

HOPPING UP YAMAHA'S NEW CT-2 TORQUE INDUCTION SINGLE

THE SHOEMAKER METHOD TURNS THIS TRAIL TOURER INTO A RACE TRACK TERROR. A 70% INCREASE AT THE REAR WHEEL IN LESS THAN 8 HOURS.

Back in our April, 1971 issue of *Modern Cycle* we featured a hop-up on the now old piston port 175cc Yamaha single. The story was built around ace tuner and rider Larry Shoemaker, who was then and still is the service manager at International Motorcycle, Inc., Canoga Park, California. This article was extremely popular out in read-erland which proved our theory that great amounts of interest are stirred up with factual features dealing in meth-ods to extract more horsepower from a given motorcycle engine.

For 1972, Yamaha introduced Torque Induction (reed valves), creating a whole new ball game for Shoemaker. After many hours of work, and several dis-carded cylinders, the Shoemaker meth-od was successfully applied to a reed

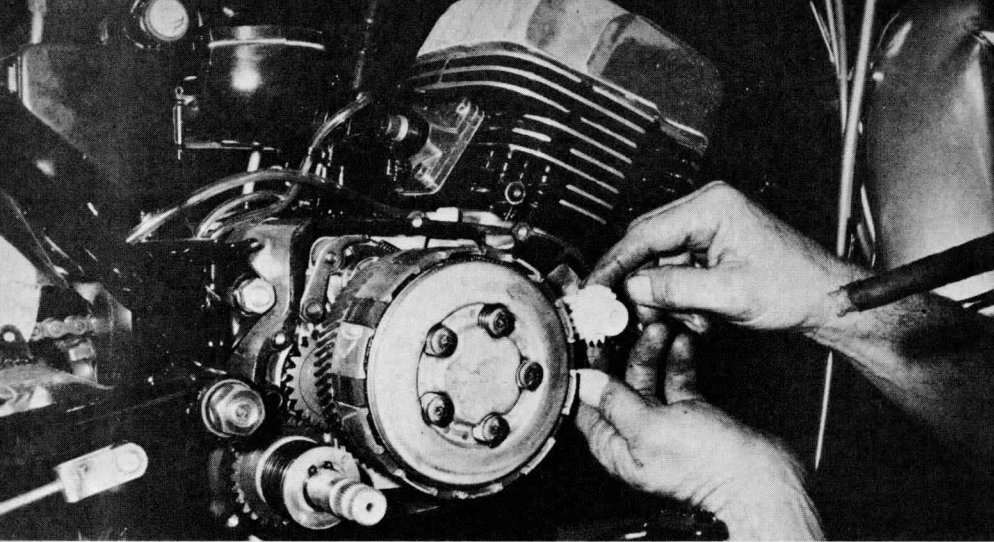
engine resulting in 70% more horse-power at the rear wheel, a very wide power curve, plus all the non-tempera-mental features of a reed valve two-stroke.

Starting with an out of the box CT-2 the service department at Inter-national M/C starts filling a large card-board box with all those unnecessary street items that come on the bike. Dur-ing this operation the oil tank is re-moved along with the oil pump and its nylon driving gear found on the inside of the outer right hand case. An alloy casting and gasket cover the hole left by an absent oil pump, and that's all that's done to the lower portion of the engine. Two O-rings found on the dis-carded tach drive and speedo drive cables are slipped over a pair of special

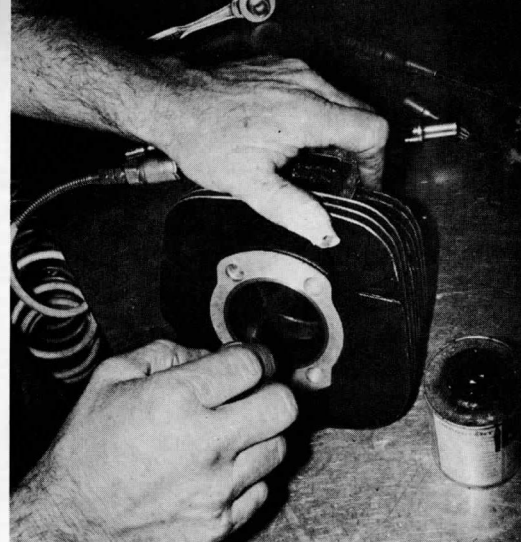
plugs supplied by Yamaha to fill the holes in their respective castings.

