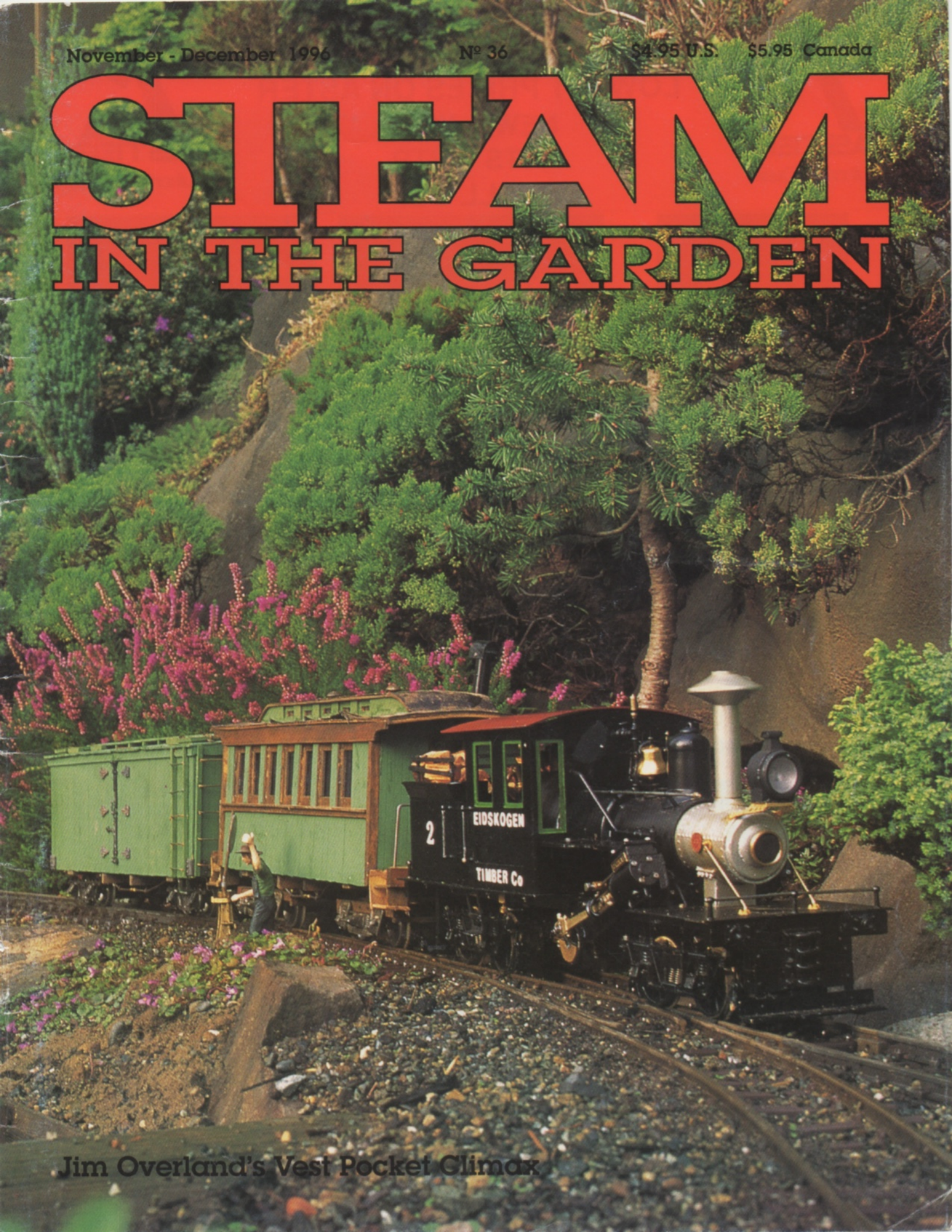
November - December 1996 Nº 36 $4.95 U.S. $5.95 Canada

STEAM IN THE GARDEN



Jim Overland's Vest Pocket Climax

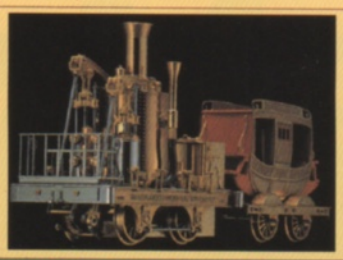
ASTER
Authorized Dealer

WORLD'S FINEST SMALL SCALE LIVE STEAM

LOWEST PRICES ON ASTER

NEW & USED
KITS & RTR
CALL US!

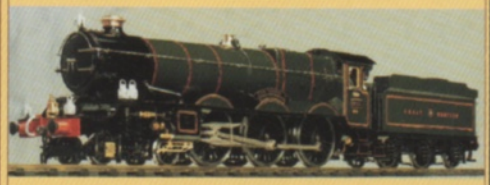
ASTER
Authorized Dealer



GRASSHOPPER

C&S MOGUL

PANNIER



KING GEORGE

STIRLING SINGLE

SNCF 232 U1

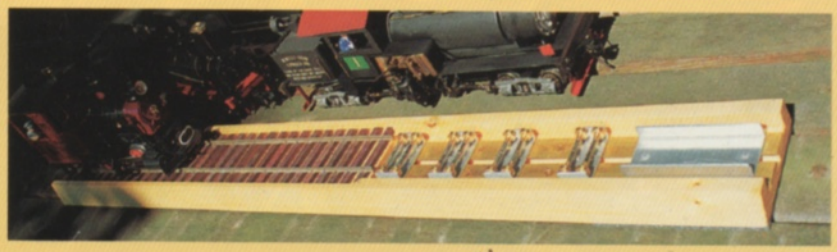
BR 96

T-3

BR 62

MANY OTHER MODELS CURRENTLY AVAILABLE

DIAMONDHEAD TWO HOUR VIDEO "THE NATIONAL GAUGE 1 STEAMUP" ● HI FI STEREO SOUND ● $29



LOCOMOTIVE TEST & OPERATING DISPLAY STANDS
for Live Steam & Electric
by Precision Mfg.
2, 3, 4, 6, 8 AXLE & CUSTOM UNITS
8-Axle holds Aster Big Boy & smaller locos
From $375

NO ANSWERING MACHINES HERE,
YOU GET A REAL PERSON WITH REAL INFORMATION

CALL

OR SEND FOR FURTHER INFORMATION

HYDE-OUT MOUNTAIN
LIVE STEAM
™

WE PAY SHIPPING!

Ohio res. add
6.5% sales tax

89060 New Rumley Road, Jewett, OH 43986 ◆ phone 614-946-6611

STEAM IN THE GARDEN

Vol. 6, Nº 6
Issue Nº 36
November/December 1996

Articles

Departments

ON THE COVER:

It's a hot, muggy afternoon in the Pacific Northwest, and everything is moving in slow motion. Eidskogen Timber Co. Climax Nº 2 rolls slowly through the points with the afternoon mixed train headed for Camp #2, while Knute stands perspiring by the switch stand. Vest Pocket Climax by High Noon Loco Works; really nifty railroad and modified Northeast Narrow Gauge rolling stock by Jim Overland. ***Photo by Jim Overland***

Captions for Steam Scene, page 27:

Top: The change of seasons to Autumn offers a pleasant outing for the passengers riding behind "Ladybug". Polished and gleaming for the annual event, Jenifer McDonald's English-style Cricket returns from a run through the lush valleys on the Unicorn Mountain railway.

Bottom: An Aster Bayern S 2/6 percolates in the Italian sunshine. As soon as the safety valve lifts to signal that it's ready, a consist will be attached for the morning run. This is just one of the many locomotives that appear on the Italian circuit each year in Valtopina.

Photos by Scott McDonald

Publisher/Editor
Ron Brown

Faithful Assistant
Marie Brown

Graphics Director
Harry Wade

CAD (and other) drawings in this issue by:
Harry Wade, Larry Bangham,
Jerry Barnes & Ron Brown

Contributing Editors

Larry Bangham	California
Crankpin	The South
Rich Chiodo	New Hampshire
Tag Gorton	England
Peter Jones	Wales
Joe Leccese	Massachusetts
Marc Horovitz	Colorado
Kevin O'Connor	California
Mel Ridley	England
Gene Rutkowski	Washington
John Wenlock	Wales

Steam in the Garden (USPS 011-885, ISSN 1078-859x) is published bimonthly for $27.00 ($34.00 Canadian, $35.00 overseas) per year (6 issues) by Steamchest Publications, PO Box 335, 6629 SR 38, Newark Valley NY 13811. New subscriptions please allow 6 - 8 weeks for delivery (overseas via surface mail may take longer). Direct correspondence to P0 Box 335, Newark Valley NY 13811. Periodicals postage paid at Newark Valley, NY and an additional mailing office.

POSTMASTER: send form 3579 to Steamchest Publications, P0 Box 335, Newark Valley, NY 13811.

USA, Canadian and overseas subscriptions may be sent to **Steam in the Garden magazine, PO Box 335, Newark Valley, NY 13811. Phone, fax and e-mail subscriptions gladly accepted. We accept VISA, Discover and MasterCard.**

In the U.K., contact Brandbright Ltd., The Old School, Cromer Road, Bodham, Near Holt, Norfolk NR25 6QG — phone 01263 588 755 FAX 01263 588 424

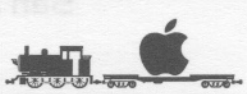
In Australia, contact RCS, PO Box 1118, Bayswater, Victoria 3153 AUSTRALIA — phone/fax (03) 97 62 77 85

Items for review may be mailed to P0 Box 335, Newark Valley, NY 13811—or sent via UPS or FEDEX to 6629 SR 38, Newark Valley, NY 13811.

Questions or comments? Call us Mon. - Fri. at 607-642-8119 before 9:00 p.m. Eastern time, please...or FAX us any time at 607-642-8978. e-mail address: docsteam@servtech.com

Our web site, ***Steam in the Garden Online***, is located at: <http://www.steamup.com>.

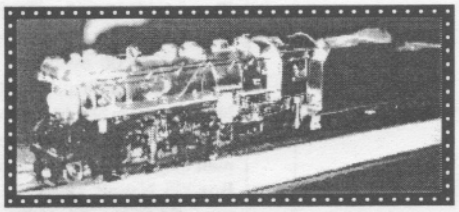
This publication is created on Apple Macintosh™ computers.



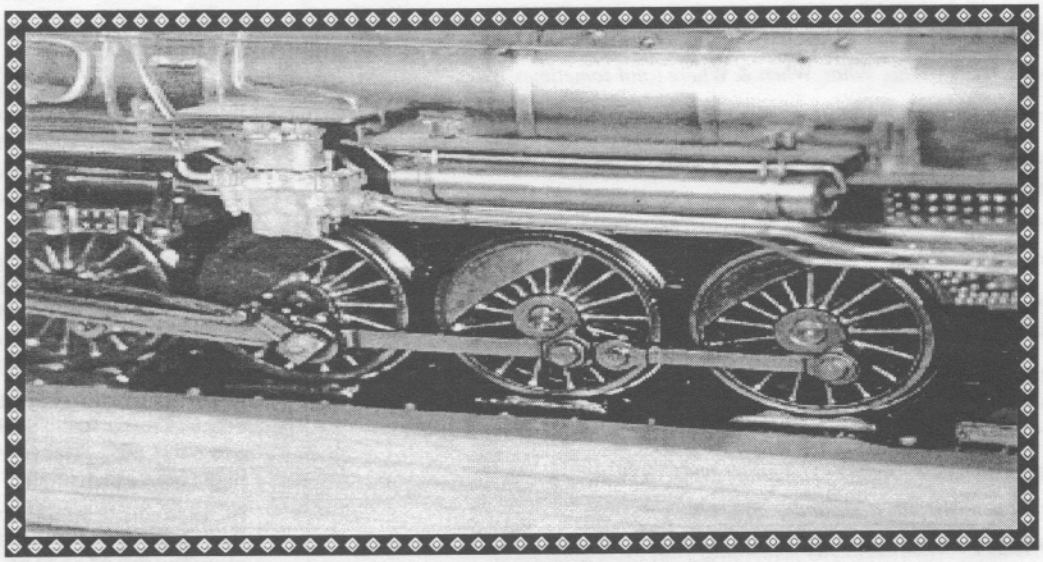
BLOW OFF SOME STEAM!

NOW! G-SCALE & NO. 1 STEAM ENTHUSIASTS CAN RUN THEIR LOCOMOTIVES AT *ANY* SPEED!

LIVE STEAM OR ELECTRIC!



Available for over 20 years in HO,HON3, O-27 & "O" scale. Please phone, write or fax for prices and brochures.

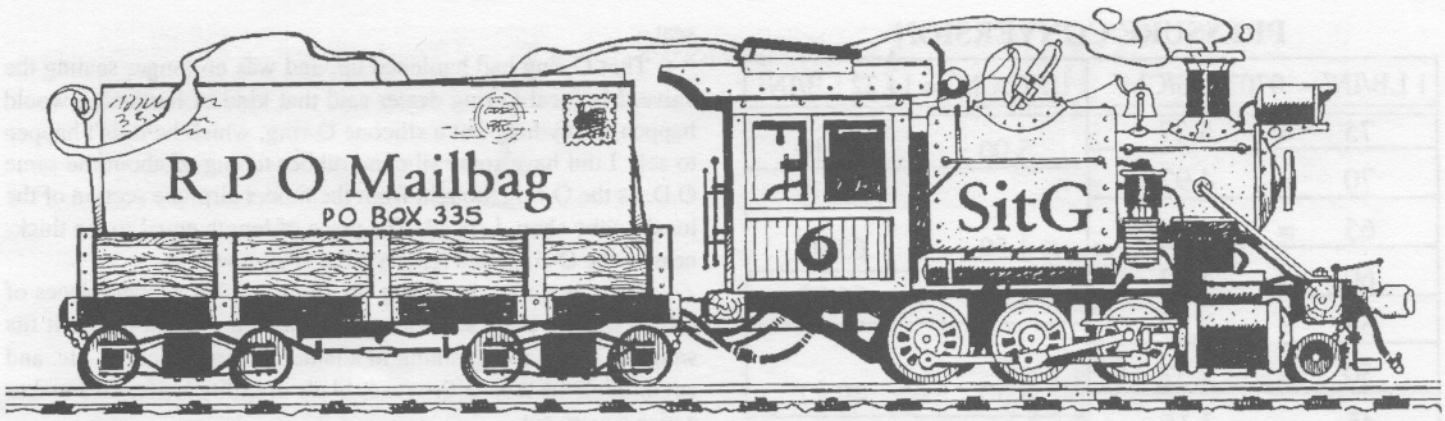


PRECISION MFG CO PRESENTS FACTORY FRESH 1997 LOCOMOTIVE TEST UNITS

(210) 648-3170 FAX (210) 648-7401

PRECISION MFG. CO.
4546 Sinclair Road
San Antonio. TX 78222

AUTHORIZED DEALER
HYDE OUT MOUNTAIN
89060 New Rumley Road
Jewett, OH 43986
(614) 946-6611



Letters from readers are welcomed and encouraged. Offer advice, encouragement, suggestions or constructive criticism. Tell us about your current project (and don't forget the photos!) or just share live steam experiences. But please keep your letters to a reasonable length so everyone has a chance to use this forum. Some letters may be edited for length or clarity. Send your letters & photos to: SitG, Dept. RPO, P.O. Box 335, Newark Valley, NY 13811, USA.

* * * * *

Sacramento, California

Dear Editor,

Here's an excerpt from a letter I sent in response to a recent inquiry, which I thought might be worth sharing with SitG readers and fellow steamers.

We all know that as the fuel tank's temperature an pressure equation loses value (drops), the burner starts to lose power and produces less heat/temperature. Most of us assume that this phenomena is due to not enough fuel reaching the burner. I say "Not so!" The real reason is that there is not enough ***air*** reaching the burner, and that in fact the burner is running rich, and that is why it finally extinguishes itself and won't relight – lack of oxygen.

Here is my theory. The first part of the burner is the mixing chamber. Gaseous fuel at the proper pressure is forced through an orifice, typically .005" to .010" in diameter, into the mixing chamber. This action of the high velocity gas causes a low pressure area to be formed in the mixing chamber, thus drawing air in through the side holes. The gas and air combine into a combustible mixture and are propelled forward into the combustion chamber, where they are burned – either completely or incompletely. When the velocity of the gas passing through the orifice drops below an unknown value due to the cooling of the fuel tank, it lacks sufficient energy to draw in the proper amount of air to support combustion, and so the flame dies.

Sincerely,
Kevin O'Connor

Somewhere in the South of ??

Dear Mr. Editor,

Having spent my life thus far deeply and continuously immersed in the arts and sciences of shop and steam, I have no difficulty navigating my way around those areas. Now, in order to more completely enjoy the fruits of my labors, I contemplate the construction of a bit of trackage and find that this is an area in which I am relatively uninformed. Do you think that one of our old hands would kindly write an article on the black art of track construction?

Many things about this will be self-evident to the bright lad, but many will not. I am specifically interested in learning about the curving, assembly, and proper laying of any one of the several extruded rail and plastic tie strip systems. Something tells me that a spoonful of well-founded advice taken now will save headaches along the line.

Respectfully yours,
Crankpin

There are certainly a great many good methods, and even more opinions on how to deal with tracklaying, and I'm sure that one or more of our readers will come to your rescue. We have received many pleas for help on this subject, and have published some articles on it in the past. We have promises of at least two more articles on the subject and would be happy to hear from anyone who is interested in seeing to it that our good and faithful contributing editor is set on the right path the first time around. - ed.

