# Taking On Nature: Three Gear Companies And Their End-Products

**Joseph L. Hazelton**

Many gear companies make parts, build assemblies . . . and stop there. But, some don't stop; they go a step further and create end-products. Three gear companies have taken that step, and taken on nature with their creations.

Ontario Drive & Gear rides across land and water with its amphibious vehicles. ATA Gears funnels water through its turbines for electricity. Amarillo Gear raises temperatures through its wind machines.

### Finding Their Niches

*Amarillo Gear.* Started in 1917, Amarillo Gear Co. of Amarillo, TX, manufactures spiral-bevel, right-angle gear drives and fan drives. The gear drives are used for agricultural pumps, bow thrusters for docking ships, cooling tower fans, drilling rotary table gears, fire control, flood control, sewage treatment plants and water desalination plants.

In 1934, the company started building and servicing gearboxes in agricultural applications.

In 1974, it turned its expertise to upper and lower gearboxes for wind machines.

**An employee of ATA Gears Ltd. works on one of the company's water turbines. The turbines are usually used by energy-producing companies and private companies that own river rapids.**

Years later, Amarillo Gear used its know-how to develop whole wind machines. In 1989, the company formed Amarillo Wind Machine Co.

Located in Exeter, CA, Amarillo Wind manufactures and services wind machines used to protect crops susceptible to frost, with a relatively high value per acre. The crops include avocados, cherries, flowers, strawberries and citrus fruits, like grapefruits, lemons and oranges.

*ATA Gears.* Started in 1937, ATA Gears Ltd. of Tampere, Finland, manufactures spiral bevel gears and custom-made gearboxes. The parts and assemblies are for machines that handle heavy or shock loads and operate in extreme temperatures or dusty environments.

ATA Gears' spiral bevel gears are in its water turbines. Pentti Hallila, general manager of sales and technical services, says the company started making water turbines to extend those gears to an end-product.

The turbines are usually provided to energy-producing companies and private companies that own river rapids. Hallila says a company buys a turbine if it happens to be on a river and wants to make electricity from it. He adds that businesses may be in very remote places where they can't get electricity from a public network.

*Ontario Drive & Gear.* Started in 1962, Ontario Drive & Gear Ltd. (ODG) developed and manufactured a special transmission for a six-wheel-drive, amphibious all-terrain vehicle.

"They were looking for a stable market for their products," says Michael Eckardt, ODG's vice president of finance.

In 1967, the company entered the market with its own amphibious vehicles, called Argos.

Located in New Hamburg, Ontario, Canada,

ODG manufactures spur, helical, internal and worm gears. It also manufactures spur, helical and worm gearboxes. Meanwhile, its amphibious vehicles use helical and spur gears. The parts and assemblies are used in agriculture, automation, material-handling, mobile lift equipment, municipal tractors, and transportation.

The vehicles are used for disaster response, emergency medical service, search and rescue, resource exploration, and recreation—like hunting and fishing.

"And anything else where you have to be off the beaten track," Eckardt says.

**The Machines In Their Niches**

*Amarillo Gear.* Amarillo Gear's spiral bevel gears are in Amarillo Wind's machines. Amarillo Wind receives the gears, assembles the engines, then creates their frames and the wind machines' towers.

Each machine has two sets of spiral bevel gears: one set in the lower gearbox, one in the upper gearbox. The lower box receives power from the engine and sends it up the pipe's drive line to the upper box, which is connected to the fan blade.

Also, each machine has a set of worm-and-worm-wheel reduction gears, allowing the upper gearbox—and the blade—to rotate 360° around the tower.

As an example, the standard machine for citrus crops is about 35 feet tall, from the ground to the blade's center—tall enough to clear treetops. The blade is 18 feet long.

Tilted 6° down, the blade draws warm air from above, from the inversion layer, and blows it down on the trees, raising the temperature at ground level to protect the crops from frost.

A machine is placed in the center of every 10 acres of citrus trees in an orchard. To affect all 10 acres, the machine blows air at nearly 30 mph.

"It stirs the air quite a lot," says Roger Hein, Amarillo Wind's general manager.

The wind machines can't hold nature at bay. As Hein says, they don't prevent all frost, but they allow farmers to change Mother Nature by a few degrees.

Those few degrees can make the difference, though.

For example, America's largest orchards for eating oranges are in southern California, in the Central Valley. Despite its warm climate, California can have freezing temperatures in November and December.

**An employee of Ontario Drive & Gear Ltd. bends over an Argo amphibious vehicle on the assembly line. ODG's amphibious vehicles are built in New Hamburg, Ontario, Canada.**

The best temperatures for growing oranges range from a high of 95° to a low of about 30°. At about 27°, oranges can start to have problems, says farm manager Edward Lorenzi of Sun Pacific. Located in Bakersfield, CA, Sun Pacific grows citrus fruits in the Central Valley and uses machines from Amarillo Wind.

