BALANCING ACT

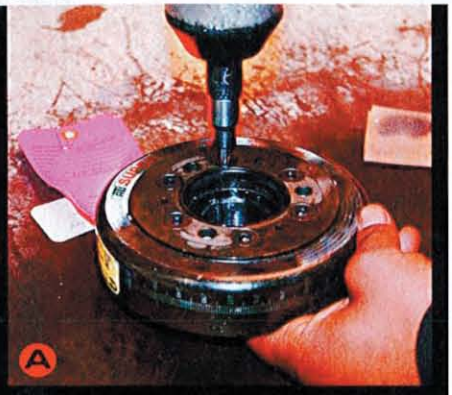
It's A Harmonic Damper, Not A Balancer

BY JOHN DiBARTOLOMEO

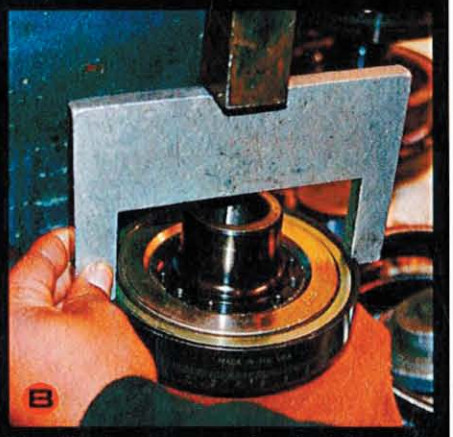
Since the very early days of four-cycle engine development, vibrations have always been a concern. Aside from internally balancing an engine, the design of a harmonic damper became necessary to control a phenomenon called *resonance*. In the case of a race engine, resonance is the tendency of a rotating assembly to *oscillate* at a point in the rpm range.

Think of it in these terms: As the pistons and connecting rods go up and down, they are imparting a spinning motion on the crankshaft. While one piston goes up, another (or two) is on its way down. Each time the spark plug fires, it causes an explosion within the combustion chamber which can effectively stop a piston from completing its intended travel had there not be another piston or counterweight on the crankshaft to help it along.

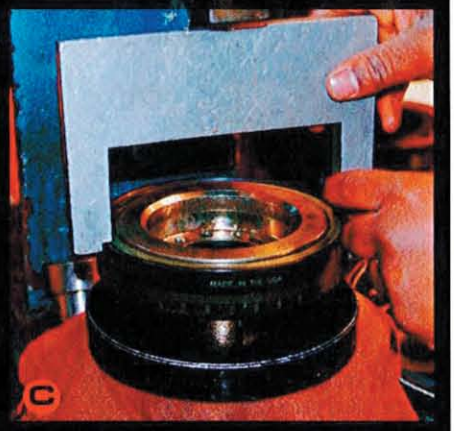
All of this causes torsional vibrations to actually twist the crankshaft in two different directions, forward from its natural state and then



The first step once an ATI Super Damper is returned to the factory from a customer is a visual inspection of the unit, followed by removal of the bolts which hold the shell assembly and hub together.



The unit is placed on a press where the shell assembly is pressed off of the center hub if it is stuck.

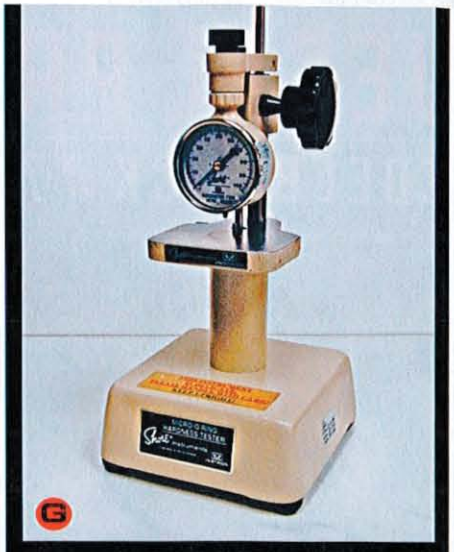


The inner shell is then pressed out of the inertia ring.

The outer shell and inertia ring is slipped onto a fixture and a couple of firm thrusts on the floor will remove the inertia ring from the outer shell.

