Lloyd Taylor and Ted Tyce are just about to drop a bomb on the hot rodding world; fabricated DOHC four-bangers blasting one horse per inch per pound.

Appropriately enough they call them...

B. H. Patchen and Chick Sjoberg, Vice President and Test Engineer of TnT, check the output of one of their new little bombs. Note the Fish type carburetor used in test. TnT has taken over Fish operation, and promises great things.

By ERIC RICHMAN

One horsepower per cubic inch per pound has long been a dream of automotive engineers and hot rodders the world over. The aviation industry has reached this goal and the new small aluminum V8's—when highly modified—can sometimes approach it. A production line stock automobile engine light enough to reach this goal was envisioned by Lloyd Taylor over twenty years ago when he first began the development of the Crusader engine. Lightweight aluminum castings of sufficient strength were non-existent in those days. His dream was of a stamped (brassed together) sheet metal engine. Two decades ago there were no processes available to produce a brassed engine in sufficient quantities and at a price that was economically practical. The advent of the jet age, and subsequently the space age, with the need for lightweight stamped precision sheet metal assemblies, has brought technological advances that today bring Lloyd's dream into the realm of possibility.

Two and a half years ago Lloyd moved to San Diego, where he met Ted Tyce, the owner of Tyce Engineering, Inc., a business devoted to supplying precision sheet metal assemblies to the aircraft and missile industries. It was his short step to the formation of Tyce and Taylor Engine Company, Inc.

The prototype engines utilize the sheet metal block assembly but the rest of the engine is made up of a hybrid conglomerate of various existing automotive components. When the final assembly lines are established all parts will be supplied to specifications for the TnT engine. Let's start examining the engine by looking into this sheet metal business. The engine will be available in stainless steel (Type 316) and an alloy steel known as Tolley, a high tensile strength and corrosion-resistant steel made by the Youngstown Steel Co. The Tolley engine will be a bit heavier, as it requires a slightly heavier gauge metal to achieve the same strength as stainless. The entire block assembly employs only two thicknesses of sheet plus the .180-inch wall 4130 chrome moly steel cylinder barrels.

The combustion chamber assembly utilizes .105-inch wall steel in Tolley or .090-inch stainless while the balance of the block is made up from .065-inch Yaley or .065-inch stainless. One of the secrets to the efficiency of this little engine lies in the uniform thickness of the sheet metal used throughout the block. There can be no hot spots anywhere and heat transfer is close to perfect. This permits a stock compression ratio of 12 to 1. The compression may be run up to 14 to 1 with no detonation problems whatever. The completely utilised upper end eliminates a separate head. It also does away with accompanying gasket problems, another bugaboo of high compression.

Basic assembly starts with the stamped hemispherical combustion chamber halves. They are spot-welded together for temporary positioning, then delta-creased to the cylinder barrels. The valve guides and special alloy steel seats are pressed into the cylinder unit before its installation in the stamped block assembly. Cast steel mounting flanges are then pressed in place on the bottom of the barrels. The braising operation leaves a solid base. The block assembly has formed sheet steel water passages and ducting tubes that direct the cooler incoming water directly to the cylinder head and the exhaust ports. All the block components are copper plated before assembly. In furnace braising, the cop-

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Components of TnT stainless steel block with completed block. Top of block with double overhead camshaft supports is shown center foreground. Note cooling water gallery and ducting tube in block, left. Ping tubes protrude, top of block.

Complete block less cam supporting cover shows ducting tubes to advantage. Large tubes extending to right cool the exhaust ports, and small tubes curving to center cool top of the cylinders. Entire assembly is surrounded by the coolant.

Completely brazed block emerges from furnace. The block is subjected to a 1½-hour heating and cooling cycle during which the temperature is raised to 2,050 degrees. At this temperature copper flows into crevices, making good bond.

Cutaway view shows simplicity of layout. Block assembly is secured to crankcase with 16 hold-down bolts through flanges at base of barrels. Engine stands 24.5 inches high overall. Width of engine is 11.5 inches with a length of 21.6 inches.

TNT continued

per plate serves the same purpose as tinning in sweat soldering. It also increases the heat transfer properties of the parts while further adding to their corrosion resistance. The block unit is assembled and tack-welded to maintain alignment during brazing. All joints are liberally coated with copper paste and, where necessary, backed up with copper foil and fine copper wire. The entire assembly is then placed in a furnace and subjected to a 2,050 degree heat during a 1½-hour brazing and cooling cycle. At this temperature the copper flows into every crevice and forms a strong metallurgical and mechanical bond.

The block emerges completely brazed and stress relieved ready for machining. It is accurate to within .010-inch and requires very little machine work. A cut is made across the cam carrier pads and the base of the block to get them square and parallel. The cylinders are then bored to square them with the base and each other. A clean-up cut is taken across the face of the intake and exhaust ports, and the block is ready to go.

The crankcase and cam tower assemblies are another story. The crankshaft is a hollow core ductile iron casting which serves as its own oil gallery. The oil enters through the front main and is carried back to the rest of the rod and main bearings through the hollow core of the crank itself. The rod and main bearing journals are 2.25-inch
diameter with massive overlap for added crank strength. The crank has five main bearings which are supported by 360-degree radial aluminum bearing carriers that are assembled on the crank. The complete unit slips into the cast aluminum case in the manner of Meyer-Drake engines. A series of horizontal draw bolts extending through the base of the aluminum crankcase lock the bearing carrier webs in place. Working our way up the cam tower, we find that the cams are driven by both a gear and chain arrangement. Ford crank and cam timing gears give the needed 2:1 reduction. The Ford cam gear drives a double row Diamond roller chain through a sprocket at its hub. The chain travels upward over a tension idler, then across the top, driving the dual cams. On the way back down it drives another sprocket opposite the idler which serves to drive both the ignition and oil pump. The cam drive and idlers are mounted on roller bearings. The gear and chain combination serves to keep the chain length down which is quite desirable in overhead cam drives.