La Mirada, California

Dear Ron,

I have made a few changes to the Harmonic Whistle (SitG #35) to improve the performance. If those interested in building a whistle will contact me, I will explain the changes and/or send them a new print.

Also enclosed is a pressure conversion chart. It seems that every time I want this type of information I have to convertf from Dynes or Pascals to get into the proper units. So I made a handy reference chart (really an excuse to use my new computer). Maybe some of our steamy-type engineers will find this useful.

Best regards,
Larry Bangham
15058 Tricia Lane
La Mirada CA 90638

PRESSURE CONVERSION

$1\ LB/IN^2 = .0703\ KG/CM^2$			$1\ KG/CM^2 = 14.22\ LB/IN^2$		
75	=	5.27	5.00	=	71.10
70	=	4.92			
65	=	4.57	4.50	=	63.99
60	=	4.22	4.00	=	56.88
55	=	3.87			
50	=	3.52	3.50	=	49.77
45	=	3.16	3.00	=	42.66
40	=	2.81	2.50	=	35.55
35	=	2.46			
30	=	2.11	2.00	=	28.44
25	=	1.76	1.50	=	21.33
20	=	1.41			
15	=	1.05	1.00	=	14.22
.10	=	.70	.50	=	7.11
5	=	.35			
$1\ LB/IN^2$		KG/CM^2	$1\ KG/CM^2$		LB/IN^2

Auckland, New Zealand

Dear Ron and Marie,

ARISE - SIR LARRY

I am brand new to live steam. In fact, my first locomotive is only scheduled for production by Roundhouse Engineering during November. Still, this does not mean that I do not recognise an interesting article when I see one.

I very much enjoyed Kevin O'Connor's "What is the best fuel." And as to Larry Bangham's "Alternative fuel....." and "The Harmonic Steam Whistle", there is only one word – SUPERB.

If Larry were a Brit, no doubt he would be knighted.

Great stuff, thank you.

Yours sincerely,
Bert Wettenschwiler

Florence, Massachusetts

Hi Ron,

Here's a quick fix to pass on to your readers. My Hyde-Out Mountain Shay had been behaving sluggishly of late. With a spitting safety valve indicating a full head of steam, it would hardly pull two cars up my hill. Water consumption seemed to be higher than I'd remembered it, too.

Eventually, I got around to looking at the safety valve...the same type used on Mamods: a metal button is pulled down by a spring, an O-ring forms the seal between the button and the valve seat.

That O-ring had hardened up, and was no longer sealing the valve. My local O-ring dealer said that kind of hardening would happen to anything but a silicone O-ring, which he didn't happen to sell. I did have some silicone rubber tubing of about the same O.D. as the O-ring, bought from the model airplane section of the local hobby shop. I sliced off a piece of length equal to the thickness of the O-ring, and replaced the O-ring with it.

There is a trick to slicing off short, washer shaped pieces of rubber tubing. Put a short length of tube on a metal rod so it fits snugly. Get the rod spinning in a lathe, drilling machine, etc. and cut through the tube with a razor blade or utility knife. This makes a nice square cut.

The valve now seals, and allows the boiler pressure to rise to its full level before releasing steam, and the Shay pulls trains up the hill again.

Bill Kaiser

Carrollton, Texas

Dear Ron,

What a great issue (SitG #35)! I have met several of this issue's contributors at Diamondhead and they are a wonderful group. They have been very willing to share their experiences and knowledge with the not-so-endowed (i.e. me!)

I wanted to add something to Mel Ridley's prototype and specifications. According to Taber and Casler in *Climax – An Unusual Steam Locomotive*, Construction number 407 was a 20 ton locomotive. Also, the normal overall gear ratio was 3:1, giving a top speed of about 15 miles per hour, with an optional 2.6:1 ratio for extra speed. Mel stated that he used the same logic to come to his 2:1 ratio. Another case of small scale live steam being just a minature of the real thing!! Isn't this a wonderful hobby!!!!!

For those wanting more information, check out the *Narrow Gauge and Short Line Gazette*, July/Aug 1986, for an article and drawing on a 20 ton Climax that looks almost identical to C/N 407. Also, look in the February 1985 *Railroad Model Craftsman*.

Best Regards,
Dan Fuller

Swarthmore, Pennsylvania

Dear Ron,

That was a bumper issue we just received. Congratulations.

I have a couple of comments. The first please pass on to Crankpin. In the comparatively small diameter bores our scales often require us to bore, the "D" bit has long been favoured, and recommended, by such experts as LBSC and Eddie Cooke. I think it deserves a mention.

The second comment concerns the article on steam whistles. This type of whistle can be found in textbooks on sound as the Helmholtz Resonator. The Helmholtz Resonator phenomenon accounts for the tiny human vocal chord being able to produce a bass voice note equivalent to a 10' long organ pipe.

The factors determining the pitch are actually a little simpler than Larry deduced from his test program. The pitch depends on the **volume** of the Resonator (chime tube) rather than any of its linear dimensions, and on the diameter and length of the Neck (supply tube). Mathematically the relationship is:

$$\text{Pitch} = \text{Constant} \times \sqrt{\frac{\text{Cross section area of Neck}}{\text{Length of Neck}} \times \frac{1}{\text{Resonator Volume}}}$$

The constant is: $\frac{\text{Velocity of Sound in the gas used}}{2\pi}$

So the pitch may be lowered by reducing the Neck diameter, increasing the Neck length, or increasing the Resonator volume. The Resonator can be any shape, and increasing any dimension will lower the pitch. It may be most space effective to make it a rectangular box.

My regards to all in the Editorial Offices,
Murray Wilson

Crankpin had the following response to Murray's note about D-bits.....

"Murray Wilson has raised a valid point in calling our attention to the D-bit, which is more familiar and more frequently used in the UK than in the U.S. This is a very useful and simple to make cutting tool, which will cut a very straight and round hole when properly made. The results obtained are very much dependent upon the skill of the user. In my own experience, I use the D-bit as a form of reamer and, like other reamers, if well made and properly used, it will produce a decent cylinder bore. However, many times D-bits are not properly made nor used and, although the bores made by them will usually be round and straight, more often than not they will require additional finishing to make them really smooth."

Grand Rapids, Michigan

Dear Editor,

I have been interested in building gauge 1 steam locos for many years. I did not pursue this interest because our property is unsuitable for a proper outdoor layout. While looking through some issues of your magazine, I came upon pictures of the Diamondhead track, and decided to build an oval of elevated track to fit inside my garage, and which can be set up whenever desired. The end result is an oval 10' x 18' with a 5' radius and elevated to 42".

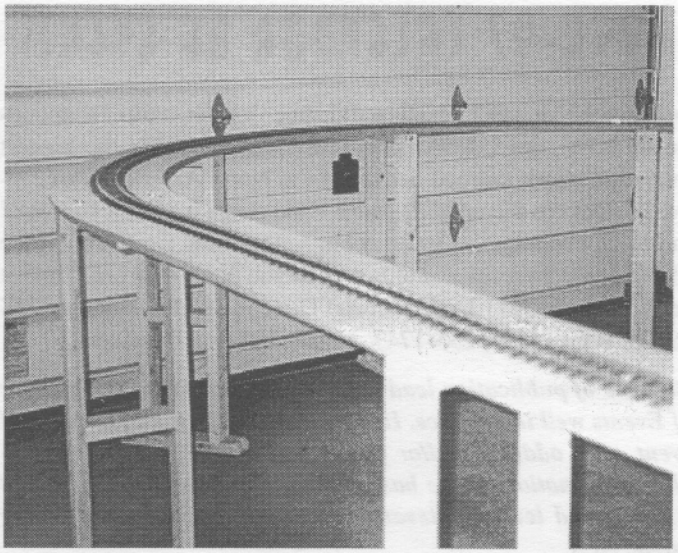
The track supports are built of 2x4's, glued and screwed at the joints. Overall height is 41", 12" wide with an 18" foot for stability.

The track base is 3/4" plywood. By laying out the curves across the plywood, 4 arcs and 2 straight sections can be cut from one sheet. Because 4 arcs do not complete a half circle of 5' radius, an additional short arc had to be added to the front straight sections.

The trackbed is fastened to the uprights with 1/4" bolts, and blind nuts are installed under the top crossmembers of the supports.

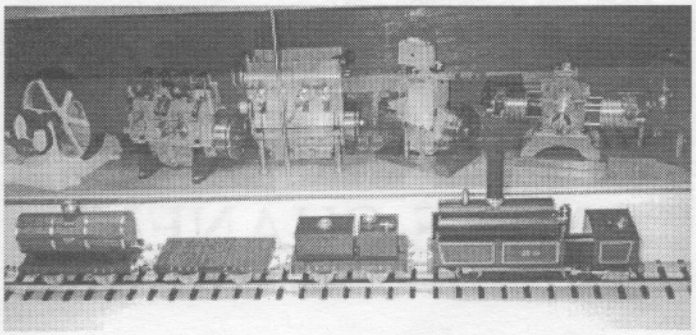
Sunset Valley track was installed with screws on the centerline of the trackbed. The rails must be pre-bent. No rail joiners are used. This track was purchased from Sulphur Springs Steam Models Ltd. This company also rents an excellent rail bender for a small charge.

The top of the trackbed is painted to protect it from water and oil drips, and a cutout is provided to serve as a steaming area.

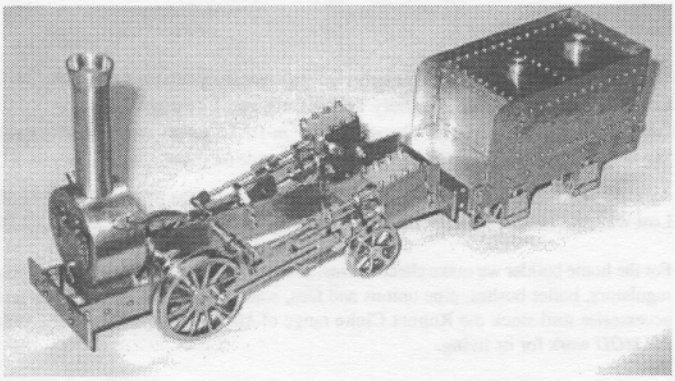


Although not ideal, this layout requires only 30 minutes to set up, is maintenance free, can be used in any weather and is at a comfortable operating height.

Enclosed are some photos of my beginning efforts at scratch building. The completed engine uses oscillating cylinders controlled by a rotary valve. The pot boiler ***(photo below)*** is encased within 2 jackets with 1/4" insulation between them. Running time is 20 minutes, during which time it travels 1/2 mile.



The incomplete engine ***(photo below)*** is based on a photo of "RAINHILL" found in an old *Model Engineer* magazine.



Sincerely,
Richard Schnur

Beautiful workmanship, Richard. And judging by the fine quality of your locomotives and the models in the glass case behind your pot boiler, you're no stranger to the workshop! - ed.

1996-97 CALENDAR OF EVENTS

January 17-19, 1997 – National Gauge One Steamup, Diamondhead, Mississippi, USA. Don't miss this one....it's the biggest miniature steam railroad convention in North America! Three elevated tracks to accomodate gauge 1 and gauge 0 – Clinics – Round the clock steaming – Dealer room – Attendees from around the globe! Make your reservations now so you don't miss out. Contact Jerry Reshew, 5411 Diamondhead Drive East, Diamondhead MS 39525. Phone (601) 255-1747, e-mail: JReshew@aol.com.

Because of publication lead time, please send info for Calendar of Events well in advance. Include name of host and location of event, with address and/or phone number to contact for complete information. Some basic info about the site is also useful (i.e., ground level or elevated, minimum curve radius, ruling grade, etc.)

WHAT'S NEW?

Llagas Creek makes tracks! Llagas Creek has a new home at DoodleBug Hobbies Ltd., Dept. LC, 106 3rd Street, San Juan Bautista CA 95045, phone 408-623-1088 – fax 408-623-9162 – e-mail: doodlebug@pnet.net. Doodlebug Hobbies will offer full display and point of sale for all Llagas Creek products, as well as full service world wide mail order and customer service. Hours will be 10 AM to 6 PM Wednesday through Sunday. The new location also offers increased production capacity. Doodlebug Hobbies is located in the historic Mission town of San Juan Bautista, 37 miles south of San Jose, California.

Brandbright Limited of the United Kingdom, The Old School, Cromer Rd, Bodham, Holt, Norfolk, NR25 6QG, United Kingdom, phone 01263 588755 – Fax 01263 588424 – e-mail: brandbright@paston.co.uk, have new representation in the United States. Mike O'Rourke of Berkeley Locomotive Works is now concentrating on his own produced products and Brandbright wish him well and continue to represent BLW within the U.K. Therefore, Brandbright have appointed two new agencies, one on the west coast and one in the east. In California, Mike Martin of **Mike's Railway Supply Co.** represents Brandbright Limited. Mike is an enthusiastic model steamer and an active member of the Bay Area Steam Group. His address is: **1461 Sierra Street, Redwood City CA 94601 – Phone or Fax (415) 361-8114 – e-mail: mike_rsc@msn.com**.

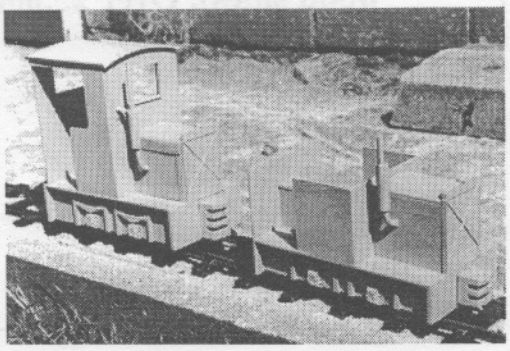
In the east, **Scott and Jenifer McDonald** are flying the Brandbright flag. Well known for their super diesels, being the proprietors of Potomac Steam Industries they are often to be caught running real steam! Their address is: **5595 Saint Charles Drive, Dale City VA 22193-3503 – Phone (703) 680-1955 – Fax (703) 590-9399 – e-mail: diesel@erols.com**. Both Mike Martin and the McDonalds offer the complete Brandbright range - steam locomotives through to figures and detailing parts in both American and European styles.

LGB of America, 6444 Nancy Ridge Drive, San Diego CA 92121 – phone 800-669-0607 – e-mail: LGBinfo@aol.com, have announced that its all-new 40770 Disconnect Logging Trucks are now available. Each package includes six twin-axle trucks and drawbars to make three complete log cars. Each truck is complete with log cradles, tie-down chains and link-and-pin couplers. A pair of standard LGB hook-and-loop couplers are included for connecting the trucks to other LGB rolling stock. To find an LGB Authorized Retailer or Authorized Train Stop near you, call LGB of America at their toll-free number.

Ozark Miniatures will have completed the move to their new location by the time you read this. Their new address is **Dept. RB, PO Box 107, De Soto MO 63020, and their new Fax number is 314-586-2480.** Our friends at Ozark Miniatures are constantly coming out with new detail parts and kits to dress up your locomotives, rolling stock and structures. Latest and greatest from them is a new line of detail parts in 1:20 scale for accurate detailing of narrow gauge railroads. Check out their ad in this issue and send for a catalog. Nothing brings a model to life like the **details!**

Kevin O'Connor's S Street Unit Shops, PO Box 161631, Sacramento CA 95816-1631, phone/fax (916) 447-5433, has developed a pressure gauge siphon for the popular Brandbright JANE locomotive. The advantage to this method of pressure gauge installation is that it does not require a silver soldering intrusion to the boiler. The siphon is neatly built and easily installed by removing the safety valve, placing the siphon banjo on top of the steam turret and reinstalling the safety valve. Plumbers pipe joint paste or the more conventional red fibre washers can be used to seal the banjo joint. Before installing the siphon, it is necessary to acquire a miniature pressure gauge (available from S Street Unit Shops) and solder the gland on the end of the copper siphon tube. This is a simple task that can be easily accomplished by anyone with the most basic soldering skills. We installed the sample siphon and pressure gauge on our JANE loco in just a few minutes. One note of warning.....before soldering the pressure gauge gland on the siphon tube, be sure that the gland nut is placed on the tube first! We must confess to having made that mistake more than once. Yes, you can run a locomotive without a pressure gauge, but it is an excellent diagnostic tool, and it really dresses up the look of the cab. A neat touch is the cute copper wire support on the siphon tube. We are well pleased with this aftermarket addition to a fine little locomotive, and we recommend it highly.

Westlake Publishing Company, 1574 Kerryglen Street, Westlake Village CA 91361 announces, beginning with the December 1996/January 1997 issue, ***Outdoor Railroader*** will change its name to ***Finescale Railroader.*** The publisher maintains that for years it has been the only magazine to treat large scale trains as *model* trains and, in the process, has become the hobby's leading large scale publication. The stunning photography, unsurpassed coverage of realistic indoor and outdoor large scale model building, layout building, scenery, prototype plans and articles, and top-notch product reviews will remain unchanged. But now, where appropriate, coverage has expanded to include the very best modeling in *every* scale down to, and including, HO. ***Finescale Railroader*** comes out bimonthly in February, April, June, August, October and December. For subscription information phone (818) 991-1479.



