"Jim Akkerman Bends 24 Horses Out of a Bender"

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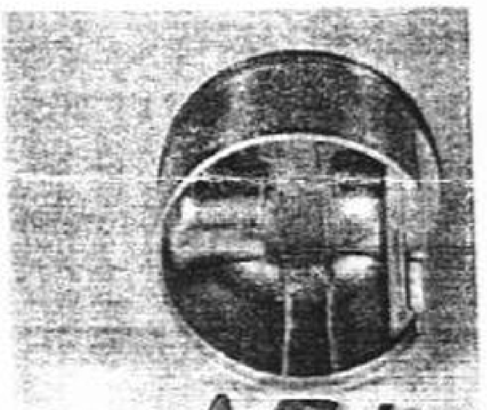


Fig. 1 – *Piston and rod ready for assembly. The bearing arrangement will run many hours.*

Chrysler's version of the old West Bend 820 can be made competitive in the B Limited class. A saving in cost and kart weight can be achieved if you are willing to take the time to make the necessary modifications.

The parts you will need are: the 820 engine, a dual top manifold (GEM V12), a flat side piston (Wiseco), a pair of alcohol carbs (Crescent), a "beefed up" cylinder head (Horstman), a piece of 4130 hot rolled heat treated steel 3/8" X 3" X 12", and a piece of 4130 hot rolled heat treated steel bar 3/8" diameter and 24" long. Also, you will need a piece of aluminum plate 1/4" X 3" X 6", some 1/2" OD X 1/4" ID fuel hose (tygon), about 8 oz. of epoxy (Hysol), a Kaydon Wristpin bearing Part No. KNO81110, four Torrington thrust washers, Part No. TRA815, two Circlips and finally, two Allen brand cap screws No. 10-32 X 5/8.

The first step is to set up the rod and piston assembly so that it can be used to lay out the port heights in the cylinder. The bearing which comes stock in this rod will ordinarily fail in about 20 minutes when used in a modified engine. The problem is with the shoulders that hold the needles. They will crack off, go through the engine and generally make a mess. An arrangement similar to that used in the foreign engines works much better. The Kaydon bearing has rounded-end-type needles that are similar to the foreign engines. By removing the shoulders and replacing them with hardened washers, the problem can be solved.

Remove the bearing from the rod and replace it with the alternate Kaydon bearing. With the needles removed, grind off the needle retaining shoulders. The Torrington thrust washers will retain the needles and center the top end of the rod. Continue to grind away the bearing race until it is 1/16" longer than the thickness of the piston end of the rod. Grind the race as square as possible and try to avoid overheating the unit. Check the "stack-up" of parts by placing the rod and the three washers in the piston to verify that there is about 0.010" or less side clearance. About 0.003 clearance is desirable. When the stacking is right, replace the spherical ended needles and install the wristpin. Note that the 820 wristpin must be shortened for the flat side piston, or a WB 610 wristpin can be substituted. With the bearing race flush with one side of the rod, three washers and the "flush" side of the bearing should be toward the flat side of the piston in order to center the rod under the piston. See Figure 1. The reason for putting the "flush" side of the bearing race toward the flat side of the piston is not really understood. It seems that the rod always moves to that position anyway. The only way to keep it from moving out of place (away from the center of the piston) is to put the three washers on the "flat" side and let the rod ride against them. With the pin in place, install the Circlips. Now the piston and rod assembly is ready for racing without the worry of losing the wristpin bearing.

Next, we can reinstall the piston and rod assembly without the piston rings and mark the port height. The chrome cylinder is too hard to scratch, so layout fluid is required. Using a degree wheel, locate the crank at 94 degrees after top-dead-center. With the edge of the piston as a guide, scribe a line on the cylinder in the area over the exhaust ports. Reposition the crank 19 additional degrees from top-dead-center and again scribe a line to indicate proper height for the transfer ports. Again, reposition the crank four additional degrees and scribe a line in the area opposite the exhaust ports. This will be the top of the future "eight" port arrangement. Finally, put the crank in the bottom-dead-center position and mark the bottom of the exhaust ports.

The desired port shape is shown in figure 2. This particular shape is traced from the best running engine we have. Other engines with slight differences simply will not run as well. We have tried "squarer" ports but they require more blowdown for smooth running and they result in "higher end" type engine. Engines with "rounder" transfer passages seem to run well on low end, but lack the high speed and capability required for enduro karting on fast tracks. The particular port profile shown is a fairly carefully optimized shape and works well with the other features of the engine. It also gives minimum problem with chipping the chrome.