The oranges' problems are dissipation of their juice and damage to their appearance.

Oranges have small cells that hold their juice. If the temperature is too low, the oranges freeze, and the frozen juice breaks through the cells. When the oranges later thaw, their juice evaporates. Also, California eating oranges must look appetizing—no wind scars, no fungus.

Once damaged, the eating oranges would be used for any remaining juice. Their value would be limited to their juice value.

"The difference between a fresh market orange and a juice orange in California is the difference between making money and losing money," Lorenzi says.

He explains that depending on the market, eating oranges of export quality can sell for as much as $14 per carton. As for a carton of eating oranges used for juice: "You might be able to get $4."

Each wind machine usually runs about 100 hours during winter and protects probably $20,000–$30,000 in citrus fruit. As a farm manager, Lorenzi himself is responsible for 3,000 acres of citrus fruits.

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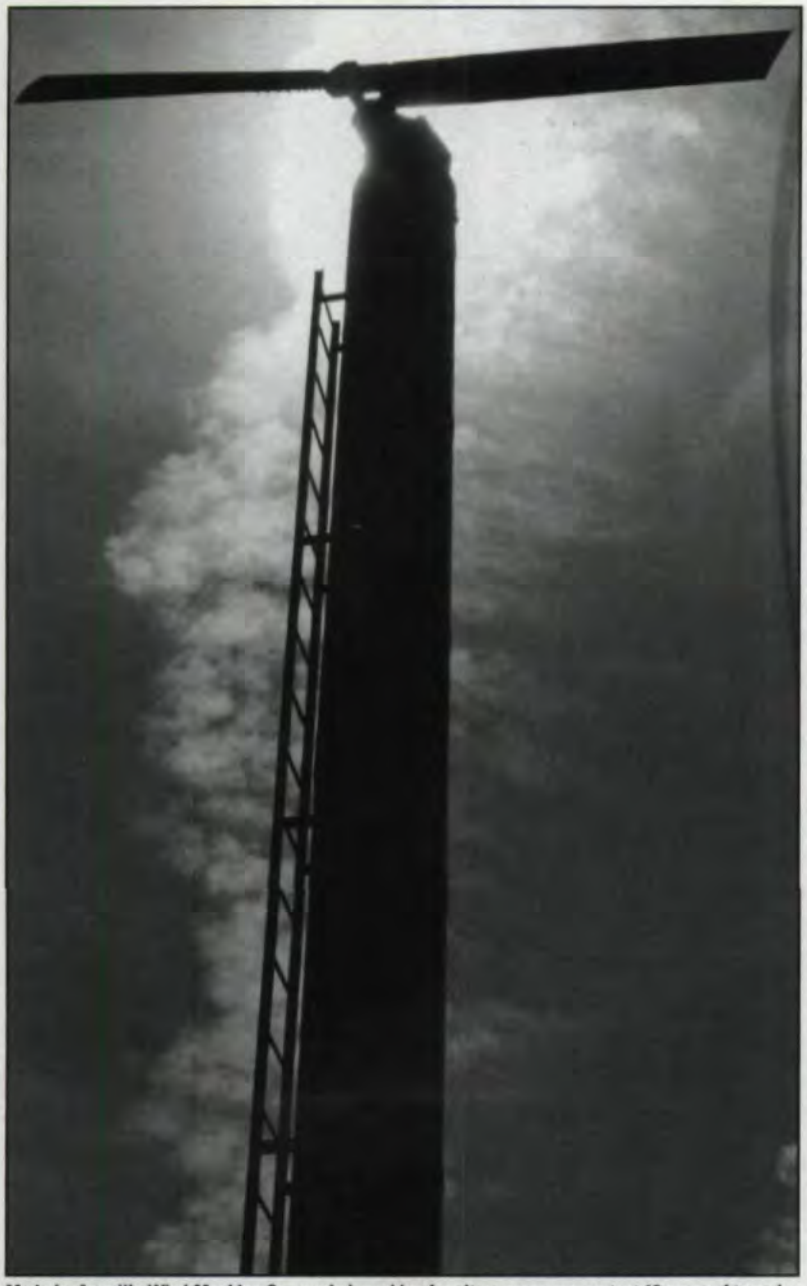
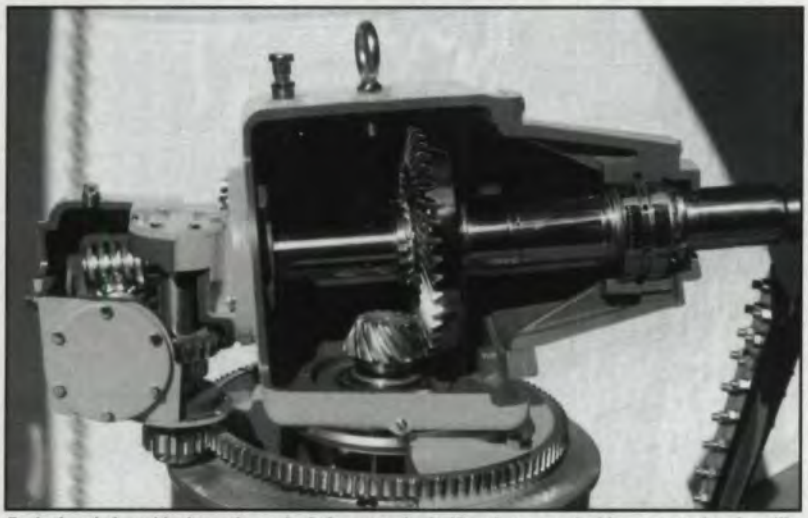


