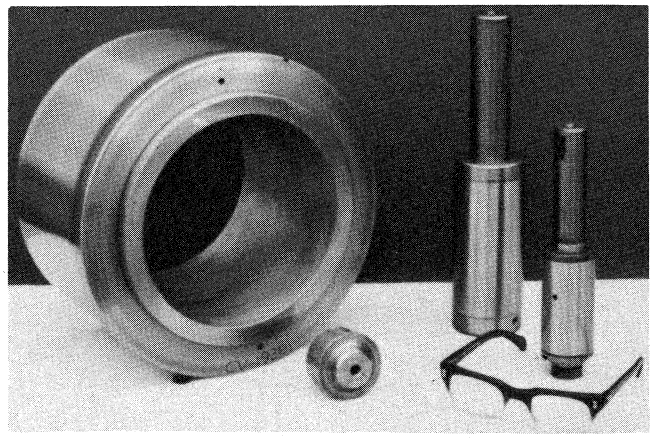
Rigid support of rotating cutting tools



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Machine tools often support solid toolholders with bronze outer sleeves or bushings. It then becomes necessary to provide sufficient radial looseness between the toolholder and the sleeve to allow for thermal expansion of the toolholder caused by frictional heat. This initial radial looseness and the subsequent wearing of the toolholder OD and the bronze sleeve adversely affect the size and finish of the workpieces. The excessive radial looseness also results in poor tool life as determined by the number of pieces cut per grind.

These factors contribute to an excessive amount of machine downtime and a large number of rejects. Fortunately, there is a solution. Standard antifriction rotary bushings manufactured by Gatco, Inc, are designed to support the toolholder or tool rigidly with a close sliding fit maintained without frictional wear, **Figure 1**.

Bushings in setup

Buick Motor Div, Factory 36, Flint, MI, had the problem of a chatter finish in the bore of intake manifold holes. Their cutting tools were mounted in a solid toolholder for each of a cluster of four holes. Each toolholder was supported radially in individual stationary bronze outer sleeves.

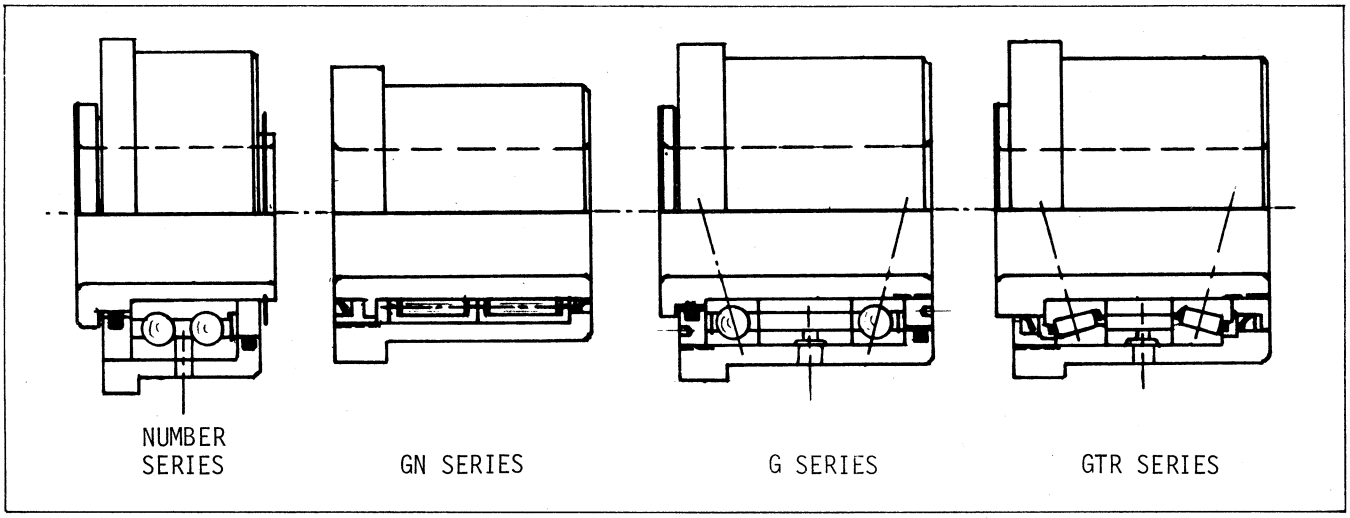
Because of the restricted center distance of the four clustered holes at this particular station of the engine transfer line, it was not possible to use standard rotary bushings. A trial order was therefore processed for one interchangeable special rotary toolholder, **Figure 2**, for one of the four holes to see if it would stop the chatter.