With the ports properly marked, we can begin to cut. At this point, we must be careful about the "direction" of the port as well as its opening profile. The exhaust is a simple straight out arrangement. The transfer ports must be directed to promote proper "looping" of the fuel-air mixture at high speed–an absolute must for smooth powerful running. To do this, the ports nearest the exhaust must aim as flat across the piston as possible and toward the back of the cylinder, away from the exhaust ports. The ports farthest from the exhaust should aim high in the cylinder. To accomplish this, the block should be cut as shown in figure 3. Remember, we must maintain the proper port shape while we provide proper port direction.

The next step is to insert pieces of fuel hose through the port passages to act as molds to shape epoxy while it cures. This is shown in figure 4. Figure 5 shows the fuel hose in place prior to

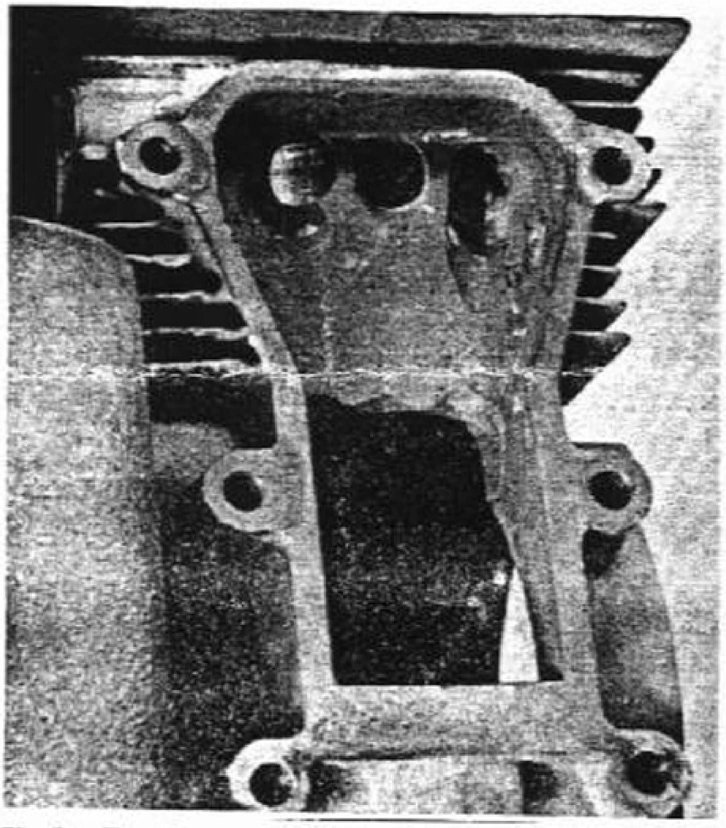


Fig. 3 – Transfer port cuts. Note that the port farthest from the exhaust is aimed highest

