# Psss sssss-s-s-s-t Wanna build a *STEAM* minibike?

**Compact and lightweight, this two-wheeler is safe and simple enough for a child to operate**

By JOHN ETHRIDGE/ *Photos by David Gooley*

THE FASTER YOU GO, the better the engine seems to run—right up to the 6000-rpm red line. The designer, Richard J. Smith, revved it all the way up to 8000 rpm and still couldn't break it.

This minibike was custom-built for Robert Noble, chairman of the Western Div. of the Steam Automobile Club of America, and may still be the only steam minibike on the road. Smith has used his steam system in a variety of vehicles during years of full-time innovation with steam engines, but this is his first steam minibike.

Combustion and steam generation take place in a cylindrical housing not much bigger than a motorcycle muffler mounted under the seat. The housing, open at the rear to exhaust burned gases, encloses the flash boiler, a long piece of .031-inch-wall steel tubing, coiled and folded many times upon itself to expose a large area to the burner flame. The housing is lined with refractory fiber to prevent heat loss, and is made from stainless-steel sheet held together at joints with stainless hose clamps. This construction permits rapid access to the burner and boiler tube for cleaning and inspection.

Propane fuel passes from a commercially available bottle of three-pound, four-ounce capacity through two valves that automatically control combustion within safe operating limits by regulating fuel flow.

The first valve is operated by boiler pressure and controls fuel flow so that a pressure of 400 to 450 p.s.i. is maintained. The second senses temperature and thermostatically keeps temperature in the 650 to 750° F. range. This double safety

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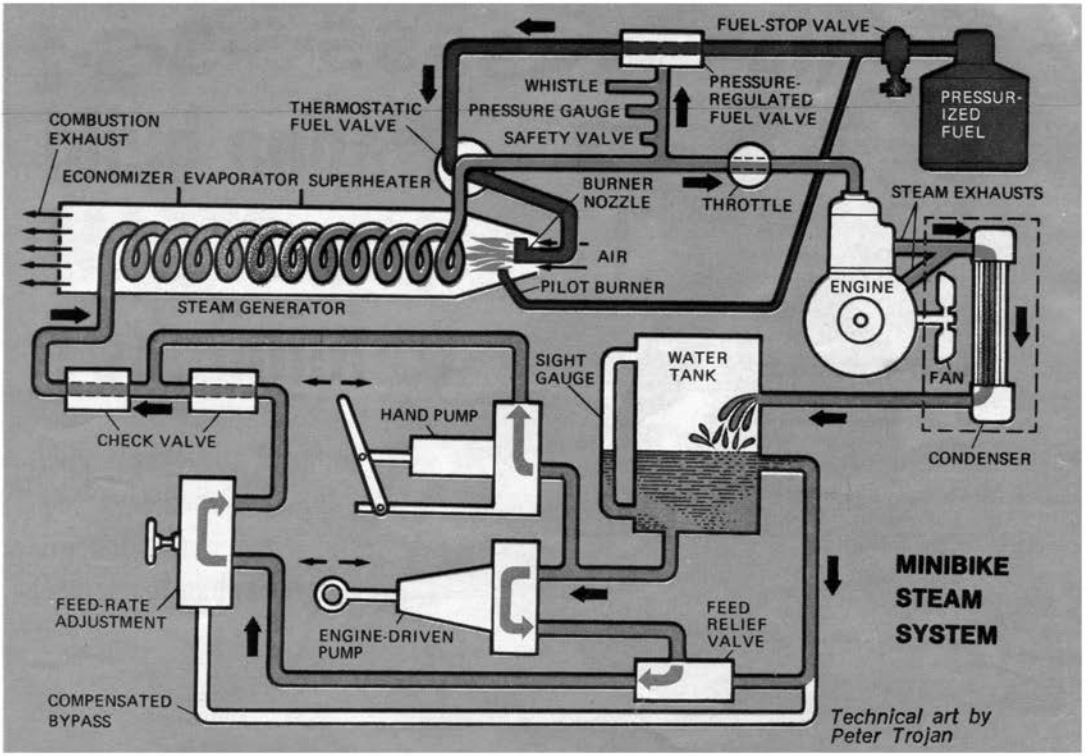


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feature guards against overpressurization and assures that heat damage to the boiler tube will not result, even if the water supply fails.

