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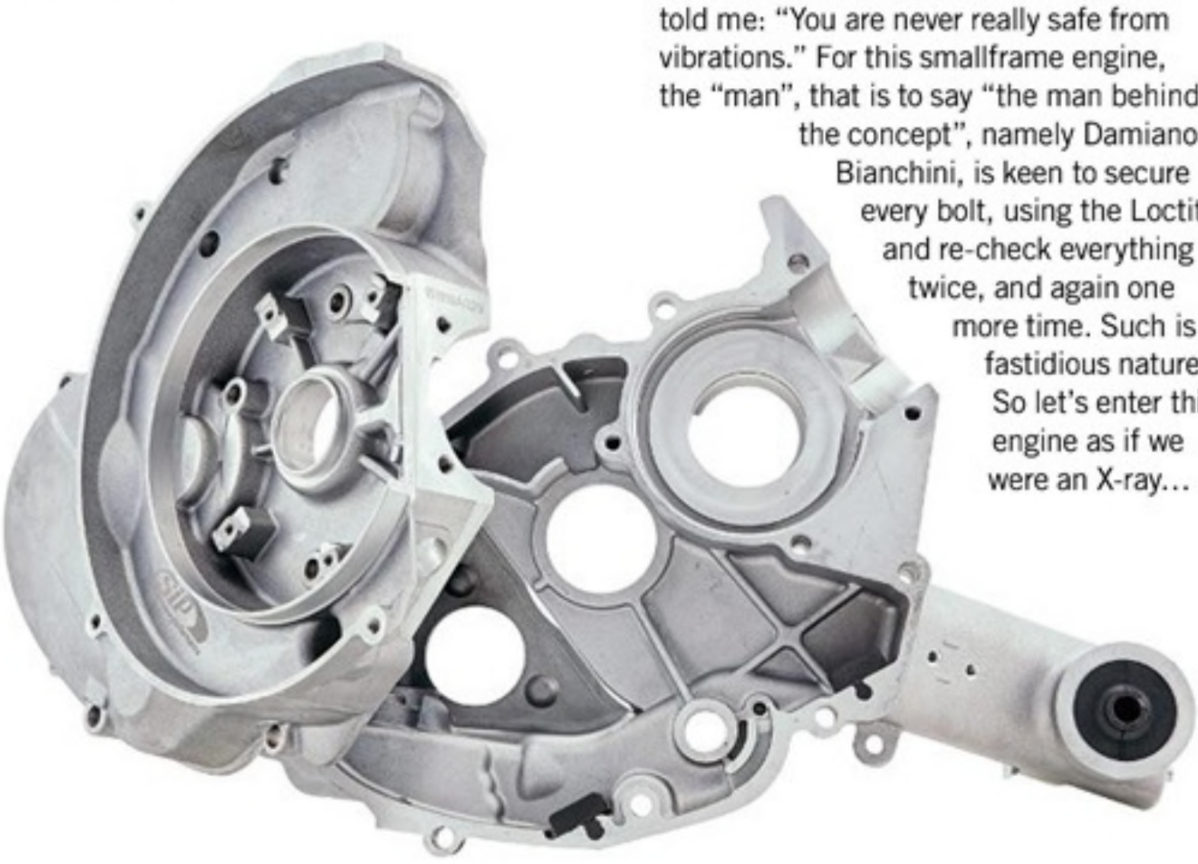
A Vespa Story: Part 1

The engine contained in this article is another experiment from the plethora of ideas contained within the perverse mind of an engineer who cannot sleep, gripped by dreams of engines and scooters. Have you ever been inside the mind of a mechanical engineer? Now is your chance...

The following notes are the sum of three months' travel throughout Italy, following the trail of tuning and performance, in our writer's unique and inimitable style. After the large frame endurance machine previously published, it is now time for the smaller sister. Let us explore the engine, taking care to point out the directions for a proper job. First things first: I am talking about an endurance machine. "If you want to place your butt in the highest positions with humble resources," erupted my interviewee, "at least you must pay great attention to details, and I really mean it. Every nut, bolt, wire, and the smallest element must be of a fastidious nature; meaning a proper engineer would be interested and devoted to avoid the consequences of the most tedious enemy of all – vibrations."