Made by Amarillo Wind Machine Co., a wind machine for citrus crops can protect 10 acres of trees by blowing higher, warmer air down on them. The machines blow the air at almost 30 mph.



Each of a wind machine's gearboxes includes a set of spiral bevel gears, as in this cross section. Amarillo Wind gets those gears from its parent company, Amarillo Gear Co.

A standard machine from Amarillo Wind costs $15,000–$20,000.

*ATA Gears.* ATA Gears' water turbines create electrical energy from flowing water. The turbine's power depends on the water's net head and flow volume. The turbines usually need water with a head of 6–70 feet, flowing at a rate of 30–1,800 cubic feet per second.

Depending on those factors, the turbines usually generate 20–2,500 kilowatts.

To generate their power, the turbines must be part of a dam. When the dam is opened, water flows through the turbine and rotates the runner blades, driving the shafts and spiral bevel gears that power the generator.

Hallila explains a water turbine's cost depends on size and conditions, but it's roughly $1,000 per rated kilowatt. Also, there may be additional costs for other items, like the dam.

*Ontario Drive & Gear.* The Argos are small vehicles that look like rugged, open automobiles. Depending on the model, they have six wheels and can carry four people or have eight wheels and can carry six people. They have 16-hp to 20-hp engines and bodies made of polyethylene, a type of plastic. The all-wheel-drive Argos can travel at 20–22 mph.

Weighing 765–1,025 pounds, the vehicles might not be expected to float, but they do.

"They can go through any depth of water," Eckardt says. "They're fully amphibious."

In the water, the six-wheelers can carry two people, the eight-wheelers can carry four people. With their wheels as propellers, the Argos can go 2.5 mph on water.

"We don't actually drive the vehicle," Eckardt adds, "we propel the vehicle through the water."

An Argo typically costs $6,000–$11,000.

**Gear Companies With End-Products?**

According to Hallila, it's unusual for gear companies to make end-products. As he explains, gear companies don't want to compete with their own customers.

Hallila knows of no other gear company that makes water turbines. At ODG, Eckardt says there is one other manufacturer of amphibious vehicles, but it isn't a gear company. Also, Hein isn't aware of any other gear companies with wind machine operations.

**The Machines' Markets**

Hallila describes the water turbine market as a relatively small market. According to Hein, the domestic market for wind machines is probably either shrinking or staying the same, but

the foreign market appears to be growing.

As for amphibious vehicles, Eckardt says the market's size is difficult to determine. He describes it as wide but shallow, explaining there are many niche uses for amphibious vehicles.

But, he adds the market has been growing rapidly during the past few years. "It mirrors—in a way—the ATV market, for the four-wheelers."

