RACE-TUNING MT's RAMCHARGER

Research Project II was launched to see how much more performance could be coaxed out of a factory hot rod. Last month's Nationals story told how the big MOTOR TREND Dodge went. This tells why.

BY ***JIM WRIGHT*** AND ***JOHN GERAGHTY***

OF ALL ASSEMBLY-LINE Super/Stockers now being turned out by Detroit, the Dodge-Plymouth "413" package has proven itself one of the fastest. In showroom condition, it'll easily run in the 108-110-mph range, with ETs in the mid-13-second bracket. While this kind of performance might be good enough for top honors at smaller drag strips, it's strictly "also ran" at the bigger ones, where competition is plentiful and fierce.

Right now, it's not at all uncommon to hear of *legal* Super/Stocks that consistently churn through the quarter-mile at speeds of 115-117 mph with ETs in the low 12s. This is the kind of performance we wanted to get from the MOTOR TREND Dodge. To date, our best top speed has been 115.23 mph, while the best ET is 12.33 seconds. As we run the car more and more at different strips and become more familiar with varying traction and atmospheric conditions, we're going a little faster each time.

While our Dodge is still "stock" according to National Hot Rod Association rules, it's not quite the same car we originally took delivery on. What we did to increase performance and why we did it are covered in the following paragraphs.

The 413-cubic-inch engine, as it comes from the factory, is rated at 410 hp with 11-to-1 compression ratio, or 420 hp with 13.5 to 1. Since this was to be an all-out effort, we decided to take full advantage of the various allowances in the rules. Biggest single advantage here is the allowable .060-inch overbore. This brings displacement of the "413" up to 426 cubic inches, and every one of those inches is worth slightly better than one hp. To be sure our displacement would be within the legal limit, we took it out to only .058 oversize.

New pistons were now needed, so we went to the 13.5-to-1 jobs. Because of availability, we used Mickey Thompson pistons. Both Thompson's and the factory's pistons are actually .050 oversize to allow for .008-.010 clearance, depending on the bore. We wanted .012 clearance, so we specified that Mickey finish the pistons .046 oversize. This much clearance makes the pistons a trifle noisy, but since the car would never be run on the street and since excessive combustion heat is a problem with this much compression, we wanted to give them plenty of room to expand.

Heavy-duty ForgedTrue pins were used, interference fit in the rod and .0008 in the piston. We picked Grant rings because of their rapid seating and good oil control. Rings were installed with an .018-inch end gap.

The crank, rods, and pistons were sent to C&T Automotive for a magnaflux check and for balancing. The rods and pistons passed the magnaflux, but the crank was found to have several hairline fractures running through a couple of the throws. This wasn't too unusual because the engine had plenty of hard miles on it before we got it. Since a new crank wasn't readily available, we settled for a used one that did pass the magnaflux check.

One rod journal had been badly scored and burned, but we decided the crank could be saved by machining down the journal and then building it back up by a hard chroming process. The standard "413" crank has flame-hardened bearing surfaces and shot-peened fillets for added reliability, but a hard chromed crank is even better. So, while it added some cost to our project, the hard chrome crank could mean a longer-lasting engine.

After chroming, the crank was reground to give .0025 clearance on both rods and mains, and .008 end clearance. The rods were ground to give an end clearance of .022, an increase of .010 over stock. This was done because a lot of rod bearing failures can be traced to oil being held between the bearing surfaces too long, which causes it to overheat and lose its viscosity. To make up for the increased clearances in the lower end, the oil pressure relief spring was beefed up with a .040 shim to keep the oil pressure up to its normal 55 psi.

Before final assembly, the crank, rods, and pistons (without rings) were placed in the block, and the deck clearances (distance from the top of the lower flat of the piston to the top of the block) were carefully checked out. It's customary to use either a depth micrometer or a dial indicator to get this reading. We used feeler gauges because a forged piston has a slightly irregular surface, and a true reading is hard to get with either a dial indicator or a depth micrometer. Our engine checked out at .039 on one bank and .041 on the other. Since the deck clearance plays an important part in determining what the actual compression ratio is, we milled the block to bring the clearance down to .019 on both banks. Here again, you'll notice, we left an extra .001-inch just to make sure we were staying within legal limits.

At a big drag meet like the NHRA Nationals, where engines of winning cars are very carefully checked out by a crew of competent tech inspectors, just the difference of .001 on the wrong side of the spec could and would be grounds for disqualification.