Doubleheader Productions, 3725 Pageant Place, Dallas TX 75244 - phone/fax (972) 247-1208, e-mail <dblhdr@iadfw.net>, has announced an addition to their line of model locomotives. "Huddy" is a battery powered industrial style locomotive built to 16mm=1 foot scale, also known as SM32, by JD Models of England. The prototype for this model was built in 1941 by Hudson Hunslet as an internal combustion locomotive for the English

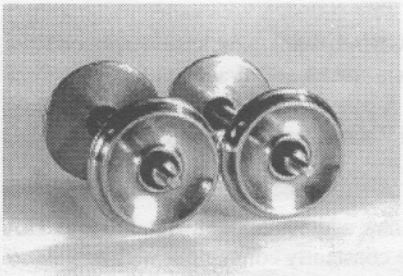
Ministry of Supply. Huddy can be ordered in full-cab or open-cab versions (see photo). Doubleheader Productions specializes in imported locomotives, rolling stock and track for SM32 modeling. They represent JD Models, Wrightscale, Roundhouse, Binnie Engineering, Saltford Models, Phoenix Figures and Jon's Models among others. In addition, they also represent Alan Keef Ltd., manufacturer of full-size (yes, 12"=1' scale) industrial and leisure railway locomotives and rolling stock for track gauges from 15" to standard gauge. Contact Doubleheader by phone, fax, e-mail or snail mail for more information. Or check it out on their web site at <http://web2.airmail.net/dblhdr>.

ECO Works, PO Box 9361, Wyoming MI 49509 - phone (616) 243-2893 or fax (616) 243-0732, now accepts Master Card & Visa on all video purchases. In addition to their 1996 Diamondhead National Steamup video, they now have five other railroad videos. Contact ECO Works for details and pricing.

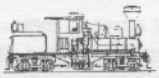
If you have an Internet connection, check out Vance Bass's web site for small-scale steamers, **Small Scale Live Steam Resources and Frequently Asked Questions**. The URL (address) is <http://www.indirect.com/www/vrbass/steamfaq.htm> Vance has done a super job on this site, and he has included links to many other great steam sites. Well worth your time to take a look. Vance asked me to mention that he has a new e-mail address <vrbass@pop.nmia.com>, so if he's in your nickname file it's time to make a change.

Steam 'n' Stuff, 11996 Gast Road, Bridgman MI 49106 - phone (616) 426-3596 or fax (616) 426-8907, announces RHONDA, a new steam motor designed specifically for Shay locomotives. Plans and instructions are available now, and a factory-built motor will be available soon. If there is enough interest (which will be gauged by letters, phone calls and faxes to the builder), a factory-built Shay will be introduced.

For those of you who would like to build a **Vest Pocket Climax**, but don't have the machine tools or the skills to do the necessary machine work, Ed Warren at Steam 'n' Stuff is also accepting orders for machine work on the Vest Pocket Climax castings. Give Ed a call for more information and pricing.



Gary Raymond Quality Large Scale Metal Wheelsets, PO Box 1722, Thousand Oaks CA 91358, announces that in addition to his Dual Ball Bearing Wheelsets, he is now shipping Single Ball Bearing Wheelsets. According to the manufacturer, these outroll other manufacturers dual ball bearing wheelsets, but are more economical. They are designed for those wishing to outfit entire trains with minimum rolling resistance. The cost for is $9.95 per axle, and the part number is G26RH. These wheelsets have a Patent Pending and carry a lifetime guarantee to maintain gauge. The wheelsets are available through local dealers or direct from Gary Raymond at the address above.



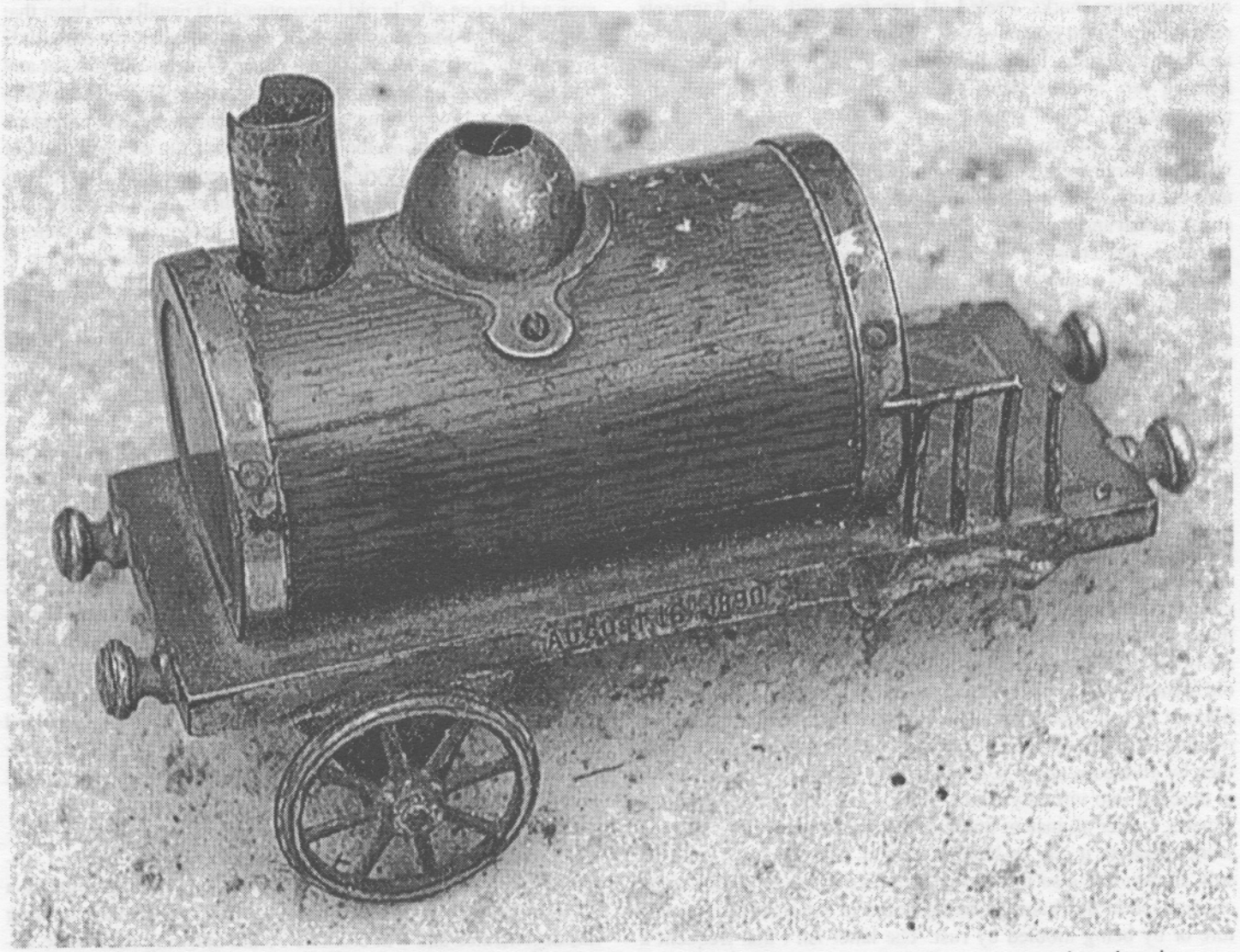
GAZING INTO THE FIRE

by Peter Jones

Conservation

It may be that you will encounter a Vintage locomotive in your travels. If it is in superb condition you may well not be able to afford it. But there is a chance that some wreck may come your way at a reasonable price. The worse the condition, the cheaper it is. Armed with this new object, you have to do a balancing act. You have to weigh up how rare it is, how historic it is (not always the same thing), if you want it as a precious object and how much you want to make it a runner.

Let's start with the definition. To ***conserve*** something means to secure the existing condition of the object against further deterioration. To ***restore*** it means (approximately) to bring it back to as new condition. It is everyone's duty not to destroy irrecoverable information. If you have a Lionel locomotive of moderate age, you may well conclude that a large number of similar models are in existence and you can improve it for better running or appearance. You will kill off its full collecting value but you have the pleasure



"Little Charlie" A silver and mahogany presentation piece dating from 1890. There is much to be done. The replacement wheels will be to 45mm gauge.

Photo by Peter Jones

of seeing it run in your garden. Indeed, something may be so wrecked that it is only worth cannibalizing for parts. You have to ask yourself 'at what stage does an original lose its originality ?' A typical example might be a model where the wheels were made of an alloy that decomposed over the decades. It makes sense to replace the wheels with a modern material.

As a rough guide, for an historic model, it would be acceptable to arrest any rusting or oxidizing. Ideally this should be done by reducing the oxides back to original state rather than by abrasion. You could legitimately run a wire cup onto a steel axle, but for the rusty corner of a piece of printed plate, chemical reduction is better (if you have access to an electrolytic bath, so much the better, but few have). Whatever you do, though, if your model is rare, document it as you go. Photograph it in its original state. Get some oil on it immediately. Further first aid might include treatment for woodworm. If something has been in salt water, get it into fresh water as soon as possible. You might also see the bluey-green traces of old solder flux eating into the metal. Warm soapy water and a toothbrush are the simplest answer.

As you work on the model, always keep a close eye open for any interesting marks. Peeled off transfers, with only fragments remaining, should be drawn out. For embossed marks, I often try and take a rubbing. If you photograph the model, try making the lighting very oblique. Above all, when in doubt about stripping any paint off.....DON'T!!!!!

Suppose you have a wood toy from the 19th century; it may well have large areas of paint worn away.... I would be inclined to treat the bare wood with a transparent preservative, give the model a wax polish and then keep it away from central heating and other extremes. But a tinplate loco from, say, 60 years ago might well be considered as a candidate for running. During any dismantling it would be important to treat the nuts and bolts with care. They are the originals, after all, and I might run taps and dies over to clean them up – particularly in the case of square nuts.

There is a chance, however, that they will be of obscure origin, with a thread totally unknown. Then it is a question of doing the best you can. Replace with modern nuts if you have to, but hate yourself for doing so.

Where rust has damaged platework, you can repaint it of course. But, after treating the rust, I like to kind of 'stain' the rust area with suitable paint. I put some enamel paint on a cloth and wipe it over the area. On clean painted surfaces it wipes off, but clings to the rough parts. This somehow seems a lot more ethical than respraying the entire loco. Springs for clockwork mechanisms are often a problem – frequently they are broken. Think about the old spring as you would an aeroplane. It only has so many hours of life in it. If your loco is rare then be frugal with its winding up and running. If the model is a fairly common Bassett-Lowke or Romby, then by all means enjoy it. Actually, the subject of springs seems to descend into virtually Black Magic. But with apologies to the experts, I offer an instant guide in a couple of lines. Spring steel works because it can be held in tension. That means it can't be soft. In turn that also means that they like to break. They can be encouraged in this habit by being stored in extremes of temperature or by being nibbled by rust. The latter isn't that frequent a problem because the chances are that the spring will be coated with congealed black gunge that was once oil and dirt. When you first acquire an engine the chances are that you will fail to resist the urge to wind the mechanism up. If you must do it, just a little wind please...until you have had the chance to look at the spring. Ignoring any possible joke about spring cleaning, I reckon that warm olive oil is the kindest thing to use. That was what I was taught to use on old clocks and have stuck to it ever since. A mixture of this (or warm linseed oil perhaps) combined with the attentions of a scalpel blade, is the most humane method of cleaning a spring. When it is dry and clean, it wants to be lightly oiled. A rust inhibiting oil makes sense, but I have a personal preference for a teflon based grease. There haven't been enough years to prove it thoroughly yet, but I have a feeling that it will make the restorer's job easier in another 60 years time.

That word – ***restore*** – meaning to bring it back to original condition; it used to be museum practice to restore things to shiny new. Now the tendency is to aim to get a good used finish. The main exception to this is full size locos and similar hardware – these are inevitably shining like jewels. Just occasionally I would like to see a dirty loco depot with a couple of rusting broken-down hulks inside, amid the spider's webs and dripping oil. But that is a personal fantasy reserved for nights when I can't get to sleep.

Old electric mechanisms come in two varieties - the very common and the one offs. In old locomotives it is usually the latter that we deal with. Fortunately, the older the mechanism, the easier it is to work on. Everything was great chunks of iron and big nut and bolt assembly. The first thing to fail are the brushes. The carbon tips wear out. If you are lucky, it can sometimes be easy to replace them by dint of cutting the right size piece out of larger bits of carbon, or whatever. Springs are easily replaced. If a motor has worn its brushes out, then there is sometimes a risk of a damaged commutator. This can often be fixed by spinning in the lathe to clean up the scratches and the gouges. But the main problem is often burnt out windings. With a really old model, to a largish scale, you can rewind the motor yourself, even if you have never tackled it before. But there are companies that specialize in rewinds. If you want to use one, don't strip off the old windings before you send it off. They will want to know about number of turns and wire thickness, whatever.

Now all this is leading up to the problems of old steam locos. Here we really should take things more seriously. If the model is an early glass case model, then little need be done. But if you have an unknown engine that you want to restore to steam, then a bit of care is called for. The same rule about having a minute examination holds good. Don't steam the loco at this stage. Look for clues - like dribble stains. Often you will encounter the result of electrolytic action where dissimilar metals of boiler and bush, for example, have caused a breakdown. This may be hidden by a big blob of solder that has been a temporary repair. If you can, unscrew the safety valve. Examine it to make sure it isn't welded shut. If you can, replace the existing spring by a much weaker one for now. The rule about documenting everything as you go still holds good.

The cylinder and motion will probably be very sloppy – especially in the case of oscillating cylinders. But you may be surprised to discover that the thing will still work, although often in a cloud of steam. If your luck is really out you may find that a fitting has degenerated and will crumble before allowing itself to be unscrewed. Sometimes a couple of weeks soaking in Pepsi Cola will free it. But if it is a component under stress, then don't be happy to use it again. Whether you can unscrew it or whether you have had to drill it out, make a replacement component. It is legitimate to

replace mangled copper pipe - and use new unions rather than blobs of solder. A spirit tank may have accumulated gunge. Throw out the old wicks and rinse the spirit tank out.

It may well be worth turning (or getting turned) new pistons, and fitting them in reamed out cylinders, if repacking can't achieve steamtight conditions. The motionwork will probably be very sloppy. You should be prepared to fit bushes at the vital points - although in some cases there is the dodge of turning fatter pins. The loco will run whilst having very sloppy motion, but will offend the soul of an engineer. In extreme cases, slip eccentric gear is so loose that the loco can't be relied upon not to suddenly reverse itself.

A lightweight pot boiler in brass seems to have infinite life, but still treat it with suspicion. Simple pots rarely give trouble beyond an occasional weep. But in the larger scales you may have collapsed firetubes and leaks that are hard to repair. It would be all too easy for me to tell you to examine a boiler carefully before purchasing, but sometimes the problems are hidden. In a fairly modern model it would be legitimate to ask to see an engine in steam. If the loco is an old one, looking a bit rough, I wouldn't want to be near it at the time. I would purchase it solely on my examination and bear in mind that the boiler could – repeat could – give problems, and reflect this in offering price.

When you steam up an old pot boiler, you will damage the paintwork. If it has just been a respray, it will go quickly. If it is a properly baked on finish, it will take longer. Even stove enamelling will soot up. There is the dodge of burning a cleaner spirit like isopropyl alcohol, but it burns much hotter and you may go past the safety limit offered by elderly soft soldered construction. I can't give you an easy answer. If you want to keep it looking good then don't steam it. But it seems a shame never to see it in motion

Old coal fired boilers are, as they say, something else, and we will leave those for another time. So, let's sum up: Conservation should never destroy unless it really has to. Some replacement parts are legitimate. Strike a balance between historical rarity and your wish to run an engine. Above all, remember that you are only the custodian of your model during your lifetime. Try to hand it on in the best possible condition.

The Fitter's Bench

by Crankpin
drawings by Harry Wade

The Tailstock Die Holder

Thread cutting is a job that you will find you are called upon to do very often during the course of even the most elementary live steam project. Even though the largest percentage of threading work for us will typically be done by hand at the workbench, some of the most important and critical threading is done in the lathe. There we have available to us a choice of two commonly used methods of cutting a thread. The first of these is the traditional screwcutting feature, which I have described in a previous article, wherein a single point thread cutting tool is driven along the work by the leadscrew and the headstock gear train. The second method is to make use of a thread cutting die mounted in a holder of some sort. The tailstock dieholder illustrated in Fig. 1 is typical of such a dieholder and is a very useful and therefore important accessory which greatly extends the basic screwcutting capabilities of the average lathe. Although I have never heard of an instance where a dieholder was furnished with a new machine, the dieholder can almost always be found as a part of the tooling offered with used machines.

