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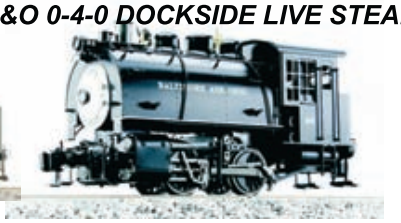

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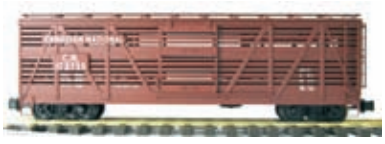

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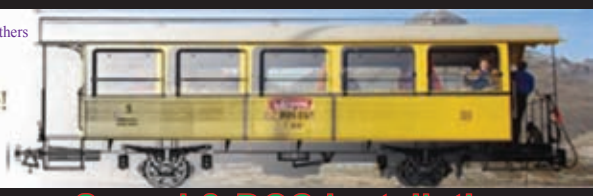

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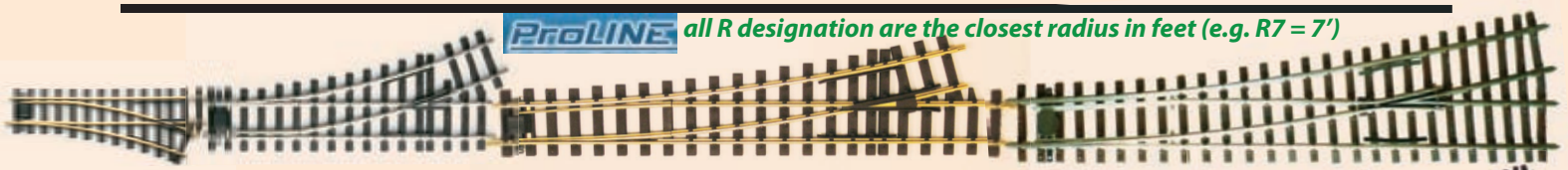

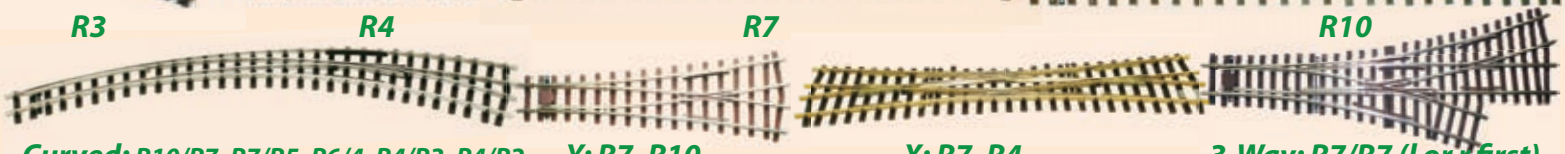

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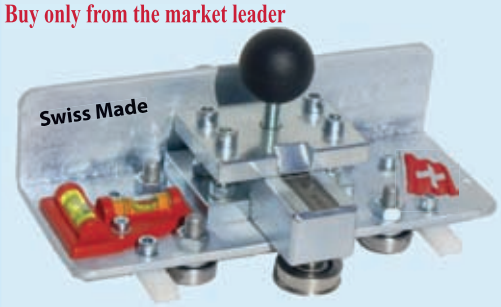

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STEAM IN THE GARDEN

Gather friends, while we inquire,
into trains, propelled by fire ...

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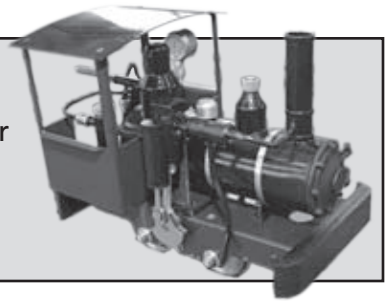

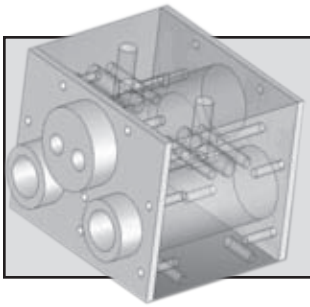

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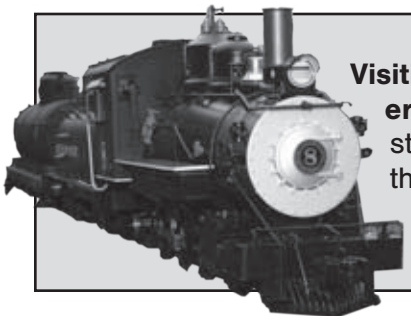
23 **Accucraft's new 4-4-4-4 — the Pennsy T1.** Alcohol-fired, 1:32-scale, this new locomotive had some problems at the outset but became a great runner. **By Will Lindley.**



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34 **The fascinating world of fasteners.** A guide to how to purchase them from dealers or make them on a lathe. **By Gerald Pierce.**

Cover: Accucraft's new 4-4-4-4, a Pennsylvania Railroad T1, sits in the keystone-shaped shield of the PRR logo. Photo by Will Lindley.

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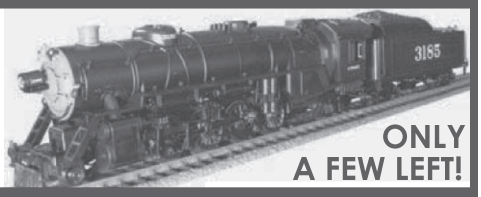

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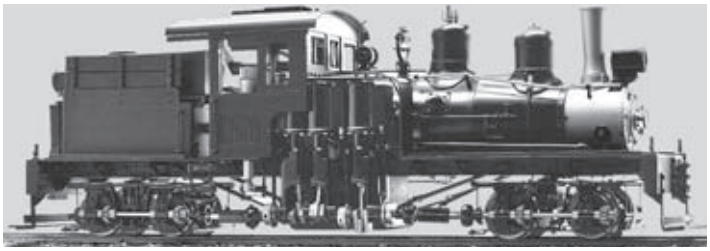


Shay: *Accucraft is planning a new Class B three-truck Shay that is expected to retail at $2500.*

Accucraft to build its biggest

On the heels of the major announcements of a live-steam model of Union Pacific's 4-8-8-4 "Big Boy," its first 7/8ths-scale locomotive and a new entry-level live steamer, Accucraft Co. said in October it was developing a 1:20.3-scale live-steam model of the Denver & Rio Grande Western K-37 2-8-2, in what will be "the largest locomotive" that can be built in the scale.

The Union City, Calif.-based maker of electric and live-steam brass models also said it was creating a new live-steam Shay locomotive, that it was developing a model of the London, Midland and Scottish Railway and British Railways "Black Five" for its United Kingdom distributor and was re-running the Saxonian 1K, No. 54, for its European distributor.

The K-37 prototype locomotives were circa 1902 standard-gauge 2-8-0 engines that were rebuilt by the D&RGW in narrow gauge in the late 1920s, with the railroad's shops creating new frames and smaller drivers. Ten of the original 30 locomotives were re-gauged and numbered 490-499; only two were scrapped, with the remainder — save one — as static displays. No. 497, owned by the Cumbres & Toltec Scenic Railroad of Chama, N.M., was operational through the 1990s but is in storage awaiting restoration.

Accucraft says the K-37 model will be 42-inches long, 6¼-inches wide and eight-inches tall. It will have cross-ported cylinders so the Walschaerts valve gear will be in the prototypical positions for forward and reverse operation. The company says the locomotive's "huge boiler" will allow runs of more than "an hour without ever injecting water."

The locomotive will come in four liveries, including a green model with the Moffat logo lettered as No. 499 as well as the "flying" Rio Grande logo lettered as Nos. 490, 491 or 495. Accucraft said it will build only 50 models and that the anticipated retail price will be $6000.

The company also said in September it was creating a new narrow-gauge Class B Shay locomotive, which will have three cylinders and two powered trucks. The 1:20.3-scale locomotive will be a butane-fired single-flue boiler with a hand-operated pump and a water-level gauge.

The Shay will be built in two models — one as an oil burner and the other as a coal burner. Suggested retail price will be $2500.

For Accucraft UK, the company is developing a 4-6-0 locomotive known as the "Black Five," which

K-37, 'Black Five,' Saxonian: *Also on the Accucraft roster will be the 1:20.3-scale D&RGW 2-8-2 (top), the LM&S Class 5 4-6-0 (middle) and the Saxonian IK No. 54 0-6-0 (bottom).*

was used by both the LM&S and British Rail. The 1:32-scale butane-fired model of the standard-gauge locomotive will be 23½-inches long, 3½-inches wide and five inches tall. It will have two cylinders, a hand pump for water and its gas tank will be in the tender.

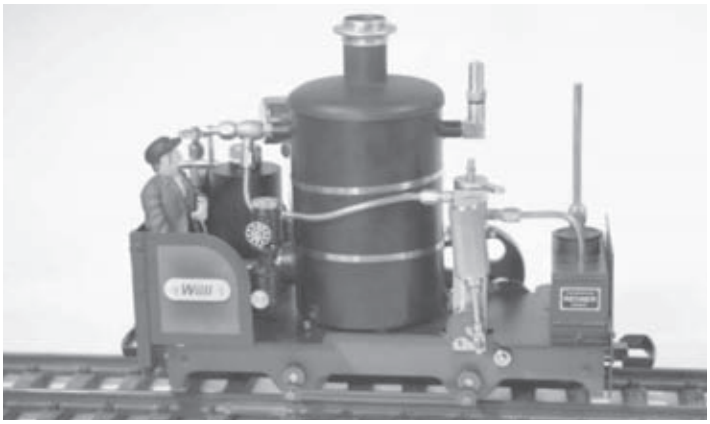
Eight-hundred-forty-two prototype Class Five locomotives were built over a 17-year period ending in 1951, Accucraft UK says, and 18 are preserved.

The model will be sold in three liveries, one in LM&S and two in British Rail. The anticipated retail price will be £2250 (about $US3600).

MBV Schug, Accucraft's representative in Europe, will be re-running the Saxonian IK No. 54. A 1:20.3-scale locomotive, the Saxonian can be gauged in either 45mm or 32mm, and is almost 11-inches long, more than 3½-inches wide and 5¾-inches tall.

It is a model of an 0-6-0 locomotive that was developed in the mid-2000s for the Free State of Saxony for a tourist railway. Schug says that the model will be built only for those who pre-order with a deposit of €250 (about $US325) with a retail price of €1954 (about $US2530).

Accucraft Co. is on the web at http://www.accucraft.com/ (510-324-3366), while Accucraft UK Ltd.



Willi: *Regner's 0-4-0 vertical boiler and wobbler piston engine helped create The Train Department.*

is at http://www.accucraft.uk.com/ and MBV Schug is at http://www.accucraft.de/.

New owner for Regner U.S. distributor

The Train Department, a small-scale live steam supplier that represents Germany's Regner Steam & Railway Engineering in the United States, has changed hands, the principals said in October.

Jason Kovac, the operator of the Hazlet, N.J.-based Accucraft dealership Car Works, has taken over The Train Department from David Orwig, a Virginia Beach, Va. hobbyist who had run the business for 19 months. No terms for the deal were revealed.

"Between new roles and responsibilities at work, plus two teenage boys and a hobby-tolerant wife who needs a little attention now and then, I had to let something go," said Orwig in an email.

Kovac, who helped Accucraft develop its Mason Bogie locomotive, will operate both companies independently. Shortly after taking over The Train Department, Kovac developed a new web site for the business and began offering new products, including bean-sized Welsh coal, an item many small-scale live steamers have difficulty obtaining.

"My plan is to fill the void Sulphur Springs left when it closed its doors," said Kovac in an email, referring to the longtime supplier of small parts and lives-steam fittings that closed in 2009. "As a one-time Sulphur Springs customer, I know how hard it is to find what you need for supplies and parts."

Regner, based in Aurach, Bavaria, has a broad product line of small-scale locomotives, steam engines and model steam-powered boats. The company is perhaps best known in the United States for its "Willi," "Konrad" and "Lumber Jack" locomotives and the recently released a kit of the "Willamette," a locomotive once built by Ephraim Shay.

In addition to representing Regner in the United States, The Train Department has become an authorized U.S. dealer for Roundhouse Engineering Co. Ltd. of Doncaster, England. Kovac says he will stock Roundhouse parts and some locomotives. "I will also have the special Goodall valves that fit the Roundhouse boilers," said Kovac.

More than a decade ago, Norfolk, Va. hobbyist Ken Johnson came to an agreement with Manfred Regner to import the "Willi" locomotive and The Train Department was established.

Kovac's new business is on the web at http://www.thetraindepartment.com/ and the new phone number is (732) 770-9625.

