1970 Triumph with 90^0 offset-crankshaft

by Geoff Collins

Figure 1 - CVMG member Geoff Collins and his offset-crank Triumph in July 2002

I became interested in building a 90^0 crankshaft for my Bonneville in 1997 after reading various Classic Bike articles on the benefits of both 76^0 and 90^0 crankshafts. In these articles the crankshafts were built using custom machined components bolted to existing stock or modified components. As a toolmaker, I looked at these constructions as something to be improved on by making a stronger, all-welded assembly from stock components with the minimum of custom machining.

A fixture was built from cast allowing the crank to be split then welded together in true alignment. Each half is machined on its cut face to true the surface and allow for the addition of a spacer plate. The spacer plate also carries the oil passages between crankshaft journals.

Figure 2 shows the welded crankshaft sitting in fixture after centre-section was turned to re-fit stock flywheel. Flywheel is a slip-fit the same way stock flywheel is mounted. Both sides of flywheel were welded around complete joint between flywheel and crankshaft centre in the fixture, rotating crankshaft to get at all sides. Welding the flywheel in place also adds strength to centre web.

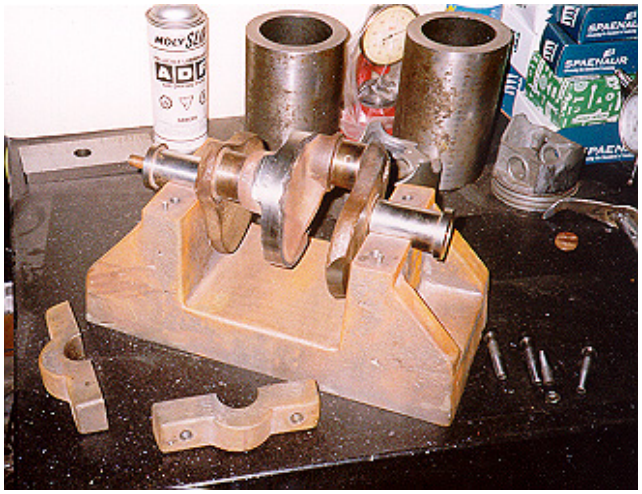

Figure 2 – Crank and fixture

The entire assembly is stress-relieved in the fixture, slow cycled up to 1500F degrees, then back to room temperature in a furnace to remove all welding stress'. Weld slag is ground off, welds are ground smooth, then crank is Magna-fluxed to check for cracks. The crank was ground and balanced with all journals checked for alignment within .0002". Big-end journals were ground .010" undersize to clean the bearing surface with factory-specified .090" radius at the edge of each journal.

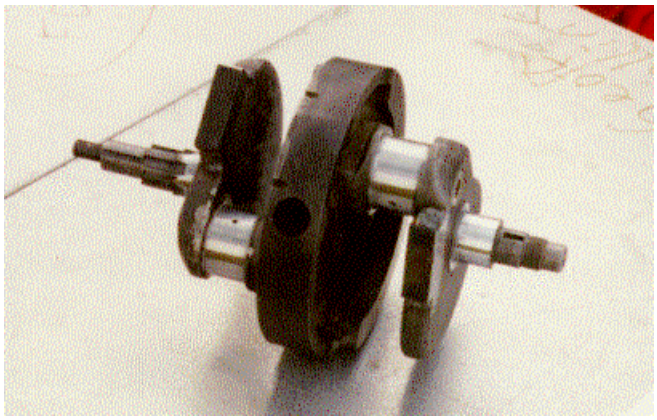

Figure 3 – The first crankshaft – original flywheel mounting holes are not used..

Camshafts

Custom cams were built by MegaCycle Cams of San Rafael, CA. to my drawings. Their 510-05 grind was used for the first engine because of its intended use as a mildly tuned city bike. MegaCycle was provided with instructions for cam modifications using drawings showing the offset required. Figure 4 shows camshaft lobe offset in comparison to the standard.

How does it Run?

At date of this writing more than 1600 klics (1000 miles) has been put on the machine. Like anything that starts as a dream, much got changed along the way. There's still lots to improve on this machine but one area that worked better then expected was the engine; a 90^0 offset crank turns a nasty vibrating twin into a smooth highway cruiser even though plan was for a lightweight city bike.

