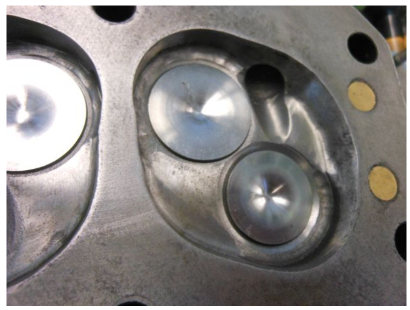
Reflections on the MMM "Valve Job"

Over the past few decades, I have sensed a subtle divide within the vintage car hobby between participants who delight in the form of the auto, its aesthetic, and those that prefer to focus on its function, how it works. To illustrate the weight of each camp, one only has to view the last ten issues of Sports Car Digest and discover the total absence of photography that could potentially highlight the fabulous mechanics of all the cars profiled. What a pity, because the beauty lies within. **Warning:** The following "tech share" is a bit esoteric, so if your interest lies less with function and more with form, you might want to skip to the next article.

A month ago, one of our MMM members expressed concern that in racing his P, there was a substantial loss of power as he hit 5000 rpm. Of course the power curve flattens out in the upper register but there may be more to the story. Our cars are now approaching eighty years old and many of the engines have gone through multiple rebuilds which have included "valve jobs." Each of these procedures lowers the valve seat into the combustion chamber, shortens the length of the valve in order to gain valve clearance, and unless precautions are taken, reduces valve spring compression. The result permits the valve to float at high rpm sapping both compression and performance. In addition, the valve adjustment for clearance, where the eccentric is rotated on the rocker, yields varying valve timing on each and every one of the valves. What follows is a prescription of how to remedy salvaging an abused cylinder head with severe valve seat recession. **Caveat:** The following is only how I address this issue: it may be performed better and more expediently by those more gifted than myself. When rebuilding my first K3, I received a letter from Cecil Cousins who roughly outlined a similar process used by the factory which follows what I forthwith describe. Additionally, Bob Jones outlines his procedure in the "MG Road Cars, Vol. 2" which is similar and conveniently less burdened by words.

To Begin:

In addressing most challenges, it is best to first assess "what you got." The photo on the left is of a New Old Stock cylinder chamber in an N head. The valves are nearly co-planar with the chamber bottom. The photo on the right is of another N head with severe valve pocketing (recession). Notice how recessed the valves are below the chamber. (Modifying the combustion chambers varies the volume of each chamber which then need to be measured and balanced with the other chambers ... but that is a story for another issue.)



Over time, each valve grinding has steadily moved the valve further into the combustion chamber, and as a result, has pushed the valve stem up toward the rocker. In order to adjust for clearance, the valve must be shortened, which at the end of the day (or decade) makes for much less purchase of the keeper to retain the valve spring retainer. Notice the difference between the well shortened used valve on the top and a new valve on the bottom.

Because the valve keepers (or cotters if you are British) are retained in the newly purchased valve stems at the same location as the old valves, the effect is to permit the valve spring to be less compressed as the valve is pocketed.This, as can be seen in the above photo, can be appreciable and decreases the valve spring's ability to close the valve at high rpm by over 25%.

What to do? One solution is to machine spacers to be installed under each valve spring, carefully measuring to insure that each spring delivers the same compressed load to its respective valve. With minimal valve recession, this is manageable and the spacers would be more like shims for fine adjustment. When the valve pocketing is more severe, a more elegant approach is possible that insures not only nearly perfect matched compression loads between valves, but also ensures identical rocker geometry and valve timing once the job is executed.

This approach starts with appropriately machined valves which have no keeper grooves installed: machined from the correct material (21-4N and stainless in my case), correct head diameter, and 9/32" stems with the original length. The sequence is as follows:

1. After the valve guides have been installed and sized to correct intake and exhaust stem clearances, and after the valve seats have been machined and valves lapped to their respective seats, each valve is numbered to its respective guide. **Note:** My process for machining the seats utilizes valve cutters (not grinding stones) with 60, 45, 30 degree angles to position the valve onto the seat with a .065" for exhaust and .050" contact on the head: wider for the exhaust to enhance cooling.

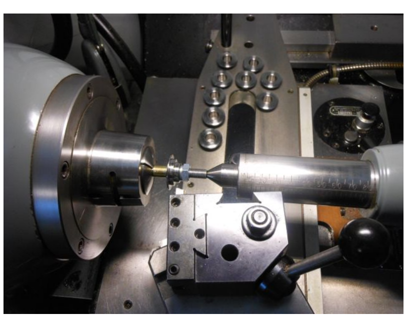
2.Valve stems are then coated with machinist dye and located in a numbered valve carrier so that no mistake can be made in keeping track of each valve's position in the head.