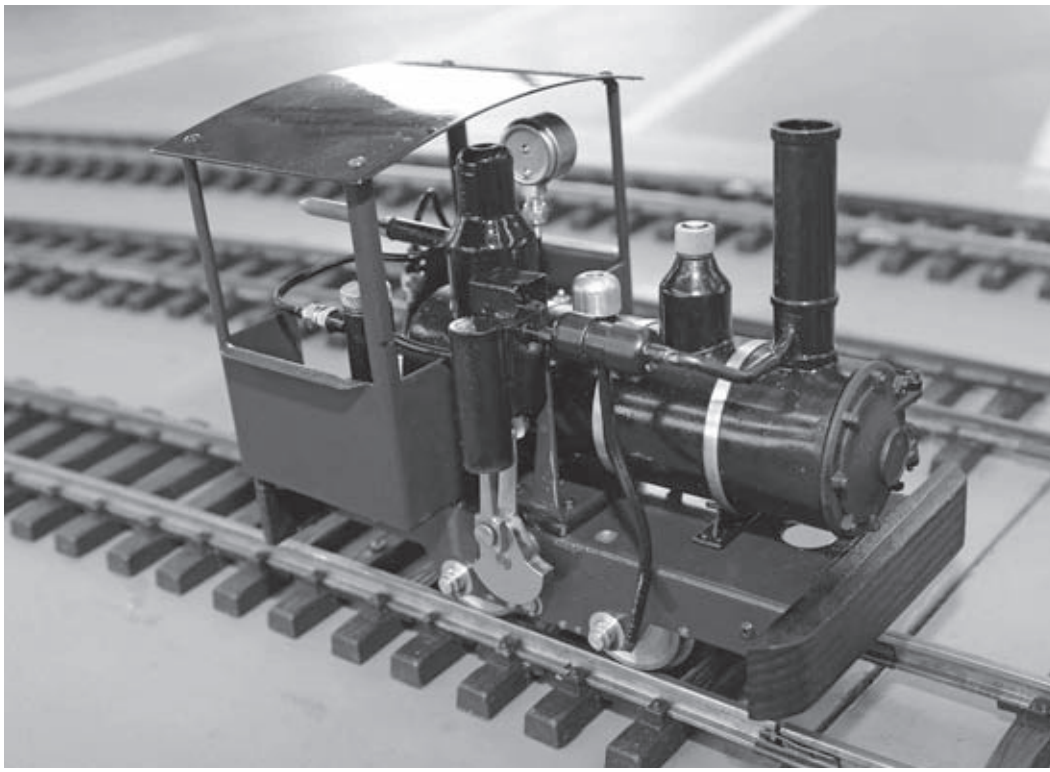
A U.S.-built locomotive that 'everyone should have' makes a comeback; by Jiminy, a new

CRICKET

Text by Geoff Spenceley. Photos by Rick Parker.

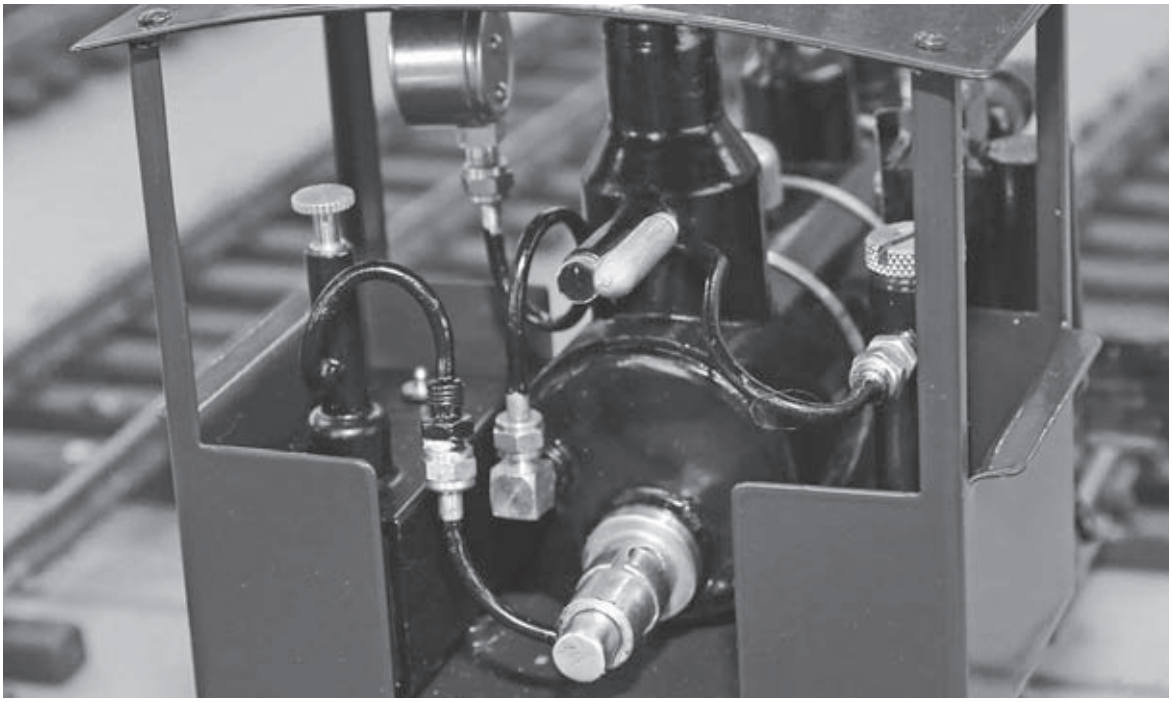
My first contact with Bellflower Locomotive Works came about early in 2011 when my Berkeley Locomotive Works' "Cricket" needed repair. I first contacted Mike O'Rourke, originator of the "Cricket," who in turn sent me along to Michael Krionderis, who bought the rights to the "Cricket" from O'Rourke. Since Krionderis had then recently himself sold the "Cricket" rights, one sunny day last January I received an email from Art Ruiz.

Anyway, a new "Cricket" was in production and Art and I made some exchange agreements. It took several months because of the difficulty in obtaining some parts and Art's diligence in wanting to produce a good model. Finally, the new locomotive arrived in early May and the delay was fine since it gave me time to dig into my wife's purse to obtain the funds!



Piston side: *Bellflower's entry-level 'Cricket' has an improved smokebox door and a built-in Goodall valve for easy water fill.*

Firstly, when I opened the very well-packed box, I found the "Cricket" nestled safely in cloth and bubble pack. I was very impressed with the excellent workmanship (just like the original Berkeley "Cricket"). It was neatly machined and fabricated — and being a kid at heart, the gold (brass) flywheel made me delighted. Unfortunately, since that day I had an LMS Duchess



Back head: *The 'Cricket's' controls include a gas valve (left) and a throttle (center). The displacement lubricator is on the right, while the pressure gauge faces out to the left. The poker burner is at the bottom.*

in pieces on the work desk, I only ran the "Cricket" by air and then steam, both on rollers. What a quiet, smooth running steamer — a real pleasure. It was July before I really had the fun of steaming on track at the National Summer Steamup in Sacramento.

Now some comments, after all, this is supposed to be a review:

• The boiler: Similar to the original "Cricket," but, most importantly, it has a smokebox with a door which enables the driver to light the burner with ease. The whistle has been replaced with a Goodall valve disguised as a small brass dome. I was able to top the boiler up with 80-plus milliliters of distilled water. The safety valve is a simple arrangement with spring, plunger and an O-ring for seating, and there is an adjusting nut with a locking nut.

• The steam engine: As the original, it is a vertical, single-acting engine with a Teflon piston and Teflon piston valve, using slip-eccentric reversing. The flywheel is well balanced to give smooth operation. There is a "gunk catcher" between the cylinder exhaust and the smoke stack. This works well but does reduce the amount of steam that plumes from the stack.

• The chassis: The gears are steel, well machined and held in place with Allen-set screws. The axle journal boxes are brass with drilled holes for lubrication and all other shafts and the like are easy to lubricate.

• The back head: Easy to reach throttle and butane tank valve. There is a brass tube supplied for filling the butane tank through the cab roof. The burner is a Roundhouse No. 6. The pressure gauge is brass and the measurements are in pounds per square inch. The lubricator is on the right side of the cab. More about that later.

Time for my rail test. You steamers know the "get ready procedure" which I won't repeat, so here we go: The temperature was a torrid 61-degrees and overcast. I first lit the torch then opened the butane valve, out came a big flame quickly retreating to the burner with an adjustment of the gas valve. In seven minutes the pressure reached 25 psi and the safety valve was spitting and fuming. I opened the regulator (sorry, throttle) one-quarter turn with the gas low, cleared the cylinder quickly by a rotation of the flywheel and off went my "Cricket."

It ran around my 110-

Bellflower Locomotive Basic 'Cricket'

- **Loco type:** An interpretation of the John F. Byers Machine Co.'s 1896 "Geared Locomotive for Contractor's Use," 0-4-0. *Gauge*: 36-inches. *Wheel diameter*: 24-inches. *Cylinders*: Two.
- **Scale:** 1:20.3, 45mm gauge.
- **Length:** 7½ inches.
- **Height:** 5¾ inches.
- **Width:** 4½ inches.
- **Boiler:** Single flue, 2.9-ounces (85ml) water capacity.
- **Fuel:** Butane.
- **Min. radius:** Two feet.
- **Cylinders:** Single with flywheel.
- **Fittings:** Goodall valve, plastic pressure gauge, displacement-type lubricator.
- **MSRP**: $850.

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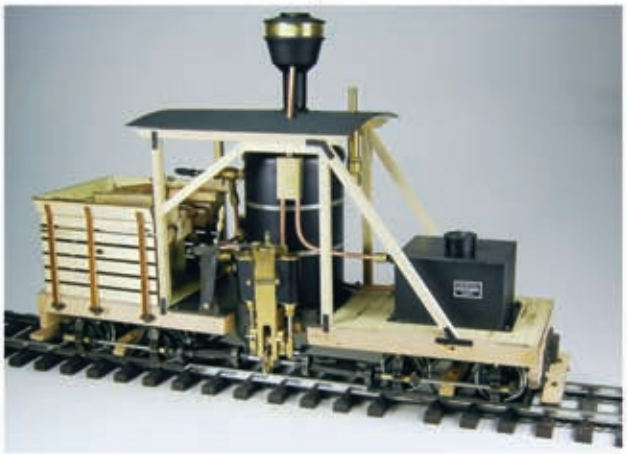

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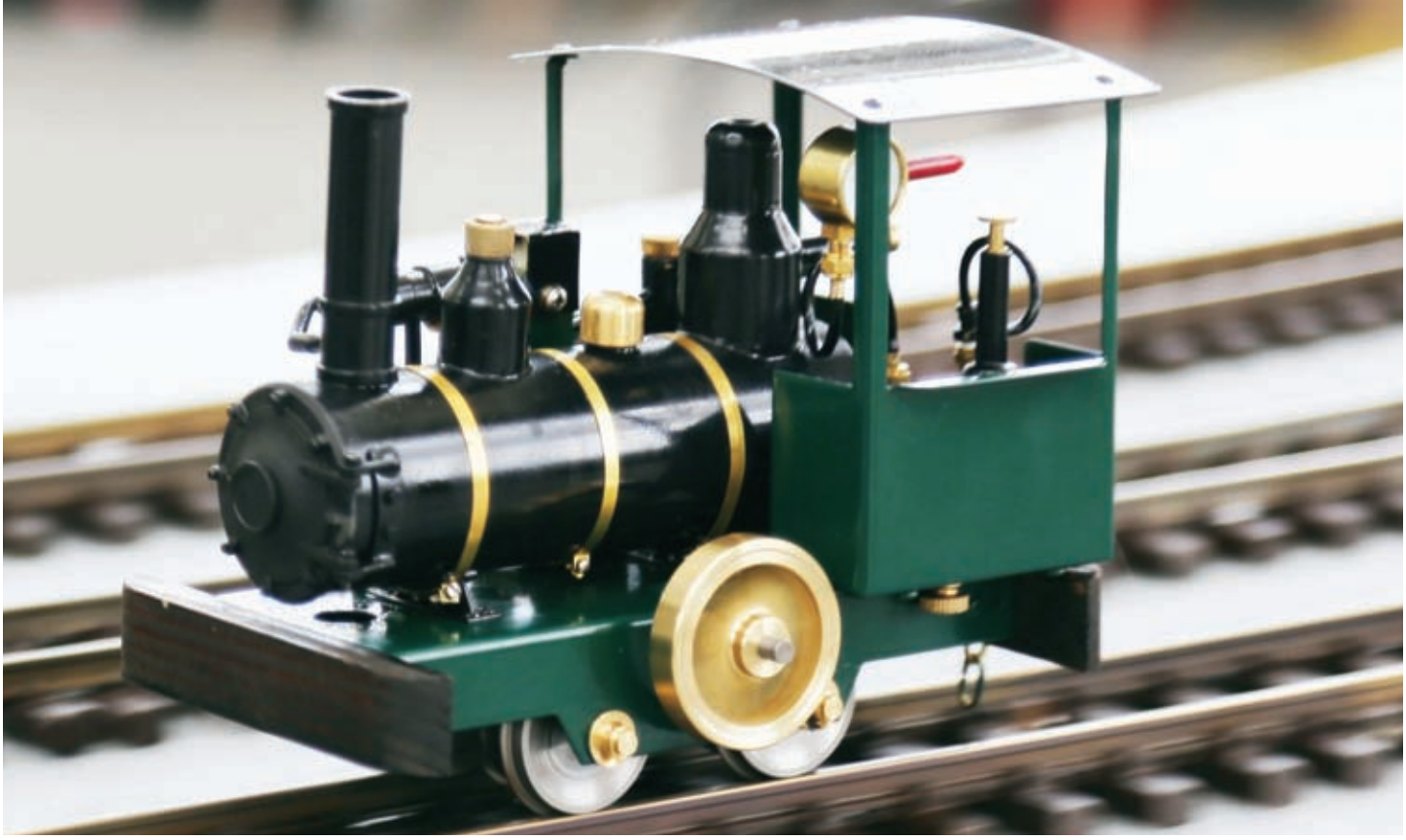


Flywheel side: *Spenceley's 'Cricket' on a layout at Sacramento's National Summer Steamup in July.*

foot circumference track at a prototypical speed with pressure between 20-25psi with no adjustments for 20 minutes, finally coasting to a stop when the gas ran out. I had around eight milliliters of water left in the boiler, perfect in my opinion.

