



Scott Wiley had an authentic flywheel made to original specifications for his 1902 Robinson steam engine. The design was re-created from a photograph using computer software.

## Steam Engine Flywheel Made From A Picture

"My fully restored 1902 Robinson 14 hp. steam engine is the only one of its kind in the country with a left-hand flywheel," says Scott Wiley of Marion, Iowa. "I had the new wheel made from a photograph and it matches the original specifications exactly, right down to the curved spindles. There are five other Robinsons in the country, but they all have right-hand wheels," Wiley says.

He bought the rusted and broken-down Robinson 22 years ago and says, "When I got it home, the more I looked it over the more I found that needed to be done. Eventually, everything that could come

apart did."

A stickler for detail, Wiley spent 10 years looking for parts, finding Robinson catalogs with drawings and tracking down the machine's original 1902 bill of sale and successive owners. Originally it sold for \$2,080 plus shipping, minus a 40 percent discount for cash, bringing the total to \$1,266. He even met the Missouri farmer who rescued the rusted machine from a fence line in 1976.

Wiley says any restoration of rusted steam engines is difficult. His was complicated because the boiler was broken beyond repair, gears and shafts were extremely worn, and

parts had been scavenged for other uses. The flywheel was from a Nichols and Shepard machine, which wasn't the correct design, and it had cracked spindles. Wiley was able to locate a vintage side view photograph of the correct Robinson flywheel and had a friend convert the picture into a two-dimension drawing. That was loaded into an AutoCAD system and scaled to the exact dimensions of the original flywheel: 40 in. in dia., with a 10-in. facing and a 2 7/8-in. hub. Friends of Wiley converted the AutoCAD drawing to 3D, which he sent to Kory Anderson at Dakota Foundry for stress analysis and casting. Wiley says he chose Anderson for the project because his equipment can 3D print sand molds rather than work from a traditional pattern.

Machining was done by Jim Briden, owner of Larson Welding in Fargo, who placed the wheel in a giant lathe, trimmed the face, created the proper angle for a wooden insert and bored the correct size hole for the mounting shaft.

Calvin Gingrich, an Ind. wheelwright, did the steam bending on two pieces of white ash. Those fit on the inside of the wheel rim, where the wood engages the clutch. Wiley secured the half circles with lag bolts, then tapered the rim 8 degrees so the clutch shoes slide over the rim and lock in place.

Wiley says he pushed hard to complete the restoration during the spring and summer of 2021. "My goal was to drive it in the Cavalcade at the Mt. Pleasant, Iowa, Old Threshers Reunion. My dad took me to that show almost 50 years ago, and I've been going ever since."

Wiley began operating steam engines as a teenager and eventually bought a 21-75 Baker. He bought the Robinson, number 2577 of about 3500 built in Richmond, Ind.,



Above: Fly wheel casting from a CAD drawing. Below: Before restoration.



because it's a rare and unusual model. "The previous owners had done some restoration, but I basically started from zero and repaired, rebuilt or replaced everything. It was a long and expensive project, but I'd sooner have this Robinson than a shiny new pickup any day."

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Onderdonk has built several large tree spades capable of moving trees up to 70-ft. tall.

## He Built His Own Giant Tree Spades

By Jim Ruen, Contributing Editor

When he couldn't find a commercial tree spade big enough, David Onderdonk decided to build his own. He also built an oversize tree wrapper to handle the big trees he moves.

"I started with a commercially built, 60-in. tree spade in 1990, and then I went to a 90-in. spade," recalls Onderdonk. "When I became one of only three certified master arborists in the country in 1995, it opened the door to wealthy clients who wanted me to move bigger trees. I wanted a bigger spade."

Onderdonk learned a lot about hydraulics working on helicopters in Vietnam. He does all the fabricating of his tree spades except for bending metal. He leaves that to a metalworking shop.

The first spade he built was 100 in., but he quickly outgrew it. At the time, there were a couple of larger tree spades out there but they couldn't be taken on the road. Onderdonk wanted one that was street legal in width,

weight and height.

Onderdonk built a 142-in. tree spade mounted on a custom-built trailer. The tires on the trailer were out to the full 142 in., which was 2 in. under the legal width. The design also kept the tree spade under height restrictions.

The trailer was 55-ft. to the kingpin but getting it into position was a challenge. He needed to be able to steer it, so he bought a 25,000-lb. steering axle. Back in his shop, he stretched it out to match the other axles.

"I could move 70-ft. trees, tipping them over 90 degrees so they laid flat," says Onderdonk. "But it was cumbersome. Also, counterbalancing the weight of the root ball was a challenge. I had to put a water bladder over the kingpin, but even 900 gals. wouldn't hold it down."

He advertised the trailer and spade for sale, and an international broker found a

buyer in St. Petersburg, Russia. Onderdonk determined to make his next tree spade easier to use.

"I found a 6 by 6, all-wheel-drive, 100-ft. bucket truck with a Cummins 475 that already had outriggers on it," says Onderdonk. "I repurposed the bucket lift cylinders for the tree spade."

The frame was 54 in. off the ground versus the normal 43 in. To mount a tree spade and be able to lay the tree down horizontal, he cut the back end off. He then redesigned the frame for an extended and lower back end.

Initially, he built a 100-in. spade. He wanted a larger one, but street legal on a truck-mounted unit was only 102 in. He designed a 130-in. spade that would be hauled to the job site separately and then mounted.

"I was hired to move trees away from the Arthur Ashe Stadium when it was being rebuilt," says Onderdonk. "We moved seventy-five 45 to 50-ft. trees, 30 of them set aside in a parking lot. When the construction was done, they had me come back and move the 30 back."

The truck mount gave him the control he needed, and the size let him successfully transplant the trees. The truck was cab-forward, which gave him an extra foot of space for the tree end to lay without exceeding the street height limit of 13 1/2 ft. Sometimes that wasn't enough.

"When you move a deciduous tree with a large crown, it can't be squashed down to only 4 to 5-ft. over the cab," notes Onderdonk.

His solution was to build a tree wrapper. It mounts to a separate truck. It has a 90-in. inside dia. with a 100-in. outside dia. When the arms are partially closed around tree branches, a roller chain is connected and tightened like a come-along, pulling the arms and branches together. The arms are mounted to a mast similar to a very large forklift, allowing it to travel up the tree.

"It can go up to 32 ft. in the air," says



Onderdonk has built tree spades from 100 up to 142 in.

Onderdonk. "The 90-in. diameter is optimal as after a tree is wrapped. It'll expand a little, but still be street legal."

At 72, Onderdonk is starting to downsize his business. He has sold his big spade and truck, as well as the wrapper. However, he is not yet ready to get out of the business.

"I have designed a new and better, not bigger, tree spade," says Onderdonk.

Work on the spade, which he first mocked up in balsa wood, was delayed until he had a truck to mount it to. After looking at different options, he bought a Spartan fire truck with a 105-ft. rear mount ladder. It has a frame height of only 37 in. and a 48,000-lb. rear end.

He has since stripped the truck of the ladder, turntable and other extras. He is now working with a steel company to engineer and cut the metal needed.

"I'm changing the angles for the lift and radiuses so it will dig a shallower root ball," says Onderdonk. "There is no point to digging deep. Every extra yard of dirt is an extra 3,000 lbs."

He explains that while some manufacturers make 5 or 6, even 8 blades. His will have 4 large ones.

"Each spade adds resistance," he says. "The bigger the spade, the easier it is to push it in."

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