

Ask Dr. Spoke

Dear Dr. Spoke,

To Ruhloff or not: The question is, what advantage is there to an internally geared hub (IGH)? Should I get one?



First, let us define the terms. Most bikes use a grupo, comprising the chain rings (one, two, or three), a chain, a rear cassette, and shifting derailleur, allowing transfer of our foot power to the bike. It is a reliable system requiring care, maintenance, and eventual replacement of the chain (most frequent) and gears (chain ring and cassette). As most know, care must be taken not to damage the derailleur or affect adjustment. Depending on the set-up, we can use a wide range of gear ratios.

Now gear ratios are a bit tough for me to keep up on. But one method Sheldon Brown introduced is gear-inches (GI). Simply, it is the ratio of the chain ring (CR) teeth divided by the rear cassette (RC) teeth and multiplied by the wheel diameter in inches (D). $GI = (CR/RC) * D$. For example, a chain ring with 48 teeth coupled to a rear cassette sprocket with 24 teeth would have a ratio of 2. Multiplying that by the diameter of a 700 mm wheel (roughly 27.5 inches) we would find the gear inches are 55 gear inches. $GI = (48/24)*27.5 = 55$ gear inches.

Well, okay, that's great but what does it mean? So, for a range, a mountain bike in its lowest gear is around 17 to 18 gear inches. A road bike in its highest gear may be around 120 gear inches. Clearly there are trade-offs. For a mountain bike, the highest gear inches may be around 90 gear inches hence limiting top speed. Whereas, a road bike triple chain ring with a "30/32" (CR to RC) at lowest front to rear ratio may only go 24 gear inches, not so good for climbing. Another term is the gear range. It is the ratio from the lowest to the highest gearing. For example, 20 gear inches (lowest) and 100 gear inches (highest) would be 500 % (five times).

The gear ladder is the percent change from one gear to the next. The balance in any grupo is the gear range and the gear ladder. If the range is too high for the number of gears, then shifts from one gear to the next will feel disproportionate – notchy – in the pedal effort.

What is internally geared shifting? Instead of our familiar chain ring, chain, cassette and derailleur, gears exist within a hub performing much like the gears in our vehicles. There are two placements. One replaces the bottom bracket with the gearing, the other places it on the rear hub. Pinion is one company providing a bottom bracket mounted internal gear. The other, and the subject, is the rear hub mounted Ruhloff. Before I move on, let me offer the bottom bracket Pinion is, in my opinion, a better placement in terms of center of gravity.

Both Pinion and Ruhloff function in a similar fashion. However, the Pinion is integral to the frame design, hence retrofit isn't possible. Ruhloff requires a new rear wheel (dishless) with Ruhloff hub and chain ring (single). It may allow retrofit to an existing frame such as the CoMotion bikes (uses dishless rear wheel). Incidentally, the Ruhloff hub uses fewer spokes but shorter spoke length thus retaining the load strength of traditionally hubbed wheels.

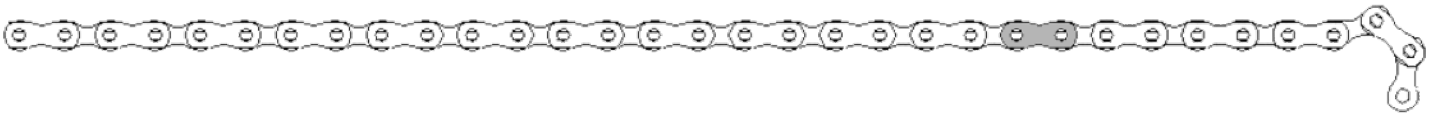
I note Shimano offers the Alfin IGH in either 8 or 11 speed hub. However, as I will discuss both the gear range and gear ladder are inferior to the Ruhloff. It is less expensive, and may be a great choice for a town bike.