On the second run in the afternoon it was a little warmer and sunny (a bloody heat wave hereabouts). This time I set the throttle one half turn and set the gas a tad higher. Same results, the "Cricket" cruised around, a little faster this time, still keeping 20-25psi. Again it coasted after the gas was depleted.

It's amazing, both runs ended when the "Cricket" coasted to a stop right where it had started as if it had been designed for my track. I must say the runs were very smooth, pulling three wagons (hopper cars) and a guard van (caboose) — two wagons had coal, one had gravel and the van was weighted.

In fact, the run was so smooth it made my rickety 23-year-old track look like one freshly laid by a professional track layer for a bullet train.

A couple of comments. On the rollers in my train room, after lighting the burner correctly, a small floating blue flame would appear in the smoke box and could only be removed by turning the gas to the minimum. I talked to Mike O'Rourke in Sacramento and he called it a "phantom flame." Being a fiddler, worrier and quiet paranoid as many of you know, I was worried. However, after talking to Art Ruiz, my fears were allayed: the blue flame is not visible out doors and cannot be seen with the smoke box door shut. Therefore, when I ran the "Cricket" in the rail tests I did not worry and there was no extra heat in the smokebox and nothing had a orange glow.

Water can be easily removed from the lubricator by attaching a silicon one-eighth-inch outside-diameter tube to the syringe and shoving it down into the lubricator.

I found Art Ruiz to be interested and helpful. One thing I am a real bear about is communication and that is where Art obviously agrees: He is an expert in communication. I hope he does very well with his "Cricket" project and wish him the success he deserves. Everyone should own a "Cricket." I obtained one of Mike O'Rourke's first productions when I traded an LGB "Crocodile" for it!

Now, you must go to the Bellflower Locomotive web site (http://CricketLiveSteamMotor.com/). You will see the "Cricket" being built and tested, including the hydraulic boiler test. You can also see an orchestra of "Cricket" variations chirping along the rail tracks.

More on the 'Cricket'

Recent *Steam in the Garden* articles about the history of the 'Cricket' are posted on the magazine's web site and appeared in the print issues No. 116 (May/June 2011) and No. 123 (September/October 2012):

- http://bit.ly/PHMu2f
- http://bit.ly/UibhWt

Computer-assisted design and computer-aided machining: Modern methods in Modeling

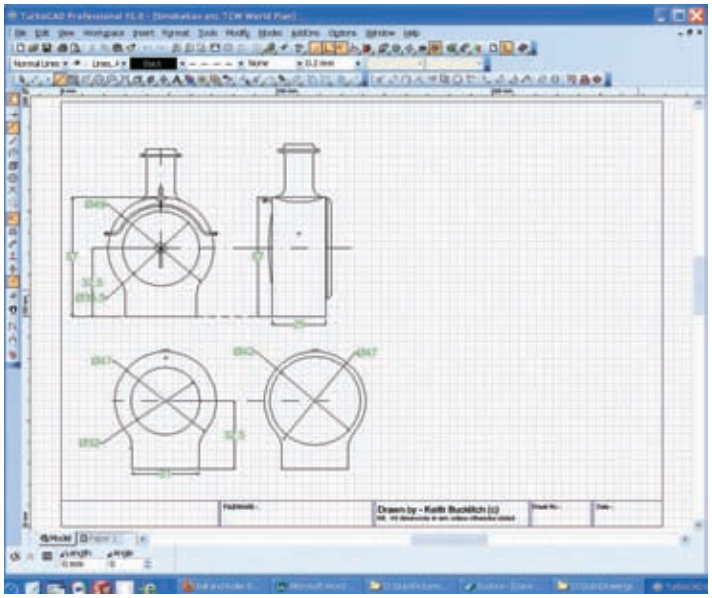
Text, photos and drawings by Keith Bucklitch

The days of building a locomotive, coach or freight car using only a small hand saw, file and lathe, working to drawings sketched on the back of a cigarette package are giving way to the use of more sophisticated methods. Access to methods of manufacture used in industry is increasingly becoming available to the amateur in his or her home workshop.

Costs are constantly falling, and it is possible to acquire equipment or source suppliers with access to what were formerly prohibitively expensive items. With a little learning and relatively small outlay, we can now expand our repertoire of techniques to encompass these modern methods in the manufacture of our small locomotives and rolling stock.

The following processes are becoming ever more readily available to the model engineer (not listed in any order of priority):

- Computer Assisted Drawing (CAD).
- Three-dimensional "solid modeling" (3D CAD).
- CNC machining.
- Laser cutting.
- Etching.

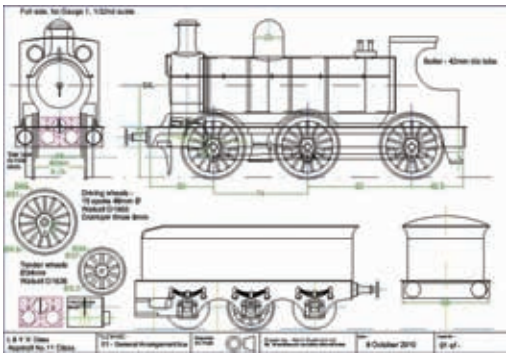


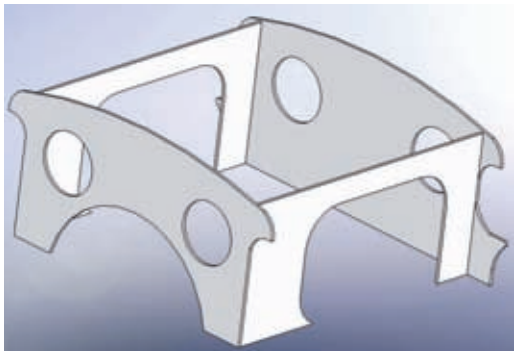
TurboCAD: *Note the co-ordinate rulers along the left and top sides of the work area. Outside the work area are a small selection of the drawing 'tools' available to the draftsman, in addition to the normal file handling tools.*

CAD

At its basic, Computer-Assisted Drawing (or Computer-Assisted Design) is the use of a computer to produce working drawings, replacing drawings which were previously made by hand on linen paper by an army of draftsmen working in front of large boards in a drawing office. CAD takes it a stage further by incorporating the mathematical ability of the computer to calculate quantities of materials, design stresses and the like.

As the use of CAD has proliferated, costs of the software have plummeted and the power and flexibility has increased. Now, it is possible to use quite "high-end" CAD software on the average home computer — even a relatively cheap laptop. For example, I occasionally use a CAD program on a small netbook computer that cost, new, $200 (£120). OK, it





CAD: *Left, a typical 2D drawing. Different components — such as wheels, main frames, boiler, cab etc. are drawn on separate 'layers.' Right, the cab for the 'Armig' loco design, which is made up from four individual components soldered together.*

is not the fastest of machines, but it is handy for carrying around and using in a hotel room or on a train.

What does CAD offer that pencils and paper do not? Well for a start, it does not get ragged in a pocket, nor thrown out with the trash. It is fast, and can be learned fairly readily. It is accurate, but easily modified. No matter how complex a drawing, one can zoom in to a small area and draw or read fine detail. It allows work to be easily distributed to several others, for perusal, adaptation or simply comment. It allows bills of material to be compiled for manufacture and lastly, it allows for checking the fit of parts together before cutting metal.

Two-dimensional CAD is often all one requires to design a model locomotive. The computer screen becomes in effect an infinite sheet of graph paper. The two dimensions, known as axes (pronounced "axe-ees"), are termed X and Y. The X-axis runs horizontally, while the Y-axis is vertical. The start point of the graph is the "origin" and is the zero position for both axes, expressed as 0:0. Any position on the graph can be determined by its co-ordinate points referring to the two axes. A drawing consists of lines (or entities), which may be straight or arcs. An arc may be complete in which case it forms a circle.

An entity has a start position on the graph and additional properties such as end point, length and angle. An arc has a center, a radius and possibly start and end coordinates. If one subsequently amends a particular entity, any other entities "snapped" to it are also amended automatically to maintain the relationship.

CAD software that is perfectly suitable for Gauge One modeling can be obtained cheaply, even for free. A search of the Internet will quickly find free CAD packages — including my personal favorite, TurboCAD.

They all take a little learning, but once the basics are mastered, one can produce acceptable drawings quickly and easily. A cheap introduction to CAD for model engineers is the booklet, "CAD for Model Engineers," by D.A.G. Brown, published by MyHobbyStore Ltd. in its "Workshop Practice" series (http://www.amazon.com/s?keywords=1854861891).

Solid modeling

A development from two-dimensional CAD is three-dimensional drawings or "solid modeling."

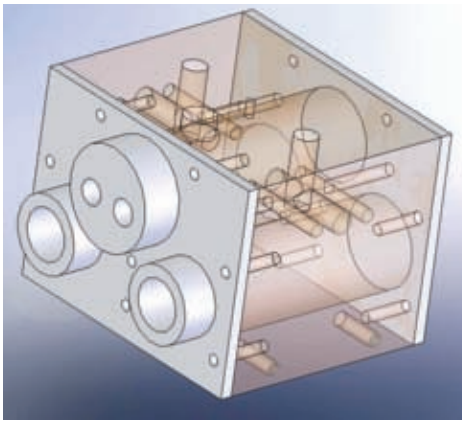
Initially, 3D drawing was a development of the earlier two-dimensional packages. It is now more common for designers to start from scratch with a solid modeling package. This differs in that a three-dimensional object is created almost from the start. The solid object is an entity in itself and making a change to any part of the entity, results in an immediate update of any related component. Subsequently, one can produce two-dimensional working drawings automatically by the software for machining a component.

I have found that apart from the ability to view a component, or even an assembly of components from any angle, or to make some part of it semi-transparent, a new advantage to me was the fact that when one assembled components into a complex object, any "clashes" where two objects were trying to occupy the same space became apparent.

For example, I had designed a chassis for a six-coupled loco, based upon the "Armig" power train of cylinder block, connecting rods, crank axle and valve gear. My original intention was to fit axle boxes to produce a "sprung" chassis for better ride and adhesion on uneven track. When I tried to install the power train into the assembled chassis (on the drawing) it became obvious that the cranks on the driven axle immediately clashed with the axle boxes, requiring a redesign of the chassis.

If I had gone ahead and only discovered this once I had made the components, considerable time and effort would have been wasted. Even when such major errors as this are avoided, the fact that other errors such as in a dimension may be revealed when items do not "line up" as planned helps to avoid them in the final design. This could be something as simple as the fixing holes for (example) the cylinder block in the frames, or the fact that the boiler will foul the driving wheels because it is not possible to exactly scale one (or the other) component.

There are a number of packages available on the market — such as Solidworks, Solid Edge and others — which tend to be expensive, costing several hundred



CAM: *Left, a 3-D drawing of a cylinder block. Right, the author's Taig CNC mill set up. The stepper motors are driven by using Mach3 software running on the laptop alongside the machine (experts discourage the use of laptops in CNC, but this works).*

dollars for a single workstation. However, a quick Internet search revealed 25 free packages, which enable an interested designer to try out the software at no cost. Perhaps the most well known and readily available is Google Sketchup, which is now in Version 6.

As these packages have developed, they offer increasing accuracy, flexibility and power to the home user. It is possible to construct a virtual model of a complete locomotive by adding the various components together to create the whole. Many of you will be familiar with the 3D models of the Gauge One Model Railway Association designs — the "Project" and "Dee," which Francis Leach produced five years ago. Francis produced those models using the powerful Solidworks package, but you can now do something similar with a free package such as Sketchup.

CNC machining

CNC stands for "computer-numeric control." Numeric control is the control of the movement of cutters or work piece on a lathe or milling machine by instructing it to move to specific positions or "co-ordinates." Initially, the instructions were written by hand, then transposed to punched tape, which was fed through a tape reader that controlled the machine tool.

With the availability of cheap computers, the use of punch tape was rapidly superseded with the added benefit that small changes to a series of instructions could be made rapidly, readily and cheaply. Programs of instructions could be stored safely, distributed widely and quickly and several machines controlled at the same time.

By combining the design of parts with CAD and the manufacture of components with CNC, the concept of CAD-CAM was born, where software can convert a drawing directly to a set of instructions for a machine tool (CAM is "computer-aided machining").

Every CAD drawing uses a co-ordinate system, where the start and end point of a line can be interpreted by its co-ordinate position. Again, think of a sheet of graph paper: This has two axes — horizontal (the X axis) and vertical (the Y axis) — and the bottom left corner is position 0,0.

A horizontal line starting from the 0,0 position measuring three units long would end at the X3,Y0 position. A similar line passing vertically would end at the X0,Y3 position. A line from 0,0 to 3,3 would end diagonally at the X3, Y3 position. (A milling machine can also move the cutter up and down, which is known as the Z axis.)

CNC machines suitable for the home workshop, whether they are lathes or milling machines, can be purchased off the shelf from several model engineering tool merchants for less than $4800 (£3000) ready to go, or it is possible to construct one yourself for around $1600 (£1000). The more money you spend, the more sophisticated and powerful the machines become, with better control and feedback systems and safety features. However, as with any machine tool, common sense, care and concentration are important attributes for the operator.