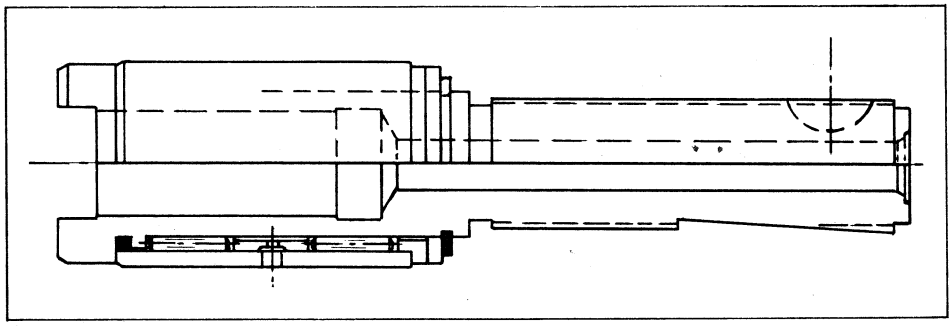
Since there is no thermal expansion of a friction-free rotary toolholder, we recommended a close fit with the stationary bronze outer sleeve to maintain a rigid support of the cutting tool. After many hours of smooth operation, the trial rotary toolholder was approved for production use. Ron Montgomery, tool engineer, also advised that the rigid support of the cutting tool substantially increased tool life and resulted in a chatter-free finish.

The gundrilling machines at Detroit Universal Div, Chrysler Corp, were originally provided with an adaptor-type hardened and ground stationary bushing. This bushing supported the concentric start of a six-fluted solid carbide drill to finish a cored ID. The part was a transmission output shaft slip yoke subsequently assembled to the drive shaft. It was impossible to maintain concentricity and size accuracy because of the frictional wear of the stationary bushing ID. Also, there was excessive downtime for replacement of the bushings.

At Chrysler's request, a special rotary bushing was designed and manufactured by Gatco, as shown in **Figure 3**. The desired accuracies and extended tool life were accomplished, reducing the machine downtime considerably. The difficult aspect of the gundrilling problem was that the cored hole was often eccentric, creating a heavier radial cutting

1. *Standard rotary bushing designs available from Gatco include: Number Series, recommended for use only when one end of the guided bar is supported in a spindle; GN Series, same as Number Series recommendation but are especially useful where limitations of case OD, for a given liner ID, are too restrictive for the Number Series, or where radial load requirements exceed capacities of the Number Series; G Series, for use with a floating bar or with a bar having one end supported in a spindle; GTR Series, same use as the G Series except they are advantageous where increased linear thrust capacity is needed.*

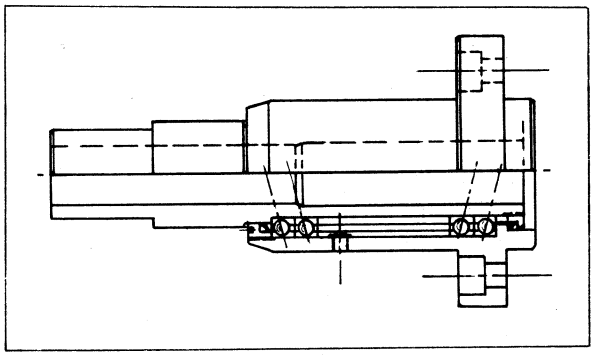




2. *Special GTH-869 rotary toolholder solved problem of tool chatter. Antifriction design also stopped freeze-ups caused by thermal expansion in solid toolholders. Application is the boring of intake manifold holes in engine blocks.*

pressure on one side than the other. This further necessitated the substantial support provided by a rotary bushing.