Feedwater (in this case a 5 percent mixture of steam-cylinder oil and water with an emulsifier) is normally supplied by a pump driven by the engine via an eccentric on the primary shaft. However, a hand-operated auxiliary pump can also be used when starting from cold or if the engine stops. Check valves to prevent back flow, bypasses and a feed-rate adjustment (set initially to match boiler demand and then left alone) complete the feed system.

Steam vehicles don't require, and usually do not have, clutches. For the sake of practicality, however, this one does. The engine is single-acting, meaning that steam only pushes the piston down, with the momentum of the crankshaft and flywheel required to return it, and is therefore not self-starting. So, both for convenience of operation and running the feedwater pump, it was desirable to have the engine running while the vehicle is stopped. Smith accomplished this by driving through a centrifugal clutch of

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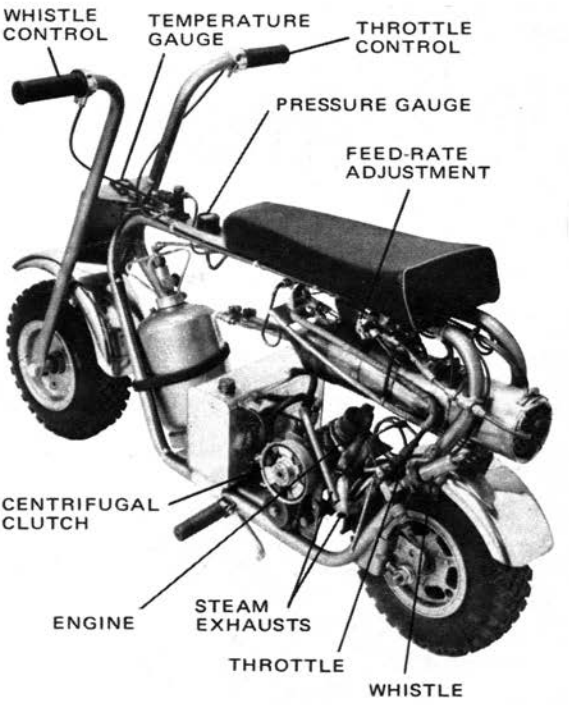
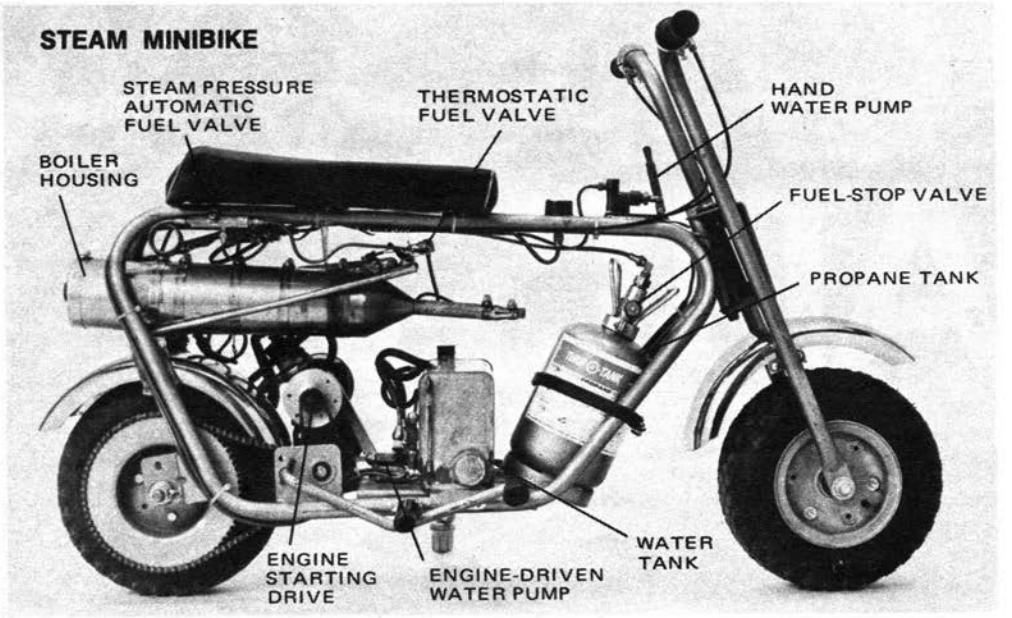
**STEAM SYSTEM** is diagrammed above. Condensing system, including fan, condenser and tubing, is shown in dashed box. Actual hardware was not yet installed on minibike at the time photos were made






