October 2002 Feature

We're off to see the Vizard

by Bill Mohr

If there was a way to get more power out of your Alpine, without switching engines, increasing displacement, or fitting new carburetors you'd probably want to know about it right? Well then, read on and don't be afraid. It sounds a lot more complicated than it is. The article that follows is almost totally from information I received in emails from Jim Ellis. Jim has done this change several times and has gone so far as to say he'll never use a head without making this change first. If you've ever ridden in Jim's car, you might say he knows a thing or two about performance.

This is the famous 'Vizard' head modification. It improves an engine's breathing. It lowers the compression slightly allowing our engines to run on regular unleaded gas. If you continue to use premium unleaded you can even advance your timing resulting in even more power. If you're thinking head modifications are not for the average Alpine owner, take heart. The main ingredient in this endeavor is patience. Of course every Alpine owner knows a lot about patience! This was originally published in a now out of print book called 'Theory and Practice of Cylinder Head Modification' by David Vizard. (click to see excerpt 1, excerpt 2, excerpt 3.) One of Mr. Vizard's examples is a change made to an Alpine head using a flow bench. He claims an increase of up to 11-15hp can be obtained, although I think you might need a flow bench to get your changes just perfect for that power! I like to think of the power gained as 'free' because you're increasing efficiency of the engine.

If you're sold on the change there are basically two ways to do it. Take the attached information to your favorite machine shop and have them make the modifications. If you're game to try it yourself, you're going to need the instructions, an electric drill, a cutting bit, a polishing kit, and the aforementioned patience. Actually, the main thing you will need is a head that is in good shape, flat, good water passages, good valves, guides and seats. I've included several pictures of work done by Jim Ellis that are invaluable in understanding the process. Of course you're asking, Bill why didn't you include pictures of the head you modified?" I could say it's because I don't have a digital camera, but the real reason, is that I'm not through -- a fact that Jim reminds me of quite frequently!

The first step is print out the template of the modified combustion chamber. Glue to some thin cardboard, a cereal box works fine. Cut out the templates and carefully punch holes at the crosshairs that show the location of the valve stem. Remove the valves, springs from the head. I used a plastic box with dividers to help me know which parts go to which cylinder. Jim uses a WorkMate to hold the head while he's working. I put mine upside down on top of a few boards and use a barclamp to hold it steady. The wood raises the head high enough to allow the valves to seat. Use some machinist bluing to blue the cylinder head surface. You can use a black marker to paint the surface if you don't have bluing. Another alternative is to use a 'Sharpie' marker. Place a brand new head gasket on the surface of the head. Drop a couple bolts through their holes to help keep it in place. If you used bluing or marker, score the outline of the combustion chamber. If you're going the sharpie method, use it to make the outline. The pictures illustrate both methods.

Put a couple valves through the holes in the template and put them in

their guides to locate the template on the head. Scribe or mark around the template making sure not to go past the outline of the head gasket. This is called undercutting, which would lead to a blown head gasket and a big headache... no pun intended. If you were wondering why the template would extend past the head gasket, there are a couple theories. One is that the reproduction of the template may have enlarged it ever so slightly. Reason two would be that head gaskets might have changed somewhat since the modification was designed.

Now the fun begins. Drop a valve in each hole of cylinder one to prevent damaging a valve seat. Chuck up the cutter in your drill and start removing metal. A cylindrical rotary file is all that's needed for a cutter since the head is relatively soft aluminum. A die grinder or a dremel-type tool will spin so fast that it will melt the aluminum and clog up the cutting tool. Unless you've done this before, it's probably best to work some on each cylinder. This allows you to hone your skill, which gives you a better feel for the tool when you are making the finishing touches. The head I'm modifying is currently in this stage. This is due more to my time mismanagement than the actual difficulty of the modification. One note is that I was using my cordless drill, but an electric is a better option. It has it has higher RPM and seems to do better with the continuous operation.

Okay now the combustion chambers look the same as the ones Jim Ellis did in the pictures. You'll want to make sure they have about the same volume. With a 50cc syringe and a 4" x 4" piece of Plexiglas, you can check it pretty easily. Make a 1/4" hole in the center of the Plexiglas. I'd suggest melting it with a hot Phillips head screwdriver. If you drill, drill slowly or it could shatter like mine did! Put the valves in the combustion chambers. Smear the edge of the chamber with Vaseline, and put the Plexiglas down on the chamber you want to measure giving a little twist to make a good seal. Fill the 50cc syringe with rubbing alcohol to exactly 50 and slowly fill the combustion chamber through the hole. Make sure the head is level so you get an accurate reading. When the alcohol is at the bottom of the hole, read the number on the syringe and subtract from 50 to get the volume of the chamber. A stock "never been milled" head has a 38.6cc chamber. The reworked chamber is 41-42cc. The size is somewhat forgiving, as long as the cylinders match pretty closely. If you can't get a 50cc syringe you could use a smaller one and add to get the volume. Likewise if you don't have any alcohol you could use some leftover cologne or mouthwash.