The use of a special interchangeable thin-walled rotary bushing serves well in applications where a cluster of holes must be drilled within limited center distances. For example, we designed special thin-walled rotary bushings for Massey-Ferguson, Wayne, MI, for a cluster of three holes. They replaced solid bronze bushings, which, as a result of frictional wear, created a lack of rigidity of the radial tool support, **Figure 4**.

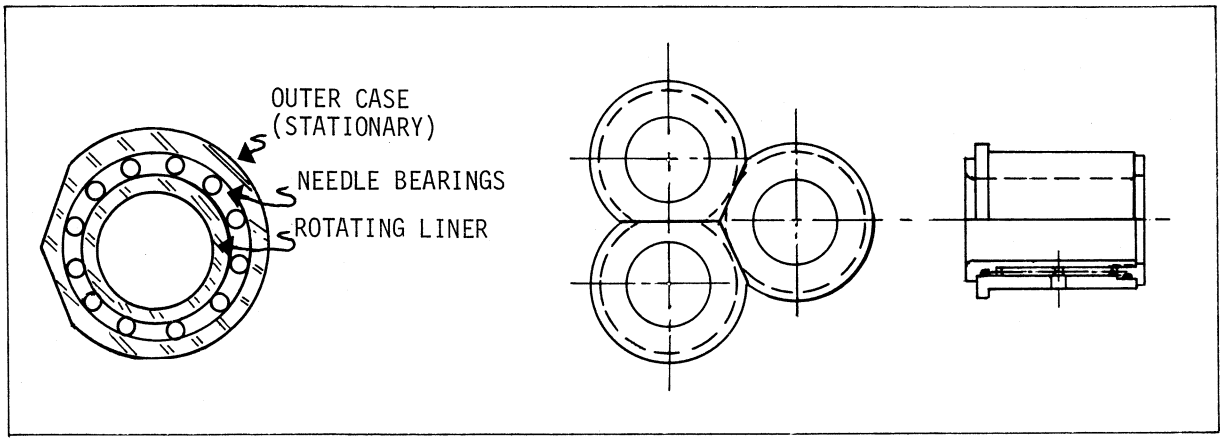


3. *Special G-884 rotary bushing replaced adaptor type bushing. Antifriction bearings reduced wear and held up to radial side loads caused by eccentricity of cored hole being drilled. The design extended length of guide bushing from bushing plate to permit drill support close to part.*

Milling applications

Nut arbors for standard or special milling machines customarily use a rotary bushing as an outboard support for various cutters. Cataloged rotary bushings generally are adequate for special machines. Only a slight modification is necessary, consisting of face grinding both ends of the inner liner and removing the outer flange if desired. For heavy-duty arbors, such as those used for multiple carbide saws for splitting engine bearing caps, the cataloged rotary bushings should be adapted by face grinding both ends of the inner liner. For longer milling arbors (for multiple side-milling operations), a mid-support special rotary bushing may be required to prevent deflection of the arbor.

4. *Thin-walled models GN-1211, GN-1212 and GN-1213 are clustered to replace solid bronze bushings. Milled flats on bushing cases assure proper seating. Each case is hardened and ground to permit use of smaller OD bearing. The bearing ID is 1.375". Size and angularity must be maintained so that the three bushings fit into bushing plate simultaneously with adequate support and without interference. Both liner and case must be distortion free, in spite of the thin walls and the added stress points of the milled sections. Design must also provide clamping flats on each case and lubrication access at both ends of the bushings.*



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