

Hercules Engine News

By Glenn Karch

Building a Cylinder Head



Editor's note: *This month, guest writer Kevin Pulver has written an interesting article on fabricating a cylinder head for his circa-1915 Champion. A very unusual engine, it was manufactured for Linger Implement, Omaha, Neb., by Hercules and based on a 12 HP Model E.*

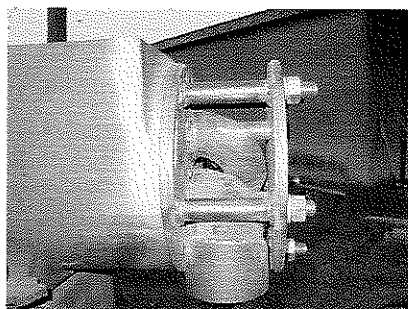
The head (and most everything else) was thrown away when my 12 HP Champion was converted to a log splitter. I wanted to cast a water-cooled head as original, but foundry work was estimated at \$3,000. It may have been a *Gas Engine Magazine* article about an engine totally made of steel and welded together that got me thinking about fabricating a head. I'm not a machinist, but after reading books and dreaming of do-it-yourself pattern making, sand casting and iron melting, this method seemed easy by comparison.

A God-given imagination let me see the plan before I ever made the rough sketches that were our prints. My wife, Maria, encouraged me to work on it when business was slow. Through Harry's Internet engine page (www.SmokStak.com), I met Joel Mosley three hours away in Omaha, Neb., who re-cast his

rocker arm for me, and took me to measure his 12 HP Economy when I started work.

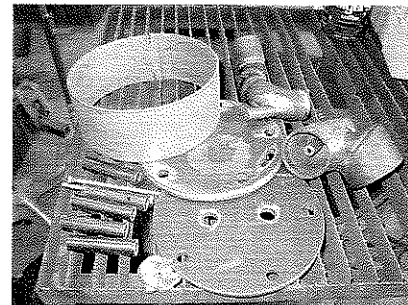
I should have kept track of time, but I would estimate the project took 80 hours. My friends Joe Dittrick and Bill Wehrman let me use their machine tools, and my brother-in-law did most of the welding.

We started with two 1/2-inch thick plates for the top and bottom. First, I tacked them together, and drilled the five head-bolt holes. Next, I located where the valves would center and drilled



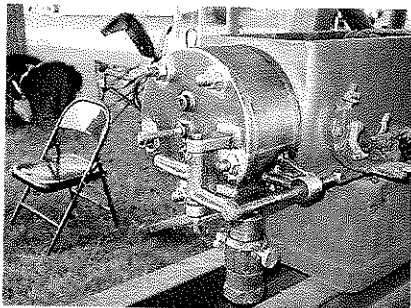
Above: The exhaust side, welded but without the band.

Right: The ports welded, band rolled, all parts ready to weld.



1/4-inch holes. The intake port was made up of 2-inch gas pipe fittings. For the exhaust, I cut 3-inch pipe wedges to get the tighter radius necessary to fit the available space between the plates. My friend Bob Clark gave me the idea to first mock up the ports from PVC pipe. I remembered enough from watching Lyle Clemens build irrigation risers to get my pipe marked out. After a bit of trial and error with my DeWalt sliding compound miter saw, I knew the lengths and angles I needed and copied them in steel on the band saw.

I turned tapered valve guides from 1-inch round stock, drilled 1/4-inch. The two ports were drilled on the lathe and mill to accept the guides, and I used round centering plugs and 1/4-inch ready rod and nuts to jig them for welding. The same 1/4-inch ready rod was used to clamp the port/guide assembly to the

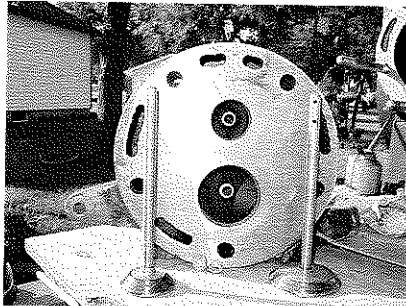


bottom plate. Next, 3/4-inch steel pipes were lathe-cut to go over the head bolts and sandwich between the two plates. They would spread the plates and seal the water jacket. Slots were milled in the bottom plate to correspond to water jacket holes in the block.