The next step is to clean up the intake and exhaust. The idea is not to enlarge, but simply to smooth the sharp edges. Remove the valves and carefully using the cutter, radius or round the bends in the intake. The idea is to make the transitions smoothly as possible, a curve rather than a turn if you will. This is also the goal of the chamber modifications, so you'll want to have the graceful curves that Jim has in his pictures. This includes smoothing the sharp edge around the combustion chamber.

Almost done... Using the sanding kit which is basically a mandrel and various size and shape sanding tapers, smooth the areas where you cut material. The goal is not a polished surface, but one that is fairly smooth. Again see the pictures for some idea of the surface texture. You can buy a sanding kit from Summit Racing. It's possible to make a mandrel from the shank of a screwdriver. Just cut the shank, taper the end, and cut a bit of a thread on the end.

Now your head is ready to go! Jim gave me the following sequence for best results for installing.

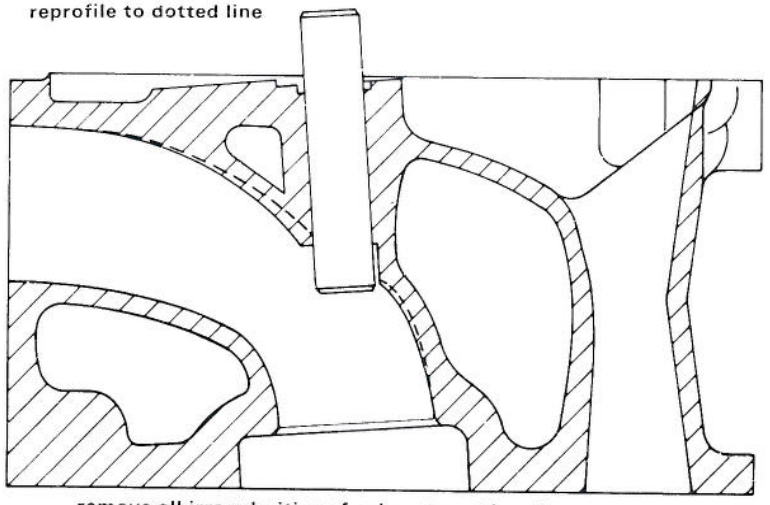
1) Torque head bolts
2) Replace rockers
3) Cold lash valves
4) Run engine until warm
5) Hot lash valves
6) Drive 3-500 miles
7) Re-torque Head
8) Run engine until warm
9) Hot lash valves
10) Drive 3-500 miles again
11) Re-torque Head again
12) Run until warm again
13) Hot lash valves again

Enjoy the power from your free breathing cylinder head and the new skills you acquired in the process.

allow the curved section of the chamber wall to be produced. Once this has been done, the head can be bored to accept the inserts for the larger valves. The valve sizes to use are 1.125in exhaust and 1.312in inlet. Using this head, together with all the rest of the engine up to full race specification will produce outputs of 114bhp.

Heads for the bigger Chrysler (Rootes) engines

Since the days when Sunbeam Rapiers were top rally cars, little attention seems to have been directed towards tuning them. The engine used in the Rapier and Alpine is, in fact, quite a good motor, but before any worthwhile gains in power can be achieved, it seems one must develop a sound chamber shape. The way to modify aluminium heads for the 1,500cc, 1,600cc and 1,725cc engines is as shown in Fig. 79. This will apply to all aluminium heads except the Holbay developed head as fitted to the H120 Rapier. Little improvement can be made to the Holbay head without extensive work, so the best plan is to smooth out ports and chambers and leave it at that.



