

A Bicycle with REAL Gears

The Addendum team was in Chicago in early March, for the National Manufacturing Week show, when it saw something unusual: a bicycle with gears. Real gears. Spiral bevel gears, in fact.

The mountain bike was at Suhner Manufacturing's booth, on a small platform. The bike was on loan for the show from its maker, Christini Technologies Inc. of Philadelphia, PA.

Suhner was featuring the bike because it manufactures the bike's three spiral bevel gear sets for Christini.

Now, the Addendum team knows regular bikes don't have gears. Being gear goofs, we've known for years that regular bikes' "gears" are really sprockets.

So, why do Christini bikes have real gears?

Because they're all-wheel-drive bicycles. Power can move back and forth between the bikes' wheels via a drive system, and the gears are part of that system.

Starting with the rear wheel, the system has a spiral bevel gear (92 mm O.D., 45 teeth) and pinion (30 mm O.D., 12 teeth) that are opposite the bike's sprocket assembly. This gear set connects to a drive shaft, which itself runs through the bike's rear suspension. From there, the drive system goes inside the bike's frame, in the top tube (the horizontal bar between the seat and handlebar).

A second

drive shaft runs inside the top tube to the head tube, where the handlebar is mounted. Inside the tube is the system's second spiral bevel gear set, two miter gears (34 mm O.D., 15 teeth each).

A third drive shaft runs down the front fork to the front wheel's hub and connects to the third spiral bevel gear set. The hub is a zero-backlash freewheel hub with a roller clutch mechanism. The gear set is a spiral bevel gear (83 mm O.D., 48 teeth) and pinion (26 mm O.D., 12 teeth). Also, these steel gear sets have a coating impregnated with Teflon® lubricant.

The bikes' overall ratio is about 0.94:1 (rear wheel to front wheel).

"That's the magic of the drive system right there," says Steve Christini, president of Christini Technologies and inventor of the drive system.

The rider drives the system so long as both wheels are rotating at the same speed. The slight gearing differential prevents power from being transferred between the wheels.

If the rear wheel slips, it'll spin faster than the front wheel. At this point, the system engages and transfers power from the rear, faster wheel to the front, slower one to bring them back in sync.

As Steve explains, the drive system won't allow the front wheel to go slower than the rear wheel.

The system transfers power to add traction, so it helps riders maintain control when they're riding over wet roots or slippery rocks or when climbing a slippery grade.

The system weighs 2 pounds 11 ounces and is engaged with the flip of a switch on the handlebar. When it isn't engaged, the bike rides like a regular mountain bike.



Look close, (with a helping hand) and you'll see this bike has a spiral bevel gear and pinion. In fact, the bike has three spiral bevel gear sets.

Steve came up with the idea for his system when he was riding his mountain bike in a park, trying to climb a muddy slope. While his rear wheel was slipping and sliding, Steve had the first, often exasperated, thought of invention—"There must be an easier, better way to do this."

That was the summer of 1994, before Steve (a mechanical engineering major, of course) graduated from Villanova University. That next school year, Steve developed his idea into a prototype for his senior design project.

In the summer of 2002, Steve's system became commercially available on his all-wheel-drive mountain bikes.

For National Manufacturing Week, Steve made one of his bikes available to Joe Agro, field sales manager for Suhner, located in Rome, GA.

Suhner's interest—and the Addendum team's interest—in featuring a Christini all-wheel-drive bike was simple.

"It was a unique application for spiral bevel gears," Joe says. ☉



From a distance, the geared drive system blends into this mountain bike.

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