By now the cardboard box has be-come quite full with such items as turning indicators, wiring, and a bat-tery. Actually, 23 pounds of street equipment are removed from the CT-2 not including its exhaust pipe assem-bly. Later we ran some dyno tests with the standard spark arrester/muffler and International Motorcycle's special si-lenced tuned pipe (more about that later).

Most of Shoemaker's secrets lie with-in the cylinder, cylinder head, and car-buretor. These three pieces are removed and attached one at a time. 1.5mm is shaved from the bottom of the head and a new squish band is machined in to match the cylinder's bore. When



With the right hand case cover removed this nylon oil pump drive gear just slides off.



Machinists Dykem blue is painted around the ports in the cylinder prior to scribing.



bolted together this area between the piston top and squish is critical, it should have an air gap of .020 to .030 of an inch when the piston is at Top Dead Center. Yamaha's claimed compression ratio for the CT-2 of 6.8:1 (measured from the top of the exhaust port), is upped a couple of points, but not enough to get into marginal combustion temperatures.

The CT-2's reed inducted cylinder gets most of the hand work and is responsible for the largest increase of horsepower. (Yamaha's single revolutionary advancement when they went to the reed valve is the addition of a cavity in the inlet port that allows some of the incoming fuel to blow over the top of the piston when it is at Bottom Dead Center. This is fuel that has gained its velocity during the inlet stroke. As the piston reaches bottom the vacuum in the cases has diminished, an opening suddenly becomes available at the top of the piston so the fuel rapidly changes direction and goes directly to the combustion chamber.) 2mm is taken off the upper part of the inlet port and a larger radius is ground in to aid this flow into the third port (ref: figure 1, section A-A). If you measure from the top of the cylinder to the bottom of the inlet port you'll find this dimension to be 85mm. An additional 2mm is ground out at the piston side of the cylinder and two fingers at the outer sides of the inlet port that go way down to 91mm and have 3mm radii (ref: figure 1).

To take care of this increased flow of fuel into the engine the upper portion of the main transfer ports are raised to 39mm from the top of the cylinder (ref: figure 1, section B-B). The exhaust port is raised 3mm to 27mm and about 1mm is removed from The completed barrel, a good view of the modified inlet port. The cylinder has been honed and washed and is ready for installation.



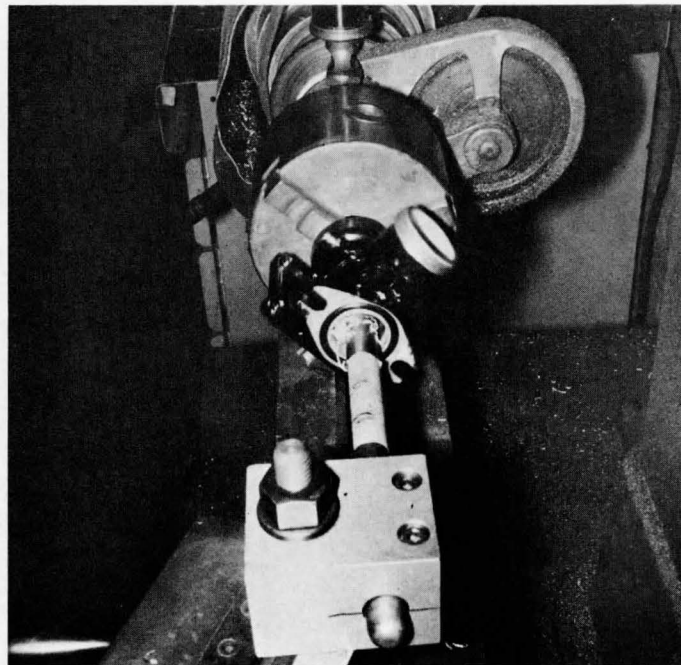
Thin scribe lines are scratched into the Dykem to serve as guidelines for the grinding chore.