Modified inlet port for Chrysler 1500, 1600 and 1725 alloy heads

The cast iron heads of the larger Chrysler (Rootes) engines are of basically differing designs from the alloy ones. These should be modified as shown in Figs. 80 and 81. The limiting factor for all these heads as far as skimming is concerned is the tapped holes along the base of the head into which the securing screws for the tappet chest cover pass. When skimming the head, we must avoid breaking into

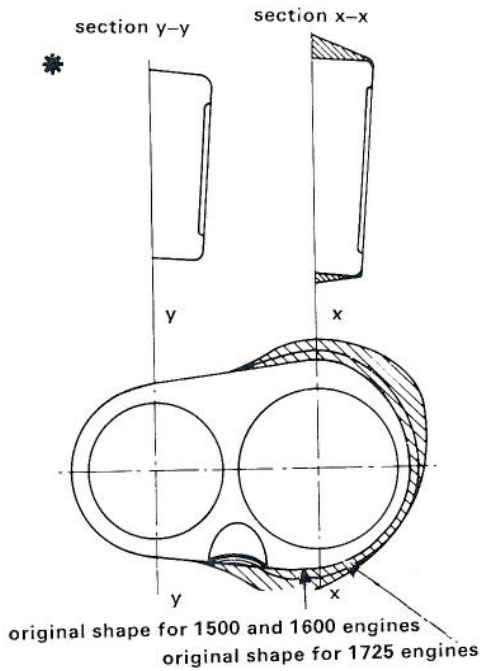
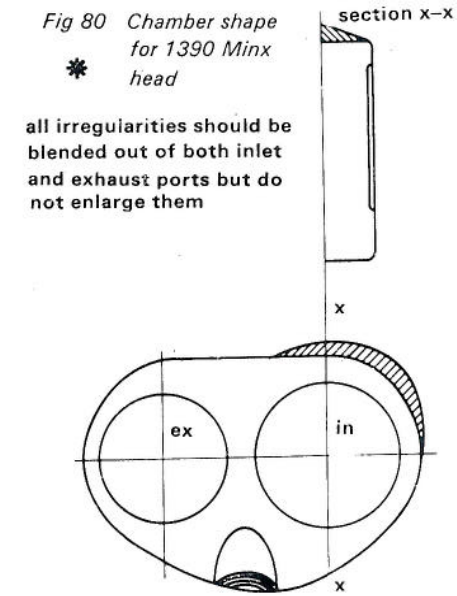


Fig 79 Modified chamber shape for Chrysler 1500, 1600 and 1725 alloy heads

Fig 80 Chamber shape for 1390 Minx head



these holes. The amount that can be taken off is usually between 0.060in and 0.075in. The power increase from these heads, both cast iron and aluminium, is quite marked. To put a figure to it we can achieve between 11–15bhp, depending upon the capacity of the engine.