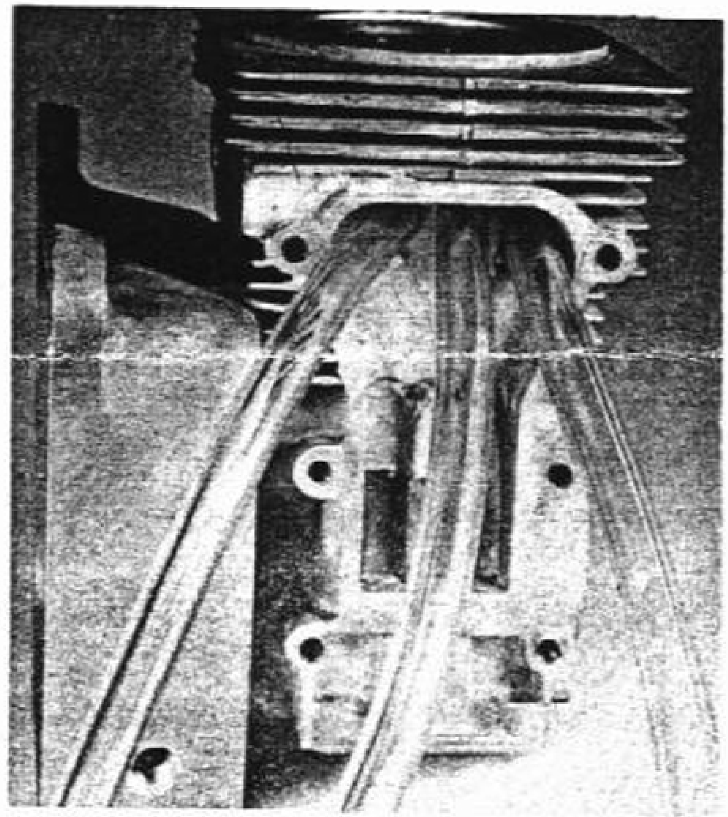
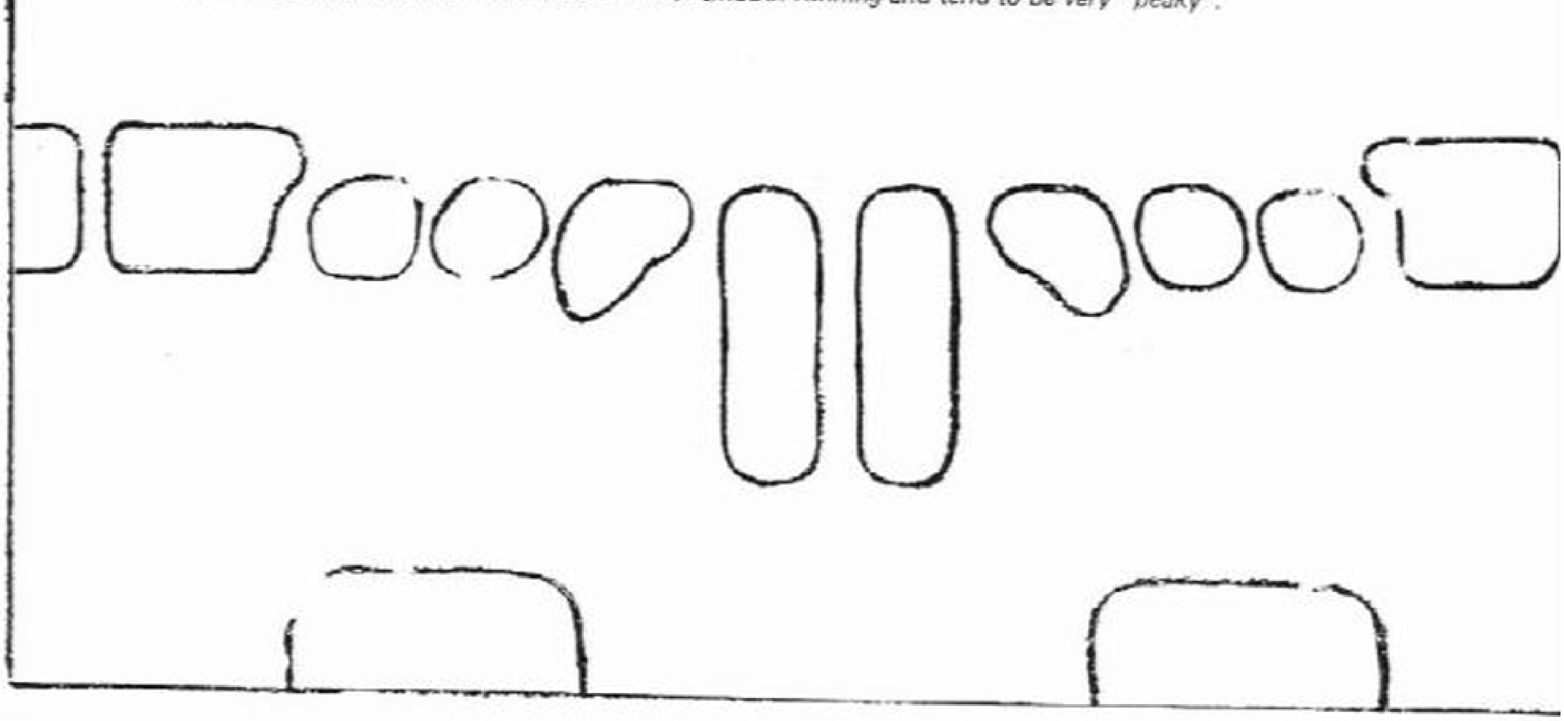


Fig. 4 – Use flexible plastic fuel hose for a mold. ½" OD x ¼" ID fuel line works fine.