To "drive" the machine, we require control software. Again, as with CAD software, free versions of control software are available. I personally use Mach 3 software, which is freely downloadable from the Internet, albeit restricted in the number of lines of code it will handle, until one upgrades by purchasing a license.

My CNC setup is based upon a Taig milling

G-code explained

Instructions for computer-aided machining (CAM) are written in a set of lines written in a form of English known as G-code, which is a set of commands that are interpreted by the computer to produce movement of the machine tool.

Each instruction is preceded by (normally) the letter G – hence the name. So, for example a line might read "G1 X2.375 Y1.125."

Starting from the 0,0 co-ordinate position, this would be interpreted by the computer to move the cutter to the position 2.357 units (inches or millimeters) to the right and 1.125 units away from the start point.

There are other codes beginning with other letters of the alphabet, such as M and S, which usually control various ancillary actions – e.g.: starting/stopping the spindle, setting the speed of rotation of the cutter, starting/stopping the program and so on.

Code	Explanation
G21.	Work using metric units. To work in imperial units the code is G20.
G0 Z10	Move the cutter to a position 10 millimeters above the workpiece.
G0 X0Y0	Move the cutter to the X0, Y0 co-ordinate positions.
M04.	Start the spindle running clockwise.
M08	Start the coolant pump.
G0 X10Y5	Move the cutter to the coordinates 10mm and 5mm from the start point.
G1 Z-0.10	Lower spindle to a position 0.10 *below* the workpiece, cutting as it goes.
G1 X30 Y –10	Move cutter to a new position 30mm and -10mm from the start position, again cutting as it does so.
G0 Z50.	Raise the cutter 50mm above the workpiece.
M05 M09	Stop the spindle, stop the coolant.
G1 X0Y0.	Return to the zero coordinate position.

The sequence here would have cut a groove 0.1mm deep, the diameter of the cutter, running diagonally between the start and end points in a straight line.

(Safety tip: When the tool is following an instruction it does not care what is in the way, whether it is the workpiece, a clamp or your anatomy.)

— *K.B.*

machine. These small machines are capable of handling the work we require for our small locos. I have successfully machined curly spoked wheels and many parts for my engines that contain complex curves — such as the rear cab for the "Armig" loco.

A comparatively recent development is the use of CAD-CAM software. Here, one imports your drawing file into the CAM software, which after being given various parameters, such as thickness of the work piece, type of material and cutter sizes will calculate the moves required by the cutter(s) to produce the component.

Laser cutting

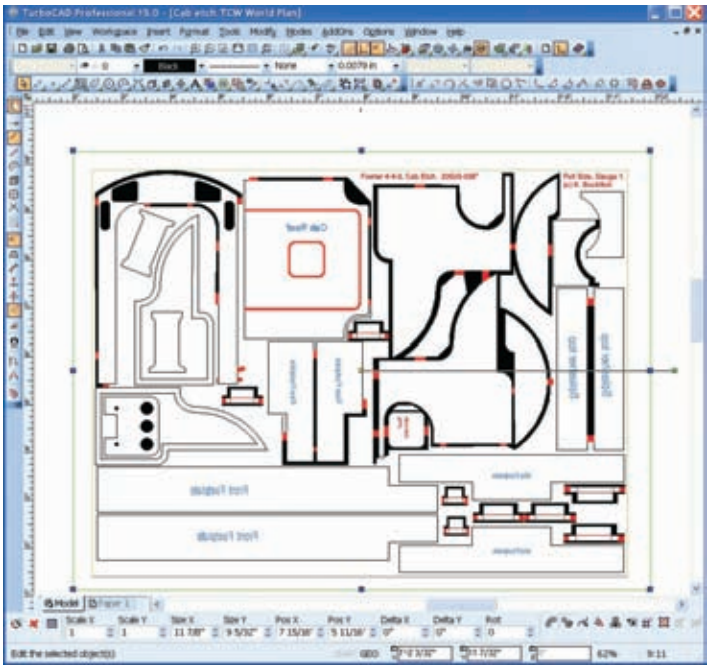
At one time, the idea of using a beam of light to blast a hole through a piece of wood or steel seemed like science fiction. Now one can have a machine in your home workshop that will do just that for a few hundred dollars.

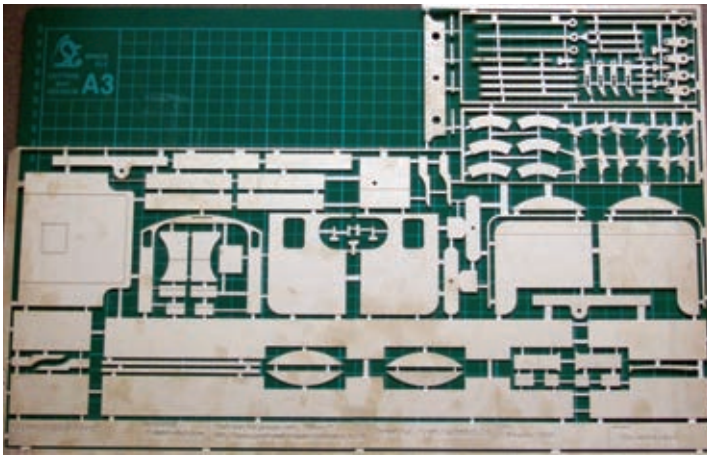
A laser cutter combines the control afforded by CNC techniques with the power of light. The ability of the laser to cut through various materials is a function of the power of the laser, usually measured in watts (or mega-watts).

The small (between a letter-sized or tabloid-sized table with a power rating of 30 watts) home machines are mostly capable of cutting paper or cardboard, MDF, plywood or plastic, up to a maximum thickness of 6mm. I have used a 50-watt machine for cutting out the bodywork for a caboose from 1.5mm plywood quite successfully. A lower-power machine may well have performed the task by reducing the cutting speed, and possibly by taking more than one cut to pierce the material.

For metal cutting, a much more powerful machine is required, and currently one has to use industrial metal cutting firms for this. They will accept your CAD drawing (often by email), convert it as necessary for their equipment and ship the finished parts back to you. One of the major advantages of laser cutting is that "one-off" items can be expensive, but several dozen or more of the same item can be extremely cheap.

Most suppliers of laser-cutting machines can provide a complete package consisting of the laser cutter, the software to convert your CAD drawing to the machine code to control it, and if you wish, the materials to be used on the machine. I suspect that the majority of machines available to the "hobby" market are produced in China, but if obtained





Etching: *Left, artwork in preparation for etching. Not all items yet outlined fully, nor linked together with tabs. Note how items have been 'nested' to make maximum use of the space available and waste as little metal as possible. Right, an etched nickel-silver sheet for a Gauge One locomotive.*

through a reputable local company with backup and servicing facilities and support available, should provide a reliable tool for the home engineer.

If you are contemplating purchasing your own machine, then I would recommend choosing a company that offers a training session before use, whether at their premises or when the machine is delivered and set up in your workshop.

If you are making your own drawings to send to a laser-cutting firm, here are a few pointers:

- Find out the CAD drawing file format desired.
- Is there a preference for individual items to be separate or a linking cut line between them? (Every time the cutter stops and lifts off the work piece to move to a new position adds to the overall price.)
- Ask what the minimum size of holes, or gaps between items they require. (Some firms take pride in making fine cuts, others will not be so keen, but may offer cheaper rates if you modify your drawings. Hole positions may be "spotted" for later drilling for example.)
- Find out materials preferences.
- Determine whether the company has a "minimum order" policy, or whether they will price per item. For one-offs, price per item may be cheaper, but for multiple items, a minimum order will often be advantageous.
- Find out the minimum material thickness. Some of the more powerful lasers cannot handle thin material too readily, often burning it away completely.
- Find out if a sample piece can be made before carrying out a full order.
- Lastly, examine your drawing files extremely carefully. Remove any unwanted or surplus layers so that only the cutting/engraving lines are sent to the cutter software. I would reduce the layers of a drawing to a maximum of two layers — one for lines to be cut completely through, the other for lines to be engraved in the material. Use different colors for each layer and notify the cutter which color applies to which cut — engraved or through. A note also as to some key dimensions so that the operator can check he is working to the correct scale of the drawing can be an added quality check.

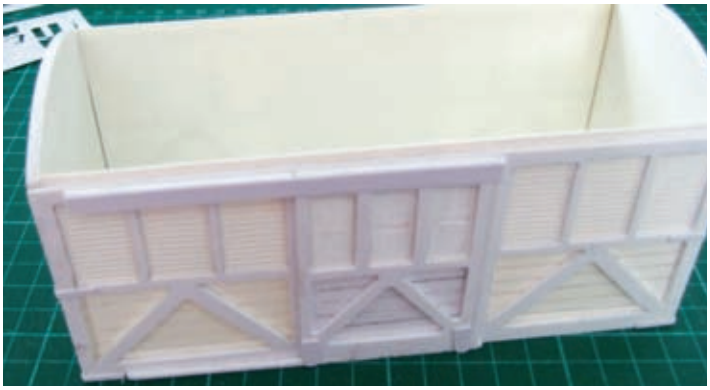
Etching

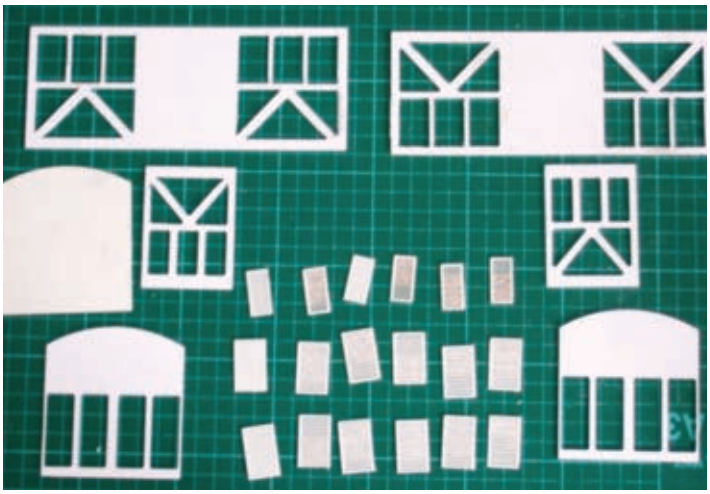
The removal of metal by etching is not a new method by any means, having been performed for a number of centuries. Also known as chemical milling, it basically is the dissolving of metal by a suitable corrosive agent. Where the metal is to be retained, it needs to be protected from the "etchant" by some form of film. At home, this can be as simple as a coat of paint, with the etched areas scraped away.

Small nameplates and the like can be made by using "rub-on lettering" to form the raised letters whilst the etching agent removes metal from around them. At one time, the metals most commonly etched were copper or its associated alloys — brass, bronze or nickel-silver. Modern etching companies are able to etch harder materials including stainless steel.

Producing an etched sheet of brass and the like requires three stages. First, a master drawing has to be produced; I find my CAD software an excellent aid to making the drawing, but one can produce useful drawings by hand with colored ink.

The drawing should have a maximum of three colors. Anything drawn in black ink indicates that the metal has to be removed completely through from both sides. Red indicates etching half way from one side, whilst lines drawn in blue are for material to be





Milling: *Top left, some styrene sides for a Gauge One van being milled on the CNC machine. Top right, the various parts for the van, milled from styrene sheet, ready for assembly. Note the fine detail of the ventilation louvers ready to be inserted in the side frames. Lower left, the assembled van. The use of CNC-milled styrene preceded the author's use of laser cutting to produce a rake of vans.*

half etched from the reverse side of the metal. For accuracy, one can make the drawing larger than the finished size of the item being produced.

This is subsequently optically reduced in size by the etcher when he proceeds to the next stage of producing the etchers "tool." By doing so, any errors are reduced as a percentage. Note that in order to produce sharp tools, it is important that the colors used are "solid" and dense. If printing on an ink-jet printer, use high (photo) quality paper and the best quality print run to obtain the densest print of colors, particularly in any large areas to be etched.

The tool is one of more sheets of transparent plastic. Two are usually required, one for each side of the sheet to be etched. The black lines of our drawing are found on both sheets, but the colored lines are only found, each one on a single sheet of the tool. The sheets of the tool are then aligned together carefully with a register to ensure accurate placing of the etched lines, with respect to each other.

The metal to be etched is coated with a photo resist. The transparent tool is placed over the metal and exposed to light. The photo-resist is then developed much like photographic film, which results in the areas that were protected from the light by the tool can then be washed away, exposing the bare metal. The sheet is then treated with the etchant until the required amount of material has been removed.

After neutralizing the etchant, the work piece is cleaned and examined for errors. As you can imagine, etching is quite labor intensive and does not benefit from economies of scale, unlike say laser cutting. However, the hobbyist can reduce the costs quite considerably by producing his own artwork and by discussing with the etcher what his needs are to produce the highest quality work.

Remember that any loose components will be lost in the etch bath, and must be held in place in the matrix by using tags. These can be half etched and later cut away from the components. Components may be built up from the flat sheet by either laminating several layers on top of each other, or by folding a flat piece into a 3D part, or by a combination of folding and lamination.

Conclusion

All the methods mentioned have something to offer the modeler who wishes to produce his own locomotives and rolling stock. It can be fun to have and use your own CNC machine, but by knowing something about the processes involved, one can speak more knowledgeably with commercial users of such equipment and obtain parts and components more readily and possibly cheaply than otherwise.