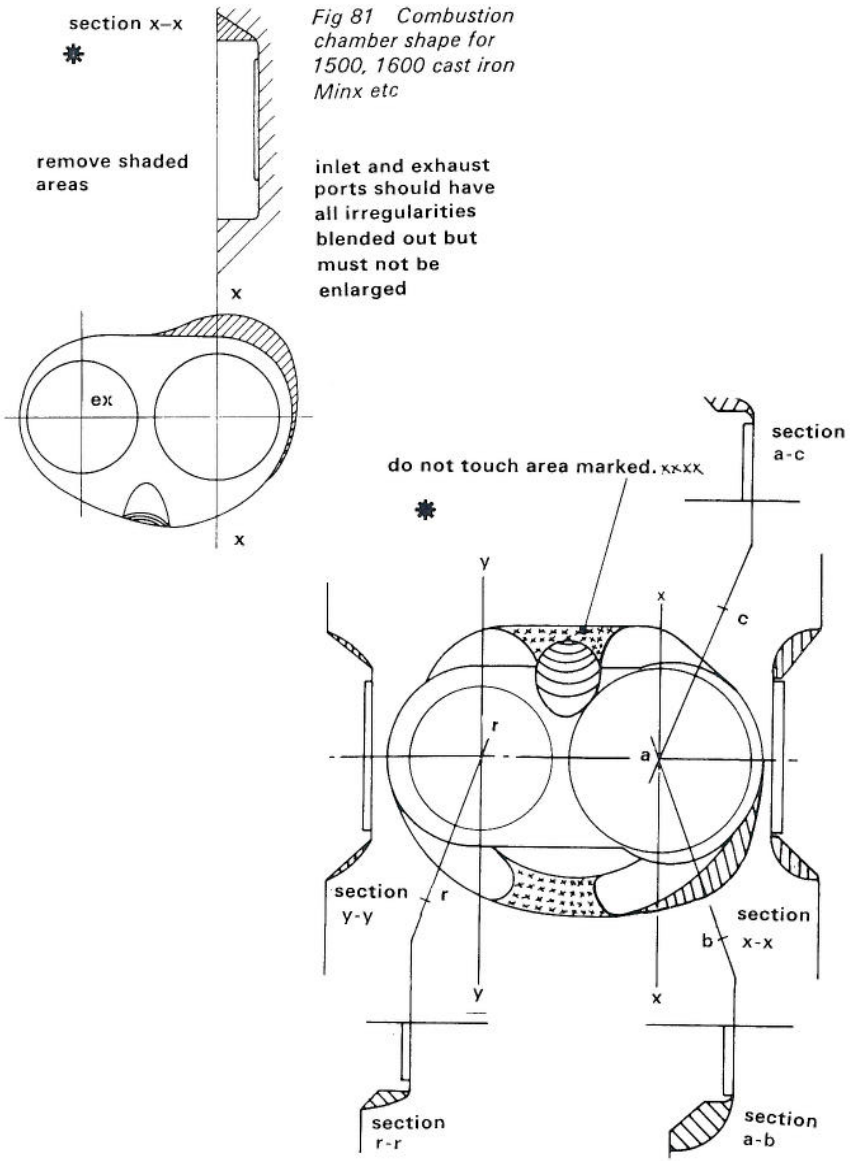


Fig 81 Combustion chamber shape for 1500, 1600 cast iron Minx etc

Triumph heads 1600 and early 2 litre engines

The 1,600cc and early 2,000cc engines, as fitted to Mk. 1 Triumph 2000, 1600 Vitesse and Mk. 1 2 litre Vitesse, have a different head casting from the Mk. 2 versions and 2.5 litre. The modifications to the Mk. 1 type of head is as shown in Fig. 82. When modifying this head for use with standard size valves, we must not enlarge the inlet ports any more than is necessary to achieve a smooth profile as they are too big as standard. Once the head has been reshaped and polished it can be skimmed by up to 0.080in to raise the CR. A head modified as per