Fig. 2 – Desired port shape. This port shape seems to be a good compromise to give an engine with the best speed range Ports made squarer than this require more blowdown for smooth running and tend to be very "peaky".



pouring the epoxy in. Note the directional arrangement of the hoses, and the roughening of the block to promote bonding of the epoxy. Also, note in figure 3 that the cylinder skirt is cut 5/8" higher than stock and rounded off to promote flow past the cylinder skirt and the crank. This is important because the passage is fairly narrow in this area. Some forcing is required to place the fuel hose through this area. Notice that the "gasket seal" ribs are removed also.

Before the epoxy is cast, a flat back plate must be prepared. This will be used as a cover to hold the epoxy while it cures, and later as a cover for the side of the engine. With the hoses properly installed, place the epoxy around the hoses. Warming the block to about 125 degrees F. will make the epoxy flow and give a smooth transfer passage. About 30 grams of epoxy can be placed over the hoses in the top portion of the transfer tunnel. The cover must then be installed, the block inverted, and an additional 30 grams poured into the lower part of the transfer tunnel. Be sure to push the hoses well up into the cylinder from the bottom, and a gentle "tug" from the top end on the hose farthest from the exhaust will promote its flow high in the cylinder. As the epoxy begins to cure, be sure to push the epoxy aside to provide clearance for the rod and crank. A small amount of epoxy may have to be removed to allow clearance for the rod.

It is best to do the side having the carburetors first, but remember, only the 30 grams in the upper part of the transfer tunnel needs to be filled, allowing a flow passage from the carbs to the underneath side of the piston. The intake manifold must be flattened off to fit against the epoxy. The finished epoxy job looks as shown in figure 6. Removal of the hoses is easier if some light oil is applied while pulling on the hoses from first one direction, then the other.

The "8" port is shown in figure 7. The

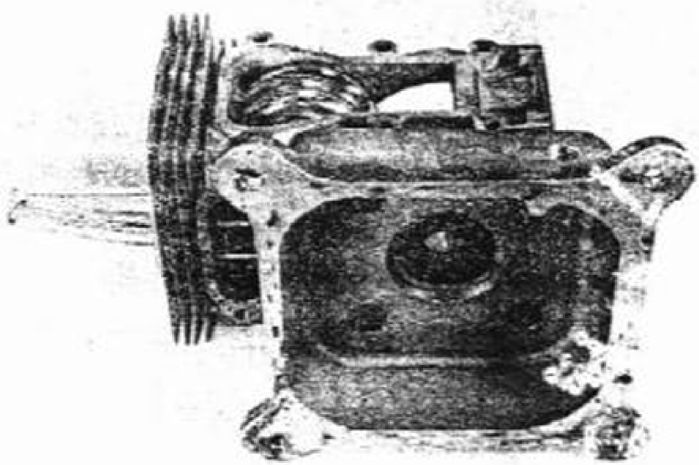


Fig. 5 – *Fuel hose in place and ready for epoxy to be cast.*

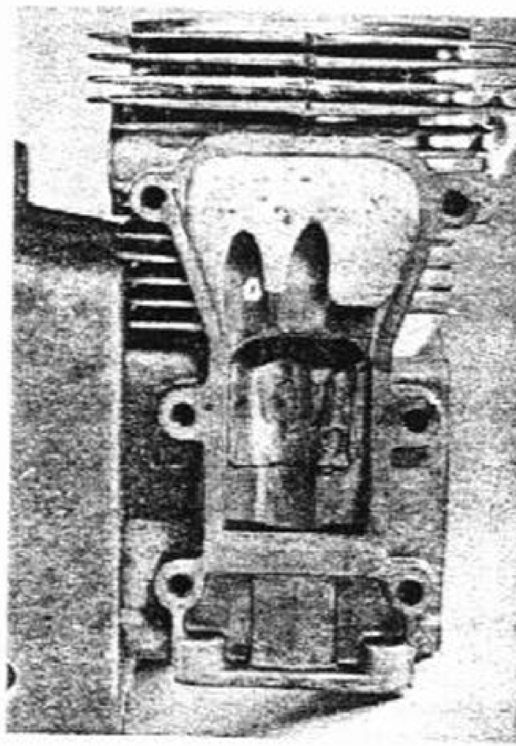


Fig. 6 – *The finished epoxy work. Note that clearance must be provided for the rod in the back portion.*