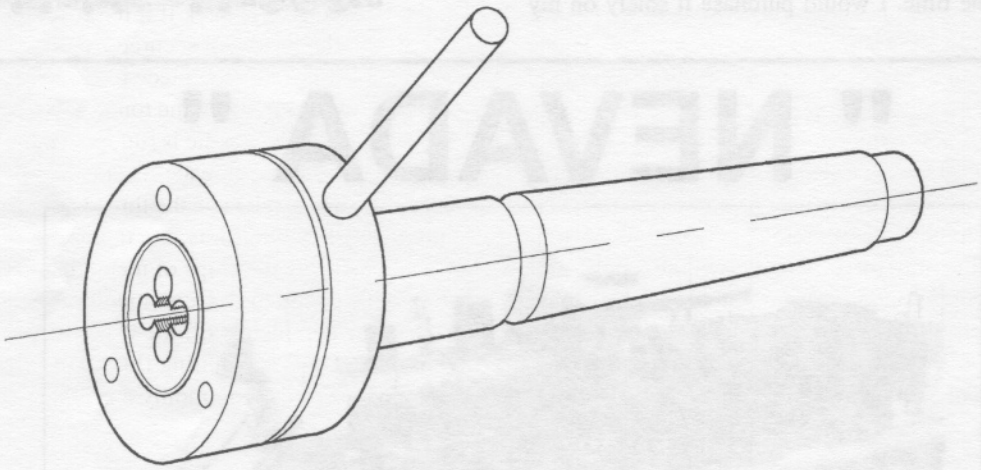


FIG 1: TAILSTOCK DIEHOLDER

When faced with a threading job for the lathe, we would of course like to choose the threading method that is best suited to the task at hand and which will produce the best overall results. Several factors should play a part in making your choice. We must consider the outside diameter of the thread to be cut, the size and power of the lathe at your disposal, the amount of time you wish to spend making the thread, and perhaps the material to be threaded. It would be unreasonable, for example, to ask a 90mm lathe to cut a 3/4" o.d. thread in an alloy steel; a lathe of that size simply would not have the power required to cut such a thread within a reasonable length of time, if at all. Little lathes must cut little threads. Also, as I will describe a bit later on in this column, there will be situations in which the accuracy and quality of the finished thread is considerably more important than the amount of time required to make the setup and cut the thread. This too will have to be considered in your choice of threading method.

In my own case, my humble accumulation of experience and a passing familiarity with the capabilities of my own lathe have shown me that even though I have a few special purpose dies which will cut threads of up to 1/2" diameter, threads of 3/8" o.d. and larger seem to be best done using the single point screwcutting capabilities of the lathe. This is principally because a great deal of torque is required to turn dies of these diameters by hand. I have likewise learned that threads of 1/4" o.d. and smaller are most beneficially done with a round die in the tailstock dieholder. These are so quickly and easily done by hand power that setting up for a screwcut in the lathe appears to be an effort that is not justified. As for jobs requiring one of those few orphaned thread sizes which fall between 1/4" and 3/8" o.d., I consider each task individually and let the type of material, the length of thread, and the required accuracy determine the way the thread is cut. It is a judgement call as to which to use, but I can say without reservation that when conditions allow, the round die in a tailstock dieholder is the preferred option for me.

The sole purpose of the dieholder is to hold the DIE, illustrated in Fig. 2, which is in most cases a round steel cutter, made of either carbon or high speed steel, which is used to cut external threads. Its counterpart is of course the TAP, which is also of carbon or HSS and is used to cut internal threads. Some dies, especially those for cutting threads of large diameter made for use away

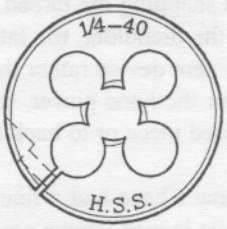


FIG. 2:
THE ROUND DIE

from the shop or works, are made in hexagonal or square shapes so that a burly lad with a #9 spanner can supply the torque. For our use, however, the round die of either 13/16" or 1" outside diameter is the standard, and most die holders are made to accept one or both of those sizes.

Many if not most round dies these days are split across the edge and have a small adjusting screw through the split so that the diameter of the thread can be adjusted to very closely fit the thread it is intended to match.

A die is usually self-centering and self-guiding, that is, if the thread is started slightly off the central axis of a piece of rod, within a few revolutions the die will find its way to approximate center and will cut the thread to equal depth all the way round. Once it finds center it will tend to stay there. The die will also pull itself through the cut requiring no pressure from you to move it along. However, a die is not self-aligning and if the thread is started with the die crooked, that is, not exactly square with the axis of the rod, the resulting thread will be wavy and wobbly all the way along and once this faulty thread is cut it cannot be corrected. The well designed dieholder takes care of all these alignment needs at once by allowing the die head to follow the cut back and forth along the lathe axis, and by to allowing some lateral movement in the die head which will let the die center itself. It does this while holding the die firmly and presenting it squarely to the thread for a good, straight start.

A dieholder with these capabilities is shown in section in Figure 3 and has three principal parts. The shank (a) can be either straight for holding in the tailstock drill chuck or tapered to match the taper of the tailstock barrel. The body (b) is a sliding and rotating fit on the shank and has a place for a tommy bar to be inserted to provide the leverage necessary to turn the die. The die head (c) as its name suggests, attaches to the body and holds the die squarely and approximately at the central axis of the lathe. Although the features of this particular dieholder make it very easy and therefore quicker to use, one need not be this elaborate in order to do the job. All that is required is that it be able to hold the die firmly and rotate it while holding it squarely to the work.

To use the dieholder, the shank is inserted into the tailstock, or into the tailstock drill chuck if it has a straight shank, and a die is inserted into the head and secured by set screws. The tailstock is then advanced towards the piece to be threaded until the die contacts the work. Then, using the tommy bar or other means of turning the die manually, the die is run on to the work. When using the die or tap for cutting threads of any sort by manual means, the usual practice is to advance the thread only a turn or two at a time. At not more than two turns, the tap or die is backed off one-half turn to break away the chips of metal that have formed behind the cutting edge of the tool. Occasionally it is good practice to back the tap or die completely off the workpiece to clear the accumulation of metal chips and cutting fluid. This practice, along with the use of any one of the commonly available and cheaply had thread

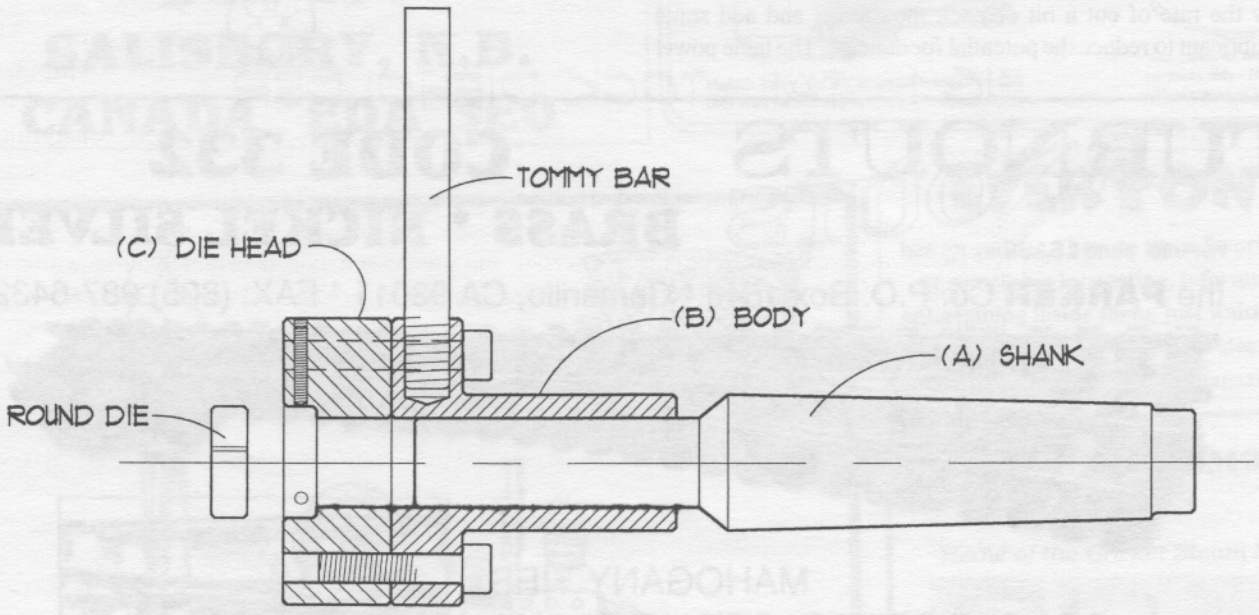


FIG 3: CROSS SECTION

cutting fluids, will make thread cutting go much more easily and result in cleaner and more accurate threads.

A word of caution and direction is called for here. The well informed machinist is aware that threading with the round die in the tailstock dieholder is not, even under the best of conditions, a precision process. Round dies are very much like drill bits in that they get very close to center and straightness but do regularly miss the mark by a few thou'. There will be times when it is important that a thread be as close to dead center and square on the workpiece as is possible, such as when one elects to attach a piston to a piston rod by use of a thread, where for good operation the whole lot must be dead square and centered on the cylinder, packing gland, and crosshead. The problem for the amateur is that although threads cut in the lathe by the single point screwcutting method are very accurate as to pitch (the distance between individual threads), and are dead on center, it is very difficult and time consuming to get the smallish thread finished to exact size. Missing the finished thread depth by a few thou' either way produces a part that is either a hopelessly sloppy fit or will not go in at all. In times such as these it is appropriate and advisable to start the thread by single point cutting in the lathe and once started straight, square, and truly on center, finish off the thread with a round die for final size. This technique can be rather time consuming, but it can be time well spent as it will consistently produce a thread that is accurately sized and exactly centered when that is what is called for.

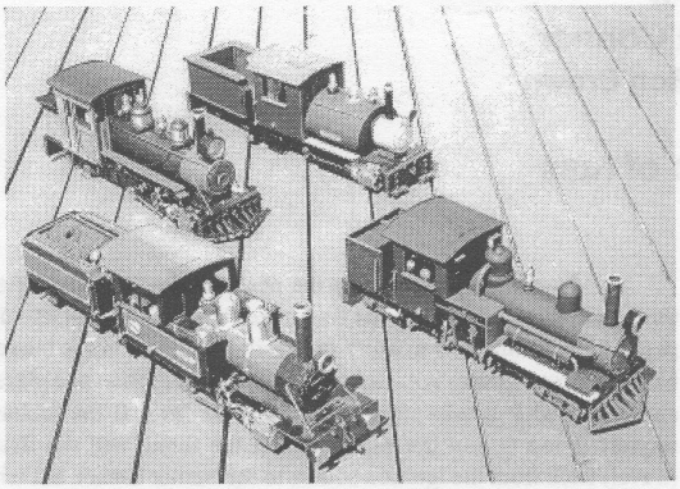
A second word of caution is that when using the tailstock dieholder it is preferable to make the cut using hand power rather than power from the lathe. Most dieholders provide some means of applying leverage by hand but why, then, have a relatively large amount of torque available and not use it to greatest advantage, one might ask? The reason is that thread cutting is a delicate process where stresses on the cutting die or on the workpiece can accumulate at an alarming rate, sometimes with disastrous results. It is therefore important to be able to "feel" the initial cut as it is taking place so that if an unusually high resistance is detected, one can slow the rate of cut a bit or back the die off and add some cutting lubricant to reduce the potential for damage. The lathe power train cannot "feel" the cut taking place and cannot know when to back off a bit to avoid snapping the thread off or breaking a die. When properly using the dieholder, the lathe is actually serving principally as an alignment device rather than as a power source. There are other uses for the lathe power, such as to make a final sizing cut on the threaded piece or to back the die quickly off the newly cut thread.

For some years now I have had a fine dieholder made by a British firm whose name is well known amongst the model engineering fraternity, and which has served me well. This tool came highly recommended and it was indeed very well done. However, I saw within a few moments when examining it that I could have made one of similar appearance and operation in my own shop without difficulty. I must emphasize appearance and operation because, in fairness to this maker, their tools are made of alloy steels, hardened and ground on their working surfaces; a process which would be difficult if not prohibitive for the amateur. Even so, a lathe dieholder is an item which requires little or nothing in the way of special treatment or materials beyond a bar of a decent mild steel and thus is very often built by the hobbyist in the home workshop, often as a first real project. There have been over the years any number of articles in the model engineering press which describe the construction of several versions of the dieholder. It is not a tool shrouded in mystery and the making of one should be easily within the grasp of even the beginner.

Perhaps some of you are at the point where there is a coming need for a lathe dieholder on your workbench and a short article on making such an item would be of interest. If so, please feel free to let our Editor know of your interest and perhaps a construction article for this or another useful bit of tooling could be arranged in the near future.

We will at last finish up our series on the lathe next time as I describe the taper attachment and a few other remaining odds and ends. Best holiday wishes and a prosperous new year to all of you.

GEOFFBILT



SEND $2.00 FOR CATALOG TO:

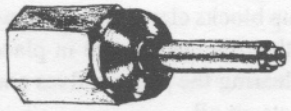
GEOFFBILT
BOX 277
SALISBURY, N.B.
CANADA E0A 3E0

AN IMPORTANT NEW DEVICE AIDS PASSING GAS

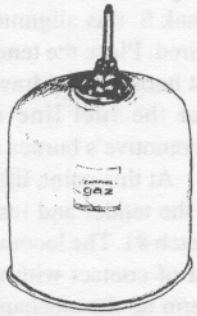
Kevin O'Connor's "S" Street Unit Shop announces a new approach to fueling up your small scale steamer. It is the "Hadden Fill Valve", designed to mate up those super economical, blue, one pound butane/propane gaz® containers with the fill valve on your locomotive. Aside from the cost advantage of paying 40% less for fuel, the 20/80% butane/propane mix provides significantly higher vapor pressure on those cold, marginal days when coal firing takes on a certain allure. Even on warm days the higher vapor pressure of the gaz® mix provides increased gas vapor velocity through the metering jet, thus drawing in more air though the mixing tube and providing a more efficient, easier to light flame in the combustion chamber. The cash savings realized in using just three (3) one-pound gaz® cannisters, versus an equal amount of isobutane, will pay for your new Hadden Valve. Hadden valves are available in burnished brass for $10.95 each plus $1.50 shipping and handling. Ask for my free product sheet describing Frank S. and C&S Mogul accessories when ordering. California residents please include 7.75% state and county sales tax. Hadden valves are in stock and ready to ship.

Order directly from:
Kevin O'Connor's "S" Street Unit Shop
P.O. Box 161631
Sacramento, CA 95816-1631
USA

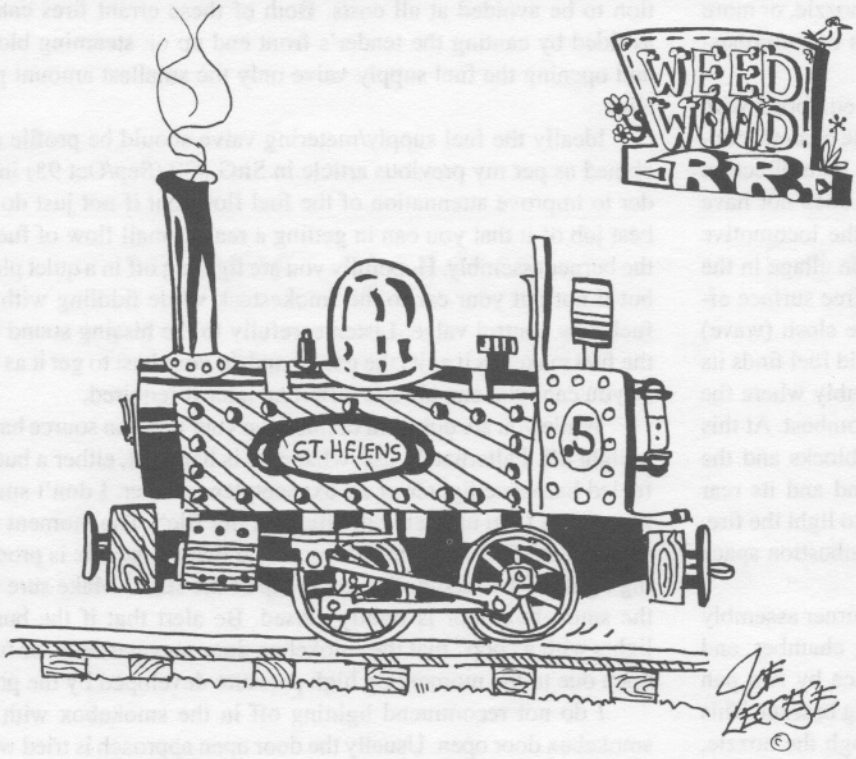
Phone/Fax (916) 447-5433



Hadden Valve - for use on gaz® brand cannisters only - not for use on cannisters with threaded nipple



Gas cannister for illustration purposes only - NOT included with purchase of Hadden valve.



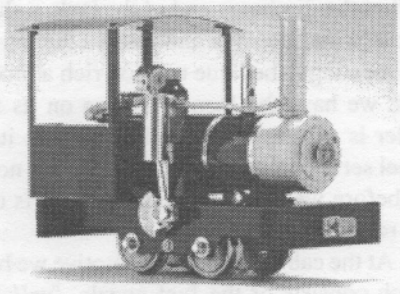
Sometimes a nameplate can say a lot.

EVERYONE

has an article, a how-to tip, a favorite photo or something interesting, informative or entertaining inside them, just waiting to get out. Share it with your fellow steamers in *Steam in the Garden* magazine!

BERKELEY LOCOMOTIVE WORKS

Home of the Cricket Steam Motor



Type 'A' American Outline Cricket

$549.00

SASE for info to:

Studio 'B' 1033 Pardee Street
Berkeley, CA 94710
Fone/Fax: (510) 849-9284

Getting Started With FRANK S.

Part II

by Kevin O'Connor
drawings by Ron Brown

Getting Frank steamed up with a minimum of fuss

Last issue we got Frank S. ready for steaming. This issue we will steamup with a minimum of lost motion and anxiety.

Place the locomotive on the track. Make sure that the wheel flanges are inside the rails. On outside framed locomotives like Frank S. this alignment is tough to see until sufficient skill is acquired. Place the tender on the track with the same caution, but do not hook up the drawbar. Roll the tender up to the locomotive so that the fuel line and nozzle assembly easily reaches the locomotive's burner assembly.

