men who have gone into the details of this class of work and made use of advanced tools and ideas concerning their application as evidenced by the results obtained, there are many places where the field for improvement along this line is large.

The average railway shop of fair size has in its machine tool equipment one or more of the horizontal knee type milling machines, usually found located in the tool room, and used for fluting reamers and taps or machining the shanks of such tools, also cutting shaft keyways and other miscellaneous jobs. In the main shops of large roads will also be found the larger horizontal mills commonly used for surfacing and fluting locomotive rods, machining shoes and wedges, eccentrics, etc., while the heavier vertical type machine is engaged on profiling and other irregular surface work or perhaps milling port openings in valve chamber bushings.

Some of the jobs above mentioned in connection with the different types of machines are no doubt being done by this method for the reason that it may have proved to be the best and most economical way, however, there is nearly always a chance to increase production or cut down the cost of same and it will no doubt be interesting for some to check up along this line with a view of getting more satisfactory and economical results or making a try at bettering the time on some job now being done in another way.

There is no question that modern high duty machines are conducive to more and perhaps better work, but they would be of little use if not equipped with proper cutting tools, and, in the case of milling machines, regardless of the type, design or age it is essential that good cutters be used in order to obtain the best results therefrom.

The modern type of milling cutters as now used, in most up to date shops, differ considerably from those generally in use but a few years ago, both in devantages of these new type cutters over the old style until a comparison has been made of the work each will do. The wide spacing permits of larger and stronger teeth and better clearance and escape for good large chips, consequently of greater feeds, also lessens amount of grinding necessary and tendency to heat the cutter and work while in operation. It was noticeable that very soon after the introduction of these coarse tooth type cutters the leading manufacturers accepted the advanced design and are now showing them in their catalogues. In many of these new design cutters considerable attention has been given to the matter of spiral and for the various classes of work care should be taken to secure the proper lead, pitch and form of teeth for such cutters.

In the last few years nearly all milling cutters for rapid heavy duty work have been made of high speed steel, the sign and material. The old style carbon steel cutter with many teeth, narrowly spaced, had to give way to the high speed cutter having few wide spaced teeth. It is hard to realize the adsmall sizes being cut from solid stock and the large ones usually built with bodies of cheaper material and high speed inserted teeth. There is no question that high speed steel is the proper material for such tools and will continue to be used by exacting mechanics even at the present high price. The necessity for economy in this line, however, has caused wonderful development in the design and construction of inserted tooth cutters to fully meet requirements and which are equal in performance to those made from solid material.

One of the greatest factors for efficiency in milling is proper lubrication of the cutters. Without some good means of cooling, it is impossible to get near the maximum amount of work out of any design of cutters for the limit of speed is reached when the cutter burns, therefore, in order to prevent destruction and get the most out of the cutters it is necessary that they be kept cool. This is accomplished by the proper application of lubricants and it has been demonstrated that the nature of the lubricant is of minor importance so long as a sufficient quantity is provided. One of the prominent milling machine manufacturers after making exhaustive experiments along this line has developed a very complete system of cutter lubrication, which is featured in connection with its make of machines, special appliances being furnished for the equipment when required. This system provides for a liberal stream of fluid, which is forced upon the cutter through a hood, keeping the cutter cool and also serving to wash away the chips which adds to the life of the cutter.

The possibilities of milling with helical cutters are very great and many shops are employing this method for cutting blocks from solid in steel or iron, where formerly the job was done by drilling holes to release the block and then finishing to size on the slotter or shaper. Where proper equipment is used for such work, the time is greatly in favor of the milling process and the increasing amount of work being done in this manner bears evidence of the fact. One particularly small job of this character which may be interesting is the milling of keyways in piston rods or cross heads instead of drilling, chipping and filing them. This job may be done on a knee type milling machine, but there are some good small portable devices which were recently brought out by the use of which a considerable saving may be effected. A high speed three tooth helical cutter is used and if driven to capacity will cut keyways in piston rods in from 12 to 30 minutes each, depending upon the size and nature of the material. These rod keyways when drilled and chipped by hand usually take from three to five times as long as when done by milling process.

There are other well known operations in railway shop work which it is believed could be handled with more economy and satisfaction if a little preliminary time was given to the study and working out of the proper equipment and way to do the job. If you are interested, though doubtful, about some particular operation, which you think may be done by milling process, send in the blue print or sample of work to a good manufacturer for a guaranteed time and cost estimate of the job. This may save a lot of experimenting and they will be glad to tell you what it will cost and how it can be done.

It is always well to remember the following as essential to good results on the milling machine: Keep your machine in good condition at all times. Use arbors of as large diameter as possible to prevent chattering and springing away from the work. If a rigid intermediate support can be used with bearing close to the cutter, it will be helpful on heavy duty work. Use high speed coarse tooth cutters of design to suit your work and make them produce by keeping cool with lubrication when cutting steel. Increase the feed in proportion to the speed of the cutter to the limit of finish required. Good cutters will produce more work and stay sharp longer when used under these conditions.—C. H. Schaffer.

Steel Rail Requirements—C.M.Schwabb, of the Bethlehem Steel Corporation, is reported to have stated that United States railways will need approximately 5,000,000 tons of steel rails within a year.