

## Cruise Is Added to the Toro® Wheel Horse® 260-Series

Fifty years ago purchasing a lawn mower was easy. It was the mowing that was hard! Choices were limited to the conventional push-reel mower or, for larger lawns or taller grass, the sickle-bar machine, a walk-behind version of the mowers used in agriculture. After World War II the rotary mower was introduced in various forms. These days the mowing is easy. It's choosing a mower that's a challenge! The old push-reel is still an option, of course, now available with gasoline engine. The small rotary mower comes powered by a gasoline engine (2-stroke, 4-stroke, overhead valve, side valve) or by electricity (cord or battery), and is available in the push or self-propelled variety.

For larger lawns, homeowners can choose a riding mower (suitable for a half acre to an acre of grass), a lawn tractor (a distant relative of the farm tractor), or a yard and garden tractor (the master not only of your lawn, but of a wide array of accessories like snowthrowers, tillers, spreaders, rollers, sweepers, aerators, dethatchers, dozer and grader blades,



**The 1993 Toro® Wheel Horse® 260 Series**



**The 1970 Toro® Wheel Horse® 800 Special**

bucket loaders and utility carts). Most of these can mulch or bag clippings or operate in free discharge mode. There are models with manual transmissions and fixed speed settings and others with hydrostatic transmissions and continuously variable speed control. Now, with a little help from RFA/Minnesota Engineering, The Toro Company of Bloomington, MN, offers a line of yard and garden tractors with cruise control. Not like the old sickle-and-scythe days, is it?

While the lawn mower itself was evolving, The Toro Company, one of its major manufacturers, was growing and changing as well. The mall of the firm's corporate headquarters, commonly known to employees as "Main Street," is a virtual mini-museum of the company's history. Wall-size black-and-white photos highlight the company's beginnings, in 1914, as a builder of tractor engines and a provider of steam engines for the Victory ships during World War I and include an ad for the 1920 Toro cultivator/tractor and a picture of Toro's first rotary mower, the Whirlwind.

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Acquired by Toro in the late 1980's, the Wheel Horse® Lawn and Garden Tractor had evolved into a modern, user-friendly machine by 1994 when Toro asked RFA to help them design cruise control for the 260-Series. Powered by 15, 17 or 19 HP Toro® Power Plus (™) engines by Kohler® and with a top speed of 5.2 mph, three of the four models come with fully automatic, pedal-controlled, hydrostatic transmissions for smoother driving and easier maneuvering in tight spots. The cruise control would make long mowing jobs less fatiguing for the driver.

Toro engineers had already done some work on the cruise control feature before they enlisted RFA's help, but, according to Mike Stuber, Toro's project engineer, "We needed additional resources and we had a short time frame to work in."

RFA began with a brainstorming session and a goal: concept ten possible ways of providing speed control for the lawn tractors. As Jon Ness, RFA's Design Engineer on the project, puts it, "Sometimes the best thing RFA has to offer our clients is a clean sheet of paper, a fresh start." A number of requirements had to be met. (1) The system had to maintain a steady pedal position from 0.5 mph to full stroke in the forward direction. (2) The control had to be turned on/off with a lever or switch on the right side of the dash. (3) It had to be inherently failsafe, i.e., any failure or malfunction would cause the transmission to return to the neutral position. (4) It had to automatically release when

the brakes were applied. (5) It had to deactivate in reverse.

During their second meeting, the Toro engineers and RFA narrowed the ten original ideas down to two viable options: an electric solenoid actuated mechanical linkage and an

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**Jon Ness,  
RFA's Design Engineer**

electromagnet. RFA pursued both ideas to determine cost and reliability, and after a third meeting the electromagnet concept was chosen. RFA completed work by providing layouts and detail drawings from which Toro built a prototype machine. The entire process took only a few weeks. Asked what he liked about working with RFA, Stuber said, "I like their input and their openness. If they disagree with a proposal, they say so. We stayed really involved throughout the project."

Using the electromagnet concept, Toro made cruise control standard on the 267-H and 269-H and optional on the 265-H model of the Wheel Horse® Lawn and Garden Tractor. Simple foot pedals on the right side control speed, while in back, under the operator's seat, a steel plate

moves over the electromagnet. When desired cruising speed is reached, the driver pushes a button on the right side of the dash and locks in that speed. In reverse, the plate moves off the magnet, deactivating the speed control.

While it now produces items as diverse as fertilizer and landscape lighting, as varied as composters and electric blowers, The Toro Company hasn't abandoned its heritage as the builder of top-of-the-line lawn mowers. Diversity is something RFA understands well. We continue to offer a variety of engineering services, applied to everything from huge off-road construction equipment and logging machines to tiny medical devices and electric razors. Whether it's adding one feature to a lawn mower, redesigning a line of vacuum cleaners or designing an entirely new product like a card shuffler, RFA can lend a hand — with fresh ideas, fast turnaround and dedicated employees.