At this point, lift up both ends of the locomotive and the front of the tender and insert the steamup support blocks described in sketch #1. The locomotive steamup blocks elevate the drive wheels out of contact with the rails so that they can rotate in place and warm up the mechanism while clearing the piston valves and cylinders of condensate and excess steam oil.

The single tender block cants the fuel tank up at an angle so that the ullage (gas bubble) in the tank is forced forward and there is no chance of passing over liquid fuel through the delivery hose and nozzle. If drops of liquid fuel are passed over to the nozzle through the supply line they will either plug up the nozzle, or more likely, richen the fuel to air ratio beyond the limits of a combustible mixture and thus extinguish the fire.

This phenomena is the reason that Frank S. equipped with single channel R/C perform so erratically. The single channel control of the reversing block as an attempt to control both direction and speed is flawed because the reversing block does not have enough modulation designed into it. As a result the locomotive jerks through starts and stops. Each time it jerks the ullage in the fuel tank is disturbed by the liquid fuel sloshing (free surface effect) from one end of the tank to the other. As the slosh (wave) reaches the discharge end of the tank, a slug of liquid fuel finds its way into the fuel line and thus to the burner assembly where the fire is extinguished due to a too rich a mixture to combust. At this point we have the locomotive up on its steamup blocks and the tender is resting on a similar block at its front end and its rear wheel set is resting on the track. We are now ready to light the fire, but before we do let us review the parts of the combustion space and revisit their functions.

At the cab end of the locomotive we have the burner assembly which consists of the fuel nozzle, fuel/air mixing chamber, and burner basket assembled into one unit held in place by two pan head screws and attached to the rear boiler mounting bracket. This unit meters and accelerates the gaseous fuel through the nozzle, draws in the proper amount of air to provide the correct flammable mixture for efficient combustion at the mixing chamber and directs the flammable mixture into the burner basket where it is burned.

The flammable mixture that we need resides in the order of three to seven percent gaseous fuel mixed with ninety something percent air. Ideally this mixture ratio will only exist in the burner basket, but sometimes not, and sometimes in more than one place, and this is what causes stack and smokebox fires. If the fuel/air mixture is too rich at the burner basket the flame will not flash (travel) back from the ignition source to the burner basket, but will light somewhere between the igniter and the fuel source.

Since the smokestack is surrounded by an unlimited supply of air a too rich a mixture will tend to burn very happily there until the fuel is cut off or the stack looses all its paint. If the stack is cast from a pot metal such as pewter or Zamack it will melt. The second, and not so obvious, place that an errant flame will propagate is in the smokebox. I personally know of smokebox fires that went unnoticed until the locomotive exhibited the forward rake, more usually seen on "funny cars" at the auto race track, that indicated a most abject surrender of the front frame/pilot assembly due to the generation of liquid metal and carbonized nylon. The nuclear engineers call this state "meltdown" and it is an apt term and a condition to be avoided at all costs. Both of these errant fires can be avoided by canting the tender's front end up on steaming blocks and opening the fuel supply valve only the smallest amount possible.

Ideally the fuel supply/metering valve should be profile machined as per my previous article in SitG #30 (Sep/Oct 95) in order to improve attenuation of the fuel flow, but if not just do the best job of it that you can in getting a really small flow of fuel to the burner assembly. Hopefully you are lighting off in a quiet place, but if not put your ear to the smokestack while fiddling with the fuel flow control valve. Listen carefully to the hissing sound that the fuel makes as it exits the gas jet and do your best to get it as low as you can; you can always turn it up later if required.

While you are doing all of this have your ignition source handy to light off. I alternately use, what ever is handiest, either a butane fueled barbecue lighter or an oxyacetylene striker. I don't smoke tobacco so I am unwieldy in "flicking my Bic". The moment that you are satisfied with the hissing sound that the nozzle is producing light off the locomotive at the top of the stack. Make sure that the smokebox door is tightly closed. Be alert that if the burner lights with a "pop" that the smokebox door may partially, or fully, open due to the momentary high pressure developed by the pop.

I do not recommend lighting off in the smokebox with the smokebox door open. Usually the door open approach is tried when the fuel supply valve is open too much for the burner to light properly and so it does light in the smokebox where there is a more abundant supply of air. I suspect that there are Frank S. engineers out there that have mastered the smokebox approach and I think

that they can be recognized by their hairless right hands. There are probably equestrians that mount on the right as well, but I think that I'll pass in the interest of longevity.

Peter Jones has called our small scale live steamers "dragons" in at least one of his articles and I think that the smokebox lightemup crowd have taken him too literally as evidenced by the flaming maws that are seen at steamups.

Hopefully all is well and we are rewarded with a light or non-existent "pop" and a gentle "burbling" sound from the burner. The burble indicates partial and incomplete combustion of the gaseous fuel in the burner basket. It is caused because the stainless steel burner basket is much colder than the burning fuel mixture and, in its heating up to operating temperature it is stealing heat from the burning fuel and so, locally and intermittently, combustion is interrupted in one portion of the burner basket only to resume in another. In practice the flame is jumping around from one set of perforations to another. The flame will stabilize and the burbling will stop when the burner basket reaches operating temperature. Only when this point is reached should the fuel supply be increased to the level needed to raise steam.

I recommend that the fuel supply to the burner slowly be increased as the boiler comes up to heat. If one would go directly to high fire in a cold boiler, the cold boiler will steal heat from the burning flame much in the same way that the burner basket did on first lighting off. The result will be incomplete combustion of the gaseous fuel and the production of carbon monoxide, a normally odorless gas, but in this case a bad smelling complex product, and excess water vapor. This practice will waste fuel in steaming up that otherwise could be used to pull the load. I use a setting that results in a very dull roar.

Once steam pressure starts to build pull up on the safety valve stem to test for free operation and freedom of steam flow. Let the steam pressure come up to 2kg/cm2 (28 psig) and put the motion control lever in either the forward or reverse position and slowly open the throttle valve to admit live steam and condensate to the cylinders.

Pay close attention to the cylinder/motion/drive wheels assembly. With the admission of steam pressure to the cylinders some rotating motion should be observed at the wheels (remember, they are suspended above the track by the steamup blocks) and you may, in fact probably will, see some relative motion between the cylinder blocks and the chassis. This relative motion is an indication that the cylinder bores are bound up with condensed water that is slowly being squeezed out via the piston rod gland seal, the clearance in the piston valve bore, and the reversing block/cylinder O-ring seals. It pays not to rush this process as it will only put undue strain on the valve and connecting rod motion.

One advantage of the steaming blocks is that the direction control lever can now be pushed alternately forward and reverse causing the drive wheels to try to rotate in either direction. This cycling of the direction control lever helps the cylinders to free themselves of condensate and is far more gentle on the motion and the seals than the oft repeated mantra of "bearing down on the locomotive and forcibly rolling it in one direction or the other" to clear the mechanism of condensate. If you observe the cylinder blocks moving relative to the chassis during the condensate clearing process don't be unduly alarmed.

Once the condensate has cleared and the cylinders have come up to temperature their relative motion with regard to the chassis will stop and the locomotive will perform normally.

It will pay to check the tightness of the two screws securing the cylinder blocks to the chassis at the end of the run, but as was pointed out in the last issue of SitG (#35, September/October 1996), their tightness should have already been documented in the pre-steamup preparations. All four of these cylinder block securing screws are of the Phillips flathead (+) variety and don't tighten up readily, as the American type Phillips head screwdriver appears to have a slightly different angle of attack than the metric type. Eventually the Phillips slots in the flathead screws become routed out and useless. The answer is to obtain four M5x.05x16 flat head socket machine screws and use them to replace the originals (they are available at Unit Shop if your local foreign auto supply does not carry them).

I will recommend against two things at this point: do not use the regular, and more common, socket head cap screw in lieu of the flathead variety, and do not use Loctite™ to secure them in place. Reasons? The flathead screw, because of the angle under the head, acts as a locator of the cylinder block in reference to the screw's tapped hole, reversing block, and piston motion. The cap screw will let the cylinder block "float" with regard to alignment.

Loctite™ is a wonderful tool and I have been using it since 1962, but it has become much abused. Kinda like a screwdriver being utilized as a pry bar or as a chisel; it works, but not well. If the flathead socket Allen screws are tightened to the max using the short lever arm of the Allen key in the bare hand, the correct amount of tightening torque will be applied to the cylinder block screws.

Some Frank S. engineers may say that this concern is overkill, but my practice dictates that one can't be too careful about little things because they have a habit of becoming progressive errors; I speak from painful personal experience.

While you are cycling the reversing block control lever to clear the cylinders of condensate keep an eye on the pressure gauge. There is no need to let the boiler steam pressure rise above 2kg/cm2 as the locomotive is not pulling a load and we want to conserve fuel. At some point the locomotive will clear its throat and run easily in either direction.

For those Frank S. engineers who have replaced the smokebox mounted "gunk" tank with an exhaust tube that discharges out of the stack, I recommend that they fabricate a "U" shaped copper tube that will slip over the discharge tube and so direct the spurting condensate and steam oil onto the track's ballast, and not all over the locomotive; remember to remove it prior to leaving the station.

During the lighting off process and steamup we are consuming gaseous fuel that has been evaporated from the liquid fuel in the tender fuel tank. As a result, the tank has started to cool and soon fuel pressure will drop due to this cooling effect (see SitG #34, page 21 for a comprehensive explanation).

In order to offset this heat loss and temperature and pressure drop, warm water (90°F to l00°F) must be added to the tender fuel tank water bath. In order to not raise the pressure in the fuel tank too much at one time, thus taking a chance on blowing out the burner's flame, add only enough warm water from a small Thermos™ bottle to the water bath container to restore the dull roar of the burner. Add more warm water as necessary.

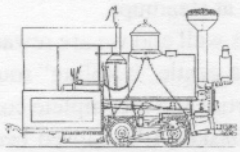
Check the boiler water level and top up through the Goodall-type valve if necessary. To come off of the steamup blocks, first lift the locomotive up slightly by the rear of the cab roof and remove the rear steamup block as you place the rear driving wheels on the

track. This area rarely gets hot so bare hands are OK.

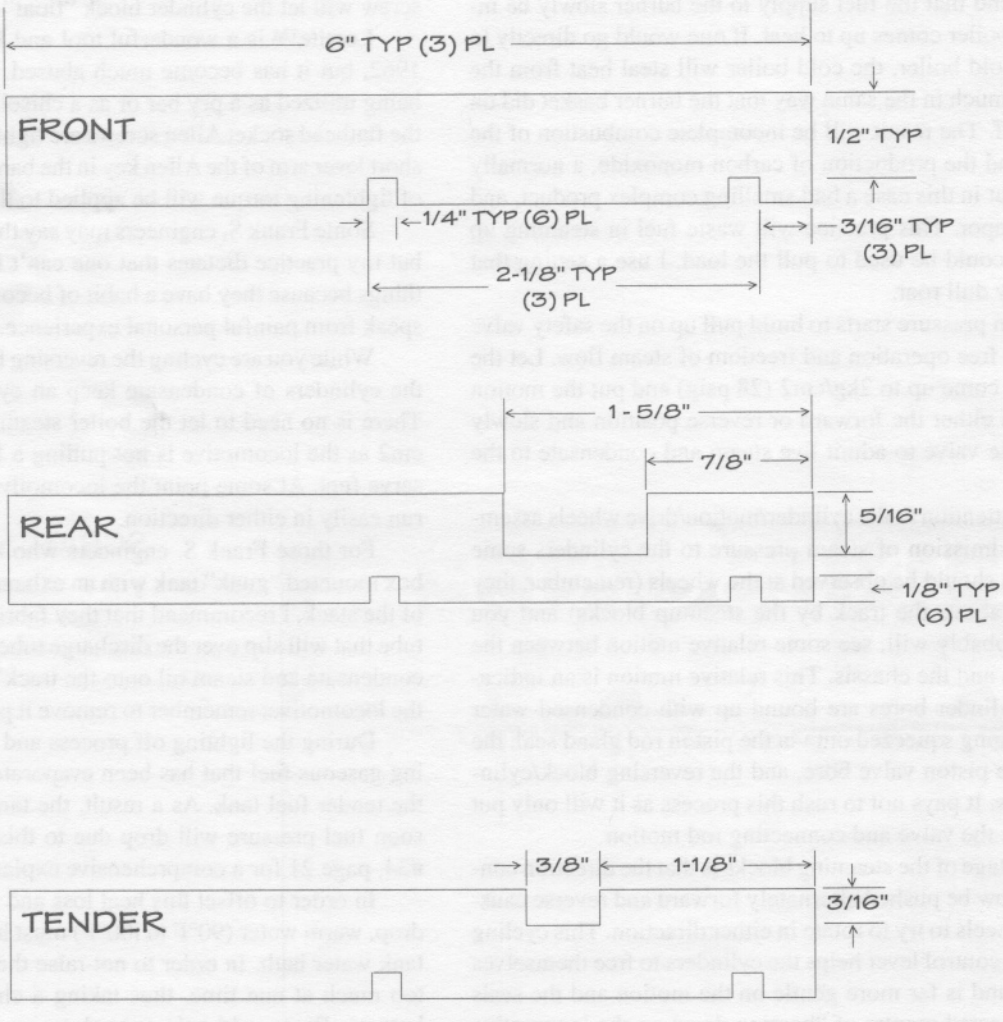
Next, gently push down on the rear of the cab roof, pivoting the locomotive upward on the rear driving wheels, until the weight of the front of the locomotive comes off of the front steamup block; remove this block too.

Now with the locomotive properly located on the track, carefully remove the steamup block that is canting the tender and the fuel tank upward, and properly locate the tender on the track. Now push the tender up to the locomotive and connect the drawbar. At this point you are ready to shunt, pick up the consist and enter the mainline.

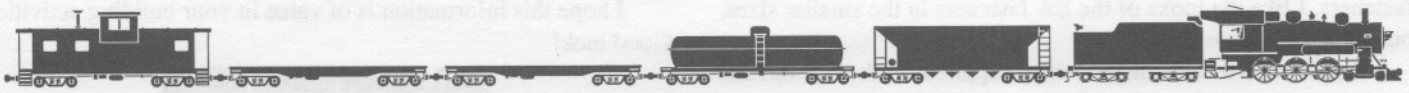
Next time the subject will be dedicated to the proper and efficient operation of Frank S. As always, I may be reached with comments and questions about the content of this series on Frank S. at PO Box 161631, Sacramento, CA 95816-1631. Please include a SASE to facilitate a reply.



NOT TO SCALE



ALL BLOCKS 5/8" X 5/8" X 6" PINE



What's the Difference?

by Bob Paule

8BA or 2-56NC? Does it really matter?

A significant number of the live steam locomotives we operate are built in England or one of her former colonies. As such they are assembled using the British Association thread system. This is commonly abbreviated as BA.

The current article that is running on the Vest Pocket Climax is designed using the BA thread system. This, as you probably know, is not the standard thread system that is used in the United States. We use the Unified National system. Ours is an inch based system, and the BA system is a mathematical progressive series based on the metric system.

When repairing our locomotives it is easier - one could even say best - to use the same fasteners (screws & nuts) that were originally used. There are many reasons for this, most of which are obvious.

If we are building our locomotives from scratch, one may wish to consider switching screw thread systems from BA to a USA standard. The reason for this is that you might already have the US taps and dies, plus the necessary fasteners, already laying around the workshop.

The following information may be of use to you if you decide to build a model which calls for BA thread on the drawings, and you decide to use American threads instead. I am not suggesting that you change. I personally have built many models using BA fasteners. I like the looks of the BA fasteners in the smaller sizes, but the choice is yours.

Please note that the information supplied on the BA threads has been converted from the Metric system into inches.

The chart below gives both the closest US size and a recommended size. You would be better off using the "recommended size" where possible instead of the "closest size", since these fasteners will be much easier to obtain.

Please note that I am not suggesting changing from BA to American threads in this article. I'm only supplying the data in case you wish to do so. Beware if you do make the change that one problem can occur, and you need to be aware of it. Carefully check that the American fasteners will physically fit in the allotted space. The BA head sizes on screws and the nut size dimensions across the hex are significantly smaller than those used on commercially produced hardware store fasteners available in the USA. If you change, you could have interference problems. The way around this problem is to use Model Hex Nuts & Bolts as offered by many of the suppliers to the live steam hobby. One could also use socket head cap screws, but their looks, in my opinion, are unpleasant in highly visible areas on a locomotive.

For steam and water connections the British have been using a combination of fractional size 40 & 32 threads per inch, called the Model Engineers thread series. These use the Whitworth thread form, and they have provided excellent service for us in the hobby for many years. I feel that there is no reason to even consider changing them, and thus offer no suggestions to do so.

I hope this information is of value in your building activities. Good luck!

THREAD COMPARISON AND SUBSTITUTION CHART – BRITISH TO AMERICAN

BA # size	Thread Dia. in inches	Threads per inch	Closest Size U.S. thread	Suggested Size U.S. thread
0	0.236	25.4	1/4-28NF	1/4-2-NC
1	0.209	28.2	12-28NF	none
2	0.185	31.4	10-32NF	10-32NF
3	0.161	34.8	8-36NF	8-32NC
4	0.142	38.5	6-40NF	6-32NC
5	0.126	43.0	5-44NF	5-40NC
6	0.110	47.9	4-48NF	4-40-NC
7	0.098	52.9	3-56NF	3-48NC
8	0.087	59.1	2-56NC	2-56NC
9	0.075	65.1	1-64NC	1-72NF
10	0.067	72.6	0-80NF	0-80NF

Notes From The Backyard

by Rich Chiodo

Evolution

You may know the story of Compton Down. Peter Jones has eloquently documented the rise and fall (literally) and rise again of this famous line. Mr. Jones, in my opinion, has gotten the whole thing right. A balance of form, function, image, and place.

