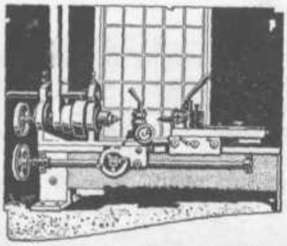


BUILDING A SIX-INCH TURRET LATHE

By J. V. ROMIG

[Arrangements have been made to supply the necessary castings for this lathe, at a low figure, to any who are interested. This magazine has no financial or other interest in this, beyond that of service to the reader. The name and address of the maker will he furnished, upon request, by the Shop Notes Department, Popular Mechanics Magazine, 6 N. Michigan Ave., Chicago.—Editor.]

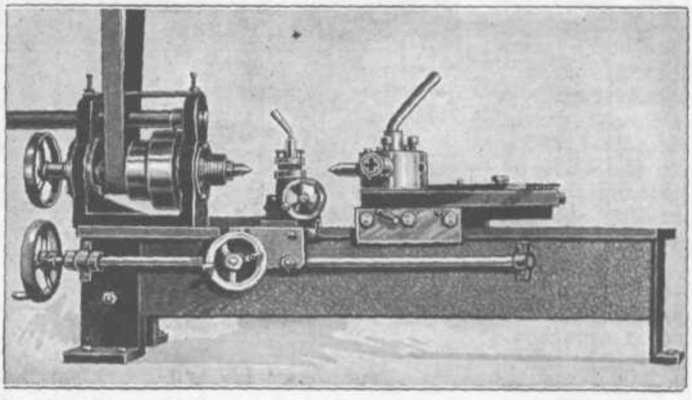
WHILE the turret lathe is essentially a tool for the production of work in large quantities, a 6-in. lathe of the type described in this article will be found exceedingly useful in the small experimental shop. With a center held in the main turret, the machine may be used as a simple engine lathe, and when a number of similar pieces are to be turned out in a hurry the work may be performed in almost as expeditious a manner as on a commercial turret lathe.

This machine was built and used by the author in his own workshop, on fine precision work, and many accurate jobs have been done with it very quickly. Most of the work of building can be done in a workshop equipped only with a vise and bench drill, with the necessary small tools, as flat cold-rolled steel is used for the ways, carriage, and other parts of that character; it will be necessary, however, to have certain things, such as the machining of the headstock and the cutting of the feed screw, done in a machine shop, but this is a small item.

The headstock is made of gray iron, and is fitted with an overarm steadyrest, which allows the carriage to travel the full length of long work, as the work is supported from the top and rear. The spindle is carried, at the rear, by a double-row ball bearing, .75 in. wide, of the combined axial and radial-load type, and at the front by a single-row bearing, .629 in. wide. Both of these bearings have an outside diameter of 2.441 in., and an inside diameter of 1.181 in. Care must be taken to bore the bearing housings a push fit for the bearings, and to have all faces square and parallel with each other.

The spindle should be made of a good grade of steel, of about .3-per-cent carbon content, and is hollow. It is best to bore the spindle first, then re-center and finish the outside. The nose is taper-bored to take the collets, and threaded eight threads per inch, U. S. standard, to fit the faceplates and chucks. The taper seat for the collets should not be finished until the lathe has been completely assembled; it should then be machined with tools held in the toolpost of the lathe itself.

The inner races of the ball bearings should be a good fit on the flat threads on the rear of the spindle, and on the outside of the spindle at the front. Bearing-retaining rings are fitted at the rear, clamping the outer race of the bearing firmly, and taking up the end thrust. These are fitted with felt dust rings, bearing on the collars on the spindle; the rings at the front are also fitted with dust rings, running on the spindle, but these rings do not clamp the single-row bearing, which is permitted to float.



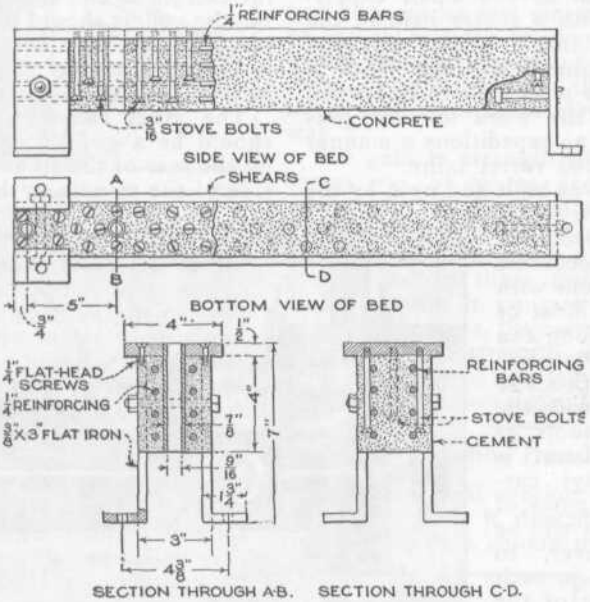
Photograph of the Completed Lathe as Used in the Author's Workshop: It Is Capable of Performing Both Fast and Accurate Work

When the headstock is assembled, the bearing housings should be packed with a good grade of vaseline, which will last a long time; see that the vaseline supply is at all times sufficient for good lubrication. Spindles fitted in this manner are far superior to those fitted with plain bearings, as they consume less power, are free from vibration, and allow of accurate as well as heavy work. The writer has taken a 1/8-in. cut on a piece of 1/2-in. cold-rolled steel at a distance of 5 in. from the collet, the reduced diameter being very accurate as to size.