Now I know what you readers are thinking: "Yes, fool, you remind us to tighten all the screws." Far, very far, from just that. Even if I am not a professional driver I have sensed the danger of a loose bolt, I would not recommend attempting a trip – even at normal and prudent speed – with a damaged component. You might end up in a frontal assault against a wall just like that. So picture a major problem on a race track, a loose handlebar pivot for example, while your machine is whistling into a turn at high revs and your knee is just 2mm from the sandpaper-like tarmac. This is the reason why in every documentary concerning motor sport there is always the man who knows every bolt, every little spot of the racing machine. An aeronautic chief engineer once told me: "You are never really safe from vibrations." For this smallframe engine, the "man", that is to say "the man behind the concept", namely Damiano Bianchini, is keen to secure every bolt, using the Loctite and re-check everything twice, and again one more time. Such is his fastidious nature. So let's enter this engine as if we were an X-ray...

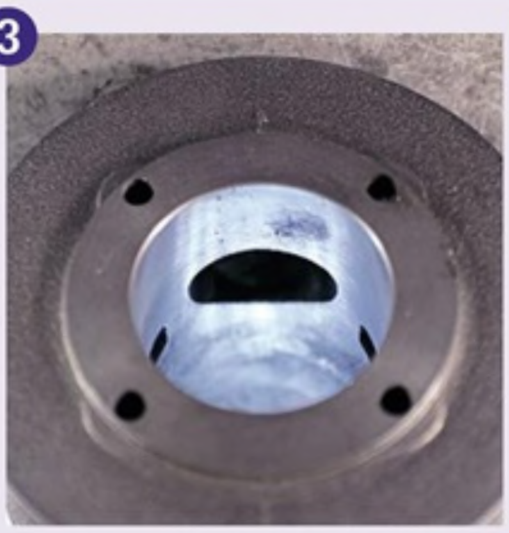
1

2

Base transfers

As you can see in picture 1, the difference between the left port and the right port is subtle but important. This is because the cylinder is intended to match the smallframe casing, but since internally the ports are very large, if you let the gas pass from a smaller diameter to a wider one, a disturbance of velocity occurs. To avoid this, the engineer evens out the port walls and enlarges the area. If you compare the distance from the stud holes on the left to the modification's shape on the right, you will see. Needless to say that absolute symmetry of the ports is pivotal to the result. To avoid any slip-ups, Damiano suggested: "Just put a paper gasket on the first, retrace the shape and transport it 180 degrees to the second port." Image 2 shows the final result.

3



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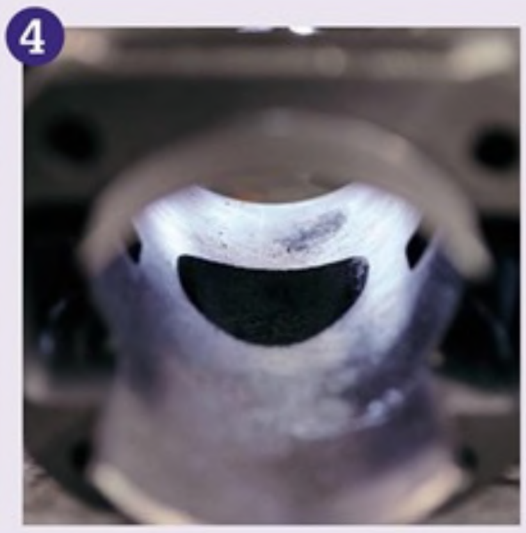


Cylinder exhaust port

Let us now move to picture 3, the exhaust port. The transfers are 128 degrees in duration, and the exhaust is 188 degrees, and this gives 30 degrees blow down. Perfect. Damiano traced down the dimensions using an old piston with the same geometry, then by the means of digital calipers and a steel-marker he shaped the port. Notice in image 4 the way the port is shaped tighter at the base to avoid much exhaust gas lost via the transfers. With a 54mm stroke crankshaft using a 105mm connecting rod, and 10mm thickness space from the base cylinder, a work of 4mm porting toward the bottom was needed to compensate.