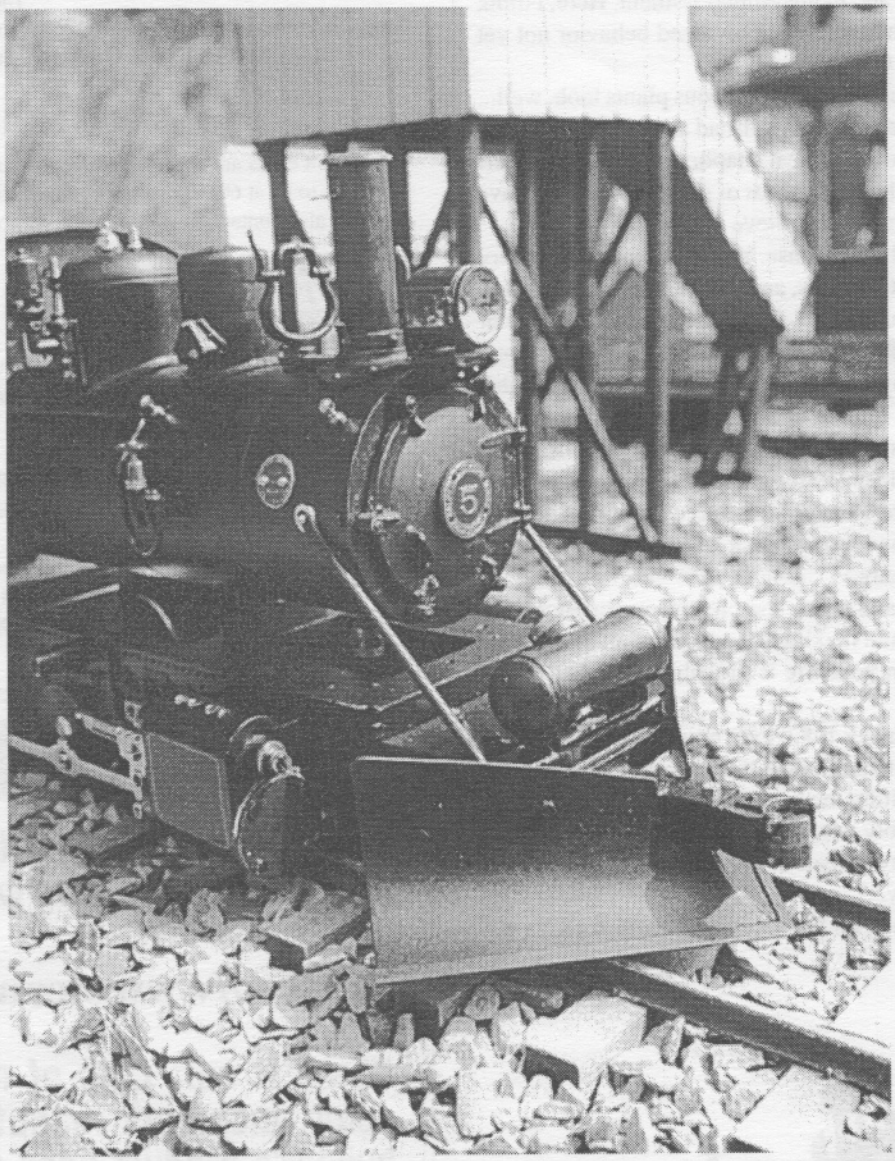
Most of you...actually all of you...do *not* know the story of the Isle of Shoals Light Railway and Navigation Company. I shamelessly admit my path to small scale live steam passed through the land of LGB and the natural progression of 'round the Christmas tree' to 'round dwarf conifer'. Its evolution may be of interest to some of you just starting out, or to others who have lost the "magic" and don't know why.

I was determined that a credible garden line could be built using LGB 1100 curves with several 1600 turnouts, built on the ground in the shape of an 8 foot by 20 foot figure eight. This was about 7 years ago and certainly the genre of stateside railways at that time more often than not reflected this concept.

The name attached to this first attempt, "The Lostock & Barrow Garden Railway", reflected its heritage and the lame attempt of the author at onomatopoeia or whatever.

Some good things did come of this effort, however. Experience is a great teacher and in this case I guess I signed up for a PhD.

1) Brass 332 rail is bullet or elephant or small child proof, proving eminently serviceable with all kinds of locomotion and rolling stock. Its looks can be well disguised with heavy ballasting and the aged brown weathering aids in reducing the perceived height. It is also easy to work with if you are scratch building crossings and turnouts or the like. Weather in New England is severe and after 7 years in service the LGB rail has shown no signs of deterioration.



On Shed! Fresh from the Isle of Shoals Light Railway & Navigation Co. backshop. This engine was an LGB Frank S. in a former life, now rebuilt to a 2-6-0 wheel arrangement and ready to move some serious snow. Only his hostler knows for sure!

Photo by Rich Chiodo

2) LGB turnouts should remain under the Christmas tree if you have any thought of running fine scale flanges or stiff/ light weight stock. At least that has been my experience.

3) Track power is for masochists. Resist the urge to power your line to accommodate your electric buddies. Give 'em a battery op when they come to visit.

4) A small, round and round plan is quickly boring. Here you are outside, with 7 trillion square miles of space, playing with trains that go round and round....silly! A proper line must go somewhere – or at least be perceived to go somewhere.

5) On the ground is not much fun, especially as you and your

line mature together. Maintenance and cleanup can be a chore, and operation, especially with several of your friends, can get chaotic. Plus, looking at all those backsides.....

6) A dead level roadbed, even if you have to cut and fill just a teeny bit, is worth every shovel full of dirt. Small scale live steamers of any pedigree fare much better on a level line. You can get away with tighter curves than those broad 20 foot radius jobs you lust after by adjusting your motive power and rolling stock concept, but a 5% grade is death.

7) Steaming bays and holding tracks and other such niceties are a luxury. Most guests will ignore the operating rules anyway. What is useful is plenty of setup space, whether a permanent outdoor work bench, picnic table or whatever, for you and your pals to fiddle. I'm reminded of the individual (who will remain nameless) who insisted on adjusting the gas burner of his engine on the main line as another chap blithely drove his flaming Ogwen by, causing a minor explosion and major embarrassment. Here, I think our UK friends have reached a level of civilized behavior not yet attained at most Stateside GTGs.

8) Plants should fit the line, and indigenous plants look, well... like they belong there. They give the railroad a sense of place, not likely achieved by that exotic tropical snapdragon on life support next to the MOW shack. The best photos of garden railways I have seen understate the plantings and achieve that sense of place.

9) The railroad should make sense. You have read this in every other magazine for the past 50 years, and yet we find the mix mash, hodge podge, run what you brung 2, 4, 6 or 8 axle, fixed, bogey or articulated stock being pulled by an SAR Beyer Garret. So what's the point? Sorry, this is my hot button. Choose a concept. Welsh quarry, logging, mainline, mining, industrial.....please.

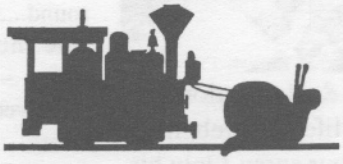
10) Have fun. This is a hobby, and you don't have to get it done over the weekend. I do enjoy those few articles written about some couple who created the Pennsy Mainline, complete with stone viaducts, overhead wires and 4 track right-of-way slicing through rolling farm land, in 48 hours.

Stay within yourself and enjoy the creative experience. You likely already have a job, and making the construction of a garden line another stress point in your life is probably not what it's all about.

Anyway, do those Pennsy folks ever enjoy the simple pleasure of an early morning steam up and the almost alive sounds of that favorite pot boiler orbiting the line while the birds provide the background music? Probably not.

The L&BGRy lasted two years while much of the above was being learned the hard way.

More on what happened on the way to the IofSLRy&NavCo next time.



BUILDING THE VEST POCKET CLIMAX

by Mel Ridley

drawings from the author's sketches by Harry Wade

Getting started.....

1:0. CHASSIS: This is fabricated from 5/16" solid square brass section and, with the exception of the smokebox stretcher, is pinned and soldered together. Refer to drawing.

MATERIALS: 5/16" square brass x 36"; 1/4" x 1/4" brass angle x 5-1/2"; 1/8" round brass x 3"; 3/16" round steel x 2"; pilot castings x 2; 4BA x 1/2" cheesehead screws x 2; 8BA x 1/2" countersunk screws & nuts x 4; 1" x 1/8" brass spacers x 2.

1:1. Cut and face off or grind 2 longitudinal pieces to 13.5/8" and 4 stretchers to 1.3/8". To ensure a good fit, lay the pieces out on the bench as per drawing. They should all be exactly the same length. The overall width should be 2". Any more or less and problems will arise later when we come to mount the gearbox and cylinder assemblies.

1:2. The 2 end pieces and the rear truck mount will be pinned in place using 1/8" brass rod. The smokebox end is fixed with 4BA cheesehead screws. To ensure that the stretchers are drilled accurately, mount them each end in turn face up and level with the top of the bench vise jaws, and scribe a line using a straightedge across the diagonals. Centre-pop where they cross. They will then be dead centre. Mount the first 3 in the machine vise and drill 1/8" to a depth of 1/4". As mentioned before, the combined smokebox and front truck stretcher calls for different treatment. It will be held in place by 4BA screws. Drill #34 by 3/8" deep and tap 4BA using taper and plug.

1:3. On the main longitudinal frames, decide on an outer face and, along one only, mark off and centre-pop the various hole locations, including one extra for the rocker arm shaft. All are 1/8" excepting the smokebox stretcher, which is drilled #26 for 4BA clear. This will later be countersunk to accept the cheesehead, but will depend on the head size you have available. In the UK, the current batch are 1/4" across x 3/32" deep. The rocker arm shaft needs to be a snug, but not a force fit, so try it before reaming. A gentle nudge with a small drift will be all that is required. Clamp the 2 longitudinals together, ensuring that they are aligned correctly, and drill them together in the bench drill. De-burr and clean the frame components.

1:4. Clean with wire wool and saw off & dress 6 – 1/2" long pins from 1/8" brass rod. Dress the 2" length of 1/8" steel rocker shaft.

1:5. Assemble and clamp the components together, having fluxed the 3 stretchers and their mating frame holes to be pinned. Drive home the brass pins until they are flush with the outside of the frames, inserting the smokebox stretcher & rocker arm shaft, and place the assembled unit on a flat piece of firebrick or hearth, ensuring the whole is square and true. The next operation is to solder the 3 pinned stretchers to the outer frame members (belt & braces) and for which some heat will be required. A 1/2" nozzle will be adequate so that when it comes up to heat (a little piece of solder laid at each joint will be a good indicator), slop in a bit of multicore and the job is done. Clean off the flux residue with an appropriate cleansing agent and scrape or file away any excess solder.

1:6. DRILLING FOR BOLT-ON ATTACHMENTS. We now need to drill a further series of holes in order to mount the pilots, cylinder and gearbox assemblies, trucks and smokebox.

The front & rear stretchers call for 2 8BA clearance holes, countersunk either for cheesehead or countersink screws, to mount the pilots. Drill through 3/32", 1" apart on centreline and countersink 5/32" according to depth of head. The other holes are 3/32" 8BA clearance to mount the cylinder saddle and gearbox assemblies, and are 3.11/16" for the cylinder assembly and 5.7/8" for the gearbox, measured from the frontface. The 2 intermediate stretchers for the rear truck and the front truck & smokebox require a tapped hole through the centre to affix the truck mounting pins, so drill #28 or 9/64" and tap ME 3/16" 40T. In addition, the front stretcher accommodates the smokebox and saddle. This has been fastened by 2 - 4BA cheesehead screws. Turn through 90° and drill 2 - 3/32" 8BA clearance holes 1/2" apart on c/l as per drawing.

1:7. TRUCK KINGPINS: Fashioned from 3/16" steel rod, the task is simply accomplished by marking off first in the bench vise, and we'll do both in one go. Dress one end and make a slight saw mark 5/16" along, including the thickness of the saw blade. Make another mark for overall length of 3/4". Centre-pop 1/8" in from there for the split pin. Repeat for the second pin at the other end of the available material. Clamp in the Vee block or machine vise and drill through 1/16", opening out a shade more to #50. Thread each end in turn ME 3/16" 40T up to the saw mark, then part off and dress. Touch a bit of bearing fit to the screwed end, and fit to the stretcher so that it is flush with the top side. Jiggle the split pin hole around until it is 90° on to the frames.

1:8. PILOTS: Refer to the Drawing. Clean up the castings of any flash or spelter (henceforth in this series, this will be referred to as fettling). It was found under test with some rough handling (just like the prototype) that the running boards were apt to bend when introduced to an immovable object, as there was inadequate strength with just the two retaining braces. The additional brace

cures the problem and is virtually unseen as it lies directly underneath the coupler pocket. In order to strengthen them, cut & dress 2 - 1/2" long pieces of 1/4" x 1/4" brass angle. Also cut 2 pieces of the same material to 2.1/8" long for mounting the finished assembly. Cleaning thoroughly, flux the areas to be soldered, clamp in place (surgical forceps are ideal) and solder up. Clean up the flux residue and any excess solder and offer up the frames so that they are centrally positioned. Using the 3/32" clearing drill in a pin-vise, mark off, centre-pop and drill through. Fix to the frames with 2 - 1/2" 8BA screws and nuts.

1:9. Make a couple of brass spacer washers between 3/4" and 1" dia. x 1/8" thick. Bore 3/16" clear. These sit between the truck bolster and frame, giving extra stability and correct body height. The chassis is now complete, apart from three further sets of holes to be done "in situ" later – for bolting on the rear end of the boiler, the crosshead trunk guides and rear mounting holes for the front footplate. So we now have a neat & sturdy little chassis onto which we can bolt all the blobs, gadgets and appurtenances so beloved of the logging fraternity.

SOURCING

In order to assist our readers in the acquisition of all the bits & pieces they need for the Vest Pocket Climax project, we will publish this list of sources at the end of each article on the Climax. We will continue to add sources to this list as they come to our attention, so if you know of a reliable source that isn't listed here, please let us know.

Castings & boiler ..... Llagas Creek, Dept. SG
2200 Llagas Road
Morgan Hill, CA 95037-9429
Phone/Fax (408) 779-4391

Fasteners (BA & ME) ..... Sulphur Springs Steam Models
(including taps & dies) Dept. RB
PO Box 6165
Chesterfield, MO 63006
Phone/Fax (314) 527-8326

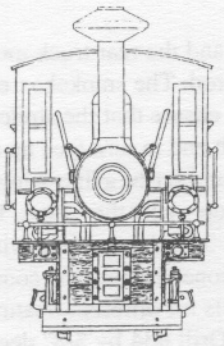
Machine Work ..... Sulphur Springs Steam Models
Dept. RB
PO Box 6165
Chesterfield, MO 63006
Phone/Fax (314) 527-8326

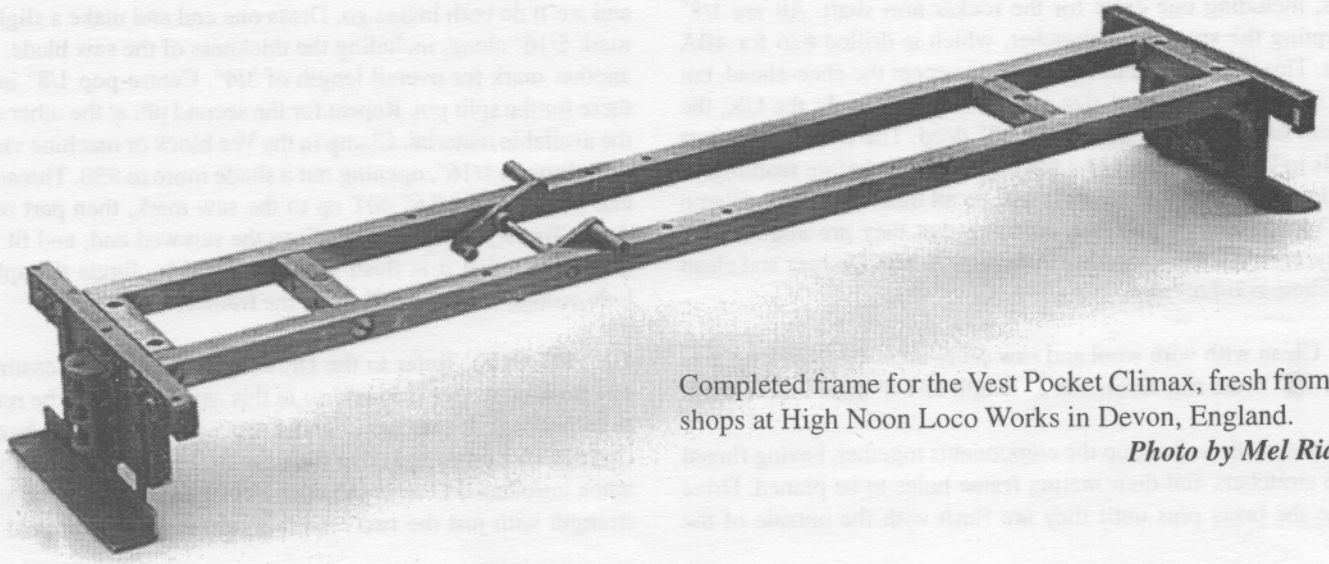
Steam 'n' Stuff, Dept. SitG
11996 Gast Road
Bridgman, MI 49106