Before and during final assembly of the lower end, we took extreme care that all parts were kept free of dirt and other foreign materials. Standard factory copper-lead bearings were used, and all nuts and bolts were torqued to factory specifications.

Equally important to the final and actual compression ratio is the volume of the combustion chambers. Ours checked out to 83cc, so we milled .010 from the bottom surface of each head

continued

to bring the volume down to the minimum 81cc allowed by the rules. This also necessitated milling .012 from the intake side of each head so the intake manifold would fit properly. We went to the minimum limit on the combustion chambers, because if by chance the volumes were reduced a shade too much, they could be brought back by sinking the valves a little deeper on their seats.

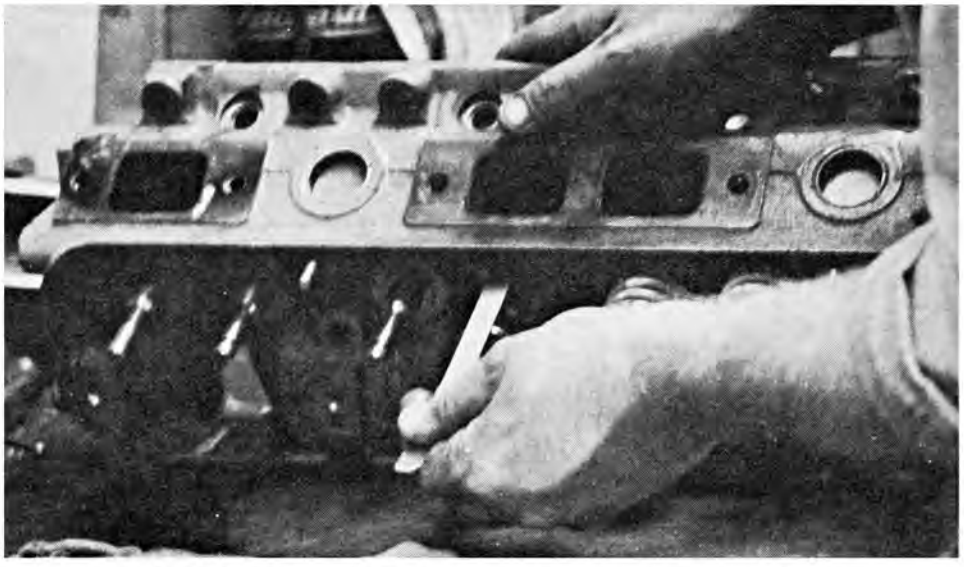
To illustrate just how important deck clearances and combustion chamber volumes are, we checked the compression ratio before milling the block and heads and found it was only 11.8 to 1. Bringing these to the minimum raised the ratio to 13.3 to 1. It isn't 13.5, but it's about as close as you can possibly get.

The valve seats had to be left at their stock 45-degree angle, but we narrowed them considerably to give better gas flow around the valves. We used a 70-degree hand reamer to narrow the intake seats to 1/32-inch and the exhausts to 1/16-inch. Stock, the seats were close to the middle of the valves, and these were moved – during the narrowing process – to the outer edge of the valves. We used a hand reamer in place of a regular stone for this operation because the reamer leaves a rather rough surface (similar to stock), while the stone polishes. The rules say that no polishing will be allowed anywhere in the valve port or pocket.

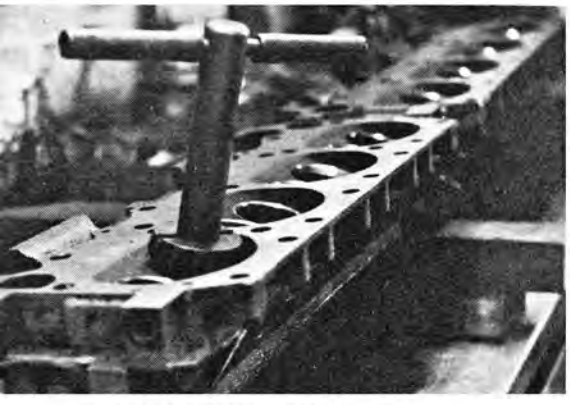
Before assembling the heads, we checked all valve springs to see that their open and closed pressures were up to spec. During assembly, the springs' installed height was brought to the minimum by using shims under them. For a good seal, the head gaskets were sprayed on both sides with aluminum paint, and then we torqued the heads down to factory specs.

The camshaft was installed and checked out with a degree wheel. We found that the stock marks were off

Advance curve of stock "413" distributor was changed slightly to meet the needs of this particular engine. Slight point bounce was cured with sponge rubber pieces.