Fig. 7 – *Eight port arrangement to take advantage of flat side piston.*

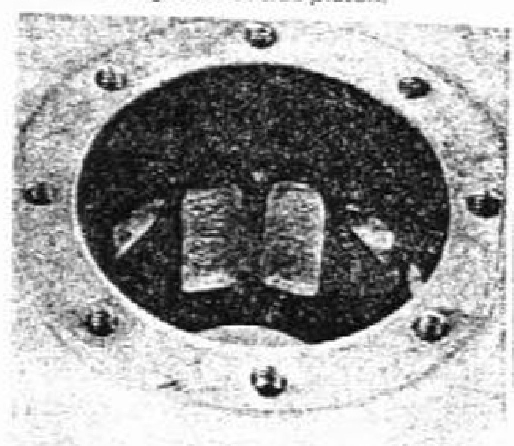


Fig. 8 – *The full-circle conversion of the T crank is not complicated but does require some special attention.*

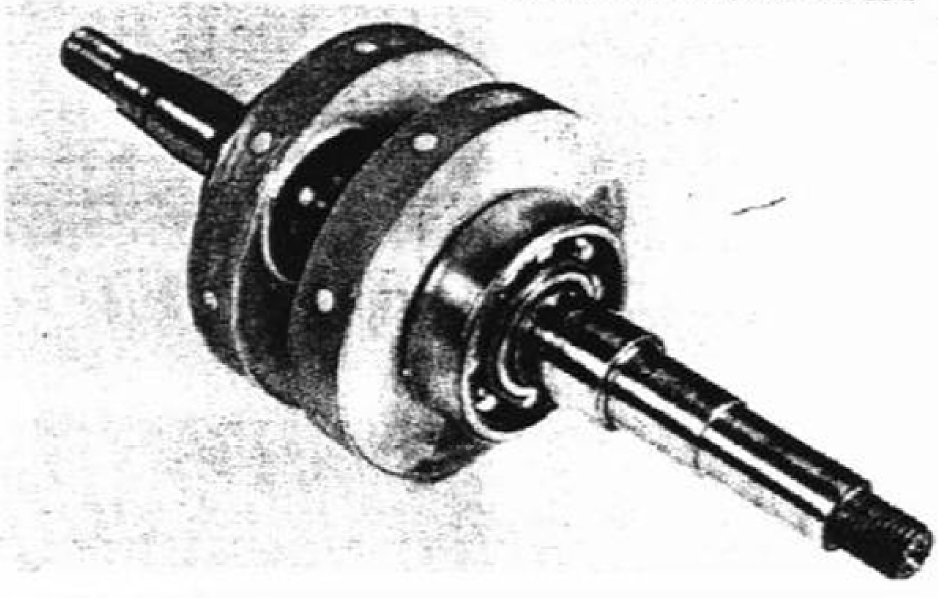


Fig. 9 – *Crankshaft centering tool fits the bore and the stub indicates location of crank journal. Proper alignment is important!*

