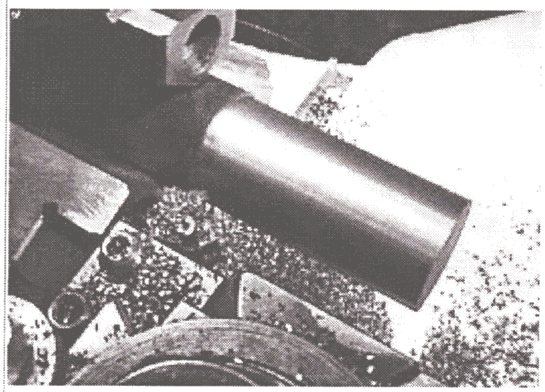
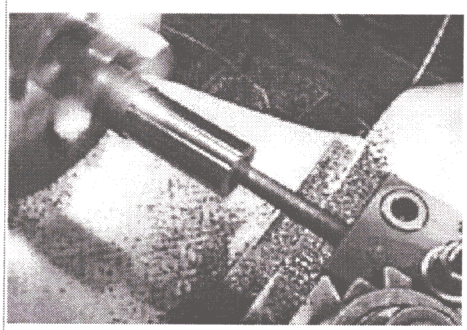
Pistons and Rings

Piston rings are not difficult to make IF you have the necessary formulae. There is a fine line between a piston ring which works, and another which is too weak (compressive wall force), too stiff (impossible to install without breakage), or otherwise unsuitable. The finest treatise on making custom piston rings can be found in the magazine *Strictly IC,* issues 7, 8, and 9. Editor Bob Washburn has all of the back issues. The author of the series on piston ring construction is Mr. George Trimble, and he approached the subject scientifically, deriving a method which will make great rings for *any* IC engine. The method makes use of a mandrel which holds the rings spread for heat treatment, and is based on ratios of ring thickness to bore.



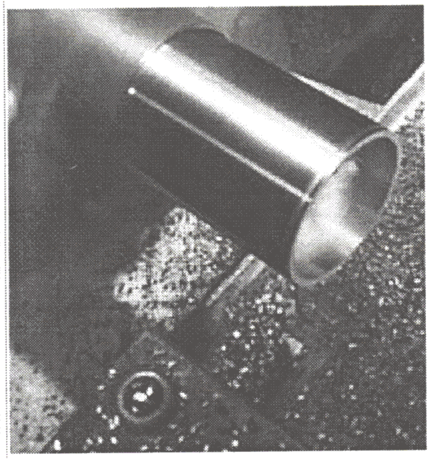
The first step in preparing rings is to rough out (and then polish) the outside diameter of the rings from a fine-grained cast-iron bar. Tolerance is +.0006, -.0000. UNDERSIZED RINGS are a no-no, and will not work. The bore size of all my cylinders is 1.0003", +.0002, -.0002. Hence I needed this bar to measure 1.0005" minimum. I shot for 1.0005". The bar is turned to 1.0015", and the taper carefully measured. In my case it tapered .0004". I used silicon carbide wet-dry paper in grits 320, 600, 1200, 1500, and 2000 to SLOWLY remove the taper and polish the bar to a mirror finish. The paper is backed with a hardened steel parallel. Final dimension was within .0001 throughout the length.



The bore of the ring stock is cut. The grooves already cut in the piston measure .904" diameter. I elected to bore the ring stock to .914 to provide plenty of clearance. Final cuts were taken with a very minimal feed to remove spring from the tool, maybe 3 passes for the final .005". Internal taper was negligible.

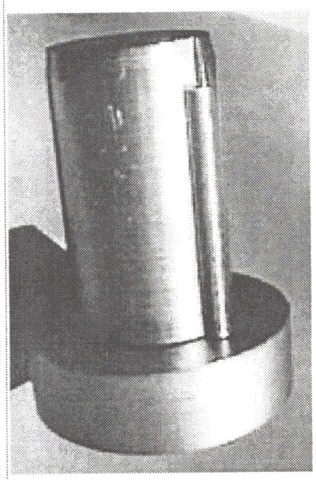
Note the high finish on the OD of the ring stock compared to the turned finish in the above photo.

A *mini-thin* parting tool of width .027" was used



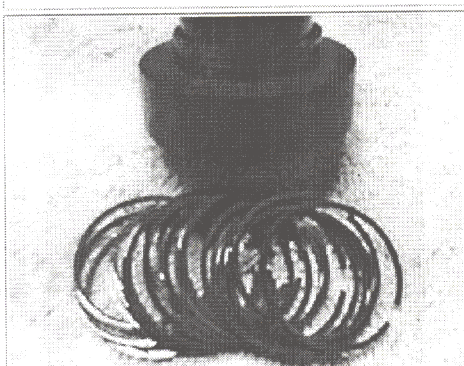
to part the individual rings. Before parting, the outer rim is deburred with a hard arkansas stone, and partway through the stock, the tool is withdrawn and the inner OD rim is deburred as well. The ID rims are deburred after parting with a Cratex rubberized abrasive mounted in a Foredom hand tool. My engine uses 2 rings per piston... I planned on 36 rings, as many will be scrapped for one reson or another. The white stuff inside the bore is a paper towel shoved in to control ringing and chatter during parting.

After parting, the *faces* of the rings are lapped on a surface plate with progressively finer wet-dry, with 2000 grit producing a mirror finish.

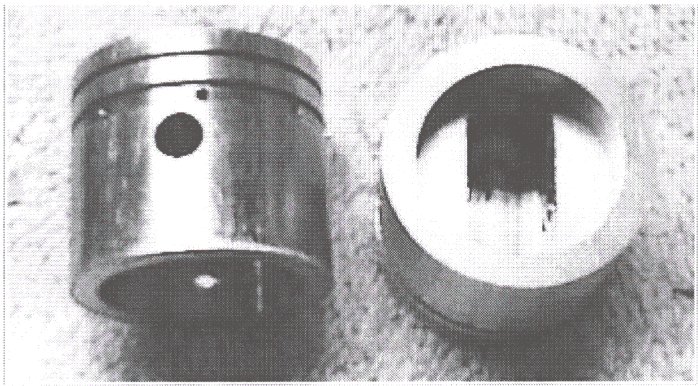


The mandrel is shown here, constructed of 1018 steel with the formula derived from the SIC articles. Basically, the formulas give you the large mandrel size, the small dowel size (the small dowel opens the ring) and the distance between centers of the two.

The rings, after polishing, are split with ordinary wire cutters. This will usually cleave them cleanly, but perhaps one in ten will be discarded due to a jagged, uneven break. The survivors are slowly spread and mounted on the mandrel. The whole assy is then heated to 1475 deg. f. for 1/2 hour. Scale prevention is important... I used a double-wrapping of SS foil, with Nitrogen gas injected before sealing. I have used keepbryte in the past which works, but the SS foil is neater and easier to use.



After heat treatment, the rings retain their expanded set. The dark color is not scale... I was a bit anxious to open the SS envelope, and the whole assy was hot enough to darken the rings a bit. If you look closely, you can still see some rings mounted at the base of the mandrel. Note the gap in the loose rings... this is the set of the rings, *not* the traditional ring gap which must be cut after the rings are inserted into a bore.



Two pistons with ring grooves cut but without rings. The top groove is purely compression... the bottom groove is a combination compression and oil-control setup. Note the holes drilled axially. These holes are drilled after a band perhaps .005" deep is turned in the piston, and drain to the wrist pin cavity seen in the right hand piston. The lower ring scrapes the oil into this shallow groove, where it is forced back inside the piston.

Back