Raw Materials ..... Sulphur Springs Steam Models
Dept. RB
PO Box 6165
Chesterfield, MO 63006
Phone/Fax (314) 527-8326

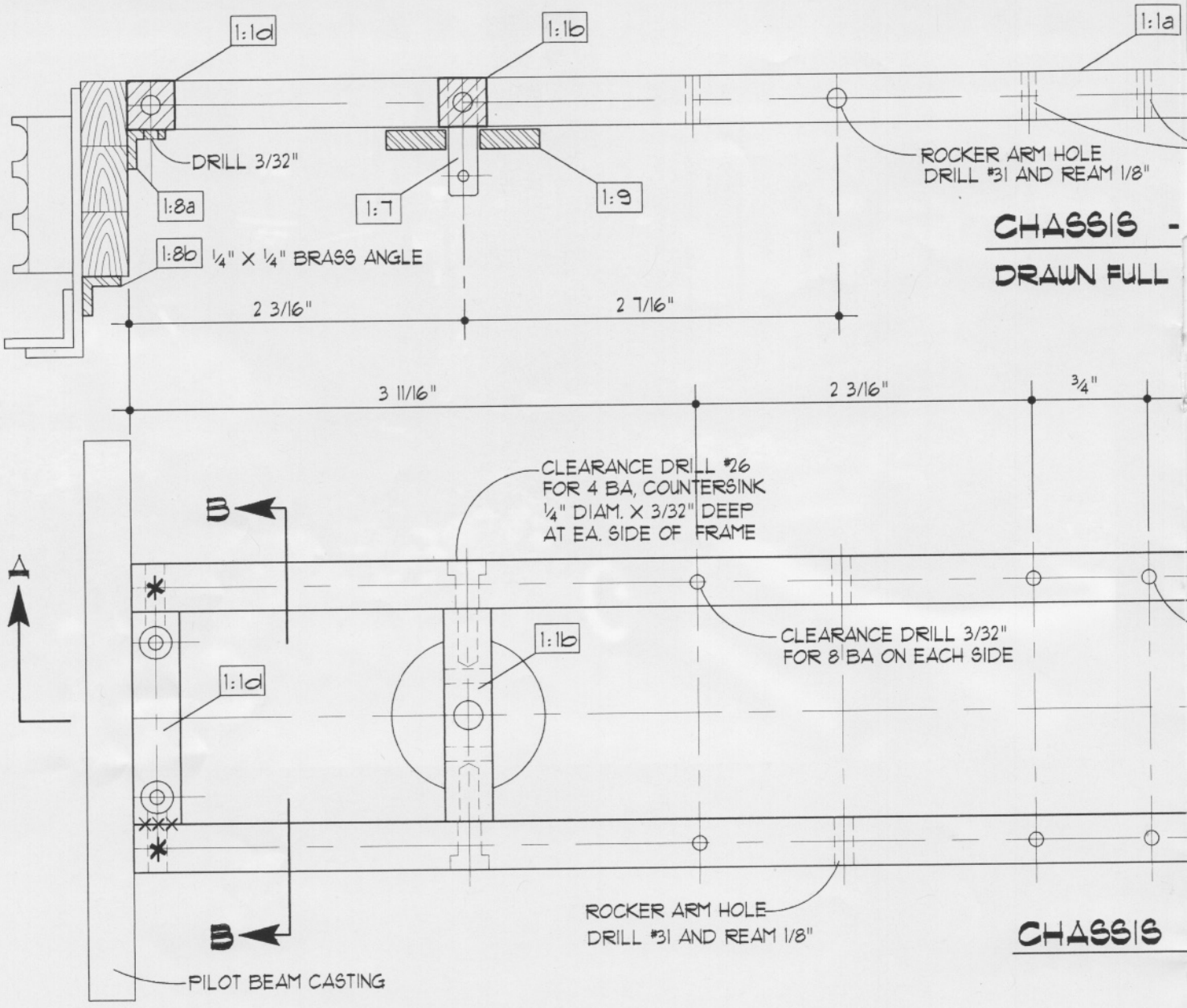
Mean Jean Metals, Inc.
8120 Industrial Way, Unit B
Covington, GA 30209
Phone (800) 638-2547

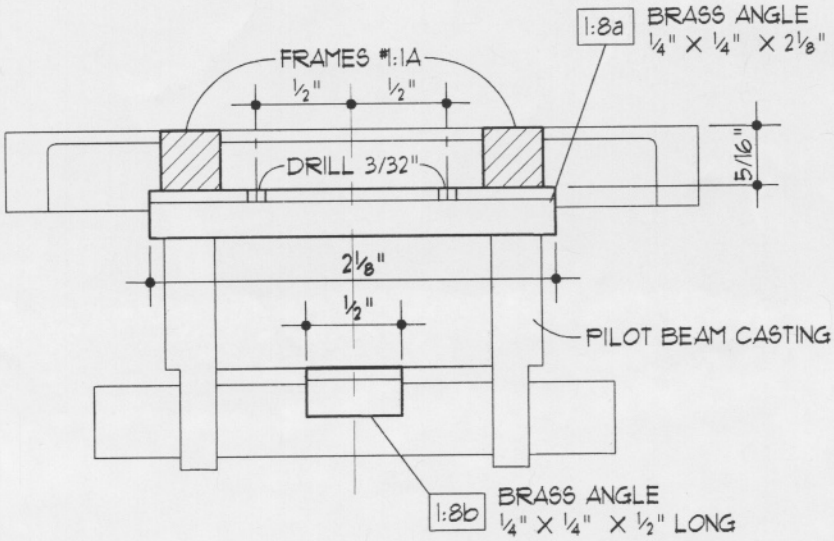
When you contact any of these suppliers, please tell them that you found them in* Steam in the Garden *magazine.



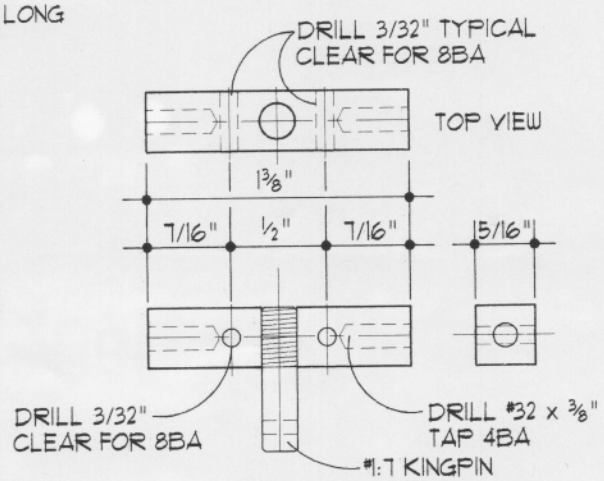


Completed frame for the Vest Pocket Climax, fresh from the shops at High Noon Loco Works in Devon, England.
Photo by Mel Ridley



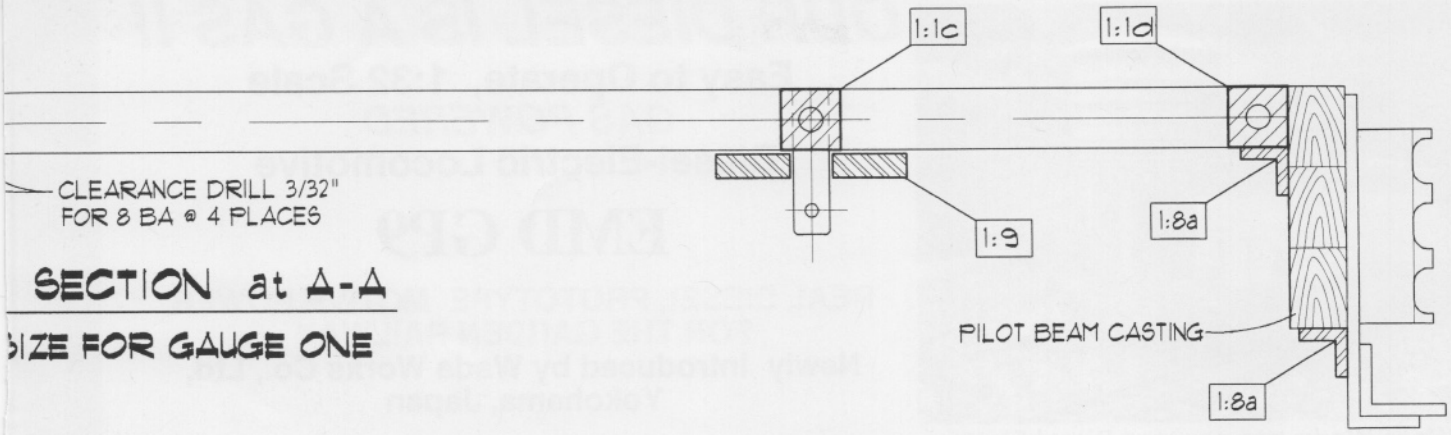


SECTION at B-B



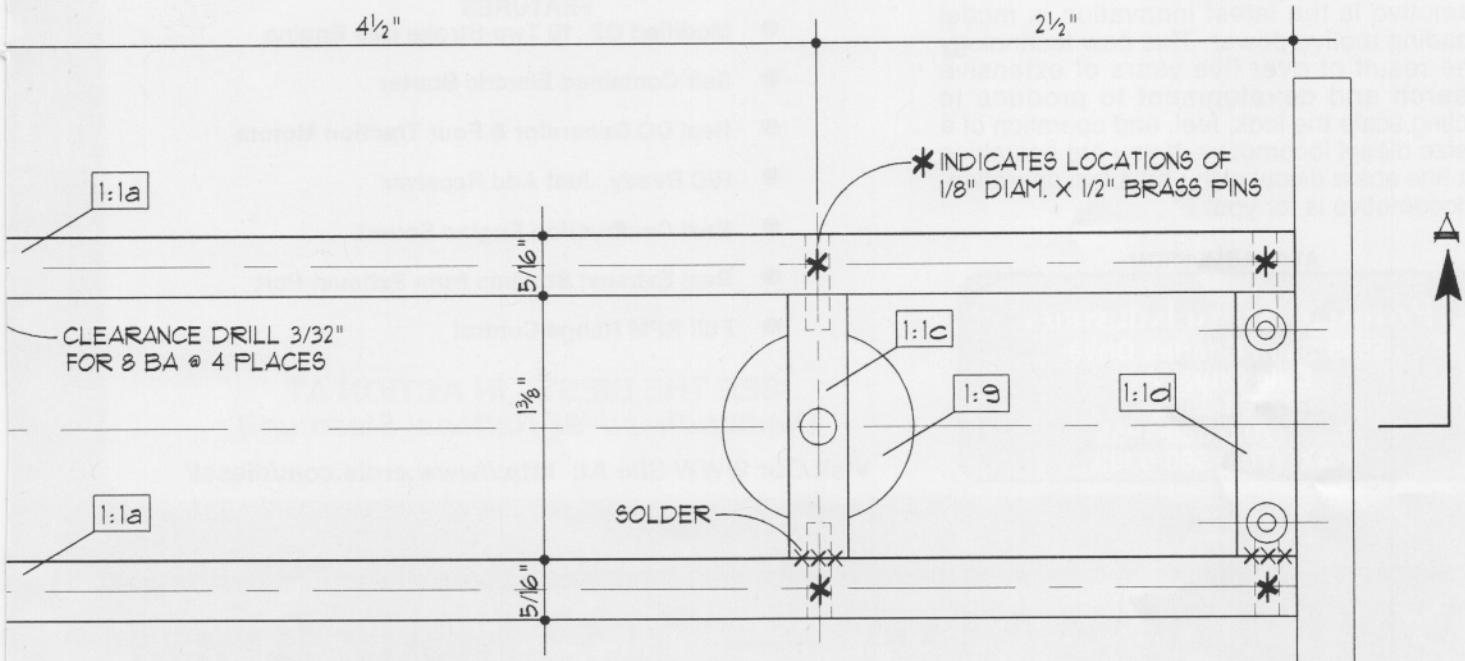
1.1b FRAME STRETCHER

1-OFF 5/16" SQ. BRASS

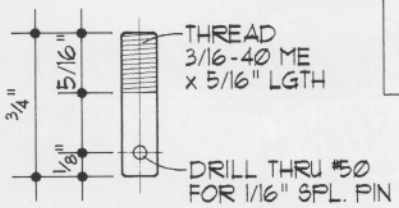


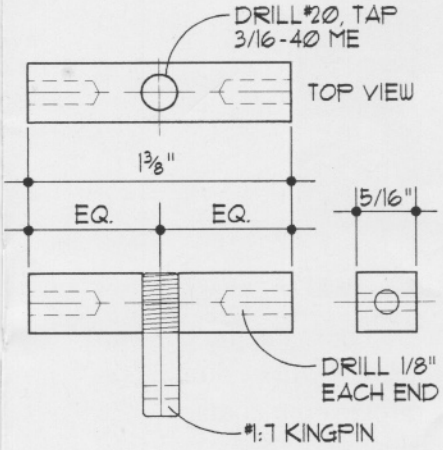
SECTION at A-A

SIZE FOR GAUGE ONE



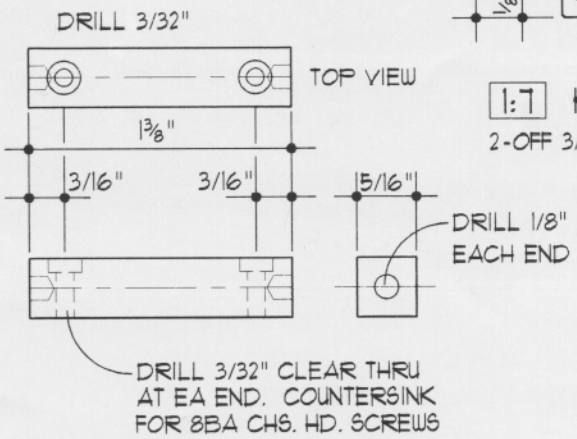
- TOP VIEW





1.1c FRAME STRETCHER

1-OFF 5/16" SQ. BRASS

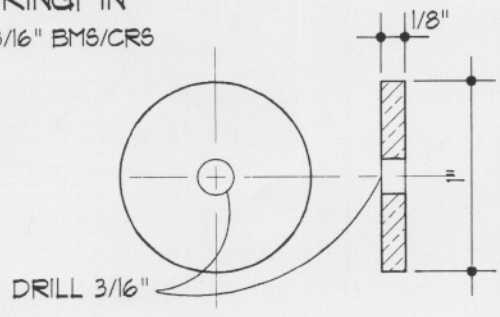


1.1d FRAME STRETCHER

2-OFF 5/16" SQ. BRASS

1:7 KINGPIN

2-OFF 3/16" BMS/CRS



1.9 SPACER WASHER

2-OFF BRASS

THE VEST POCKET CLIMAX

Locomotive design by Mel Ridley

DRAWING
NO.3

OUR DIESEL IS A GAS !!

Easy to Operate, 1:32 Scale

GAS POWERED

Diesel-Electric Locomotive

EMD GP9

REAL DIESEL PROTOTYPE MOTIVE POWER FOR THE GARDEN RAILWAY

Newly Introduced by Wada Works Co., Ltd, Yokohama, Japan

The Wada Works gas powered Diesel-Electric locomotive is the latest innovation in model rairoading motive power. This new technology is the result of over five years of extensive research and development to produce to exacting scale the look, feel, and operation of a full-size diesel locomotive. If you are searching for a fine scale diesel with protypical operation, this locomotive is for you!

FEATURES

- **Modified OS .10 Two-Stroke Gas Engine**
- **Self Contained Electric Starter**
- **Real DC Generator & Four Traction Motors**
- **R/C Ready. Just Add Receiver**
- **Real Combustion Engine Sound**
- **Real Exhaust Streams from Exhaust Port**
- **Full RPM Range Control**

SEE THE DIESEL IN ACTION AT
Diamondhead '97 National Steamup!!