By being able to produce your own drawings and artwork one can show others what you have in mind and the anticipated outcome. This article is intended to give an overall view of some of the modern methods available to model engineers today. It is not meant to provide an in-depth study of each method. For that I recommend further reading. Several books and magazines are available covering all these techniques.

T1

Accucraft's Pennsylvania Railroad 4-4-4-4

Text and photos by Will Lindley

Since I first learned of the proposal by Jerry Hyde of Hyde-Out Mountain Live Steam to commission Accucraft Trains to build a Pennsylvania Railroad T1, I had visions of running one of my own. After an almost 2½-year wait, my locomotive finally arrived in a very large box. I learned that the locomotive and box would weigh in at about 60 pounds so I was concerned about shipping damage.

United Parcel Service didn't fail me. The box was compressed at both ends, one corner was crushed and there was a substantial tear along one edge of the box. I wonder whether the "Fragile" tape brought on the rough treatment. Further, despite clear instructions that the box should be shipped in a horizontal position, there it was, standing in a corner and on end waiting to be picked up. Because of the obvious damage to the box, UPS offered to return the shipment to Accucraft. I rejected the offer as I was anxious.

With the box in hand, I decided to set aside an area of my garage to remove the locomotive from its packaging and inspect everything. First, it was obvious that the box had been opened after it was originally prepared for shipping as there were two layers of tape, one of which was cut. When opened, I found an eight-page manual, a zip lock bag which contained a couple syringes and a small casting designed to fit into the chimneys to accommodate a suction fan and two internal packages inside sleeves, all of which was protected by thick foam. Despite shipping damage to the outside box, the internal containers were unmarred.

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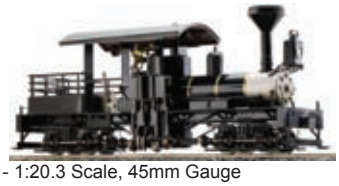
SHAY - 13T OPEN CAB



- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired

$2,049.00

MOGUL 2-6-0 RGS #11

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired
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- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired
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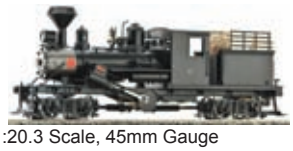
CLIMAX MICH CAL #4



- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired

$2,149.00

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- 1:20.3 Scale, 45mm Gauge
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- Butane Fired

Starting at $499.00

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ACCEPTING RESERVATIONS

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired

$759.00

PLANTATION 0-4-2

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired

$999.00

BALDWIN 4-4-0

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired

Starting at $2,199.00

MASON BOGIE 2-6-6T

SALE

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel ~~$2,500.00~~
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Free Goodall Valve & Water Bottle

D&RGW C-25 2-8-0

NEW

- 1:20.3 Scale, 45mm Gauge
- Production Limited to 100 units

$3,479.00

EBT #12 2-8-2

- 1:20.3 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired
- D-Valve

$3,499.00

D&RGW K-28 2-8-2, COAL FIRED

NEW

- 1:20.3 Scale, 45mm Gauge
- Few Units in Stock

$6,500.00

28 TON CLASS B SHAY

NEW

- 1:20.3 Scale, 45mm Gauge
- Butane Fired

$2,499.00

PLEASE RESERVE WITH ACCUCRAFT AUTHORIZED DEALER

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ACCUCRAFT COMPANY, 33268 CENTRAL AVE, UNION CITY, CA 94587, USA TEL: (510) 324-3399, FAX: (510) 324-3366, WWW.ACCUCRAFT.COM

ACCUCRAFT TRAINS
MUSEUM QUALITY BRASS MODELS

PENNSYLVANIA T1 4-4-4-4
NEW
- 1:32 Scale, 45mm Gauge
- Brass & Stainless Steel
- Production Limited to 75 Units
- Alcohol Fired
- D-Valve

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UP 4-8-8-4 BIG BOY
ACCEPTING RESERVATIONS
NEW
- 1:32 Scale, 45mm Gauge
- Brass & Stainless Steel
- Production Limited to 75 Units
- Butane Fired
- D-Valve

$8,995.00

GS-5 SP #4458
NEW

- 1:32 Scale, 45mm Gauge
- Brass & Stainless Steel
- Butane Fired, D-Valve

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ALLEGHENY 2-6-6-6
NEW ACCEPTING RESERVATIONS

- 1:32 Scale, 45mm Gauge
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- Butane Fired, D-Valve
- R/C Ready

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DB BAUREIHE 45 010
ACCEPTING RESERVATIONS
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- 1:32 Scale, 45mm Gauge, Butane Fired
- Limited Production

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ROYAL HUDSON 4-6-4

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- Brass & Stainless Steel
- Butane / Alcohol Fired, D-Valve
- Few Left in Stock

$3,995.00

SP F4/F5 2-10-2

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'BLACK 5" LMS/BR
NEW ACCEPTING RESERVATIONS

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SP M-6 2-6-0
NEW ACCEPTING RESERVATIONS

- 1:32 Scale, 45mm Gauge
- Brass & Stainless Steel, Butane Fired

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'FLYING SCOTSMAN' LNER
NEW ACCEPTING RESERVATIONS

- 1:32 Scale, 45mm Gauge
- Brass & Stainless Steel
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$3,400.00

PENNSYLVANIA K-4 4-6-2

- 1:29 Scale, 45mm Gauge
- Brass, Steel, Die-Cast Metal, Butane Fired

$2,899.00
Free Case of Stock Cars

B&O 0-4-0 SWITCHER w/ SLOPE TENDER
SALE

- 1:29 Scale, 45mm Gauge
- Brass, Steel, Die-Cast Metal
- Production Limited To 50 Units
- Butane Fired

~~Reg. Price: $1,599.00~~
Sale: $1,199.25

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Four cylinders, eight drivers

A mixture of success and failure, the Pennsylvania Railroad's T1 4-4-4-4 locomotives came at the tail end of the steam era and had the misfortune to be expensive to operate, not to mention cursed by the rumor they were prone to high-speed slippage.

Pennsy was searching for a solution to the early 1940s problem that it needed to double-head its K4-lead passenger trains between Crestline, Ohio, and Chicago. After designing the too-large experimental S1 class, the company came up with a shorter rigid-frame, two-paired cylinder system that provided greater thrust with less "hammer blow" (uneven application of power from pistons to the wheels). Each cylinder was connected to two wheels by rods and the locomotive had four leading wheels and a four-wheeled trailing truck.

The railroad commissioned Baldwin Locomotive Works to build two T1 prototypes in 1942. The streamlined outer shell of the engine was created by famed industrial designer Raymond Loewy (who, over a 67-year career, designed everything from the modern Coca Cola bottle to the interiors of the Concorde aircraft and the Skylab space station) and featured a shark-like nose and portholes.

Testing of the prototypes and World War II slowed the acceptance process, but Pennsy finally ordered 50 of the T1 locomotives in 1944, with production split between Baldwin and the railroad's own shops in Altoona, Pa. Delivery came in 1945-1946 (much of the Loewy styling of the prototypes was gone) and the locomotives began to head named passenger trains such as "The Broadway Limited," "The Manhattan Limited," "The General," "The Admiral" and "The Pittsburgher." The two prototypes were numbered 6110-6111 and the production runs were Nos. 5500-5549.

Portholes: *T1 No. 6110 at the Baldwin Locomotive Works prior to delivery to the Pennsy. Photo courtesy the collection of William Ayers.*

Operational reports came in indicating T1 locomotives were "notorious for violent wheelslip" but modern rail historians suggest there was much exaggeration to the reports and suggest properly operated, the powerful T1 did not slip (training of T1 engineers may have been lax).

Nonetheless, the duplex design was difficult to maintain and as railroads across the United States began to adopt diesel locomotives, Pennsy sought to replace the T1s first. The railroad had the last T1 service in 1952 and the company had scrapped all 52 locomotives by 1955.

— dmc

is attached to a piece of plywood which nests in a Styrofoam cradle, covered with several layers of a thin foam and wrapped tightly by wide packing tape. The packing was so well done, neither could move in their respective cradles no matter how roughly the box was handled. As the tape could not be removed, I placed each on an uncluttered table and carefully cut the packing tape from the plywood bases and models.

When I finally reached the locomotive and tender, I was surprised at how well they had survived the shipping ordeal. All detail parts were properly in place, hand rails were straight and the paint jobs on the locomotive and tender were beautiful. I found only one flaw. A small deflector on top of the tender in front of the coal load (water and alcohol tank cover) had been bent. Because of the packing, the bend had to have been done before packing.

Now to the inspection, starting with the tender. The first thing to do is to open the cradle slowly/carefully as the *Up* arrow doesn't designate the orientation of the contents. The tender (and loco) would fall out if opened in accordance with the arrow. When removing them from the cradle, I found it easy if the tape and packing Styrofoam were cleanly cut away from the plywood base (7/16-inch plywood with grooves to fit flanges).

Upon inspection, I found everything as it should be. The paint job is exceptional. There were no marks, scratches or dings. The same was true of the locomotive. Next, I removed the artificial coal load which covers the alcohol and water tanks. Because of its tight fit, I think most would leave the cover off while running this locomotive.

On further inspection, I find it disappointing that the tender coupler does not have a working coupler release lever to permit uncoupling without lifting either the tender or first coach/car. Also, the tender is missing air, brake and steam hoses. Equally disappointing is that the tender does not have a quick disconnect for the alcohol and water lines.

Locomotive

Well packed with no chance to move during shipping, for the locomotive — as with the tender — the

Cab: *Top, the pressure gauge shows out of the fireman's window. Bottom, the throttle and gas valve peek out of the back of the cab.*

Up arrows were also sideways. Because of the design of the Styrofoam cradles, they will be almost impossible to use after opening. A sturdy carrying case or other container will be required to move the locomotive and tender to a track, as both are heavy.

Accucraft provides a couple long-handled nut drivers, a pump handle and a fitting that allows a single suction fan to fit in the locomotive's two stacks.

To get ready for steaming, I used the garage as rain was predicted for the whole day. Since the running gear must be lubricated, I decided to use a firm foam cradle from a friendly orthopedic surgeon. It is firm enough to support the heavy locomotive and tender, and although being foam, it does not absorb lubricating oil or steam oil. With the lubricating completed, it's time to fill the lubricator.

Note that the manual says the reservoir is under the fireman side running board, but it is actually located under the nose extension which holds the headlight and is held in place by four spring clips (the nose piece is large enough to accommodate a working headlight and batteries, so expect to see conversions). Be careful not to either bend or break the clips. The cap for the lubricator is located just below the bottom of the nose piece. The cap will require a screwdriver for removal and you will need almost 1½-ounces of steam oil to fill the reservoir.

Next, the tender and all lines to the locomotive must be attached. Here, I found little room to work, and when everything was attached, I found that the front of the tender interfered with the operation of the blower valve and steam regulator handles. I placed everything on a wide radius track and found that the interference was so severe that it would not be possible to operate the locomotive without corrective action.

I talked about this with Jerry Hyde and we concluded that the tender pin was mounted about five-eighths-inch further away on my locomotive than his. As I have "phat phingers," I elected to build a draw bar that is about five-eighths-inch longer than the original rather than wait for Accucraft. The extended draw bar eliminated the physical interference and allowed easy access to the blower and throttle handles and to the whistle lever.

The boiler must be filled and this is done through the hand pump in the tender. Of everything I found during the preparation process, the need to fill a 20-ounce (600ml) boiler using a hand pump was aggravating. It should be possible to fill the boiler quickly by using a syringe. I don't look forward to

Accucraft T1

- **Loco type:** Pennsylvania Railroad T1, 4-4-4-4, No. 5500, built at PRR's Altoona Works, 1945. *Cylinders:* Four, 19¼-inch diameter, 26-inch stroke. *Drive wheels:* 80-inches. *Boiler pressure:* 300 psi. Tractive effort: 58,300 pounds. *Locomotive weight:* 502,200 pounds. *Tender weight:* 442,500 pounds, loaded
- **Scale:** 1:32, 45mm gauge.
- **Length:** 47 inches.
- **Height:** 6¼ inches.
- **Width:** 4¼ inches.
- **Boiler:** 20.3 ounces (600ml).
- **Fuel:** Alcohol.
- **Min. radius:** 10 feet.
- **Water pumps:** One axle pump with bypass valve; one tender water pump.
- **Cylinders:** Four with D-valves.
- **Valve gear:** Simulated Walschaerts with slip-eccentric reversing.
- **Fittings:** Throttle, water-level gauge, pressure gauge, blower, four wicks, manual drain cocks at each cylinder.
- **MSRP:** $6050.

Fittings: *Upper left, a wrench tightens the water-supply nut. Lower left, the coal load taken off the tender shows the alcohol and water tanks. Above, the smoke box door opens to reveal extra space.*

this process. On the plus side, the sight glass clearly shows the water level.

The high-pressure line from the tender pump to the boiler requires an eight-millimeter wrench to connect or disconnect this line while the alcohol and bypass return lines are simply pressure fit. Regardless, you must swing the tender to the side in order to connect any of these lines. A Rectus-type quick disconnect would make this process quite a bit easier.

Next I placed the locomotive and tender on rollers, filled the tender tank with alcohol, topped up the water tank, set the eccentrics for forward, turned the throttle and blower off, opened the bypass valve and opened the firebox door. The tender's alcohol tank took a whopping 17-ounces (500ml); I then inserted the suction fan fitting in the stacks and opened the alcohol valve to feed the wicks. I think having a firebox door which can be opened is a great idea. There will be no question whether the wicks have been lit as they can be seen.

