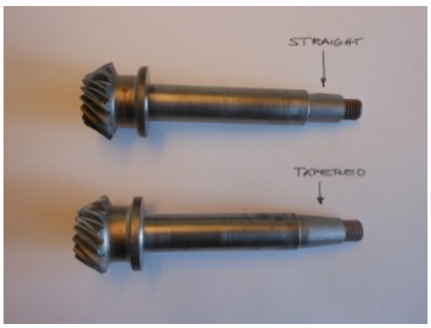
The Flex Plate and Vertical Drive.
An article Inspired by Bill Bollendonk who is negotiating his way through an L rebuild.

In the restoration of the prewar triple M engines, there are a substantial number of tricks and procedures, which if applied, will assure success. This article delineates a protocol for addressing the flexible coupling and the components which drive the overhead camshaft, a source of common failure from the factory floor to the present day.

For many of you who are familiar with this drive, the goal is to prevent stress to the coupling both on assembly and in operation: the coupling should remain perfectly flat in one plain (no wave) and aligned with the head so that the D-headed bolts drop into the coupling bores without flex plate distortion. Reduction in cylinder head thickness and periodic decking to the block are obvious sources of geometric change. To establish a flex free flex plate is a goal that requires attention to detail.

The Fork Drive:

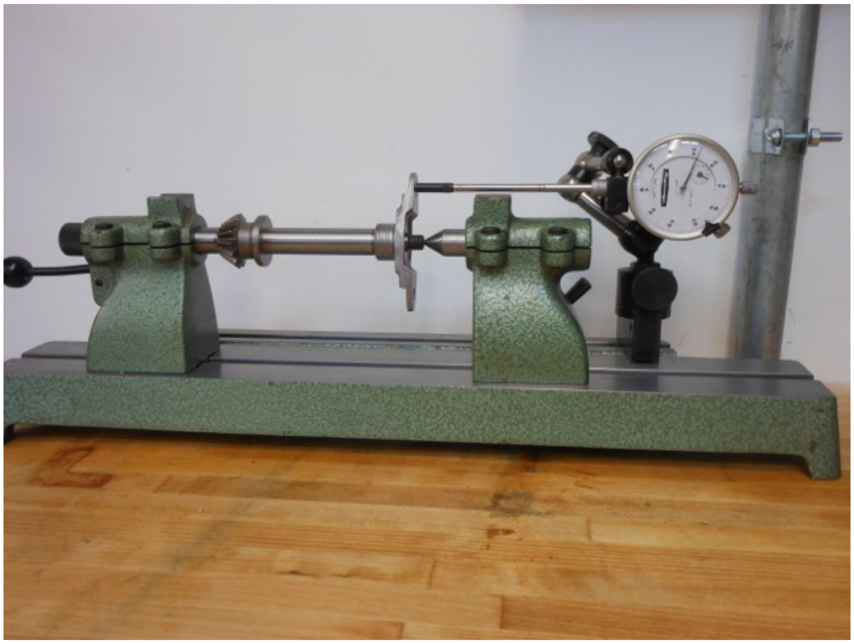
The vertical bevel geared shaft that drives the camshaft comes in two flavors: one with a straight shank on which the fork is assembled and the other with a tapered end to engage a tapered bore in the fork. Most engine builders have abandoned using the straight shank variety because they are prone to failure unless assembled with a heat shrink fit. The bevel gear with a tapered end, assures a steadfast attachment to the fork, however, it requires a thoughtful review of the liabilities on assembly.