Once the outer shell and inertia ring are separated, the elastomer o-rings are removed and the entire unit is cleaned and inspected for any damage. If there is any damage to any of the components, they are replaced once the customer is contacted.

New o-rings are then installed on the inertia ring.



It's imperative that the elastomer o-rings are of a certain hardness, which is checked on this O-ring Hardness Tester. Softer o-rings are used for lower hp, rpm and inertia weights. Harder o-rings, such as 80 durometer are used in most high-rpm engines.

The o-rings are lubed with a light silicone spray and the inertia ring is then pressed back into the outer shell. It's very important that the correct silicone spray is used to install the inertia weight so the rings do not roll, but also that they are not too slick inside the damper allowing the inertia weight to spin.

rebound back past that point. This flexing sets up a torsional vibration as the crank speeds up and slows down. In order to control this vibration, a damper of sorts becomes necessary.

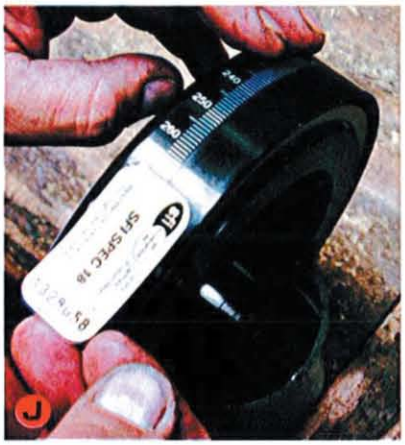
An OEM stock damper is made up of a hub and outer inertia ring, bonded together by an elastomer (or rubber) material. The outer inertia ring is continually oscillating back and forth while the elastomer controls its movement.

The term "harmonic balancer" might come to mind, but as JC Beattie Jr. of ATI Performance Products puts it, "The names harmonics, torsional, damper and balancer all seem to be mixed and used together. A 'dampers' job is to rebound the recoil of a spring; in this case, the spring is the crankshaft, which is exactly what our Super Dampers do."

In the mid-'90s, NHRA and the SFI mandated the use of an approved damper on the front of engines in certain classes. Originally awarded a patent some 13 years ago for their Super Damper, ATI purchased torsional testing equipment back then in order learn how harmonics can be controlled. Each engine can be somewhat different, but through their testing, they have found several different standard models which work on most engine combinations. Beattie said, "If a customer calls and has any combination that is outside the box in horsepower, rpm, cubic inches, or applications like Bonneville or Baja, our patented design can be tuned to their needs.

"In drag racing," he added, "since crankshafts are torsionally twisted to their

Using a special line-up fixture, the inner shell is pressed back into the inertia ring, followed by the center hub.



A new SFI-approved sticker is installed, and corresponding serial number is stamped on the outer shell. The unit is boxed and returned to the customer in as-good-as-new condition.

max for only a quarter mile at a time, a drag race crankshaft can endure large amounts of torsional twist for many years. This would be the case with an inferior damper that is not tuned or sized correctly for a high hp and rpm engine. That same amount of twist in a circle track car would not make it one race."

ATI's Super Damper is based on rubber o-rings, which are installed to take up the back and forth twisting of the inertia ring and hub. Beattie said, "The o-rings do all the work. The inertia weight is constantly oscillating back and forth on the o-rings. As the o-rings take this load, being rubber, they start wear. Many engine cycles, heat cycles, cleaners and dirt coming in from the back side, front main seal leaks allowing oil in the Damper, all will degrade the rubber over time. I have taken apart 10-year-old dampers that look like brand new and 10-week-old dampers with melted o-rings either from the wrong application or other engine issues."

With the understanding that nothing lasts forever, it is important that from time to time, you have your Damper looked at by a professional who knows what to look for in the case of damage.

Beattie said, "It really varies based on horsepower and use. We do, however, recommend that at each engine rebuild, you should have your damper looked at to be on the safe side. If nothing else, in the case of our Super Damper, it's $75 of insurance for your expensive race engine."

Follow us along as we tail ATI technicians as they rebuild one of their Super Dampers. DRA

SOURCE

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