We get to where the rubber meets the road, so to speak. The Ruhloff has 14 internal gears, equally spaced (see the photos on Page 10). There is only a single chain ring. However, different chain ring sizes can be interchanged to lower or raise the gear inches. Hence, a mountain bike set may use a Ruhloff 38 toothed chain ring matched to a 16 tooth rear sprocket to achieve 17 gear inches in low gear (first gear); and, 90 gear inches in high gear (fourteenth gear). It is possible to use a different rear sprocket (17 versus 16), but not recommended due to higher and potentially damaging torque loads on the Ruhloff (it also invalidates the warranty!).

I mentioned the gear range. For the Ruhloff using a 38x16 (ring to sprocket) set up, it is around 526%. Compare this to the SRAM XO single chain ring to 12 ring cassette of 525%. Not a bad comparison, and as most know, the usable gears on multiple chain rings is less than possible combinations.

Leading us to a virtue of the Ruhloff. A straight chain line from ring to sprocket increases chain life upwards to 12,000 miles! And, since there is no chain movement (recall, its internal gears) one avoids the chain falling from a sprocket. The chain can be replaced with a much longer life carbon belt (18,000 miles or more before replacement).

Continued on Page 10



Ask Dr. Spoke, Continued



I mentioned maintenance. Yes, even the Ruhloff needs it. So, at every 3,000 miles one must perform a relatively straight forward oil change. It requires about to 10 minutes to drain and replenish the oil. The lifespan is well over 60,000 miles.

The Ruhloff uses a two cable, twist shifter. Unlike our traditional derailleur shifting, cable stretch isn't a factor. Hence tune-ups are unnecessary. Set it up once. Placement of a twist shifter and use are different, but literature – I have no experience – suggest one adapts quickly. In fact, one person preferred it strongly. My research indicates twist shifters on drop bars is inelegant if even possible. On straight bars or the Jones Bar, placement and use are straight forward.

Shifting: Typically to shift we must pedal for the gears to change. On the Ruhloff, gears may be changed while standing at a stop light. Shifting several gears at once is possible. However, to shift while moving requires a moment of non-pedaling. Again, no experience but strikes as an easily-acquired technique. As an aside, the gear ladder is a consistent 13.6% change between gears. That's good, as some grupos to achieve a gear range create a variant gear ladder and "notchy" performance. The Ruhloff actually has seven gears but uses a high/low shift (from 7th to 8th gear) to reach 14. The seventh gear can be relatively noisy.

There are downsides to the Ruhloff, chief being the cost. At this writing it is around \$1,500. A second, the weight is significantly more than a traditional derailleur set up. And, a third is repair. Most Local Bike Shops (LBS) will have to send it back to the factory. The upside, the Ruhloff is highly reliable and repairs are very infrequent.

I conclude with my take on the internal gearing and the Ruhloff in particular. For touring, it is worth a close look. At present, 30% of touring cyclists use the Ruhloff. More of these cyclists are switching as the traditional providers for tour bike grupos such as Shimano and SRAM are moving more toward racing configurations. While field repair is improbable, the high reliability and low maintenance are strong arguments in favor of the Ruhloff. For mountain biking, the weight may be an issue and probably requires more thought. For road biking, I think the weight and the twist shifting may be a non-starter.

One area I am really concerned about in touring and mountain biking is the low gearing. Face it, those who tour are less concerned about speed and more about climbing with a fully loaded bike. I am sold. The low gearing is in the magic range of 18 gear inches. The upper range provides sufficient speed. And the ability to make a large gear change, stopped on a hill for example, is a huge plus.

So we come to question, should I buy one? Alternatively, on a future build should I opt for the Pinion gearing? For me, it is highly tempting. I suspect to do it right on my tour bike, I would switch from drops to a Jones Bar. While cost is a concern, I think the higher reliability, ease of use and infrequent maintenance make up the difference. Stay tuned!

If you have a question for Dr. Spoke, send an email to "DrSpoke@nmts.org" and watch for a response in a future newsletter.

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