The drawbar for the collets is a tube, the outer diameter of which fits the bore of the spindle. It is threaded at the front to fit the collets, and is fitted with a handwheel at the rear. A tiebar at the top of the headstock keeps the two arms stiff and rigid. The cone pulley is fastened to the spindle by a setscrew, spotted into the spindle; two cone pulleys, of the same size, should be cast and machined, one being used on the countershaft. The arm for the steadyrest is a length of 1-in. cold-rolled steel; it is clamped in position by 3/8-in. capscrews, which compress the slotted headstock arms. The headstock is fastened to the bed by two 1/2-in. bolts, running up through pieces of pipe cast into the bed; by this means no strains are put on the cement.

The construction of the bed is somewhat of a novelty, although it has been thoroughly tried out by the writer in this and other machines, and found to be very satisfactory. This method of making the bed eliminates the hardest work of making a small lathe, as it does away with the bed casting and the necessary machining.

A piece of 1/2 by 4-in. cold-rolled steel, 30 in. long, is used for the shears. This is first drilled and tapped for a number of 3/16-in. stove bolts, of varying lengths, which are used to anchor the shears to the cement, also drilled and countersunk for the leg screws and for the 1/2-in. headstock bolts. It is next carefully straightened and scraped to a true surface on top and sides, testing the width throughout with a micrometer, and using a knife-edge straightedge on the surfaces; these must be as true and straight as it is possible to make them, as upon their truth depends the accuracy of the lathe. When trued, all surfaces should either be frosted or polished.



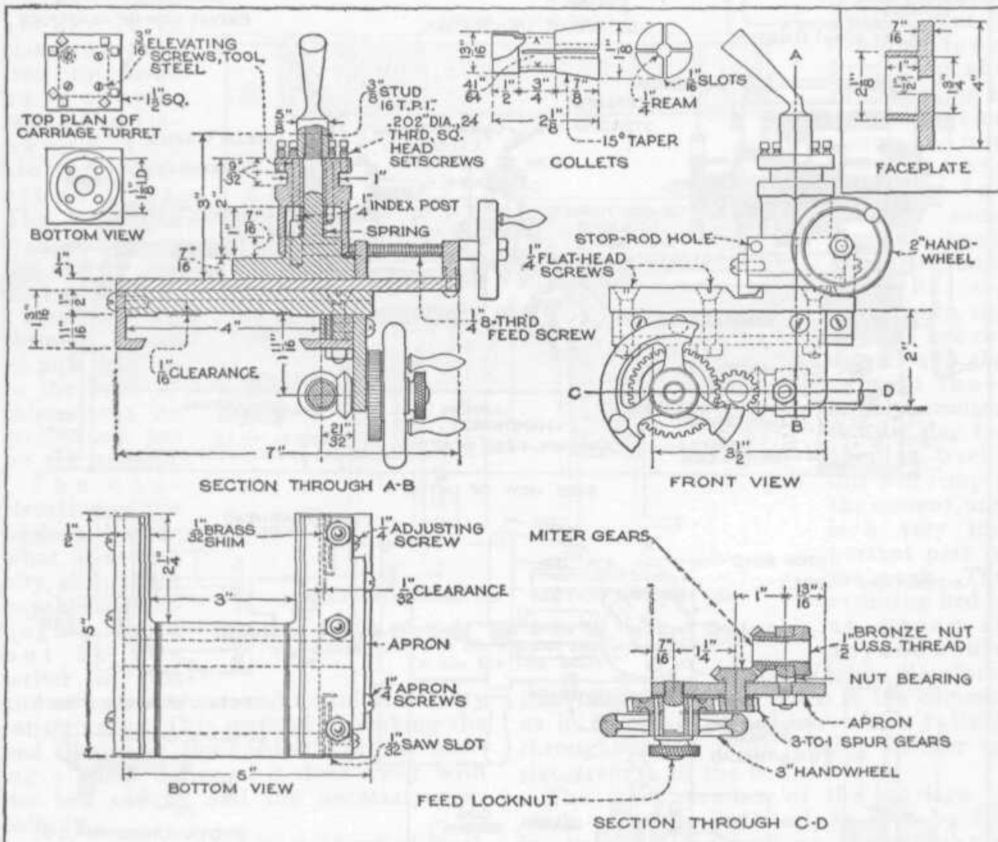
Method of Making the Bed: The Bolts for the Rear Leadscrew Bearing are Not Shown, but should be Cast In like the Leg Bolts