Variances in valve spring pressures were compensated for with shims. We took care to see that the installed length of each spring wasn't less than allowed minimum.



***(FAR LEFT)** Factory valve seats were wide and uneven, so we narrowed and trued them by using a hand reamer.*

PHOTOS BY BOB D'OLIVO, JIM WRIGHT

***(LEFT)** Deck clearances came down to minimum by milling block. This operation is usually necessary to get true specified compression ratio.*

two degrees (retarded) at top dead center. The retaining holes in the cam sprocket were filed out to allow proper alignment of the cam with the crankshaft, and then we set the valve clearances according to the factory specs.

Subsequent running has shown that this engine responds very critically to valve settings. Closing up the clearances produces more top-end power, while opening them up does the opposite. What we set them at depends on the strip itself. If it's rather slick and offers poor traction, we close them down so we can get on the throttle harder out of the hole. If the strip has a good bite, we open the valves back up. We've found that a setting of .025 straight across is about as far as the valves can be closed down without low-end torque falling off too badly.

The factory headers are as efficient as any we could make or buy for this engine. But unfortunately they weigh quite a bit, so more in the interests of saving weight than expecting an increase in power, we discarded the factory jobs in favor of a set put out by Horsepower Engineering. These are designed for maximum flow, and weigh about 60 pounds less than the stock units. The rest of the factory dual exhaust system was also replaced with a single glass-pack muffler fed by two small-diameter (and light) take-off's from the headers. The single tail pipe ends just forward of the left rear wheel.

We kept the stock distributor, but changed the advance curve slightly. Stock, the distributor has 24 degrees (crankshaft) at 2000 rpm. With a 10-degree initial advance, this totals out to 34 degrees. We wanted more advance sooner, so the initial advance is now set at 14 degrees, with the distributor limited to 20 degrees at 2200 rpm — still a total of 34 degrees. We feel this increase in initial setting keeps the engine cleaner and sharper coming off the line. We wedged a soft piece of sponge rubber between each point arm and breaker spring to cut down a tendency for the points to vibrate above 5800 rpm. The points were each set at 30 degrees' dwell angle, with a total dwell on both sets of 36 degrees. To date, Champion J2J spark plugs, set at .025, produce the best results.

All carburetor jets were left stock, and although we run without air cleaners, we haven't noticed any tendency toward leaning out at high rpm. A small amount of weight was ground off the secondary control valve weight of each carburetor to let the throttle plates open sooner (at four inches' vacuum against seven inches' stock).

The chassis came in for its share of changes, too. Starting at the front end, the car was raised 2½ inches by adjusting the torsion bars to load the static chassis weight to the rear. We left shock absorbers stock. With the front end in the raised position, camber and toe were set to factory specifications. Caster was set at three degrees positive for greater directional stability.

The rear springs were de-arched 2½ inches, and then stiffened up with additional clips. A set of Traction-Master traction bars was installed. The mounting on these is strictly experimental and differs from their stock setup, as the accompanying photo shows. We felt they'd be more efficient if they were mounted directly from the axle housing to the frame. To date, there hasn't been a trace of wheel hop. We also used Gabriel adjustable shock absorbers, because they make it easier to change the rear end load to suit varying strip conditions. Excellent bite is supplied by the 9.50 x 14 M&H Super/Stock tires mounted on optional 6½-inch-wide rims. At present, the 4.56 "Sure-grip" rear axle is adequate.

Self-adjusters have been removed from all brakes and the brakes are set as loose as possible to ensure against drag.

An adequate supply of fuel to the carbs came about by eliminating the two in-line fuel filters and mounting two Bendix electric fuel pumps (in addition to the stock unit) back by the gas tank. A Sun electric tachometer helps us keep track of engine speed and shift points. Because the engine performs best when its temperature is between 100° and 140°, we added a direct-reading mechanical temperature gauge to help us keep it in this range. The stock low oil pressure warning light is supplemented by a direct-reading mechanical oil pressure gauge. Both accessory gauges are mounted in an Eelco panel below the dash.

Up to now we've been more concerned with finding the right combinations for the various strips in the Los Angeles area than with actual competition. Now that it looks like we've found them, it's about time to go out hunting for the "hot dogs." We'll let you know from time to time how we make out. /MT

Mickey Thompson 13.5-to-1 forged pistons (left) were used instead of stock units.

We checked combustion chambers for volume, reduced them to allowable minimum by milling heads.

***(BELOW)** Chassis modifications which helped traction included stiffer springs, adjustable shocks, and Traction-Masters. We removed brake self adjusters.*