Modifying 2-cycle cylinder ports not only takes special tools but a special talent, also.



Measure the height of the piston at the edge, subtract 1mm in the calipers, and scribe a line at the skirt.



The boring of a Mikuni. This delicate operation is very important to the CT-2's performance.

the entire exhaust port downstream of the opening. Both exhaust and inlet holes are polished to a fair degree, and the upper and lower edges of the ports are slightly chamfered with a half round file to keep from snagging piston rings. Only 1mm is cut from the skirt of the piston on the inlet side, this small amount is all that's needed in view of the work that has been done on the inlet port.

It's highly recommended to replace cylinder gaskets when reassembling. Yamaha's Autolube injector ties into a fitting on the outside of the inlet manifold. With the oiler removed a simple 6mm screw fitted with a fiber washer

is all that's necessary to plug the hole.

The standard 24mm Mikuni carburetor actually measures 23.6mm in diameter. It is stripped down to its basic casting and bored to 26.6mm in diameter. A new seat has to be cut in the bottom of the venturi area so the slide will shut off. With this larger diameter venturi only about 4¼ full threads remain in the body for the needle jet to screw into. The venturi diameter has been increased 3mm, and if the needle jet is screwed back in it would protrude into the venturi too far. So a 1.5mm brass washer is slipped onto the needle jet before it is installed so it will remain at its proper height. The

needle is left in its central position and the main jet increased from the standard 200 to 240. (If a high performance Filtron or Unifilter is used then a 250 or 260 main jet is recommended.)

With a new head gasket the cylinder head torques down to 22 ft. pounds. The inlet manifold and insulator block are opened up to match the carburetor and the whole thing is bolted back together. Remember, nothing was done to the reed block itself.

Only the black wire coming from the flywheel magneto is used. It's attached to the coil with an extra lead going to a kill button. Ignition timing in stock form is 1.8mm Before Top



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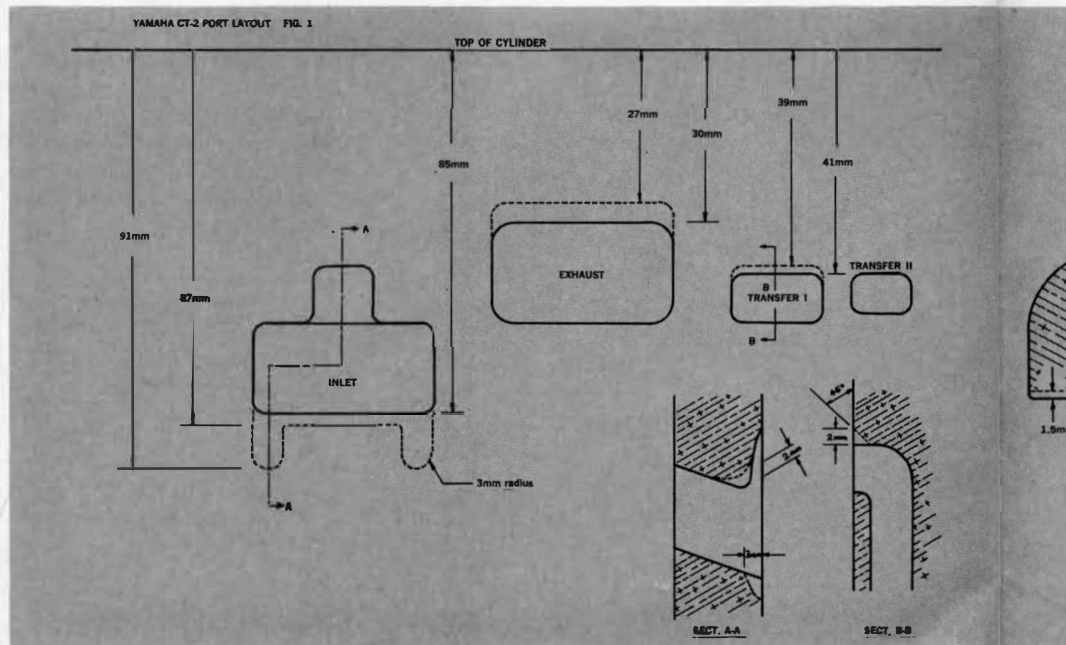
HOPPING UP YAMAHA'S NEW CT

Dead Center (BTDC). In order to take full advantage of this port work the ignition spark lead is increased to 2.4mm BTDC. Something else you'll need are two 8mm bolts, 50mm long. They replace the rear turning indicators and are needed to hold the fender in place.