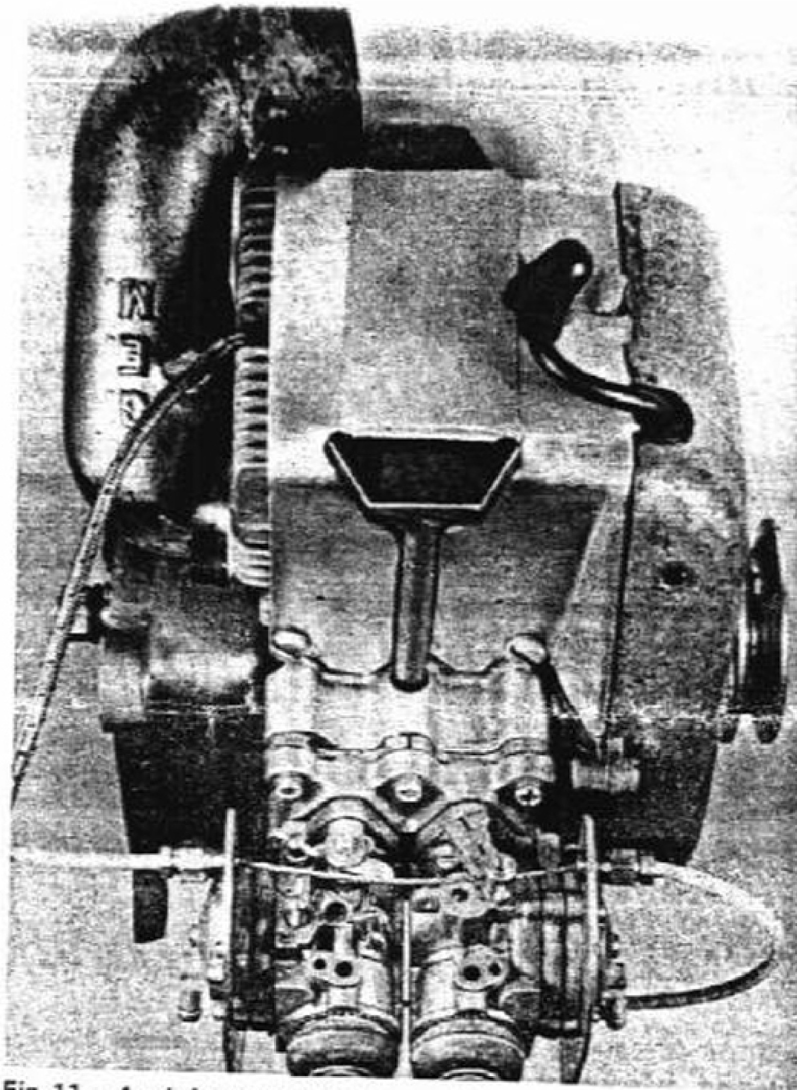


Fig. 11 – *A reinforcement plate top and bottom will help hold the cylinder together. The restraining rod passes through the manifold between the reeds. The cooling shroud can be cut to fit over the top plate.*

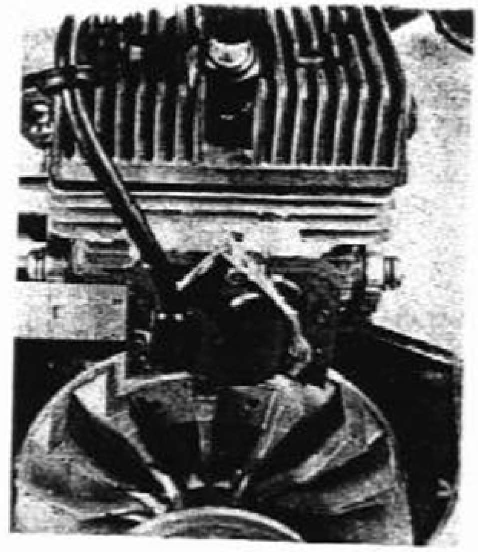


Fig. 10 – *Ignition assembly showing proper position of the stator plate. Also, proper position of flywheel when points open. Note coil "T-job" and epoxy to reinforce stock stator plate.*

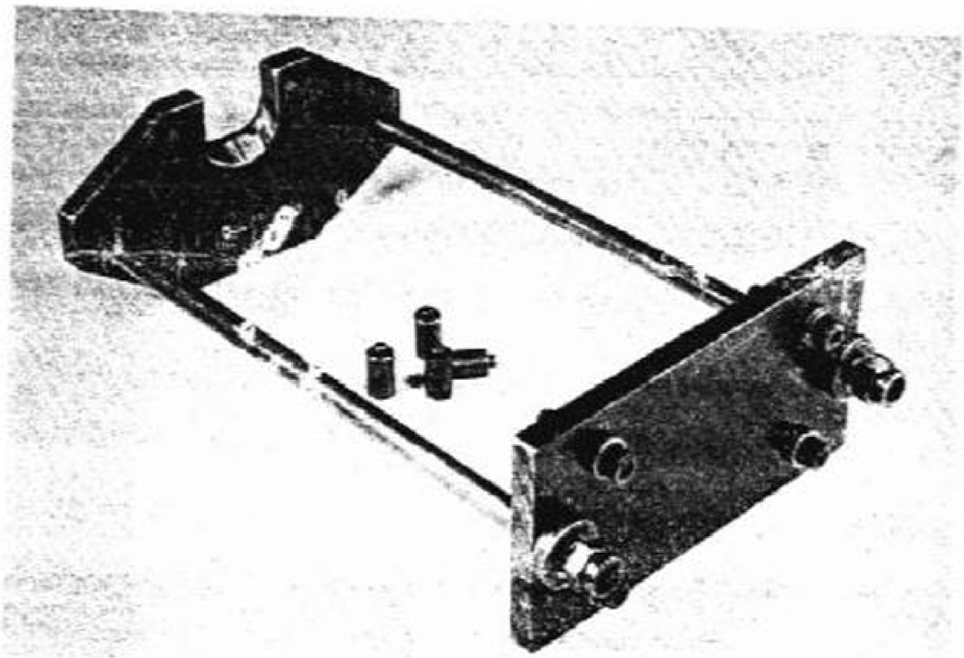


Fig. 12 – *Reinforcement for the cylinder block. The four small pieces hold the upper plate off the cylinder head fins.*