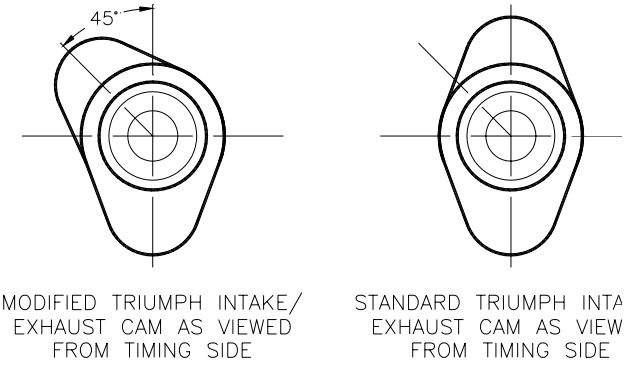

Figure 4 – Camshaft lobe offset, timing side is standard, drive side is 45 degrees behind

Other specs:

Triumph uses a 1970 T120R frame without modifications, a 1984 Yamaha RZ500 anti-dive front fork with modified stem for tapered roller bearings, a single 1984 Yamaha brake caliper with 2 pistons, a front hub from a '73 Honda 750 using a custom-machined rotor carrier to mount one lightweight RZ500 disk. The front hub is laced to a flangeless WM3 x 18 alloy rim using SS spokes. The rear hub and brake drum is stock Triumph with lightened internals all laced to another WM3 x 18 alloy rim with SS spokes.

A small fairing from a 1981 Yamaha 550 Seca was modified to remove the former horn bulges. Honda GL1000 instruments fit nicely under the small screen with a useable red line on the tach (8000 rpm). A rounded plastic front fender is painted to match the fairing and seat tail piece while a black plastic fender is buried at the rear. A titanium skid plate was added to keep the underside clean and for fearless curb jumping. The fibreglass seat base was fabricated by the owner adding VW Bug upholstery and a taillight from a 1998 Suzuki Katana. LED lights are used for the licence plate. All handlebar switchgear is from a 1982 Yamaha RD350LC with a ½" Seca master cylinder.

Figure 5 – View from the rear

The bike is painted Pacific Blue/Alaska White Triumph colours using the '69 "Detroit" paint style. White stripes are added to the seat tailpiece, fairing and front fender for that '60s racing appearance. The rest of the bike is black, like a Triumph should be with silver powder coated rear hub to match the front wheel's aluminum hub. A 1968 T120R engine with a 4-speed gearbox was used as the plan was to build a city bike. Originally, a 20 tooth drive sprocket was used to lower the revs, which suited the 750cc Nikasil barrels and 8.4:1 compression pistons, but I have since changed back to the stock 19 tooth as the primary drive gearing (Tony Hayward belt running wet with alloy 14 plate clutch) drops the revs enough. A 45 tooth rear sprocket also helps. A single Amal 30mm carb is used with chrome slide, another item that makes the bike smooth.

The ride:

At typical city speeds (between 50 and 80 klics) the bike is vibration-free. Some vibration showed at higher speeds in the fairing but that was fixed with rubber mounts. Cruising 100-120 klics (60-75mph) is smooth but seems slow as the fairing hides the wind blast. A slight tingle that came through the bars was fixed using aluminum Renthal trials bars with the cross-brace removed. An indicated 130-140 klics (80-90 mph) is also acceptable for extended periods but limits the range of the stock 2- ½ gallon tank. Going further, its not how fast it goes but how you feel after a ride; I wasn't tired and didn't have to find a can in a hurry for a big dump. The same run on a stock Triumph would be tiring but on this bike its effortless. I've run it up to 160 klics (100 mph) for short bursts and the bike still feels smooth and rock-steady. Around the city I notice another feature aided by the 2 pounds shaved from the stock crank's weight and the lighter front end; the front easily hops up in first gear without dumping the clutch – just roll it on.

The sound:

Its a hooligan bike; the custom two-into-one exhaust system starts as two 1.5" stainless steel pipes before merging under the left sidecover into a 2" collector. The modern aluminum can looks good but its loud. The bike doesn't sound like a Ducati, as I expected it might; it has the low rumble of a slow V-8 at idle then takes off with a similar stock-car sound. It reminds me of childhood visits to stock car tracks more then a motorcycle. Someone listening from behind might have another impression but that's what it sounds like from the saddle. A offset-crank bike using a stock exhaust system may have more of that early Ducati v-twin sound to it.

Other Notes:

The exhaust system is a one-off 22 gauge stainless steel item. Its routed inside the frame under the left sidecover with a Hindle aluminum "can" muffler hung from a titanium bracket. An in-line oil filter compensates for the lack of a sludge trap, buried neatly beneath the stock left sidecover. The battery box was moved back a bit to fit the oil filter. Of note; there are only two head-steady brackets, both made from 1/16" titanium. Compare that to the stock heavy steel items (4 pieces). The bike weighs about 325 lbs dry.

It took 4 years to build and its still under development. There's still lots to do such as a better chainguard and a modern steering damper. One recent modification was moving the footpegs back 3" to improve the riding position. Figure 6 shows the shift linkage that was built by adding another pivot point into the stock gearbox cover.

Figure 6 – Footpegs back 3" using shift linkage

Other Cranks

The same fixture can be used to make other offset crankshafts such as the Norton crank shown in Figure 7. BSA cranks can also be built using two donor cranks and the timing-side roller bearing conversion. Stock Norton and BSA cams can easily be modified using special tooling (not shown).