The shear anchor bolts should now be screwed home, the pipes, leg and rear leadscrew-bearing bolts placed in position, and a wooden form made to fit closely around shears and legs, in which to pour the cement. The cement used is a mixture of one part Portland cement to three parts clean, sharp sand, mixed with just enough water to enable a handful of the mixture to be picked up and squeezed and to leave the impression of the fingers in it. This cement is tamped down firmly in the form, poking it around the screws and into the corners with an ice pick, or some similar tool. When the concrete has set thoroughly, the boards are removed and the cement thoroughly wetted twice a day for about a week; this will temper the cement, and is a very important part of the work. The resulting bed is as strong as anyone could wish. Reinforcing rods may be laid down in the cement, as it is being placed, or wires twisted throughout the bolts, adding further to the strength of the bed.

The main member of the carriage is made of cold-rolled steel, 1/2 by 5 by 5 1/4 in. in size, machined as shown in the carriage-detail drawing. A piece of 1/4 by 2-in. cold-rolled steel, 7 in. long, is fastened to the top of the main member by 3/16-in. screws; on this piece the cross slide runs. The cross slide is also made of steel, machined as shown, and is fitted with a turret toolpost. The cross slide is held to its ways by means of angle pieces, as shown in the front view of the carriage. The turret is made of steel, and is casehardened; four tools can be mounted in this at once. On the boss of the cross slide is mounted a small index post, into the countersunk top of which the elevating screws fit, allowing each tool to be adjusted to its correct cutting height. A spring pushes the turret upward when the clamping handle is loosened, allowing the turret to be turned to bring another tool into cutting position. A 1/4-in. square-thread screw operates the cross slide, and the tools are held in the toolpost by 1/4-in. square-head setscrews.

The apron of the carriage is made of steel, 2 in. wide, and is fastened to the main carriage member by flat-head machine screws. The front angle piece of against the edge of the shears. Brass shims, or wearing pieces,1/32in. thick, are set in the ends, to take the wear on the filler piece. The rear angle is plain, machined as shown in the drawing.

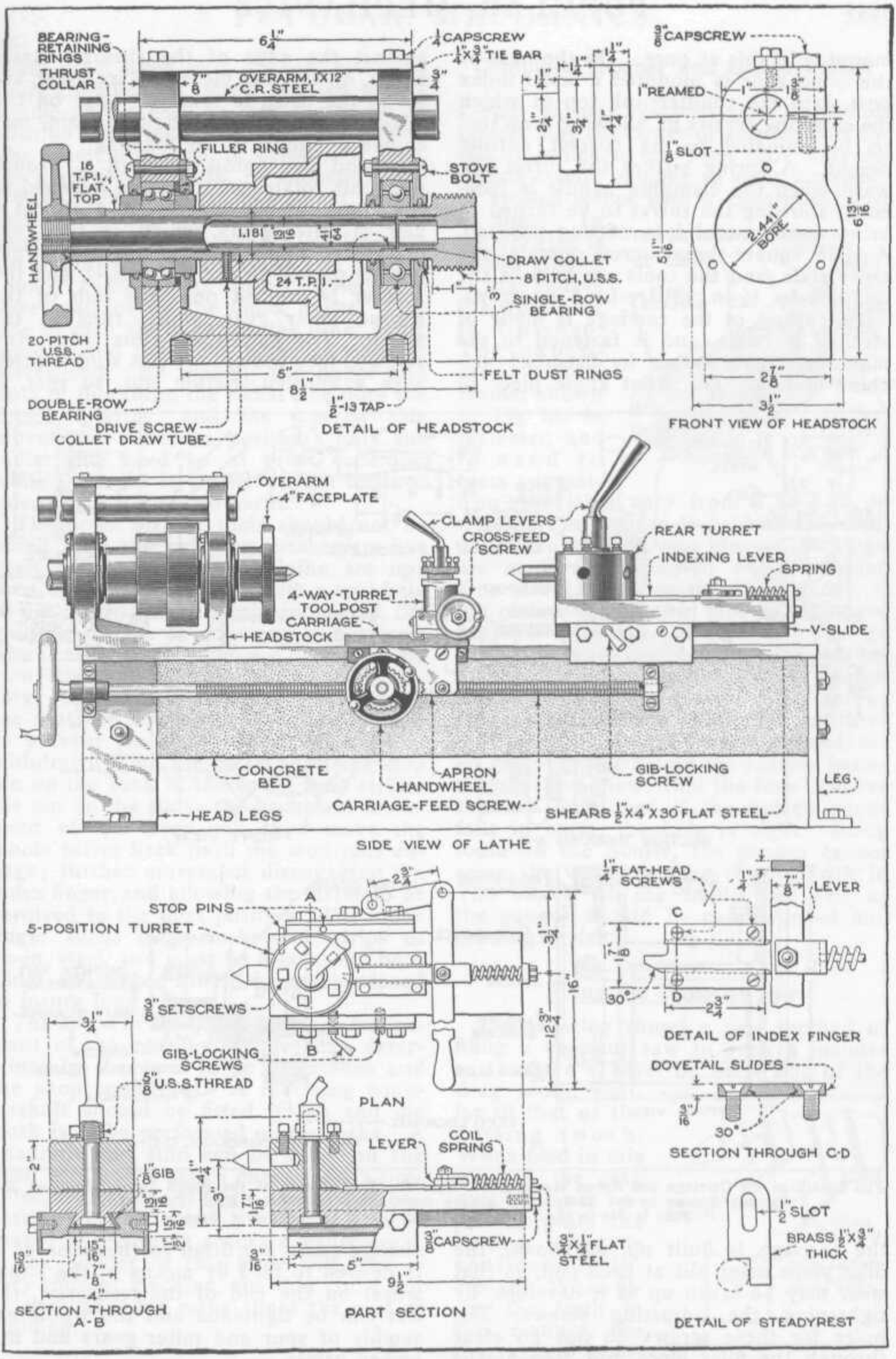
Behind the apron is fitted a bronze nut; this rotates in a bearing fastened to the apron, and is screwed into one of a pair of miter gears, which, in turn, are driven by 3-to-l spur gears; the larger gear is pinned to the handwheel, and the smaller is pressed onto the hub of the second miter gear, which runs in the apron. The handwheel runs on a stud screwed into the apron; this stud is fitted with a knurled friction nut, so that, if