**Niches in Production?**

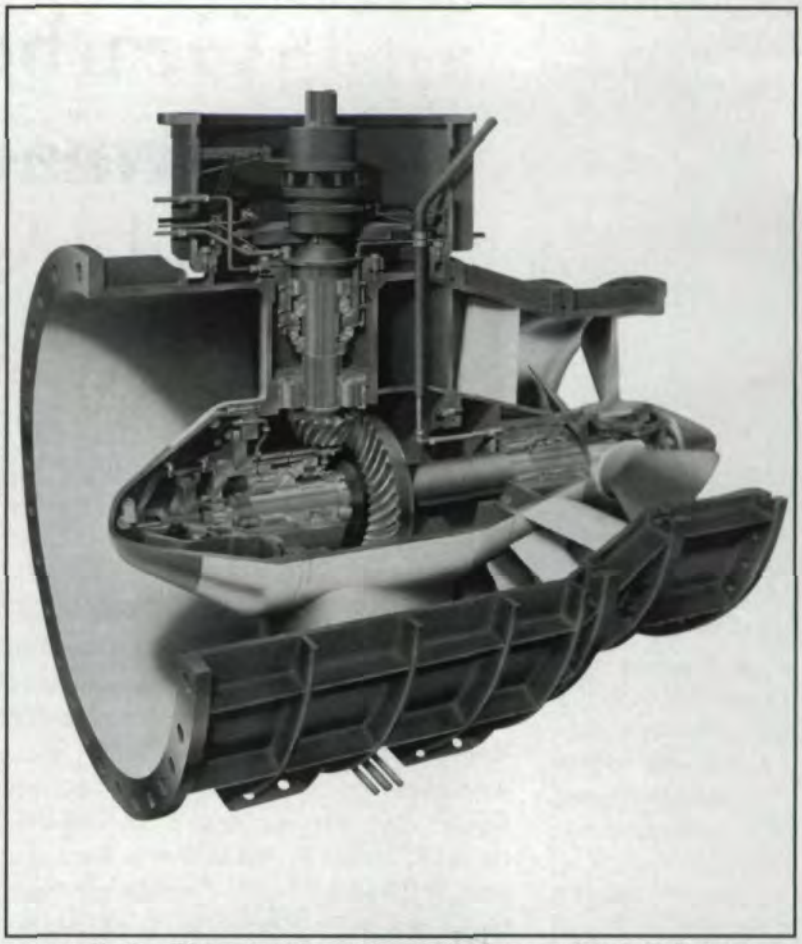
Having gone a step further, the three gear companies have made their end-products part of their operations. But, the step hasn't had the same effect on all of them.

ATA Gears makes its small-scale water turbines only when customers specially order them. And, it designs them to suit customers' local conditions. Amarillo Gear's subsidiary makes its end-products as part of its daily operations. Amarillo Wind makes 200–300 wind machines each year. Likewise, ODG makes its amphibious vehicles in its daily operations—about 2,000 vehicles each year.

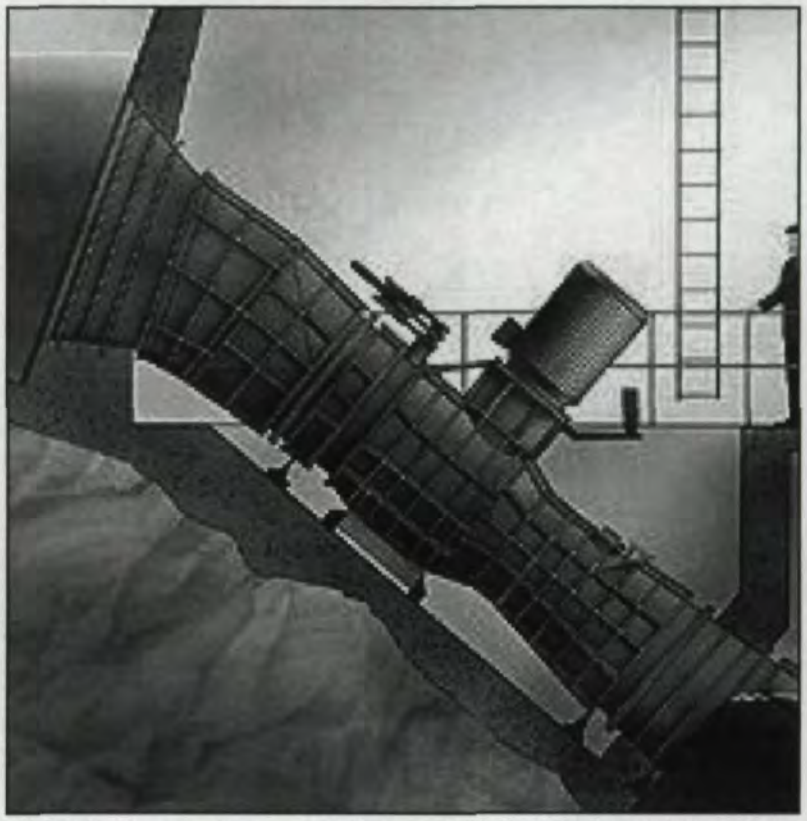
Hallila says the water turbines are a specialized part of ATA Gears, not in the company's mainstream operations. For example, ATA Gears has 170 employees, but the number of employees making water turbines varies depending on workload.

Hein also describes Amarillo Wind as a specialized part of Amarillo Gear, not in its mainstream operations. Amarillo Gear has more than 130 employees, Amarillo Wind has 21—and only eight of them build wind machines.

But, ODG's amphibious vehicles are its mainstream. Out of 110 employees, 30 work in sales and administration, 34 in the gear division, and 46 in the vehicle division.



**A water turbine from ATA Gears includes a set of its spiral bevel gears, as shown in this illustrated cross section. Entering the turbine, water turns the runner blades (right), driving the shafts and spiral bevel gears that power the generator.**



**ATA Gears' turbines generate power as part of a dam, as in this illustration. To generate power, the turbines usually need water with a head of 6–70 feet, flowing at a rate of 30–1,800 cubic feet per second.**

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