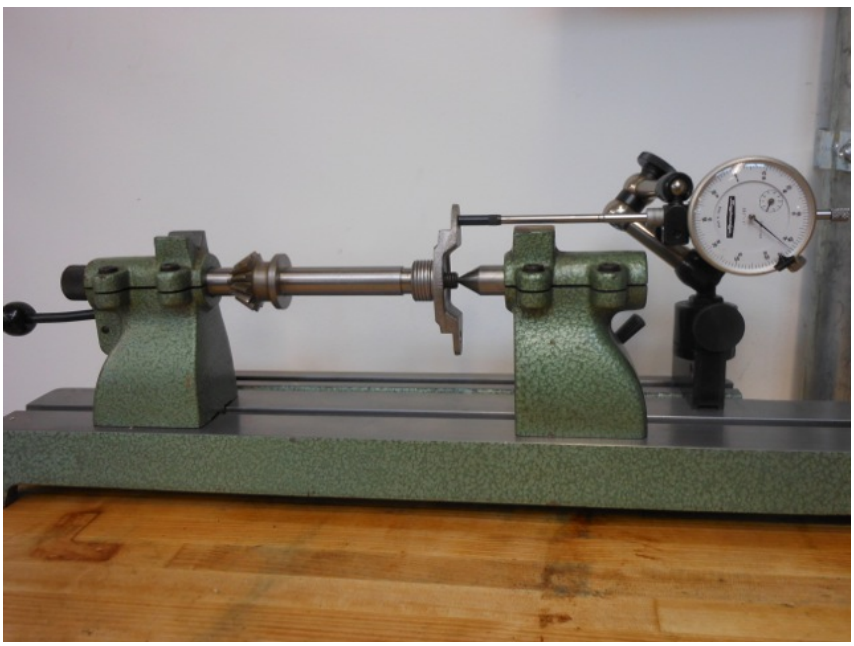


1. The tapered bored forks also come in many varieties, the consequence of which is a varied position on the bevel geared shaft. This, in turn, affects the acceptable clearance with the flex disk on assembly: a fork that protrudes vertically too far will flex the coupling down; a fork that falls short of the disk will warp the coupling vertically up on assembly.

A careful look at both new and old forks assembled below show some that are relatively flat and others whose forked ends are significantly offset.

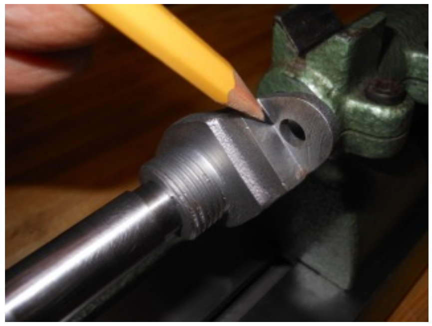
In addition to these varied offsets, the tapered bores vary significantly and will position the forks in different locations on the shaft. Notice the variations in fork positions on the two pictures below. (The shaft is new and the two forks are new.) The first picture will yield an assembly which is .210" shorter than the assembly in the second picture. This information would prove most helpful should a longer or shorter assembly be needed.





If it were to be anticipated that an original bevel geared fork would be reused, this component should be magna fluxed (or dye penetrant tested). A spanner of the type photoed below insures the areas of concern are easily visible during inspection.

Over long use and/or mis-registration with the generator drive, the fork will fail in two areas: 1. At the base of the scroll. 2. In the area under the D-head bolts. Failure usually occurs in these locations as a fault of a marginal or no radius machined into the fillets.



The area of the scroll will be addressed later in this article, however, the area under the head of the D-bolt can be dressed with a jewelers file with a radius edge. Set the fork into a chuck with a locked spindle and dress the milled cut. In this way, the stress raiser at the root of the cut will be eliminated.

The Tapered Shaft:

The chance that the tapered bore in your chosen fork will perfectly match the taper on the vertical shaft is less than probable. To insure that fork is secure on the shaft when assembled, these two components must be lapped together. Using either machinist lapping compounds or a combination of coarse and fine valve grinding compound, lap these two together oscillating thirty degrees, lifting up, relocating, and re-lapping similar to the process of lapping a valve into a cylinder head. To start with a grit of 240 and end with 400 to 600 grit would be appropriate. The end of your efforts should leave a evenly mat surface finish on both components. You may be surprised how long this will take.

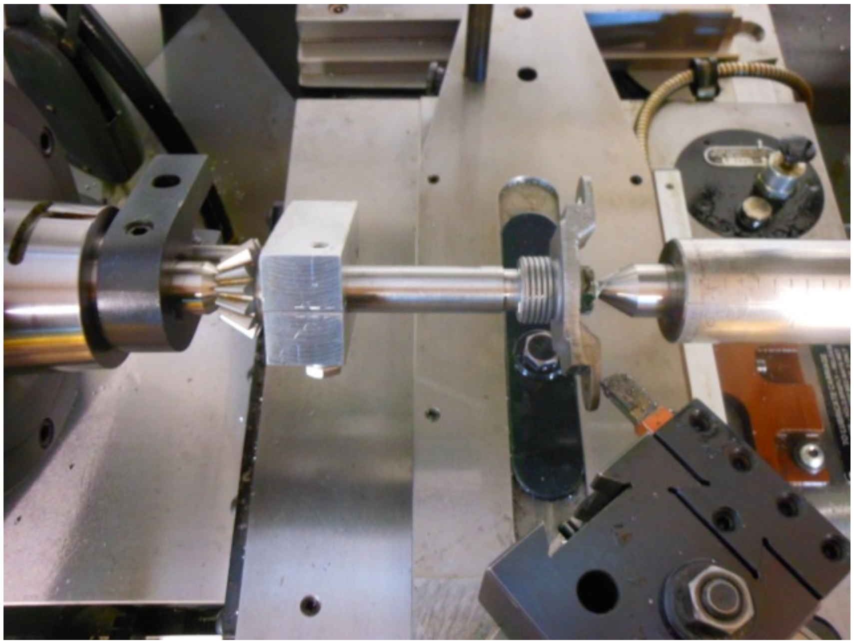
With the potential of the fork and shaft now to be mated as an assembly, there is still no assurance that the plane of the fork is perpendicular to the axis of the shaft. It most likely is not, especially if the chosen components are new. To address this issue, and it is an IMPORTANT ONE to address:

