DYNAMIC BALANCING
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If a rotating part is not absolutely uniform, that is, if it has a bit more weight on one spot or one side, it will vibrate, oscillate, and/or shimmy when it spins. The heavy spot causes the problem as it rotates and the faster it rotates, the worse the shimmy by the square of the speed. On a motorcycle, you can have that sort of imbalance in any rotating mass. The wheels, to give one example, rotate at around 950 rpm at 60 mph.

There are two kinds of balancing. The cheap and easy way is "static balancing." Does the part tip over to one side instead of balancing on its center? That indicates a heavy side. Add or subtract weight until balance is achieved and you have static balance.

But the real kind of balancing is called "dynamic balancing" because the operator spins the part to see if it shimmies and/or goes unstable at any speed of rotation. Remember, the out-of-balance changes as the square of the speed: what's balanced statically may not be balanced when spinning as inertial forces build up. When spinning faster and faster, the forces change and the faster the spin, the more it is off.

Some of the masses on a bike are (or should be) factory balanced. And unless, they are manufactured very precisely or are just uniform disks, they should be dynamically balanced. There are telltale holes drilled on the heavy side to reduce the weight on that side.

For example, the alternator armature that spins at about 1.5 times the crank speed will have telltale dynamic balance drillings. It has to be dynamically balanced due to the high speed at which it spins even though it is a kind of uniform, automatically machined hunk of metal. Other parts should be carefully manufactured and/or factory balanced, like the crankshaft and wet-clutch assembly. Yet other parts, such as the dry-clutch flywheel/clutch assembly on BMWs subsequent to the well made /2 series certainly should be dynamically balanced but aren't. Shame on BMW and a curse on their stock price.

The Oilhead flywheel/clutch assembly (like the /7 bike) has three pieces, all as minimal and vestigial as possible, for obvious reasons like cutting weight and facilitating acceleration and braking. At the factory, they weigh each piece and place a white paint mark on the heavy side.[1] Then they assemble the assembly, placing the three marks each 120 degrees apart. If you have to re-assemble the unit, you do the same. Of course, even if you follow that rule, it is just a matter of luck if your static balance will be marginal, moderately bad, or terrible. Your vibrating rear-view mirrors will reveal the truth.

[1] It might be the light side. Nobody I know knows. And it doesn't really matter which it is so long as you follow the rules.

When tires are renewed, the wheels require to be tested for balance although some new tires are so precise that they may not need any treatment (granted, at best the balance test is crude compared to the balance precision needed for the high-rev'ing flywheels, but that is still pretty impressive). Even though the wheels turns no more than roughly a quarter of the crank speed and we are talking about soft rubber being "earthed" or "damped" by contact with the ground, balance is important.

Getting your flywheel/clutch assembly dynamically balanced

There are two kinds of industrial dynamic balancers: those who balance big parts in the field and those who do little (or at least, transportable parts) in the shop (some companies do both). The *big* guys go out to balance giant motors and big fans. The *little* guys use a tool that looks kind of like a sewing machine to hold the part and spin it.

I had my clutch pieces on a previous Airhead balanced piece by piece although I did only the chopped flywheel on an earlier one too. It should be only slightly more expensive to do the separate pieces (just two or three maybe) than as-a-whole; but then you can replace them piece-by-piece.[2]

The charm of a boxer is in the balance and in experiencing minimal vibration as a rider. Don't short-change your balance by living with the cheapie 120-degree method like everyone else... that's not even a static balance, eh.

Dynamic balancing is not a lost art and it is more relevant than ever with high-rev'ing engines. By the way, a counter-balance shaft, as on the 1200 cc engine, doesn't correct in any way for flywheel/clutch imbalance. Nor is it wasteful to balance one component, say the flywheel, while ignoring a tied component like the crankshaft. Each imbalance contributes to the vibration.

[2] On the /2, characteristic of the high quality of design and workmanship prevalent at BMW at the time (prior to 1968), the /2 flywheel is a work of beauty (especially if you like 15 lb flywheels). A taper holds it. If you bring a taper-mounted part to the balancer, be prepared to also bring a matching mandrel or extra cash. BTW, judging from the tone of those posting at the R1100S websites, something similar can be said about the change in quality of BMW owners as compared to 1968.