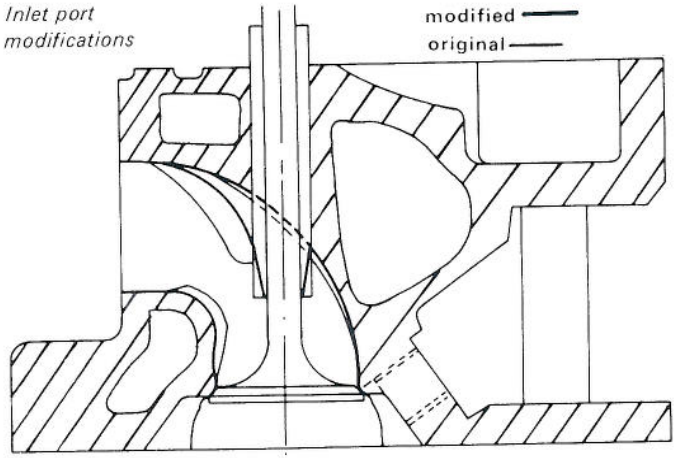


Fig 82 Modification to 2000 Triumph combustion chambers stage 1

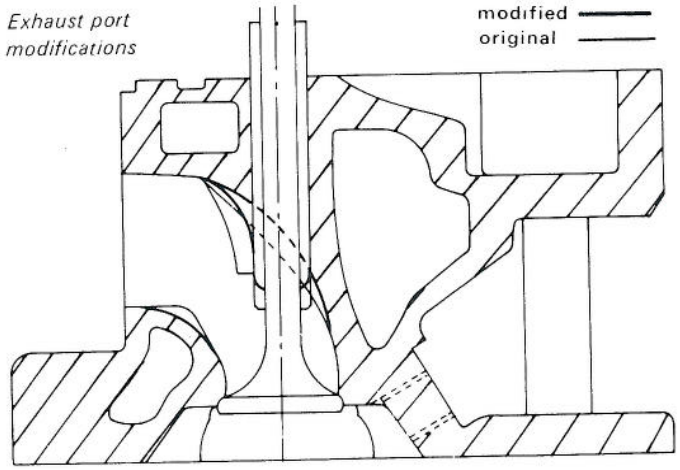
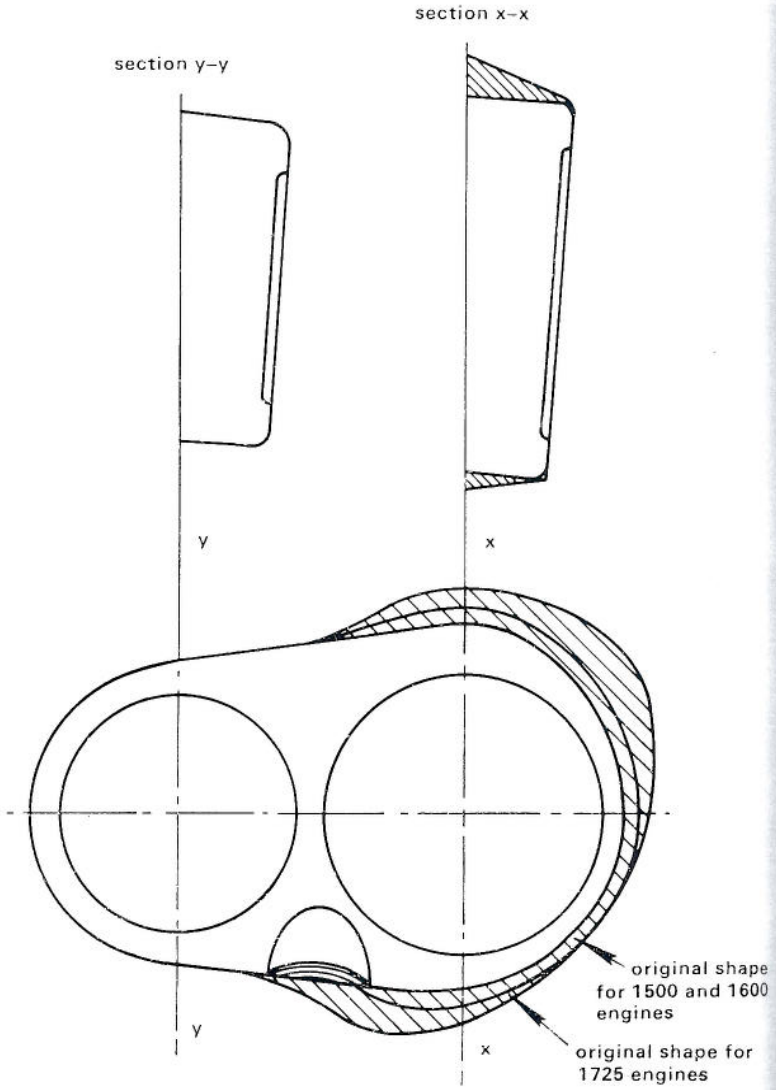


Fig 79 Modified chamber shape for Chrysler 1500, 1600 and 1725 alloy heads



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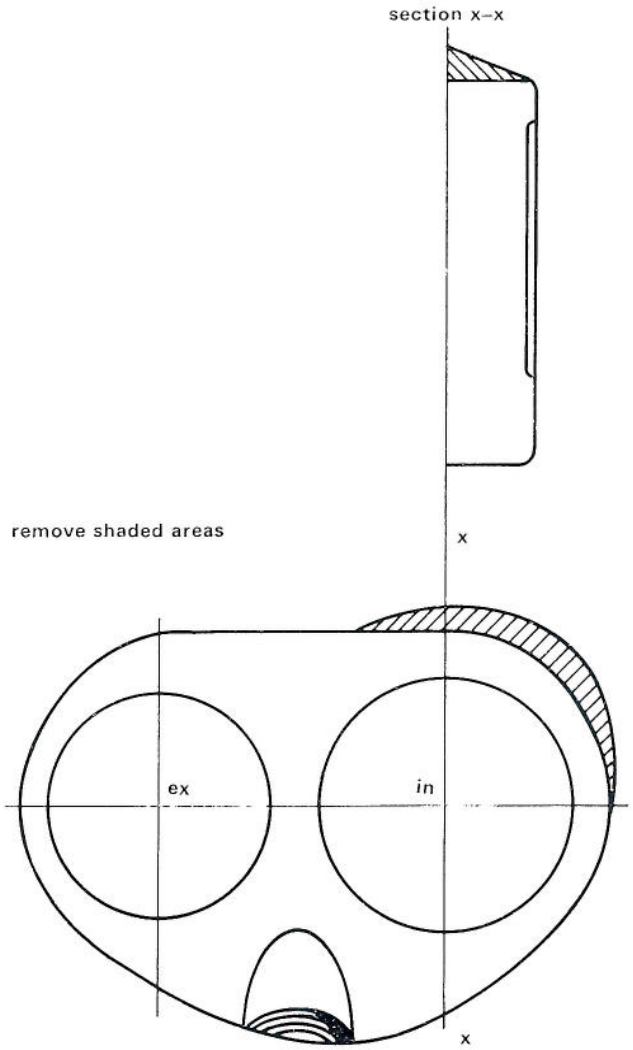

inlet and exhaust ports should have all irregularities blended out but must not be enlarged

Fig 80 Chamber shape for 1390 Minx head