1. Clean the fork bore and the shaft of all residual lapping compound.

2. Install the key insuring a tight fit into the keyway slot in the shaft.

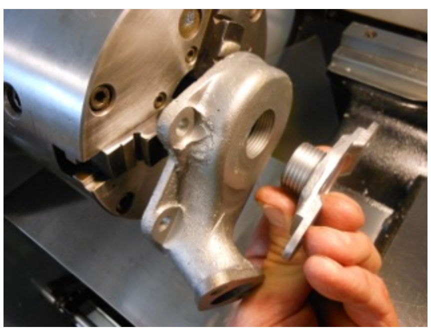
3. Lightly lubricate the shaft and fork and torque together.

3. Assemble between centers on a lathe with a suitable dog drive and machine the face of the fork as seen below. **Note:** It is recommended that if the generator was finish assembled to the front housing and the head fitted to the block with a gasket of appropriate thickness, the distance between the generator fork and the vertical drive fork could be measured and the fork machined to the thickness of the flex coupling swaged collars.

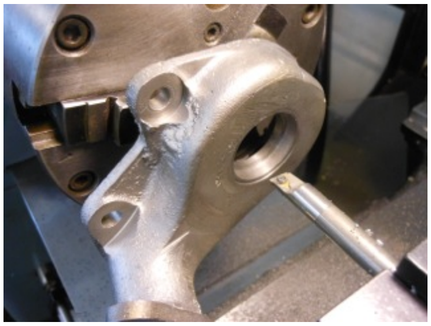


Oil Sealing the Vertical Housing:

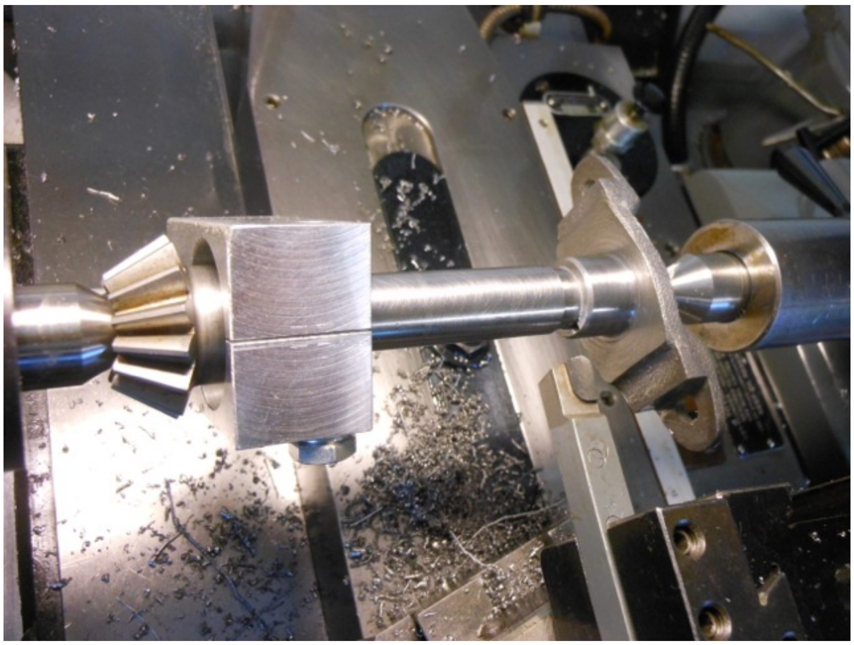
Before removing the fork from the shaft, it is wise to reflect on oil control. Traditionally, oil accumulating in the housing above the generator would overpower the reverse acme threads machined onto the fork. Misalignment and loose assembly would compound the problem by imparting matching grooves in the upper casting making oil control nearly impossible. Remedies in Great Britain would include soldering a disc to the underside of the fork to act as a slinger to shield the generator but create a spray of oil around the engine bay and inside bonnet.