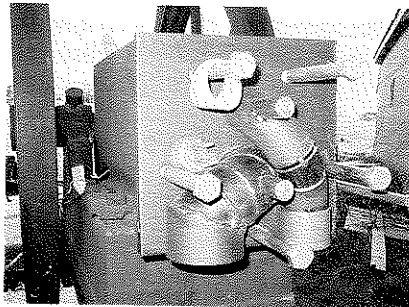
The plates were cut round on the lathe and a relief was cut for the 1/8-inch outside band and weld bead to go between the two round plates. I foolishly cut the corners off with a torch, which work-hardened the piece. It took lots of bit sharpening and hours of turning to knock off the high corners and get it round. When I was almost finished, I figured out my center was off on my 4-jaw chuck! I had barely enough stock left to clean it up upon re-centering. The

top plate 1/4-inch holes were drilled to 1-inch to let the valve guides pass through. Thermo-King sheared a piece of plate for the band, and Hastings Equity Grain Bin rolled it for me.

After all the pieces were ready, we assembled them on the engine. We tacked the intake and exhaust ports to the bottom plate then disassembled and welded them. It took both MIG and stick welders to reach some tight spots on the exhaust and others. Next, we reassembled, wrapping masking tape around the 5-head studs to center the pipes on them for



Above: The seats ground, valves lapped and blued, head planed. Right: A bottom view of the finished head showing port details, drain, washers, etc. Below: Square plates on engine, with ports. Left: The finished head with "junkenheimer" mixer.



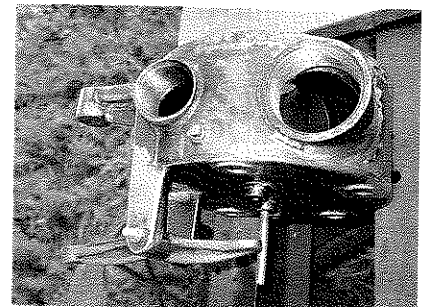
correct fit. We were concerned about warping, but the top plate with 1-inch holes dropped right over the valve guides and up against the "spreader" pipes. It was all clamped tight again and welded. The head had to be pried off the studs, but when the hot, gummy tape was removed, the head slid on and off beautifully.

Cardboard templates marked the band to fit around the ports

and a jigsaw cut it out. Home-made hose clamps pulled it tight and it was welded. We used a hole saw to rough-cut the valve seat holes in the bottom plate, using the 1/4-inch holes as centers.

Next, the valve guide holes were drilled oversize and reamed to 1/2-inch. A pilot was used in the guide holes for a boring bar to finish-cut the rough holes that will be our valve seats. Scrap steel formed the pushrod guide and rocker arm pedestals. Lots of valve train geometry was studied on the engine before these parts were welded solid. The bottom plate did warp a few thousandths and we had the bottom surfaced.

Valves were made of 1/2-inch drill rod and old scrap steel plugs from hole saw cuts. Center holes were opened up to 1/2-inch, counter-bored, stems pressed and welded, then chucked on the lathe and turned down and ground. I couldn't find 3-inch seat cutters,



so I glued emery cloth to the valve face with weatherstrip adhesive. I chucked the stem in my cordless drill, pulled it in and spun it until I had a narrow seat. Then I lapped and blued them, and they came out pretty good. Lastly, washers were soldered to the head to resemble the castings where the head nuts go. The engine started and ran on my birthday, but that's another story.

Contact engine enthusiast Kevin Pulver at: pulverk@alltel.net

Glenn Karch is a noted authority on Hercules engines. Contact him at: 20601 Old State Road, Haubstadt, IN 47639; glenn.karch@gte.net