Crankshaft

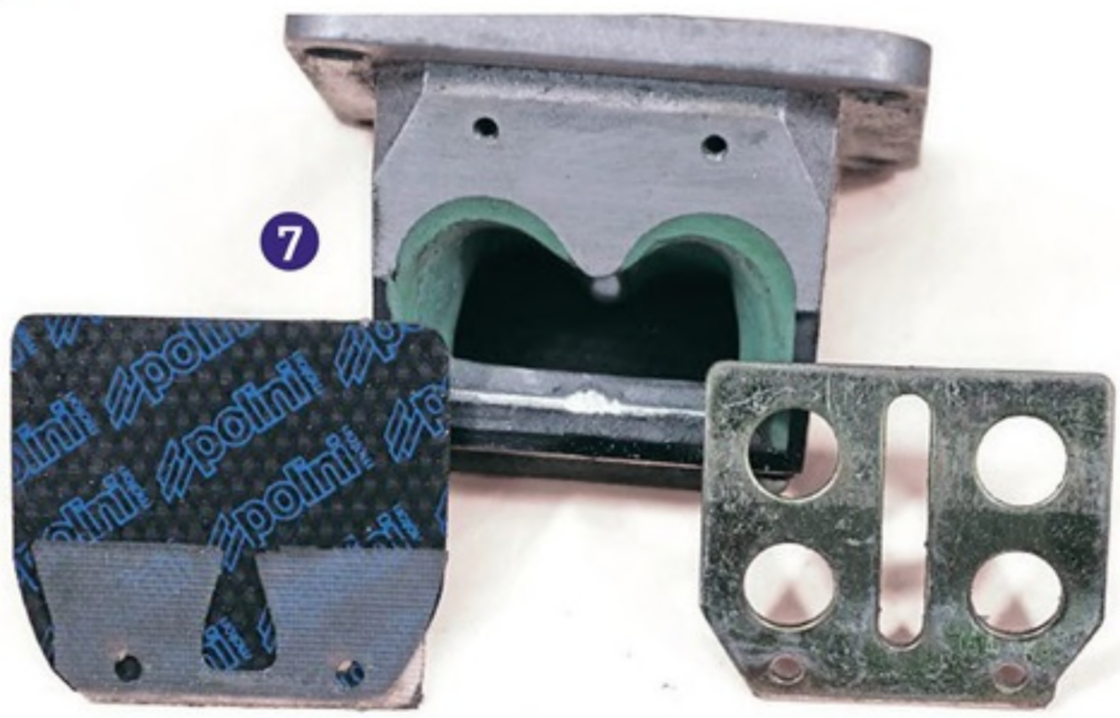
The crankshaft seen in image 5 received a laser weld to the big end pin to avoid a well-known problem regarding misalignment or 'twisting' of the webs. This is a relatively low-cost solution to an already strong component since the team already used the same crank for about 250 hours of heavy-duty usage. The additional modification in this case related to the webs that were solid and have now been cut equally to the port.

6

5

Inlet manifold & reed block

The intake manifold shown in image 6 is totally hand crafted. The thickness is designed to avoid the carburettor hitting the engine, the block and rubber flange are bolted together and since the external carburettor diameter is 36mm and the internal 24mm, an aluminium ring fits perfectly to this last piece to hold it all together. Just like the endurance large frame I tackled in the previous article, a resin component is used to model the intake manifold at its best, to maintain diameter and velocity throughout. Take also a look at the reed block shown in image 7, using 0.30 thickness reed petals, with the central support rib in the block removed.



7

8

Flywheel

Look at the cooling fan in image 8, what do you see? Yeah... it is a large frame item, and guess what? It fits like a glove without any interference to the flywheel cover, the casing and all. A super quick screw-holes adjustment and that was it, along with a great benefit in terms of cooling. Sometimes a bit of luck is needed too.

Casing work

Travelling within the engine through images 9 and 10, as if we were a portion of air-fuel travelling from the carburettor, we stumble upon the guide-flow carved inside the casings. A key point to this handmade tune was focused on the desire to push as much as possible to the centre of the crankcase.