**COMPONENTS OF STEAM SYSTEM** are easily accommodated on even the smallest conventional bike frame

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the type normally used on simpler gasoline-engine minibikes.

An overunning, or one-way, clutch installed in a chain drive working between the engine crankshaft and the primary driveshaft is used for starting. The one-way clutch is installed so that when the bike is pushed, the engine turns. With steam up, starting is simply a matter of cracking the throttle and nudging the bike forward.

The engine is based on an Ohlsson & Rice 1.2-cubic-inch, two-stroke miniature engine. Superheated steam is fed through a fitting screwed into the spark-plug hole. Incorporated in the fitting is a piston-actuated poppet valve that cuts off admission of steam at around one-twelfth of cylinder stroke. This means the steam is expanded approximately 12 times its original volume during the working stroke, which Smith says accounts for the high efficiency of the engine.

Expanded steam was exhausted through both the original intake and exhaust ports into the atmosphere when pictures of the minibike were taken. But a condensing system has been added. Spent vapor is piped to a fan-cooled condenser (an automotive heater core) where it becomes liquid and is returned to the water tank. Lubrication is by oil droplets in the working fluid, very similar to premix two-stroke practice.

Even without the condensing system, the minibike will run for about an hour on just less than one gallon of water/oil mixture, which isn't any great inconvenience or expense. The bottle of propane is good for nearly two hours running, depending on how fast the bike is driven.

Starting from cold is easier than with most miniature steam locomotives and tractors. You just turn on the fuel and light the burner, which can be done with a match or cigaret lighter, but Smith finds a spark igniter of the kind used to light acetylene torches is the handiest. Lighting takes place at the rear of the boiler housing, and it catches with a whoosh about like that of a gas hot-water heater. A pilot flame relights the burner on subsequent demand cycles as long as the fuel is left on. Full pressure and temperature are reached in only 15 seconds after lighting, but if you're in a big hurry, you can get underway as soon as 200-250 p.s.i. shows on the gauge.

At 6000 rpm, speed of the bike is about 30 mph. Smith estimates the output of the engine at 1.5 hp, but as is characteristic of piston steam engines, it feels like at least twice that amount. The throttle, controlled by the right twist-grip, has a nice progressive feel and requires no getting used to. The muffled putt-putt of the exhaust isn't noticeably different from that of small internal combustion engines, but a twist of the left grip produces a shriek from the whistle just to let the

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world know that this is no ordinary minibike.

Smith is primarily in the business of building to order, but sells plans of his steam system that list sources for all parts and specifications for materials. The plans are only for the steam system itself, which you can adapt to a minibike or other type of vehicle. You can write to Richard Smith at 8591 Pyle Way, Midway City, Calif. 92655. The $20 price of the plans for the steam system includes, in addition, plans for conversion of the Ohlsson & Rice engine, plans for boilers of various sizes, feedpump plans and plans for a rotary valve for use with engines of more than one cylinder. ★★★

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