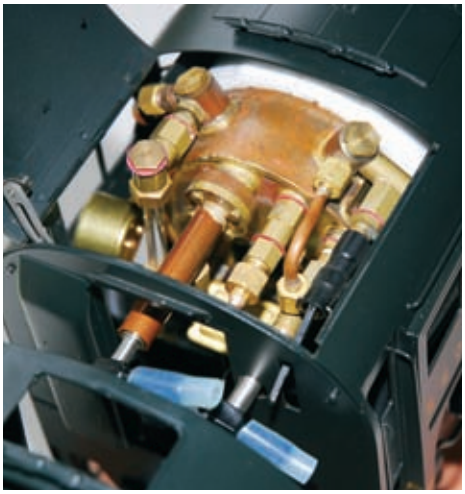
In order to light the wicks, Accucraft provides a piece of spring wire to which a piece of wick material is attached. You must first turn the suction fan on, and then dip the wick material in alcohol (making sure the container is closed when done). Light this small piece of wick material and then thread it through the firebox door to light the wicks. I would prefer a lighter with a flexible tip to light the wicks as you must find a safe place to dispose of the lighter when the locomotives wicks are lit using the method suggested.

Now that the suction fan is on and wicks are lit, I opened the drain cocks on each of the four cylinders and waited. After about 4½ minutes with the pressure gauge showing 20 psi, I removed the suction fan and turned the blower on. Within two minutes, the gauge read 60 psi and the safety valves started popping. I was surprised at how quickly the pressure raised to full operating pressure.

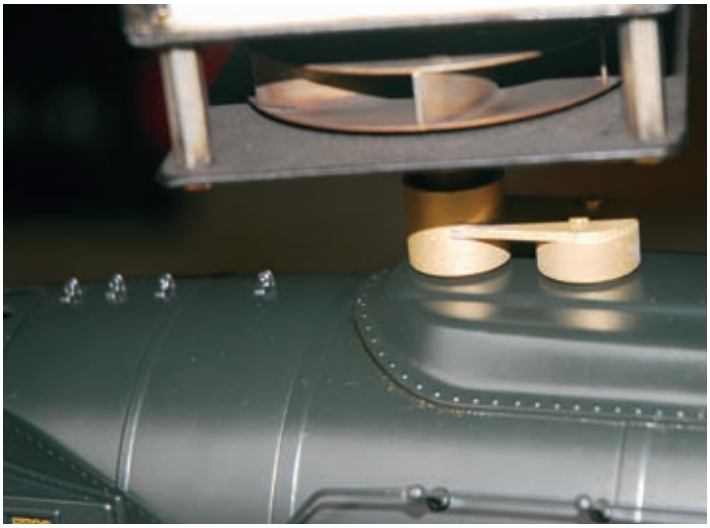
With the bypass open, it was time to open the throttle. Given the size of the locomotive and the fact that there are four cylinders, it took a little persuading for the drive wheels to start turning. Everything was obviously quite tight as the locomotive was slow to get moving. In about two more minutes, the drain cocks were closed and each part of the locomotive increased in speed. At this point it was obvious that there would be a longer break-in period than I had expected, so I played around with it a little.

Since direction is controlled by the eccentrics, I thought it would be fun to have each set of drivers work in opposite directions. This was easily done by simply moving one set in the opposite direction to the other and then opening the throttle. I know of no other locomotive where this is possible. I then played with the bypass valve and found that closing it even a little caused the rear drivers to stall. Steam pressure dropped quickly as well, so much so that front drivers stopped too.

During the first runs on actual track, first at Bob Weltyk's and later on our club portable, running light the T1 ran well, but not robust. When coaches were added — even just five lightweight MTH



Light my fire: *Left, the roof hinges to reveal the controls. Upper right, the wicks needed repacking for good flame. Lower right, the fixture to allow the dual smokestack to be driven by a single fan.*



coaches — it slowed to a stop. Upon inspection of the wicks, to my surprise, two had fallen out. I don't know when, but there was an obvious problem.

I removed the wick holder from the locomotive and carefully inspected each wick. They were not packed properly at the factory, in fact, it looks like wick remnants had been used and in a couple instances, they had been twisted when installed. I replaced the wicks and set the locomotive on my test stand to see whether I had solved the problem. Steaming up seemed to be quicker and when I adjusted the bypass valve, the rear drivers only slowed, they didn't stop.

My next stop was the annual Pennsylvania Live Steamer's Labor Day meet. I was especially anxious to see how the T1 ran there. Not only was it the old stomping ground of the T1, the PLS track is level, has wide radius curves and overall is a pleasure to run on. The locomotive fired up quickly, blowing off the two safety valves in a few short minutes. It took off with little effort, quickly gathering speed, but after about 10 laps it died with lots of steam and water gushing from the cab. The sight glass was broken.

On close inspection, I found that the upper and lower ends of the sight glass fitting were not lined up correctly and the glass couldn't take the stress of both the higher pressure and the misalignment. Here it was, Friday of a long weekend and the locomotive I had planned on running all weekend was now dead. Needless to say, I was disappointed.

That afternoon, I called Cliff Luscher at Accucraft, hoping for a quick delivery. Unfortunately, UPS and the USPS had both made their last pickups for the weekend.

On return, I received and installed a new glass in correctly aligned fittings. I then took it to another local layout with two long straights and wide radius curves. It fired up quickly and took off smoothly, all the while consuming almost a half-gallon of water during the next hour.

I played with the bypass valve so as to keep the boiler nearly full and let it run with the only attention being the addition of water. It was now running as I had hoped from the beginning. After a little more than an hour, and not wanting to be a track hog, I shut it down so that others could operate.

As the above run was the only one for the day, I shut it down and started preparing it for the next steamup. The first order of business was to empty the alcohol tank. To my surprise, eight ounces (240ml) of alcohol remained in the tank. Since I had already run about 65 minutes on 8.8-ounces (260ml), a full tank should result in runs approaching two hours!

Although I was quite frustrated with a few small things that weren't quite right, now that I have most taken care of, I look forward to many more smooth and long runs. I speculate that it will pull a soon-to-be-delivered rake of Loewy streamlined coaches. Although frustrating, the long wait for delivery was well worth it in the end.

Visiting Portland and Staver's

Text and photos by Scott McDonald

Participating in Larry Staver's biannual steamups at his facility in Portland, Ore., has been on my list for over five years. Ever since I saw some pictures online and talked with Larry at the 2010 National Summer Steamup in Sacramento, I have been planning on making his fall steamup — held Sept. 20-23 — my primary vacation for 2012. The article in *Steam in the Garden* No. 123 whetted my appetite even more as I got to read up on what I was about to experience first-hand as I packed my suitcase.

Engineer: *The author at the throttle of a one-eighth-scale Virginia & Truckee 4-4-0 at the Portland Zoo.*

The rules of the road for running at Staver Locomotive average three to four engines out on the mainline at one time. I shipped out my little Roundhouse Forney which has a 20-minute boiler capacity and was able to successfully complete 2½ laps in that 20-minute time period. The distance of the Staver layout is a great optical illusion, as you depart the building at one end and then reenter into a loop that folds back upon itself.

Attendees came from many distances to attend. Rich Morton and I were announced as the long-distance winners, coming respectfully from North Carolina and Virginia. In previous years that honor had been bestowed on Jeff Young and Dawn Brightwell coming from Ontario, Canada, who also made it this year. It was great to see many of the familiar faces at this steamup that I normally only get to see once a year at the International Small Scale Steamup in Diamondhead, Miss.

There was a wide variety of prototypes in steam over the weekend. Jim Overland made a great showing with his Southern Pacific Daylight No. 4449 and full string of passenger cars. A couple other No. 4449s were in attendance as well making the rounds. Very fitting to have that engine well represented, since its home is Portland.

Speaking of No. 4449, I took advantage of the time I had in Portland to take in a couple of side trips. As a transplanted Californian living in Virginia, visiting the real No. 4449 was on my list. As luck would have

Staver Locomotive

According to many, the twice-yearly steamups at Staver Locomotive in Portland, Ore., are the best of the live-steam events.

It is as if your best friend had invited you over to run trains on his layout. The variety of locomotives — all running on live steam — seen here is unlike anywhere else. The variety of people is another thing that draws us to the two steamups each year. Many have gained a real friendship amongst the attendees who often travel great distances.

The layout operates at waist height. There can be as many as eight trains running at once. You are the engineer as you follow your train running in blocks. The layout is about 500 feet long and there are several large passing sidings. Wide curves can accommodate the largest of engines pulling up to 40 cars.

It takes about three minutes to complete the circuit. There are no sign-up sheets or schedules for running and is quite informal, though practice is to run slow trains for two hours then fast trains for two hours. When train traffic is less intense, both fast and slow trains seem to work together, while some will pull off on the passing siding to let the fast train through. There is an additional large outside loop that can make for longer runs. Future expansion has been started and the plan is for more outside track.

You will have a table to work on your engines with lots of storage space for boxes and tool trays and a spur or siding to raise steam. Trains run from 8 a.m. to 8 p.m.

The best part is the hospitality of Larry Staver and family. Staver Locomotive is a great venue and when not used for hobbyists, can also be rented for nonprofit events, weddings and fashion shows.

The schedule for 2013 is April 25-28, and Sept 19-22. The fee for each four-day event includes butane and alcohol fuel and distilled water. There are also great meals and the ability to run and watch trains.

— James Small

Doing laps: *Jim Small taking his Accucraft SP 0-6-0 for a run. In the background, steamers Curtis McCarthy and Dave Sykes chat.*

it, that weekend was the grand opening and dedication of the new engine facility for No. 4449 and the other two locomotives that call Portland their home: Spokane, Portland Railway No. 700 and Oregon Railway and Navigation Railway No. 197.

All three locomotives now reside in a brand-new facility in the Oregon Museum of Science and Technology District (OMSD), under the auspices of the Oregon Rail Heritage Foundation. No. 4449 was under steam sitting out in the brilliant sunshine as I walked to the facility from the parking lot. Access to the cab was made easy by a staircase to get a great view. Just a few more gauges and valves than on my model and the pressure gauge sitting pretty at 250 psi. That gauge by the way, goes all the way over to 500 psi!

My other side trip that week was to visit the Portland Zoo. Most people go to the zoo to see animals. Not me. Portland Zoo has the Zooliner that connects the zoo with the famous Portland Rose Gardens on the other side of the hill that the separates the two facilities. Built before the opening of the zoo in 1958, the 30-inch gauge railway operates several "grand scale" diesels and a 4-4-0 based on the Virginia & Truckee's 4-4-0s of the late 1800s. The 4-4-0 was not in steam since it was the middle of the week when I visited, but after a friendly discussion with James Abney, the Zooliner engineer, I was offered a personal tour of the facility when he found out I was in town for a steamup.

What an impressive piece of industrial-gauge locomotive! Jim offered a climb into the cab to get a better look and then told me to give him my camera so he could take a souvenir photo of me in the cab. It's obvious to me that he has entertained a lot of railfans, so I handed him my camera and posed for

Antique: *Don Scott of Fox Island, Wash., readies his Bassett-Lowke on the portable layout.*

a portrait. "Naw" he said. Not good enough! "Too dark, even with the flash."

He then walked over to a hose hanging from the wall and plugged the end into a fitting on the side of locomotive under the running board. He then opened a valve and I heard an air compressor come alive as he started to fill the boiler. I watched as the pressure gauge moved from zero to 100 psi.

With the gauge holding at 100 psi, John said, "Put the thing in gear and pull it out into the sun." So I did. With the valve lever pushed forward, just like on my little models, I grabbed the throttle lever and slowly eased it back as the sound of air filled the cylinders and slowly I moved the engine out of the shed into the sunshine with a solid chuff.

As I eased the engine forward, the leftover condensate in the cylinders from the last run spewed up out of the stack and splattered all over the boiler jacket. Typical, I thought as I laughed to myself. Mine do the same thing after having sat for a while after a run. I brought the engine to a halt and Jim looked at the splatter over engine. "That won't do," he chortled as he grabbed some rags and set about to clean off the water drops. He grabbed the decorative flags for the pilot and on each side of the headlight and now we were ready for my photo shoot!

After the picture, he took me on a personal tour of the engine shed where the 7½-inch gauge model of

Staver sights: *Top, Kevin Schindler's Accucraft SPng 4-6-0 No. 8. Left, Michael Williams at one of the guest workbenches provided. Right, Dan Pantages assisting on a fix of an Accucraft GS-4 Daylight.*

the 4-4-0 sat, as well as some other photos on portable display boards. I noticed a picture of a Southern Pacific maintenance speeder on a poster board and asked about it. "Oh, that's a pic of that little speeder in the yard. It came from the SP narrow gauge in the Owens Valley back when they shut that line down. We re-gauged it to 30 inches." So now here is another bonus of the visit: The SPng is a favorite railway of mine, so I had to get some pictures of it.

With the steamup and two bonus trips accomplished, I had a great time with a great host and steam friends, and I won't let it go too many years before I'll be back again to enjoy another Staver Steamup!

The fascinating world of Fasteners

Text and photos by Gerald Pierce

Our small-scale live steam locomotives are held together by many and various threaded fasteners. A knowledge of the thread series, size and notation make assembly, maintenance and repair of our engines that much easier.