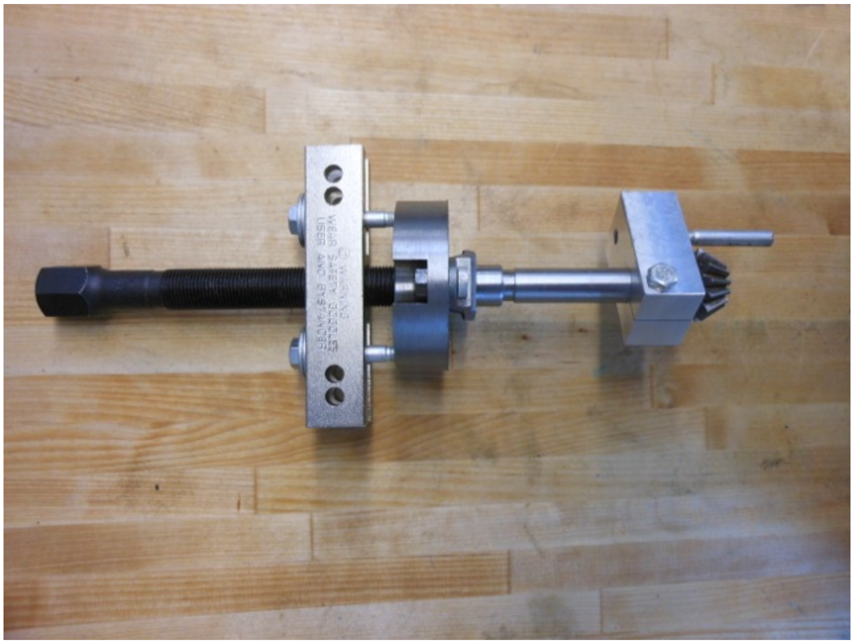
Perhaps a more reasonable solution is to machine the housing to accept a modern lip seal. This is easily accomplished by centering the housing on the lathe and machining a counterbore into the housing to accept the seal. Use of a National Oil Seal, number 240816, might be an appropriate choice. Because the housing is tapered on the underside, a wise machine practice is to machine the face of the bore where the seal would enter so that when pressing in the seal, the seal will not cock on entry.



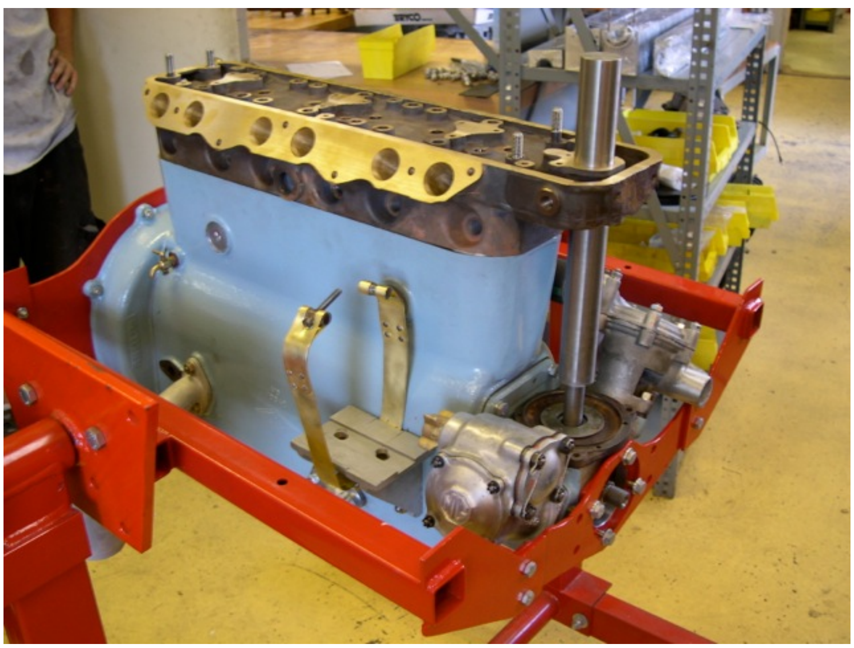
Having kept the shaft and fork attached, this assembly may now go back onto the lathe to machine off the acme threads to the prescribed diameter for the oil seal. This journal needs to be very smooth (perhaps finished with an emery cloth while on the lathe). Special attention should be payed to radius the cutting tool so as not to create a stress raiser in the fillet of the journal.



The efforts to create an absolutely true shaft and fork assembly can be ruined without one last precaution. It is an often seen in practice to pull the fork off the shaft using a dual armed puller engaged to the two ends of the fork. With the fork tight on the shaft, this will likely bend the ends of the fork inward, and thus negate all mentioned previous efforts. A far safer and best practice would be to engage the use of an intermediary disc that would bolt to the fork to keep the arms in the same plane and then use a puller pushing through the center of fork to release the fork from the vertical shaft. The fork will pop off the tapered shaft and no damage will be incurred to the fork arms.



For the practice as just described to have merit, it is imperative that the vertical drive and the generator have a common axis. This procedure is described in Blowers Manual and elsewhere and employs a fixture similar to what is pictured below.



If you feel a sense of exhaustion from having plowed through this article, it is because the prewar MMM engines are complex and lack the simplicity of their pushrod cousins. The rewards, however, are in having Safety while going Fast.