This brings us to the cams themselves. You old four-banger single-stick and DO men know what can be done with the overhead set-up. Reciprocating mass is reduced almost to a minimum by using a finger follower arrangement.

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RIGHT — A cam bearing and hold-down with finger follower assembly rear. An inverted follower, foreground, reveals the valve lash adjusting screw and lock nut. Lightweight finger followers permit higher rpm's. Oil flows in hollow follower shafts.

BELOW — Cross-section of TnT engine reveals excellent breathing characteristics combined with hemispherical combustion chamber. A uniform combustion wall thickness does away with troublesome hot spots, permitting compressions as high as 14:1.

Photos by Eric Rickman, TnT Co.

TNT continued

in the manner of Jaguar, Mercedes, Ferrari, etc. The fingers have adjusting screws with lock nuts to provide valve adjustment. The valve springs are double coil Corvair. Top end lube is provided by oil passing through the cam finger follower shafts. The overhead cam layout permits the use of just about as wild a grind as anyone might desire as well as making the cam readily accessible for quick changes. Here again is where this little engine gains a tremendous advantage. “Cammers” may be wound much tighter with no strain. This particular engine operates between 5500 and 6500 rpm and may be wound up to 8 grand with little fear of things coming unglued. The prototype engines are hybrid assemblies as they use quite a list of assorted parts. Ford cam and crank gears, Ford 6 connecting rods, Corvair valve springs and starter, Jahn's pistons, Mercury intake and Pontiac exhaust valves. Mallory and Delco-Remy make up the distributor assemblies and AutoLite will provide alternators. Four displacements are being contemplated for final production; 91, 105, 129, and 135 cubic inches respectively. These will all be in the same block utilizing a 3½-inch bore but with different crank strokes.

Now let’s get into some performance figures. For a comparison, the 135 cubic inch TnT engine produces up to 175 horsepower at 6500 rpm while a current U.S. compact engine delivers just 101 hp from 170 inches at 4400 rpm. One Tyce and Taylor field experiment brought the efficiency of their little engine home to us with great impact. After much tinkering, hopping up, camming, raising the compression, etc., with an engine of our own, we were finally able to get 71 horses at the rear wheels from 170 cubic inches without a supercharger. Tyce and Taylor dropped one of their 120-inch engines in a Falcon and pulled 70 horses without even raising the engine temperature to normal. After running two hours under full load the fan had to be disconnected to get the engine up to the proper operating temperature. The Falcon engine weighs upwards of 800 pounds while the TnT engine weighs in bare (less starter and generator) at 175 pounds. The Falcon with the TnT engine ran around with a
Cast ductile iron crank with its five main bearing support webs in place. Unit slips into case, background, in the Offy manner, and is secured by draw bolts through the base webs.  Rods and mains utilize 2.25 inch Moraine aluminum bearings.

Ford 6 rods and Jahns pistons are used in the powerplant. High compression necessitates valve pockets in top of piston as well as the sturdy dome cross-section with heavy internal webs to the wrist pin bosses. Note top land depth.

Cast aluminum portions of engine are shown here. This is a Marine mounting unit. Starter is from a Corvair. Automotive engine will have bellhousing cast to match up with most all the popular small European and American transmissions.

Remarkably clean installation takes power off front of engine for Aerojet-General's new "Hydrocket" propulsion unit. Note the dual Fish type carburetors on log intake manifold. Return tubes at rear of engine route oil back to crankcase.

decided rake to the rear. The stock performance (on pump gas) figures read as follows:
175 hp at 6500 rpm with 135 cubic inches
150 hp at 6500 rpm with 120 cubic inches
125 hp at 6500 rpm with 105 cubic inches
115 hp at 6500 rpm with 91 cubic inches

Each of these power packages weigh in at a maximum of 175 pounds. The first engines will be available with adaptors as replacement units for MG's, Triumphs, Sprites, and various other small sports cars as well as for marine use. You may well ask why all the excitement over a small but very efficient four-banger for rodders? TN'T has a few dreams of their own that may be soon realized as they are contemplating bolting a couple more cylinders on the end for a DO-6, then hanging a pair of 4 cylinder block units on a new crank and case assembly to come up with a DO cammed, lightweight V8. Just think of it, a 4 cam V8 with 270 cubic inches at 14 to 1 compression weighing in at around 225 to 250 pounds. This should produce, at a minimum, 325 horses stock. The word stock may be a bit misleading here as these engines are highly refined packages of efficiency as they come from the factory. In fact, the whole thing may be a bit frustrating to the hot rodder, as there will be little left to do except decide what type of carburetion or injection to use. The intake ports are laid out on 4-inch centers and will accept quite a variety of carb layouts or log manifolds, including side-draft carbs and injector. You might give some thought to a blower with compression also. While on the subject of carburetors, we might mention that Ted Tyce has taken over the well known Fish Carburetor Company and will shortly be producing a carb which he feels will outperform anything on the market. This and the performance story of a rodder's dream V8 we shall save for a later issue.