two grooves should be about 1/8" deep and 1-1/4" long with about a 30 degree angle at the top to direct the flow high into the cylinder. The cylinder is only about 3/16" thick, so be careful to not remove too much metal.

A careful and thorough sandpapering of the cylinder wall will complete the job. Be sure to do a good job of smoothing the exposed edges of the chrome so they won't catch on the rings. Also, be sure to sandpaper away all the epoxy protruding into the cylinder because it will skuff the piston. The aluminum piston and steel rings will wear away much faster than the epoxy.

With the piston and rod assembly completed and the block modified, we are ready to work on the crank. Conversion of the T crank into a full circle unit is not complicated but does require some special attention. The process requires installation of 1/16" thick counterbalance weights, proper cleaning and casting of about 43 grams of epoxy on each side. A metal ring should be used to provide reinforcement for the epoxy. A makeshift mold can be fabricated using tape. The finished job is shown in figure [illegible]. (Editor's Note: Jim is being modest. He also sells full circle cranks for those who don't want to risk their own fabrication.)

This completes the modification work. Next, we must assemble the engine. The first problem is to properly center the crankshaft under the cylinder bore. We use a tool as shown in figure 9. It fits the bore and the center "stub" indicates any misalignment of the crank. A measuring scale can be used but is more

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time consuming. Careful centering of the crank will avoid rubbing of the rod face on the crank. This generates heat that seriously reduces power. Most engines require an .017 steel shim (old type tin can, not aluminum) under the bearing on the power takeoff side and an extra gasket on the magplate. Check for end play of the crank. It should be about .010" or less and can be checked with a feeler gage between the crank and the block.

Next install the piston using new Allen brand screws for the rod cap. A number 10-32, 5/8" long is the proper size. Torque the rod bolts to about 72 inch-pounds.

The installation of the cylinder head is next. Normally, an .032 gasket will provide the proper clearance between the head and the piston. This should be checked, however, by using plastigage or modeling clay. The clearance should be about .010" to .012". This dimension is critical. Our best "hi-enders" are always the ones that end up with the clearance close to 0.010". The turbulence generated by the close deck clearance apparently promotes rapid combustion as required for high-end operation even though we use a retarded spark timing for good low-end operation. Be sure and maintain at least 0.010 clearance or the piston can strike the head. The compression presure should be about 225 psi.

The ignition is installed next. Locate the stator as shown in figure 10 with the lamination about 5/8" to 3/4" ahead of the edge of the block. The points should then be adjusted to open just as the centerline of the magnets pass the trailing edge of the center lamination in the coil as shown in figure 10. This will give maximum spark intensity and minimize sparkplug problems. In this position, the ignition timing will be between 25 and 30 degrees, which seems to work well with the other features of the engine. A "dab" of epoxy should be placed between the coil and the block to hold the coil, or one of the special sturdy units should by used (FMS Products).

Next, install the bottom, the back plate, the flattened-off intake manifold, and the air shroud. We use the Crescent carbs, which work just fine if a short open type exhaust is used. If you plan to use one of the long reflector type exhausts, however, the carbs will need a little "tweeking." An 0.070 hole should be drilled through the low end section cover. (Through the little Welch plug) This will provide a steady supply of fuel directly to the low end section, bypassing the control needle; and will eliminate the "hot midrange" problem of undrilled carbs. Normally, this will allow complete shutoff of the high end needle, providing the lean situation required for high revs using the long type muffler.