3. The object of the game is to machine new keeper grooves into each valve stem to produce the correct loading to close the valve. The required spring load for competition and supercharged engines is slightly greater than normally aspirated engines used for touring. My rule of thumb is: (This differs slightly from Blower's manual which does not take into account the spring retainer inner boss)

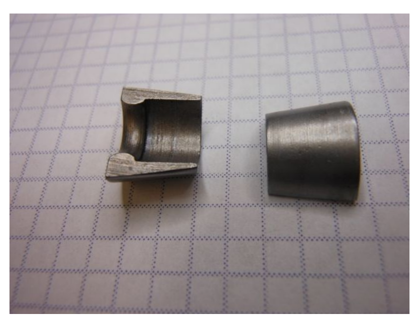
	Normally Aspirated	Supercharged/Competition
Installed	48-50lb	58-60lb

It might be noted that for competition use, I machine my own valve spring retainers from titanium and use single groove classic Mini Cooper keepers. This combination reduces reciprocating weight and thus requires the valve springs to do less work. This helps ensure against valve float at higher rpm.

Machining titanium retainers



Single groove keepers

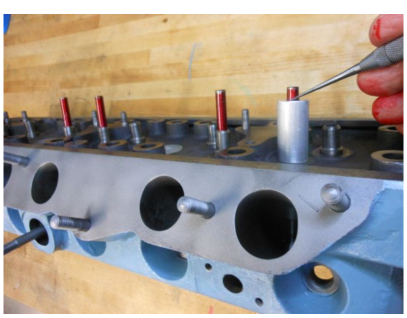


It is also good advice to start with a matched set of springs, all producing the same load at the same installed height. In the MG world, there will be variations within each spring set. I separate each spring, record its compression at the installed height and mix and match until I find uniformity.

Testing spring load

Duplex + Inner helper spring

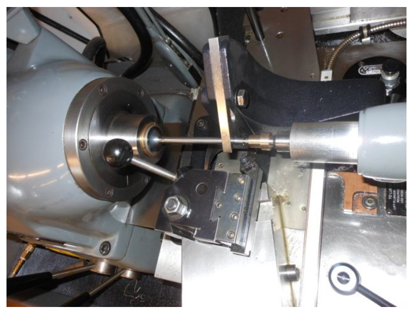
4. Knowing where the keeper groove now needs to be located to produce identical valve spring heights for the correct installed load, each valve is installed into the head and marked for keeper groove location. I machine a tube which fits over the valve and the guide to a length which is the desired installed valve spring height moderated by the thickness of the retainer and how it is positioned by the keeper. OK, this may seem abstruse on first reading, but it's just describes an effort to get the valve spring at the correct installed height....and it depends on what variety of retainer and keeper you select to use. With the valve held firm against its seat, I mark the position to machine the keeper groove.



5. OK, if I told you that machining the keeper groove into a stainless

or 21-4N valve is easy, you would not believe me and I would be lying. That said, this is how I do it.

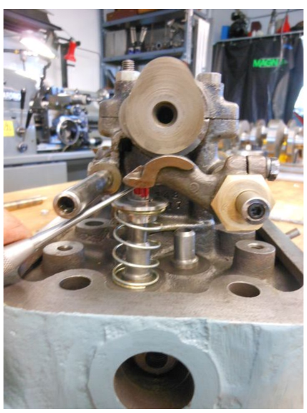
a. I use carbide insert tooling ... and for the Mini radius keepers ... a radius cutter .106" diameter
b. I set up on a Hardinge toolroom lathe with digital readouts, follower bar, and a live tailstock machined to take the end of the 9/32" valve. (I ain't sure how I would do it otherwise ... but there are thems that know better and are more clever ...)



The photo on the left shows the product of one's effort. A rule of thumb is to have the combination of keepers and retainer such that when assembled and pulled tight, the retainer stays in position held by the wedge action of the keepers. The photo on the right shows the finished valve with new retainer next to an original assembly. The new retainer is machined to more positively locate the valve springs, whereas the original allows for substantial unwanted radial movement between the pair of springs.

6. With each valve now machined with a keeper groove in the

appropriate position, the valve must be machined for length to gain the required valve clearance. Parting off the end of the valve requires only a suitable chuck in the lathe and a carbide cutoff tool, however, locating where to cut is a bit more involved. The following assumes that all attention has been paid to the cam bearings, camshaft, rocker bushings, rockers and shafts. Next, install the valve into its designated guide and using a light spring, assemble the keepers and retainer. Coat the end of the valve with dye and install the camshaft into cam carriers. With the eccentric on the rocker oriented in the correct position (**Caution:** the J differs from the K/L/N/ and P), slide the rocker onto its shaft tucking it under the heel of the cam lobe. The valve can now be scribed for shortening. This will, in most cases, produce zero clearance which is then more finely tuned by a grinding fixture on the end of a valve grinder. This last operation has the increased benefit of producing a very fine finish on the end of the valve which prevents abrasion with the rocker and a surface that is precisely orthogonal to the axis of the valve stem.



With each valve done, in turn, the valve job is now complete and final assembly and timing can commence. The described process is a lengthy one ... both in process and description ... but the result can be satisfying when the RPMs rise and the power is faultlessly generated. It also might salvage a head deemed to be unusable! A perspective often missed by novices to the marque is that the design of the prewar MG cylinder head is complex: to rebuild the top end of a prewar Maserati, Delahaye, Miller, Alfa Romeo is SOOOO much easier ... no complicated rocker geometry, eccentrics, etc., etc.. But, in your core, if you're a "MG Man/Woman" you may have to rise above the complexity to compete with the rest of the prewar field. This is written as an encouragement and guide to help pilot your way. GOOD LUCK!

Chris Leydon

Christopher F. Leydon
chris@christopherleydon.com