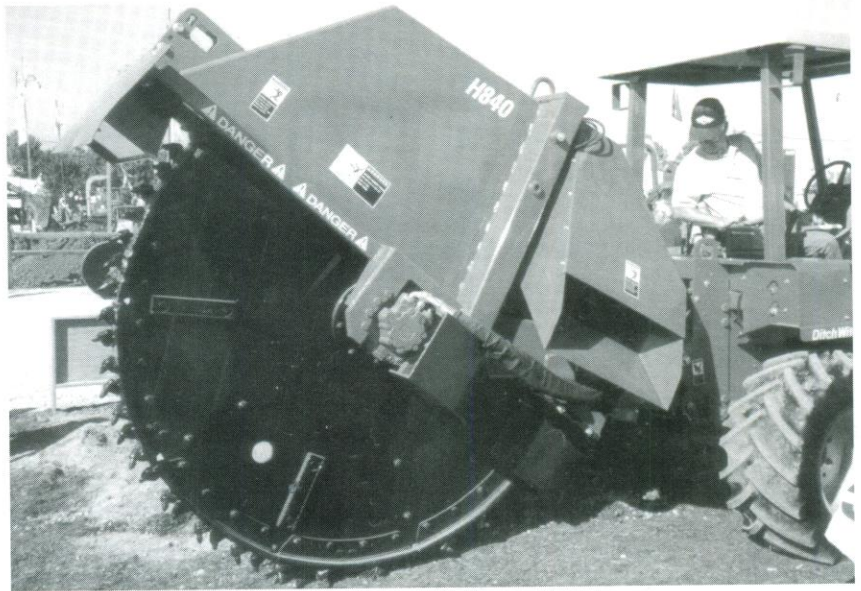
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## The Ditch Witch® H840 Earth Saw

Asphalt and concrete make good road surfaces, but they present a challenge to the contractor whose job it is to place pipes or cables underneath them. Like any other difficult job, the right tool makes all the difference. The Ditch Witch® H840 Earth Saw, made by Ditch Witch/Charles Machine Works of Perry, OK, can cut a trench 39 inches deep and 6 inches wide through concrete, rebar, asphalt, rock or permafrost. It is used for the installation and replacement of utility lines, such as water, sewer, gas, electric, telephone or fiber optics.

Charles Machine had been building Earth Saws since 1968, with a number of improvements over the years, but in 1994 the market demanded a larger, deeper-cutting machine. They asked RFA/Minnesota Engineering to design and detail the model H840, a disc-type, centerline saw that would mount to the rear of the Ditch Witch® Model 8020 tractor. According to Tom Teller, RFA's Project Engineer on the H840, "The main thrust of the project was to get the 39-inch cutting depth, because



**The Ditch Witch® H840 Earth Saw**

*"They  
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**Charles  
Machine Works**

various areas of the country require 36 inches of cover over utility lines, and also to provide a design that could be placed into production quickly."

First, RFA designed a solid, 1-inch thick wheel 82 inches in diameter to carry the mining bits that actually do the cutting. The 1-inch thickness is necessary, not only for strength, but also because it provides inertia for smoother cutting. The wheel is driven by a RexRoth radial piston motor and its speed is hydraulically controlled by a single lever at the operator's station on the tractor.

The actual cutting is done by 60-70 tungsten carbide tipped mining bits. Each replaceable, self-sharpening bit is tapped into a cast holder, where its spring steel retainer snaps into place. When the bits wear out, they are replaced using a slide hammer. The cast holders are welded onto 10 segments, which are bolted onto the wheel. The H840 can be switched from the 6-inch trench width to a 4.5-inch width simply by switching the bolt-on segments.

RFA also designed the attachment frame for the saw itself, the mounting for the RexRoth motor and the hydraulic lines for the saw drive, the saw lift and the stabilizers. Stabilizers support the unit while it is being mounted to the tractor and also minimize shock and vibration during operation. At the foot of each stabilizer is a gauge shoe, which slides along the ground as the saw moves forward. The shoe is angled so that it

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**RFA/Minnesota Engineering has  
ties. This will enhance our ability  
th our customers.**

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Ditch Witch *continued from page 3*

plows debris off to the side where it cannot fall back into the trench.

Keeping the trench clean was an important part of the design criteria. If too much debris tumbles back into the ditch, another time-consuming step is required to clean it out before pipes or cables can be laid. RFA designed dual spoils chutes with a splitter plate in the middle through which debris is directed to either side of the trench. The chutes are positioned to drop the spoil outside the stabilizer foot.

The shroud over the saw is made of 1/4-inch thick HSLA (High Strength Low Alloy) 80,000 psi material. Kevin Brase, RFA's Senior Designer

on the project, said they needed an extremely tough material that rocks could not tear through. "This material can take a beating," said Brase. Attached to the back of the shroud is the rear deflector, which helps prevent any debris that is carried over the wheel from falling back into the trench again.

As is always the case with RFA projects, communication was a critical factor. During the course of the project, Teller and Brase made frequent trips to Oklahoma to confer with Ditch Witch® engineers. "It went pretty quickly," said Brase, "and as the project was picking up pace, we went down every two weeks." A consensus at Charles

Machine Works praised Teller and Brase for their ability to "focus on the task at hand." They said, "They presented possible solutions, but at the same time 'listened' when we felt strongly about a particular feature." Focus, communication, listening - all are just typical components of an RFA project.



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