9

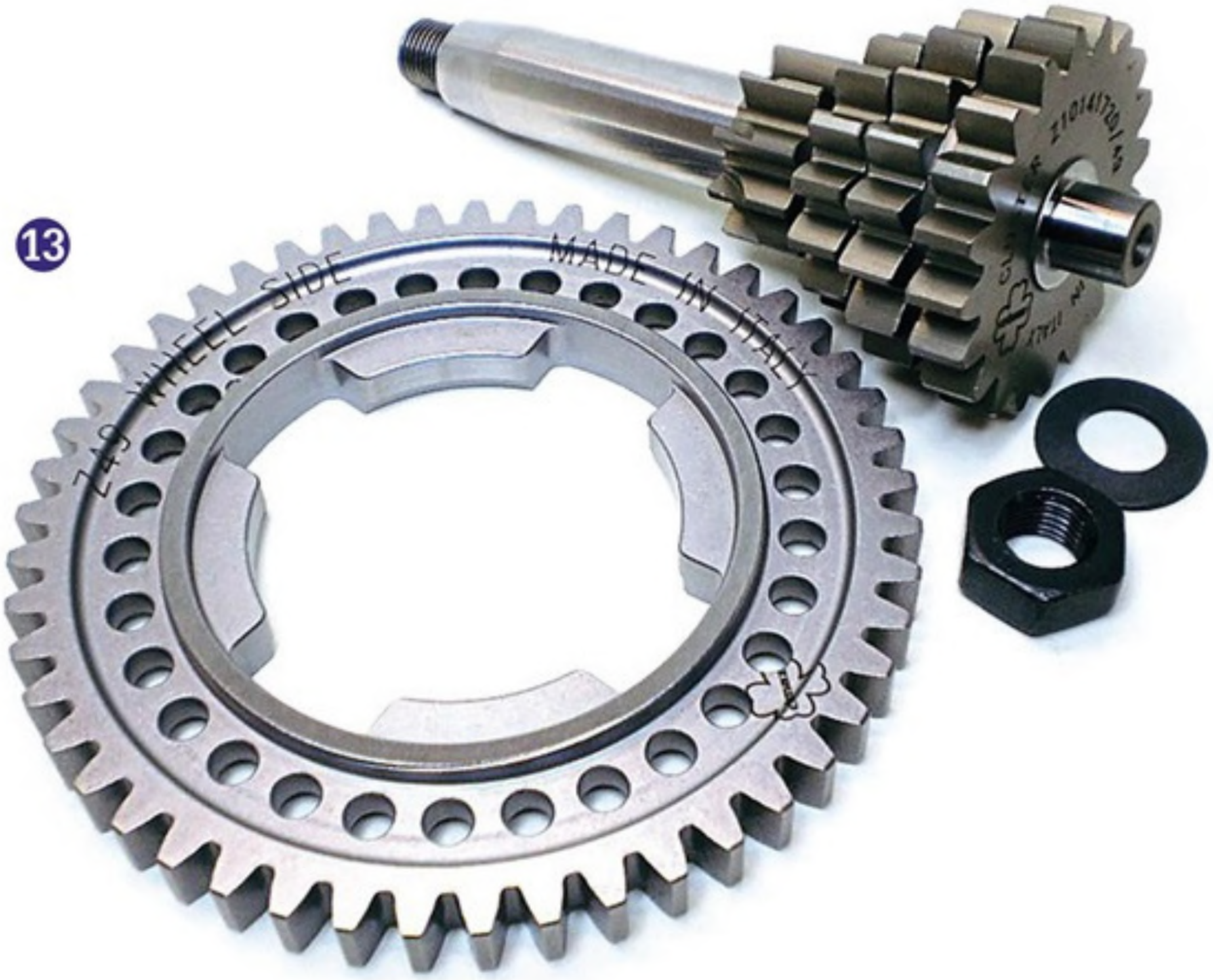
10

Exhaust manifold

When dealing with endurance race rules, it pushes you to new and sometimes less beaten paths. Picture 11 is an example of that matter, since you can admire the final result of the porting with a very fine polishing to the walls. In this particular application, the exhaust manifold is the only one you can modify so the team chose a 32mm bore hole as the exhaust, despite the original diameter which was 27mm. A Giannelli Endurance exhaust was the final choice, shown in image 12, firstly because it is better built, and secondly because of the construction being in three sections, which means less trouble to assemble and fewer problems with vibration and cracking. Damiano explains: "We are expecting 10 hours of riding at around 100kph for 950km distance, so you can understand how obsessive in details we need to be." The engineer smiled while looking far from me.

11

12



13

Gears
Moving on to the parts inside the engine, I want to explain that the primary gear was designed by a local tuner whom I will interview soon. This engineer is not like others, are you familiar with the kind of man always keen to help? In image 13, there is a close ratio third and fourth gear on the cluster, coupled only with a specific gear of 49 teeth, not like the usual 46-tooth Piaggio. If you want to go deeper on this you would discover that this specific part is no less than the replica of third gear Piaggio APE 50. So, using a 79 crown and a choice from 25-28 pinion the whole championship is covered. Can you imagine how many hours of work within the garage walls this trick would save?

Layshaft
Here is another "must" of the track race; image 15 shows a reinforced and oversize transmission shaft, stronger in flex and torsion. As you know the mix of the tyres grabs the asphalt like glue, this component is to avoid the problem concerned. Such a strong energy could move gears and blow them off each other.

15

14

Clutch
The clutch shown in image 14 is a masterpiece from the Italian constructor Crimaz which first of all has the steel discs, plus this is a design based on the Special 50 clutch instead of the usual HP Vespa. Smaller discs from the HP model have the medium diameter wider, fighting back more torque, the smooth discs on the other hand are more adaptable to high temperatures due to wider surfaces. Ergal-made springs support completed the pack.

The man Damiano Bianchi
Not inspired by any mentor, this engineer has consumed pages and books of various kinds. From university books to slipped handwritten notes, unavailable on the open market. With a lifelong experience and more than six years in the field, this engineer is to me the best approach from theory to practical application. We will bring results of the endurance event in a future report.

Words and photographs: Christian Giarrizzo