A dedicated hobbyist should understand the fasteners used in our steam engines, including the basics of threaded fasteners, where to buy and how to make fasteners, ranging in size from about 1/16-inch to one-half-inch diameter.

Threads: *An assortment of tools to help determine threads.*

Threaded fastener basics

There are four characteristics to every threaded fastener. You need to determine the nominal diameter, the thread count (inch series) or pitch (metric series), the length and the head type and size.

The nominal diameter is the approximate outside diameter (OD) of the threaded portion of the fastener. The thread pitch relates either to the number of threads over a designated length or to the distance between the threads. The fastener length is based on the type of head. Generally, the length includes the threaded section but not the head, but for a flat-head screw, however, the length is the entire screw.

Threads usually are right hand. Turning the fastener to the right or clockwise will advance the screw into the threaded hole or draw a nut towards the fastener head. A fastener with a left hand thread must be turned to the left for the same action. Left-hand threads are rare. Some locomotive screw reversers will use a left-hand thread to advance the reverser nut forward when the handle is turned clockwise.

Left-hand threads can be used to prevent a fastener from coming loose. The left-side pedal on bicycles have a left-hand thread to prevent the pedal from coming loose as it is normally rotated in a counter-clockwise direction. A lathe lead screw and cross-slide screw are usually a left-hand thread

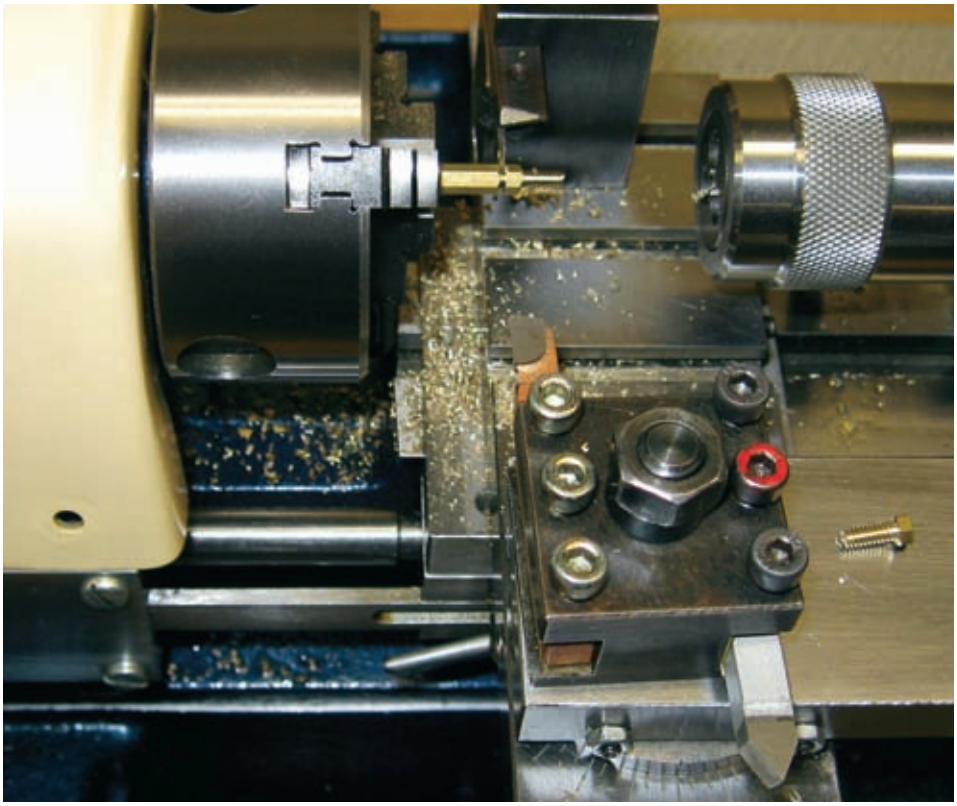
Threaded fasteners used in small-scale live steam are hex bolts, machine screws, socket screws, stud bolts and nuts. Hex bolts and machine screws can be used with a nut or in a tapped hole. Machine screws have several head styles such as pan, flat, round, oval and the like. Some fasteners are headless, such as socket set-screws and studs bolts.

Studs bolts are threaded on both ends with a tap end and a nut end. Studs bolts are rare in our railroad sizes. In the larger gauges, these will be found on slide valve and cylinder covers. Studs for cylinder and valve rod glands are better than a screwed gland. Socket set-screws have an internal hex socket.

Fasteners have several drive types. We usually use hex, slotted, Phillips and hex socket.

There are many standard thread series, but we'll only discuss four series. These are the American Unified Thread Standard, British Association, Model Engineer and metric. The diameter/pitch combinations are various. Some are in inches and some are in millimeters:

• American Unified Thread Standard (UTS). This series has several sub-series. We are mainly interested in the National Course (NC) and the National Fine (NF) sub-series (there is also a fractional series called National Special — NS). The pitch is measured in threads per inch (tpi). For example, a 4-40 thread has 40 threads per inch. A course thread does not mean a rough or inferior cut thread, but refers to the number of threads over a certain length.



Lathe: *Making a 6 BA bolt on a lathe; the turning tool, the tailstock die holder and the rear tool for cutting the bolt to length.*

This series is a good choice to do modifications or repairs. These fasteners — along with the related taps and dies — are available in the United States at a reasonable price. However, this series is not used on Roundhouse, Accucraft or Aster locomotives as manufactured.

• British Association (BA). Used on Roundhouse products, this series has a single number designation as there are no sub-series. No. 0 is the larger diameter and No. 12 is the smallest diameter. The pitch is in millimeters (mm) and is based on a rather complicated formula which also determined the OD of the fastener. The No. 6 BA, for example, has a OD of .1102 inch, a pitch of .53mm and 47.9tpi. Some BA fasteners' OD is close to U.S. standard size, for example 6 BA OD is .110, the 4-40 NC thread OD is .112 with 48tpi.

• Model Engineer (ME). Also used on Roundhouse products, this standard was developed by the British magazine Model Engineer and is a constant pitch threads per inch with four sub-series. The sub-series are 26, 32, 40, and 60tpi. This is useful in making small fittings and threading tubes. The constant pitch is useful to assemble a tube or stay with different thread sizes OD on each end.

For example, a tube or stay can be inserted through the boiler with a 1/4-40 thread on one end and a 5/16-40 on the other end. The tube will thread into the boiler fitting at each end. This eliminates threading the tube or stay for its whole length. The constant pitch also allows pipes of different sizes to be coupled together. An adopter coupling is screwed fully on one pipe then the other pipe is moved in position and the adopter is backed out to the other size pipe.

Dies: *Upper two are tailstock die holders; lower a hand die holder.*

• Metric (M). Both Accucraft and Aster use metric screw sizes, which have a course and fine sub-series. The pitch is the distance between threads measured in millimeters. The OD, measured in millimeters, designates the screw size. For example, an M5X0.5 screw size has a OD of five-millimeters with a pitch of one-half millimeter.

Tube fasteners for water, gas, steam

• Cones, nuts. This is the best where pipe and fittings have to be easily removed. A tapered cone is attached to the tube, the nut draws the cone to the

fitting. These are available in inch threads, usually ME thread series and metric series.

- Taper threads. Straight threads require a washer, O-ring or cone and nut to secure the fastener. Taper threads do not, however they do require pipe sealant for a seal. Taper threads are usually not found in our manufactured locomotives. Model taper pipe taps and dies are available from Coles' Power Models, PM Research and American Model Engineering Supply. You may want to consider taper threads for modifications.

Taps: *Three hand-tap holders and a tapping block.*

- Fastener heads. There are a variety of heads on fasteners used for small steam locomotives. The main problem with most is the appearance. They are not to scale or not the correct head type as used on the full-size locomotive (which properly used far more rivets than threaded fasteners). Roundhouse uses cheese-head slotted screws, Aster and Accucraft use Phillips-head screws.

Both Roundhouse and Aster advertise their locomotives as a "model." Accucraft extends its description to "museum quality brass models." Next time I go to the Smithsonian Museum, I will look for the Accucraft section!

The manufacturers do a good job with the general appearance. They do a great job with their designs and virtually all run well. From a distance, they look like the full-size locomotive. However, boiler fittings (for example the pressure and water gauges) and fasteners heads are not always correct. It may be better to say (as the English locomotive designer, builder and author "LBSC" held) these are not true models but are simply small steam locomotives. They are a pleasure to own and operate. In my opinion, our small-scale locomotives are not a true scale "model" and not "museum quality".

Some incorrect fasteners can be easily replaced. Those brass-slotted cheese head screws on, for example, the Roundhouse "Millie" can be replaced with a 6BA hex-head screw. Slotted cheese head screws are also found on Roundhouse cylinder and valve covers and valve rod forks. The highly detailed Sandy River & Rangeley Lakes Railroad Forney also has a few slotted screws.

Accucraft has a few incorrect fasteners. For example, trucks on the company's Shay locomotives have Phillips screws. On the full-size engine these are hex head. Aster locomotives have numerous Phillips-type screws. These would be difficult to replace because of the smaller scale and many screws used.

The Phillips-head screw was invented in the 1930s. The self-centering design was useful for automated production lines. This type screw was not found on locomotives prior to then and properly not later. Although slotted screws may be found on some locomotives, I don't think they would have been used to attach large locomotive components or cylinder covers.

How to identify threads

In general, Roundhouse uses BA and ME threads. Accucraft and Aster use metric threads.

There are several ways to identify an unknown thread. A screw thread chart (or tap drill chart) for each series is helpful. This will list the major diameter and the threads per inch or, for metric, the pitch in millimeters, however these charts are not included here (they would take far too many magazine pages). The charts are available on-line from several web sites, including http://www.britishfasteners.com and http://www.mdmetric.com.

Measure the major diameter and determine and the TPI or pitch of the unknown screw. When counting TPI, it is not necessary to count threads for the whole inch, count for one-quarter-inch and multiply by four. Match these to the chart thread size. This is not as easy as it appears. It will depend on what measuring equipment you have. As a minimum, you will need to have a small ruler which is marked in inches and mm. You will also need good eye sight or a magnifier. Also, for metric threads you need a metric screw pitch gauge.

Better equipment would be a veneer caliper or micrometer. I have an electronic Mitutoyo four-inch caliper which measures in both inches and millimeter (there are plastic versions which are less expensive). The caliper has a small button to convert from inches to metric. A screw checker for inch and metric screws is helpful, however not all sizes we use are covered. A screw checker is a flat metal plate with threaded holes. The smallest size for a metric screw checker is usually a M2 thread. However, Aster will use screws smaller than M2 diameter. If you have a collection of nuts or screws with known threads, these would be helpful.

Fasteners available to purchase

Hobby shops have a few sizes. There are many sellers on the Web. I am familiar with these three sellers:

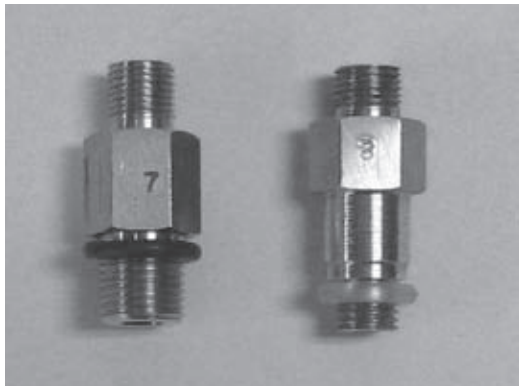
- Coles' Power Models. Coles has a good inventory of "model hex head bolts," nuts, and washers in brass

and steel. The head and nut size are correct. The 4-40 and 6-32 head diameters are the correct size. The 4-40 size is the correct 11/64-inch (.172). Some manufactures will use 3/16-inch (.188) which is too large. The 6-32 size should be 7/32-inch (.219) not one-quarter-inch (.250).

Coles, based in Warren, Texas, also has small socket set screws and socket head cap screws. http://www.colespowermodels.com.

• American Model Engineer Supply. The inventory at this Valpariso, Fla., company is about the same as Coles. The 4-40 hex size is correct in brass screws but not stainless steel. http://www.americanmodeleng.com.

• Micro Fasteners. This company has a large inventory of fasteners and most hex-head diameters are correct except for 4-40 and 6-32 sizes. I have not done business with Micro Fasteners; it appears that the minimum purchase is 50 or 100 of most sizes. The prices appear reasonable. Micro Fasteners is based in Lebanon, N.J., and is on the web at http://www.microfasteners.com.



Making threads: *Air test fittings made by the author — left, for an Aster Krauss Tank; right, for Aster BR5MT (stamped numbers are for inventory).*

Making fasteners

If you can't buy what is needed, you can make fasteners using a tap or die.

Tapping is making an internal thread using a tap. Threading is making an external thread using a die. Thread chasing is used to repair or finish an incorrectly made thread. A screw checker is also helpful to fix a damaged fastener.

Three tap types are available: the taper tap, plug (or second) and the bottoming tap. A taper tap is used to start a thread. The plug tap is used to finish a thread.

The bottoming tap is used in a blind hole (a hole not open at the bottom) to cut a thread close to the hole bottom. A taper tap is not usually needed. These can be used when the hole is tight or to start a small size tap if breakage is a concern.

Dies can be solid or adjustable. An adjustable die has a small screw to adjust the cut.

These procedures are best done with a drill press or lathe. You can do taping and threading by hand, however this is a limited and difficult exercise. You can tap a pre-drilled hole or thread some standard size bar stock. I would not try to tap a hole made with a hand drill. If the hole is not straight the tap may break. Some standard size bar stock can be used for threading a rod, such as one-eighth-inch rod for a 5-40 NC thread.