With all the excess weight trimmed off the CT-2 weighs 185 pounds wet. The engine has a very broad power band thanks to Torque Induction and is not the least bit temperamental to start. The bike goes like gangbusters and if you're not careful it will pull all the way over in second gear dumping you on the terra-firma. First gear is just ridiculous and remember, there

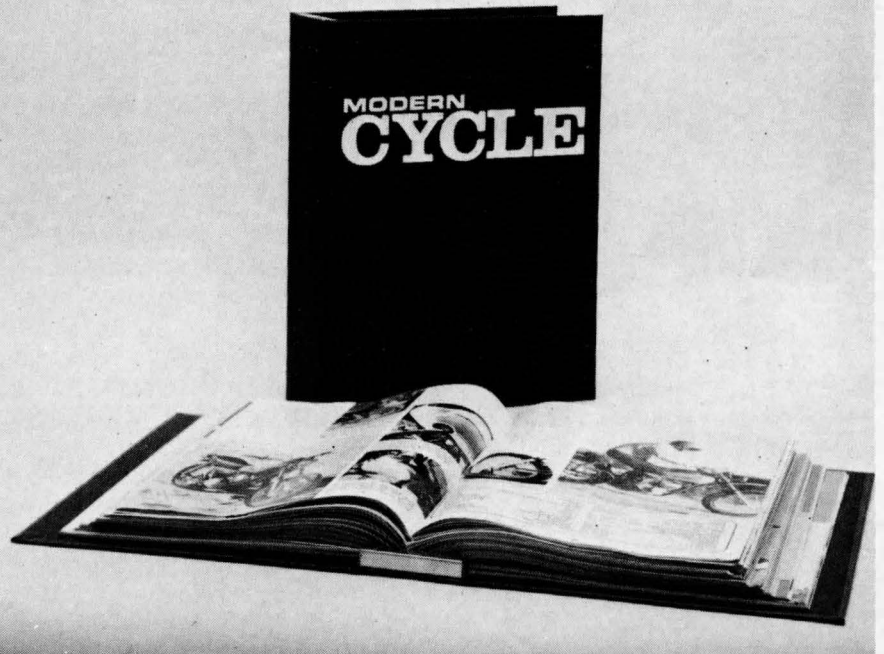
has been no changes made to the gearing; it has that much more torque and horsepower.

On International M/C's dyno the stock engine, before we altered it, was pulling 10.2 horsepower at the rear wheel and an estimated 15.4 at the crankshaft. With the stock spark arrester/muffler exhaust pipe the modified CT-2 pulled 15.5 at the rear wheel, an estimated 22.5 off the crank, and turning 9,000 rpm. Fitted with the Intentional M/C silenced expansion chamber the CT-2 would spin to 9,800 rpm, put 17.4 horsepower to the rear wheel and an estimated 27.2 at the crankshaft. Truly a lot of horsepower for so little effort.



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International M/C has several ways to go for those eager to convert their mild mannered CT-2 into an exciting handful of power. If you send them the pieces they will modify the carburetor for \$20.00, do head work for \$10.50, and the cylinder for \$30.00. Their silent expansion chamber goes for \$46.95. These pieces are labor only and the extra work for removing pieces, shipping, etc. is more. If you want the whole tricked up racer they have them available too; \$795.00. Any way you look at it the price for all this power and fun is reasonable. For more information contact, International Motorcycles, Inc., 7233 Canoga Avenue, Canoga Park, California 91303. ●

FIG. 2
YAMAHA CT-2 CYLINDER HEAD MODIFIER