Full Details of the Carriage and Apron Mechanism: Note the Employment of the Small Index Post and Elevating Screws in the Toolpost to Secure the Correct Height for Each Tool. The Post is Set in the Inner Left-Hand Corner of the Turret Base

the carriage is built up, as shown, the filler piece being slit at each end, so that wear may be taken up as it develops, by tightening the adjusting screws. The holes for these screws do not go clear through the filler piece, but stop at the slits, so that, by screwing the screws in, the inner ends of the filler are pressed change gears are fitted to the lathe or it is desired to feed by means of the handwheel on the end of the leadscrew, the nut can be tightened and the whole assembly of spur and miter gears and nut locked firmly.

The rear, or main-turret, base and slide are made of cast iron, a dovetailed slide



Details of the Headstock and Main Turret, and Side Elevation of Completed Lathe: When a Center is Used in the Turret, as Shown, and the Gib-Locking Screw Tightened, the Tool can be Used as an Ordinary Bench Lathe, for Turning Work between Centers. Five Tools can be Used in the Main Turret, and Four in the Toolpost Turret, Making for Speed in Production being used, fitted with a 1/8-in. gib. The front gib-adjusting screw is fitted with a handle and is used to lock the turret in position for plain turning operations. The turret pivot pin, of cold-rolled steel, casehardened, is 5/8 in. in diameter, with a 5/8-in. U. S. standard thread cut on the upper end, and fitted with a clamping handle. The turret is made of steel, undercut as shown in the drawings, and has five equally spaced slots milled around the lower surface for the index finger. One side of each slot is radial, the other being tapered, and the index finger is made to correspond. By making the finger and slots of this form, the radial side does the actual locating, and the tapered side moves the turret to position; only the radial side need be of great accuracy, while the wear is chiefly on the inclined side, where it does no harm.

The holes for the tools should not be bored until the indexing mechanism has been assembled and the lathe set up; then, by boring the holes with a tool held in the chuck, and correctly supported, the greatest degree of accuracy is obtained. The details of the indexing device are so complete that little description is necessary; care should be taken, however, to see that the coil spring is heavy enough to prevent the index finger from being withdrawn from the turret until the stop pin on the back of the turret base strikes the pin on the slide; the backward movement of the lever will thus move the whole turret back until the stop pins engage; further movement disengaging the index finger, and allowing the turret to be revolved to the next position. The index finger slides between beveled strips of 3/16-in. steel, and must be a good fit; both slides and finger should be casehardened to insure long life.

The speed of the lathe, and the arrangement of the countershaft, will be determined by the work to be undertaken and the shop conditions. A reversing countershaft should be fitted if tap and die work is to be performed on the lathe. A quadrant and stud can be fitted on the head end, and a set of change gears provided, if the lathe is to be used for screw-cutting; in this event, no care should be spared to secure an accurate leadscrew.

The builder of this lathe will have a very efficient machine, one that could not be purchased for many times the cost of building.