Using a drill press

A drill press is helpful to tap threads in a part held in a vice or on the table. Make a punch mark on the part and align under the drill chuck. Drill a hole using the correct tapping size drill bit from the charts. Then use a tap to cut the thread to the required depth.

You have a choice of how to use the tap. You can use the drill chuck to hold the tap and turn the tap by hand to start the thread. This will insure the tap is aligned straight into the hole. After a few turns, finish with a tap holder to depth. However, with small size taps this method may break the tap. I use a tapping block with small taps.

A tapping block is easy to make. I made one for sizes 0-80 to 3-48 from one-quarter-inch thick steel. Drill the correct clearing size hole for each size to keep the tap straight. Then you can place the part to be tapped in a vice with the tapping block over hole. Turn the tap by hand.

Using a lathe

The lathe is the most accurate way to make threads. However, this method is only useful for parts that can be held in a chuck or on the faceplate. You can drill the correct size tapping hole or turn to the correct OD to use a die.

Practical examples:

• How to make a fitting used to test an engine on compressed air. I made the fitting to screw into the safety valve boiler bush on the Aster Krauss Tank engine. The boiler bush is threaded M8x0.75.

I use an air tank filled from a compressor. The tube hose is a one-quarter NPS straight thread. I thread my hose fittings ME one-quarter-40 which is close to one-quarter NPS thread.

Place three-eighths-inch hex bar stock in the three-jaw. Turn to 8mm for one-quarter-inch length. Cut the M8x0.75 thread using a die holder, either a tailstock die holder or a hand die holder. Turn a groove for the O-ring. Drill a 5/32-inch center hole. Cut-off three-quarters-inch from rear of groove. Reverse in chuck, turn to one-quarter-inch diameter, thread ME one-quarter-40.

• How to replace the cheese head slotted screws on the Roundhouse Millie. You have three alternatives as follows:

— You can purchase 6BA hex brass screws.

— You can use a 4-40 tap in the 6BA threaded

holes and replace the screws with 4-40 brass hex screws. The 4-40 thread is close to the 6BA thread.

— You can make 6BA screws from brass hex bar stock. A 5/32-inch brass hex rod is in the three-jaw chuck, a tailstock die holder holds a 6 BA die, and a rear cut-off tool is used to cut the screw to the head height. This set-up can make a of number screws in a short time (see photo Page 35).

I would encourage readers to consider the purchase of a lathe and drill press for modifications or to actually make a steam locomotive or engine. Learning and actually making parts will give you a greater appreciation for any locomotives you purchased as a kit or ready-to-run. A quality lathe will produce better results, especially for a beginner, and will last a lifetime. Inexpensive lathes may result in poor results and have a short life.

I have a Maximat 7 lathe I purchased in 1970. This lathe has a geared headstock driven by a timing type belt for the motor. The original belt is still in use and the lathe runs well. My Cowells 90ME is good for small items. It is well made and beautiful lathe,

however it is not inexpensive.

Wrenches and drivers

A tool to install or remove a threaded fasteners depends on the head type and the location of the fastener. Hex head fasteners require an open-end wrench or a nut driver, either straight or flex style. Socket setscrew require a "L" shape hex key or hex driver. Typical screwdrivers are used for slotted and Phillips. These come in several sizes.

Small-size inch and metric open-end wrenches are available from Sears or hardware stores. Coles' Power Models and American Model Engineering Supply carry straight and flex-handle socket wrenches for inch hex head screws. Wiha and Moody offer a large inventory of drivers available from their online catalogs.

A knowledge of threaded fasteners can increase your enjoyment of owning and operating small steam engines. I find threaded fasteners a fascinating subject!

TIMETABLE

Jan. 13-22, 2013 — International Small Scale Steamup and Arts Festival, Diamondhead Inn and Suites, Diamondhead, Miss. Called "the most important small-scale event in the U.S.," Diamondhead includes 24-hour steaming, a "flea market," seminars, a dealer room, a festive meal and extracurricular activities. Info: reshew_j@bellsouth.net; http://www.diamondhead.org/ Diamondhead Inn & Suites: (228) 255-1300.

Feb. 16-18, 2013 — 16th Annual Winter Meet, Electric City Trolley Station & Museum, Scranton, Pa. Two tracks in G-gauge and 0-gauge sponsored by the Pennsylvania Garden Railway Society, Warrior Run Loco Works, Aikenback Live Steamers and Wyoming Valley Live Steamers. Info: wrunloco@aol.com or call Clem O'Jevich (570) 735-5570.

April 25-28, 2013 — Spring Steamup, Staver Locomotive, Portland, Ore. Info: http://www.staverlocomotive.com.

June 5-9, 2013 — National Garden Railway Convention, Great Wolf Lodge, Mason, Ohio. Live-steam track available 24/7. Clinics, demonstrations, tours, dealer room. Info: http://www.2013ngrc.com/.

July 17-21, 2013 — National Summer Steamup, Lions Gate Hotel, McClellan, Calif. New venue for steam hall; multiple layouts, more than a dozen loops. Info: http://www.summersteamup.com/.

Aug. 28-31, 2013 — 33rd Narrow Gauge Convention, Hilton Hotel, Pasadena, Calif. Info: http://www.33rdnngc.com.

Regular steamups

Greater Baton Rouge Model Railroad Club Open House and Gauge One Steamup. Info: Ted Powell, (225) 236-2718 (cell), (225) 654-3615 (home), powell876@hotmail.com.

Michigan Small Scale Live Steamers (MSSLS). Info: http://www.mssls.info/.

Puget Sound Garden Railway Society. Two steamups per month, one at the Georgetown Powerplant in Seattle on the second Saturday and a steamup at a member's track on the fourth Saturday. Info: http://psgrs.org/livesteamtimetable.html.

Southern California Steamers: Contact Jim Gabelich for dates, places and other pertinent information. (310) 373-3096. jfgabelich@msn.com.

Upstate N.Y. Steamers. Several steamups per year in various locations around Western New York. Info: http://www.tinyurl.com/upstatesteamers.

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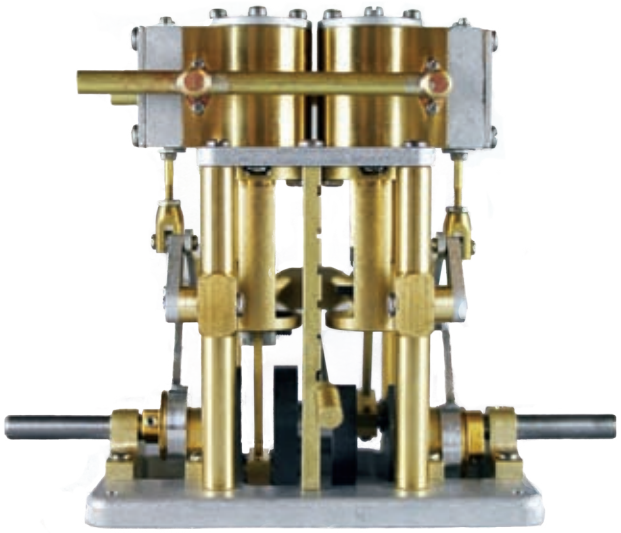
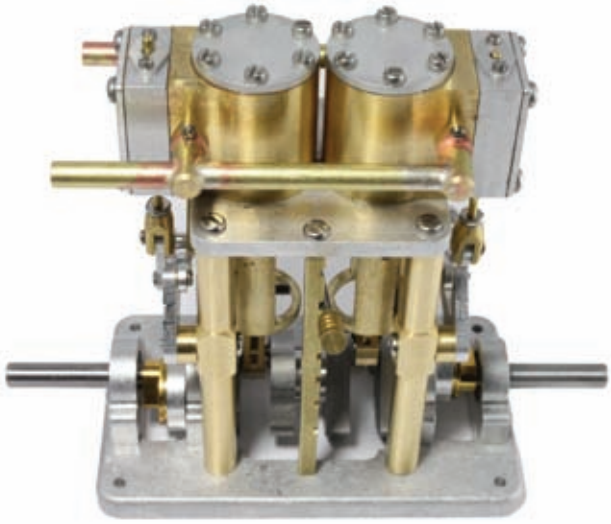
Fully Machined Steam Engine Kits



TVR1A

Ready to assemble steam engine kit: $245
Fully Assembled and Tested: $350
Includes all hardware
Double acting, twin cylinder
Hackworth reversing gear
Includes full-color assembly manual
Dimensions:
Base: 3.000" x 1.844"
Crankshaft end-to-end: 4.344"
Height: 3.375"
Weight: 327 g



TVR1ABB

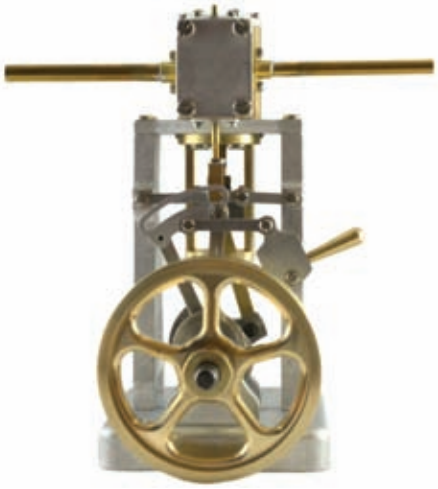
Ready to assemble steam engine kit: $295
Fully assembled and tested: $400
Includes all hardware
SAME AS TVR1A but with shielded ball bearings
Includes full-color assembly manual
Dimensions: Same as TVR1A
Weight: 323 g

Flywheels for TVR1A / TVR1ABB

MFLY: $20
1 3/8" DIA
(Solid Marine)

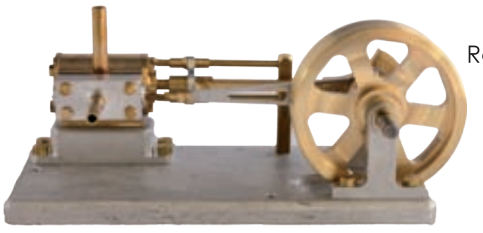
BFLY1: $25
1 3/4" DIA (5 Spoke)

BFLY2: $30
1 3/4" DIA (6 Spoke)



VR1A

Ready to assemble steam engine kit: $119
Fully Assembled and Tested: $175
Includes all hardware
1/2" bore, 1/2" stroke
Double acting, single cylinder
Reversing lever
Includes full-color assembly manual



HM1

Ready to assemble steam engine kit: $95
Fully Assembled and Tested: $145
Kit includes all hardware
.344" bore, .500" stroke
Double acting, single cylinder
Includes full-color assembly manual

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Arriving Soon **DRGW C-25**

The locomotive was nicknamed "Baby Mudhen" similar to a K-27 "Mudhen"

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If your passion demands 1/32-scale live steam models of highest precision, aesthetic presentation and prototypical functionality, look no further than Aster. All locomotives are designed and manufactured by Aster Hobby Co. Inc. of Yokohama, Japan.

SNCF 241P now going in production for summer 2013 release

This stunning four-cylinder compound model will be equipped for coal and alcohol firing. Cosmetic detailing and functional mechanical features are unparalleled, which will make this easily the finest European-type locomotive built by Aster. Available by advanced reservation only. A non-refundable deposit of $1000 is required. More details on our web site soon. Picture is of pilot model and is subject to minor changes.

New addition for your Union Pacific Challenger

Two of these auxilary water tenders are in use today behind Challenger 3985 and FEF 884 on all UP excursion trips. In collaboration with Aster Hobby USA, Aster Japan is designing a functional model featuring a removable water connection, fitting any late Aster U.S. type locomotive tender equipped with a drain plug. The water tank car will be made available as RTR in UP colors as shown, or black undecorated. Projected cost is $1500, depending upon the orders received. A $500 non-refundable deposit is required. Please contact Aster Hobby USA or your favored Aster dealer.

Great Northern S2 #2584

This superb-performing 4-8-4 is still available in glacier green kit form; RTR and black has sold out. Contact your Aster dealer today.

Narrow-gauge locomotives in 1/22 scale

Baldwin tank, Krauss tank, Lima Shay Available from stock

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Web: southernsteamtrains.com

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Sunset Valley Railroad
Bonney Lake WA 98391
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Web: svrronline.com

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Email: bob1027jane@aol.com

Gauge One Lines
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Email: gaugeonelines@yahoo.com

Bear Creek Railroad
Surrey British Columbia Canada
Tel.: 604 535 2454
Email: pantages@telus.net

ACCUCRAFT TRAINS
MUSEUM QUALITY BRASS MODELS

D&RGW K-37 2-8-2

1:20.3 Scale
Butane Fired, Live Steam
50 units

The K-37s were originally built as standard gauge 2-8-0s by Baldwin in 1902. Ten of these engine were converted to narrow gauge between 1928 to 1930 by the D&RGW. New chassis were created, and the boilers and tenders were used over again on the narrow gauge versions. D&RGW numbered these engines 490 to 499, and most survive today on display. These engines were not as popular as the K-36s. The reason for this was the K-36 was easier on the crews and the track as well. However in model form the K-37 is the largest locomotive that can be built in 1:20.3 scale. The huge boiler allows runs of well over an hour without ever injecting water. This new Live Steam version is also cross ported so that valve gear is in prototypical position for forward and reverse. This large model is extremely powerful, but unlike the prototype is very easy and rewarding to run.