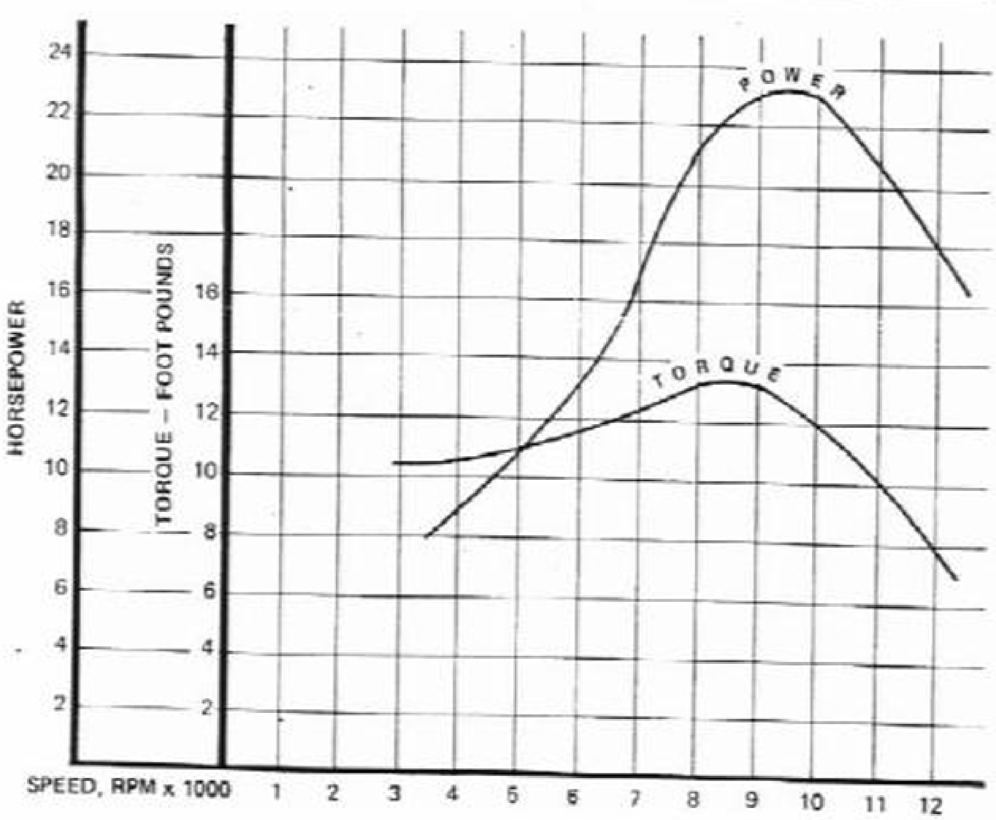

Fig. 13 – Power curves. Enough to win B-Limited at '69 Enduro Natl's and chunk plenty of tires when used in pairs on the "C" machine.

The engine is basically complete now. The only problem remaining is to keep it together. We have found that many of the light alloy blocks cannot hold together for more than about 20 minutes. The block will normally fail through the port area, or sometimes the crankshaft will push the bottom off. A simple reinforcement will solve the problem. We use a piece of steel plate across the top of the cylinder head and another piece across the bottom with a pair of tie rods to provide the restraining force as shown in figure 11. The parts required are shown in figure 12. Note that the short studs locate in the head screws and hold the plate up off the cylinder head fins. Also a hole must be drilled through the manifold in the metal between the reeds. Be careful to drill through the center or an epoxy patch will be required.

There are a few other hints that may help keep the "gray-goer" running:

1. Be sure the exhaust header is sealed against the block properly. An air leak here will cause rough running and overheating if the long reflector type exhaust is used.

2. An extra seal can be installed on both ends of the crankshaft to guarantee minimum leakage in the crankcase.

3. A piece of tape or a big rubber band, cut from an old automobile inner tube, should be used to cover the sparkplug access hole in the fan housing. This will improve cylinder head cooling and increase power.

4. Use an AE 901, or equivalent, sparkplug.

The engine is race-ready now and will produce power as shown in the curves of figure 13, using alcohol and 6 oz. of castor oil for fuel. The exhaust length is somewhat critical but you can find the best length for your track and drive line combination by some experimenting. We use a Wiseco (or H and P) muffler with about 1" to 2-1/2" flex length showing between it and a GEM elbo exhaust header.

We are presently experimenting with this design to find out if fuel additives can be used with some advantage. Also, considerable epoxy work may be saved by using the special GEM manifold and back plate which are now available. We don't have any experience with these items as yet but they do appear promising.

Another suggestion which may be helpful is to "practice" the modification once on an "old" block. Even the most careful craftsman is likely to "goof" the job a little on his first try. It is very, very important to make the transfer ports even and to arrange for proper flow direction. It is pretty tricky to pay attention to all these things at one time and a little practice will certainly improve the results.