Visit Our WWW Site At: http://www.erols.com/diesel/

AVAILABLE FROM

Potomac Steam Industries
5595 Saint Charles Drive
Dale City, VA
22193-3503
☎ : (703) 680-1955
FAX: (703) 590-9399

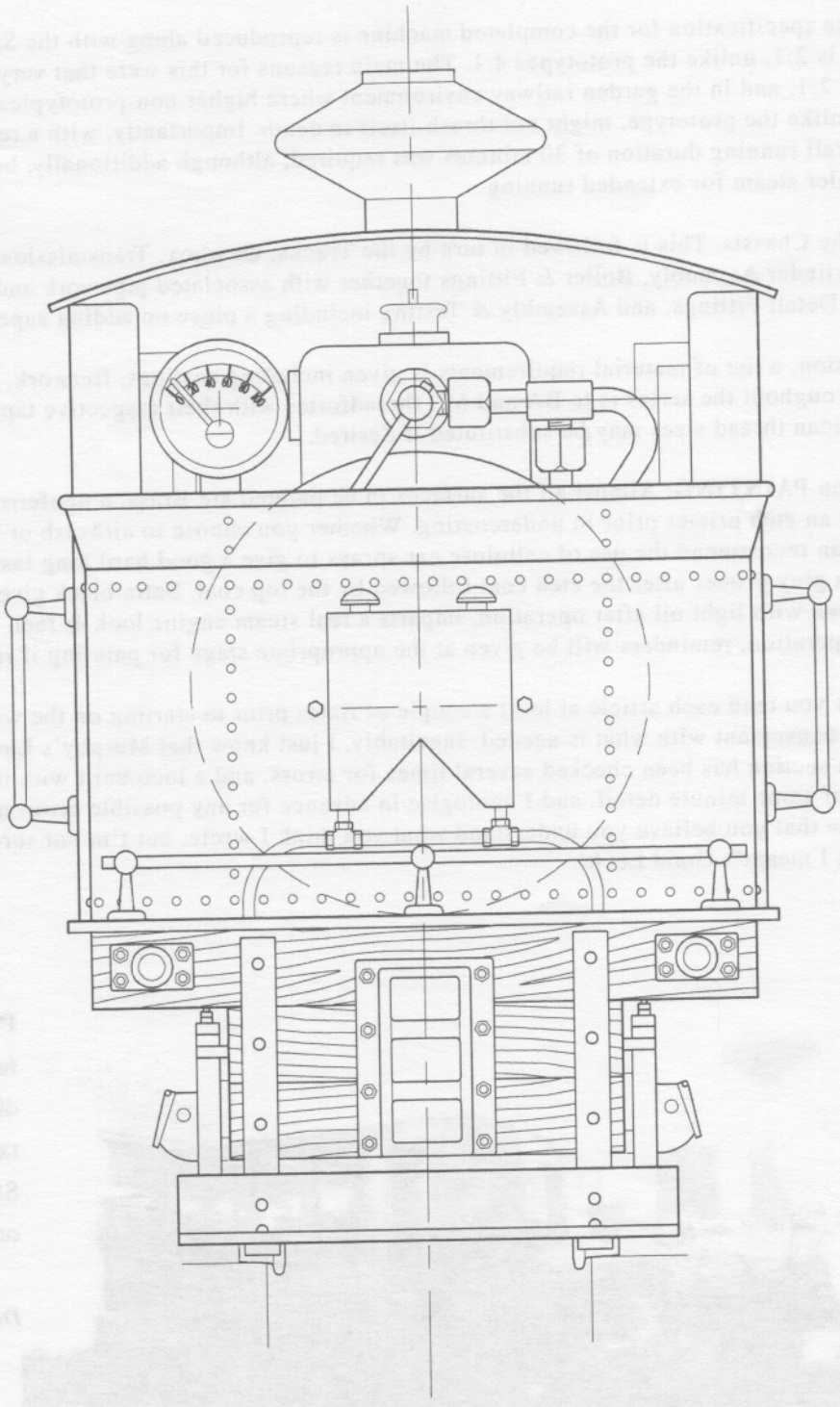
AVAILABLE NOW — 1:32 Scale Brass DAYLIGHT COACHES

Daylight Coach with prototypical corrugated sides, like those that were pulled behind the Southern Pacific GS 4 in 1936. This is the first in a series of four different Daylight cars that will be available. The coaches will be numbered consecutively, and will be fitted for Gauge 1 couplers. Price per car, $725.00. For more information contact:

J & J TRAINS

5348 Vista Del Mar, Cypress CA 90630

Phone/Fax 714-828-1537



Locomotive design by Mel Ridley

DRAWN FULL SIZE FOR GAUGE ONE

THE MODEL: From a few known dimensions, a scheme was worked out to translate it into a 1:20 scale model for 3 foot narrow gauge. A rough pilot model was made followed by masters for all the various castings required, some 100 plus for each loco. It was hoped from an early stage that I could use a variety of existing components from various manufacturers and shop out my own designs to others saving time in construction. This has been partially achieved, particularly in regard to the boiler and fittings. You will learn more about these as the series progresses together with a list of suppliers for the various components, raw materials & specialist skills.

SPECIFICATION: The specification for the completed machine is reproduced along with the Side Elevation. Overall gear reduction is 2:1, unlike the prototypes 4:1. The main reasons for this were that very slow running could already be achieved by 2:1, and in the garden railway environment where higher non-prototypical speeds are generally expected, the model, unlike the prototype, might not thrash itself to death. Importantly, with a relatively small 200ml boiler capacity, an overall running duration of 30 minutes was required, although additionally, both gas and water can be topped up whilst under steam for extended running.

The series starts with the Chassis. This is followed in turn by the Trucks, Gearbox, Transmission i.e. Valve Gear and Universal Drive, the Cylinder Assembly, Boiler & Fittings together with associated pipework and Cleading, Platework including Cab & Tank, Detail Fittings, and Assembly & Testing including a piece on adding superdetail.

At the start of each section, a list of material requirements is given including castings, fretwork, raw materials and fasteners. Reference throughout the series is to BA and ME threadforms with their respective tapping & clearing drill sizes. Alternative American thread sizes may be substituted if desired.

Just a quick word now on **PAINTING:** Almost all the surfaces to be painted are Brass, a nonferrous material, and will require de-greasing and an etch primer prior to undercoating. Whether you choose to airbrush or hand paint doesn't matter, but the author can recommend the use of cellulose car sprays to give a good hard long lasting finish without hiding fine detail. Use a grey primer after the etch coat followed by the top coat. Satin black gives an ideal covering which, when rubbed down with light oil after operation, imparts a real steam engine look & feel. To save strip-down & reassembly after each operation, reminders will be given at the appropriate stage for painting if required.

I would recommend that you read each article at least a couple of times prior to starting on the work, understand the drawings and be totally conversant with what is needed. Inevitably, I just know that Murphy's Law will intervene somewhere. Whilst each section has been checked several times for errors, and a loco built with the instructions, it is all too possible to gloss over some minute detail, and I apologise in advance for any possible error, notwithstanding the old Nixonian cliche, "I know that you believe you understand what you think I wrote, but I'm not sure you realise that what you read is exactly what I meant". Good Luck!.

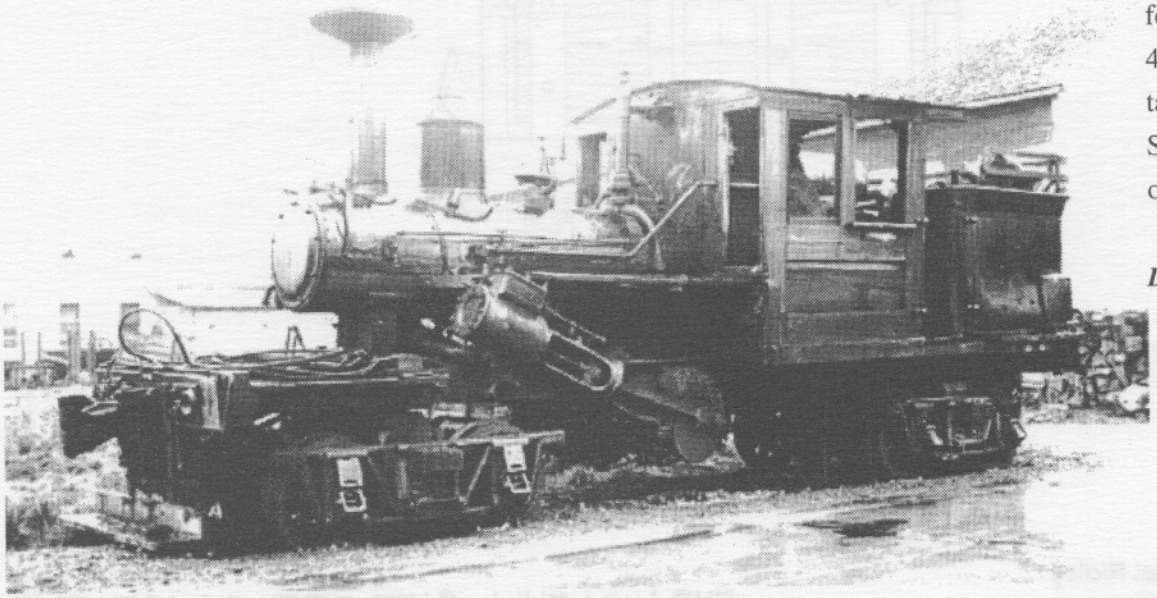


Photo left: A slightly different view of Climax № 407, seen here in a photo taken by D. S. Richter at Stanwood, Washington on March 24, 1939.

Dennis O'Berry collection

Keeping Water Over the Flame

text and drawings by Larry Bangham

An electric water pump for long runs and peace of mind

It's nice to run your steam locomotive without having to concern yourself with the elapsed time – just viewing the sight glass once in a while with an occasional pit stop to fill up the tender and refresh the steam oil. If you are running a gas fired locomotive and have had visions of long uninterrupted leisurely runs, dream no more, for with a little money and a little more work, that dream is now within reach of all C & S Mogul engineers.....and perhaps others as well.

The first leg of this strategy was presented in the article "AN ALTERNATIVE FUEL FOR THE ASTER C&S MOGUL..." (SitG #34). If you were interested in that conversion, then the next logical step would be to make sure that you always have an adequate supply of water over the flame.

Most of the mechanical feedwater pumping systems are pretty expensive, function only when under way and take power from the engine. There is an electrical system on the market but it is also quite expensive.

My approach to this problem is basically electro- mechanical, using an R/C model car battery to power a modified servo gear motor which drives the tender mounted water pump, all hidden from view. If you were into R/C airplanes or cars in a former life, then you probably have some of the parts stored away in a box somewhere. If you have to buy the battery, servo and linkage and can make the rest, the cost will be around $65.00.

Modifying the servo

With the mechanical stop and position sensing electronics removed, servos make very nice gear reduction motors. A medium size servo has adequate torque to drive your water pump against a 4 kg/cm head. By selecting the pump stroke using the proper hole on the servo arm, a very close match can be achieved between the pump output and the engine demand.

It is possible to modify the servo in a manner that will allow the pump to be activated through a radio transmitter. However, I preferred not to dedicate a radio channel, and instead installed a miniature toggle switch on the fuel car for this function. So the servo modifications 1, 2 and 3 are intended for manual control. A problem with the transmitter controlled pump is that the 4.8 volt battery required for the receiver electronics is not strong enough to drive the pump at sufficient speed to satisfy the C&S Mogul's thirst.

However, a young acquaintance of mine by the name of Matthew LeBorgne, who is making this conversion and who, by the way, at 16 years of age assembled his own Aster C&S Mogul and has built a super layout at his Palos Verdes, California home, has come up with a novel approach to the transmitter controlled pump motor. To overcome the low voltage problem he plans on incorporating an R/C car speed controller used in conjunction with a 7.2 volt battery. This will give him the added ability to regulate the speed of the pump motor as well as turn it on and off through the transmitter.

The Mod 1 drawing shows a cross section of an early Futaba servo, p/n FP-S7. These servos have been obsolete for fifteen years but are plenty rugged and make good pump motors. The mechanical stop can be removed with the gear train in place...or, by removing the keeper washer the gear can be removed and held in a tool for modification. The washer is a bear to get off. If you choose to remove it, you can leave it off since it is not required once the top cover is installed.

The Mod 2 drawing shows a cross section of a current Airtronics servo, p/n 94102. This servo may be a little light for this type of duty. However, it has plenty of torque, is small, and is fairly easy to rework just in case you happen to have one laying around.

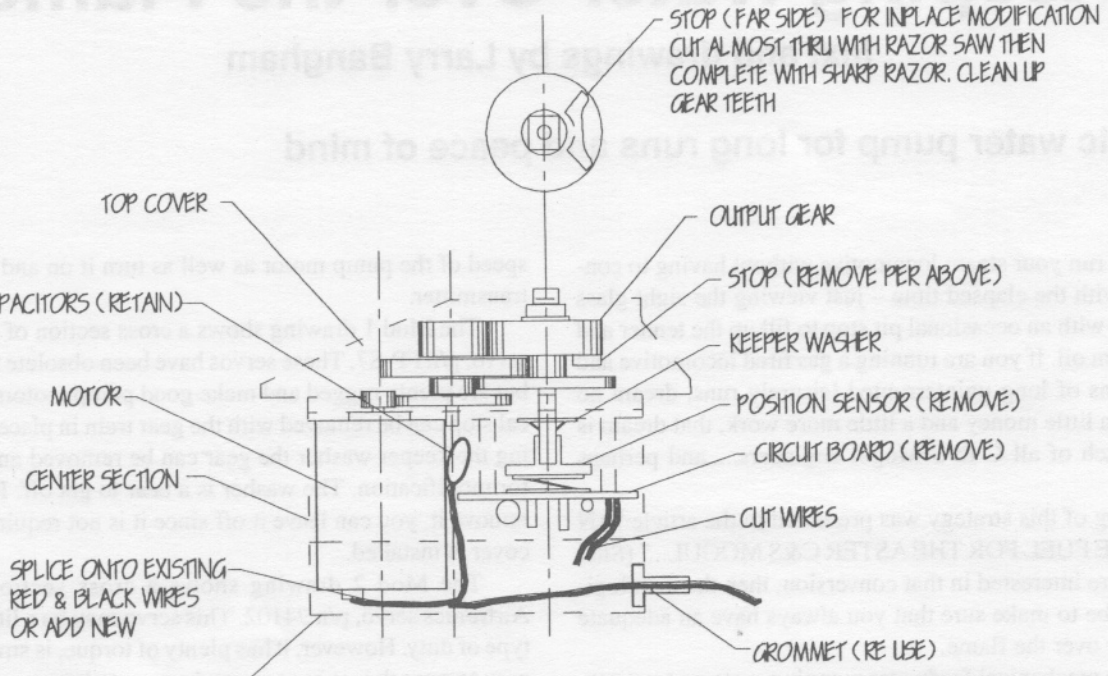
The Mod 3 drawing shows a more recent Futaba servo, p/n FP-S148. If I had to buy one for this project, out of the three I have looked at, I think this would be my choice. It is easy to rework, has plenty of torque, and has a metal bearing on the bottom end of the output shaft.

The following list outlines the steps that need to be performed without much elaboration. Take care to maintain cleanliness during all operations.

1. Disassemble case. Salvage gaskets when furnished.
2. Remove gear train. Mod 1 may be completed with gear train in place.
3. Remove stop from output gear. Gear is plastic so it is easy to cut.
4. Remove circuit board (mod 1 only), and position sensor.
5. Remove unused wires. The only wires required are the + and - to the motor. Leave the capacitors wired across the motor terminals.
6. Solder wires to motor and route through grommet.
7. Position motor and assemble lower part of case to center section. Use motor mounting screws and gasket when provided.
8. Reassemble gear train in proper order.
9. Lubricate gears and output shaft with plastic compatible grease (teflon).
10. Reassemble top cover using gasket when provided.
11. Pat yourself on the back (after testing).

Servo mounting

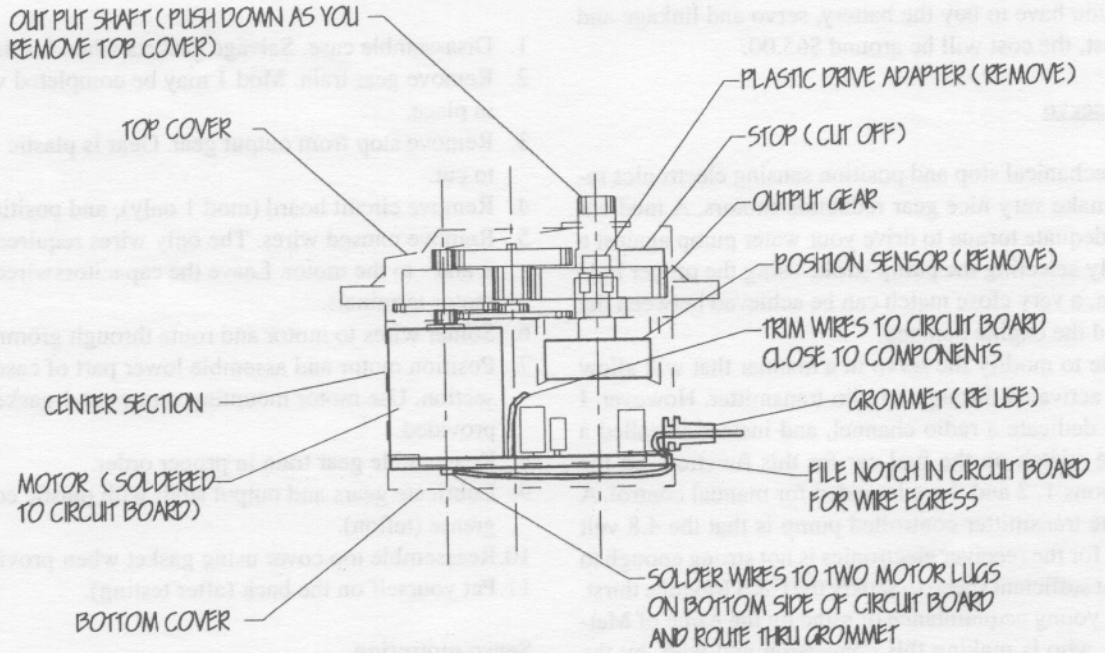
Mounting the servo requires surgery on the sheet metal of your tender. It can all be accomplished with hand tools, but is much nicer with a metal cutting band saw and drill press. Figure 1 shows the servo location in the tender of the Aster C & S Mogul. I made two angle brackets out of 1/16 steel about 5/16 wide to support the



MODIFICATION OF EARLY FUTABA SERVO P/N FP-S7

GEAR MOTOR - MOD 1

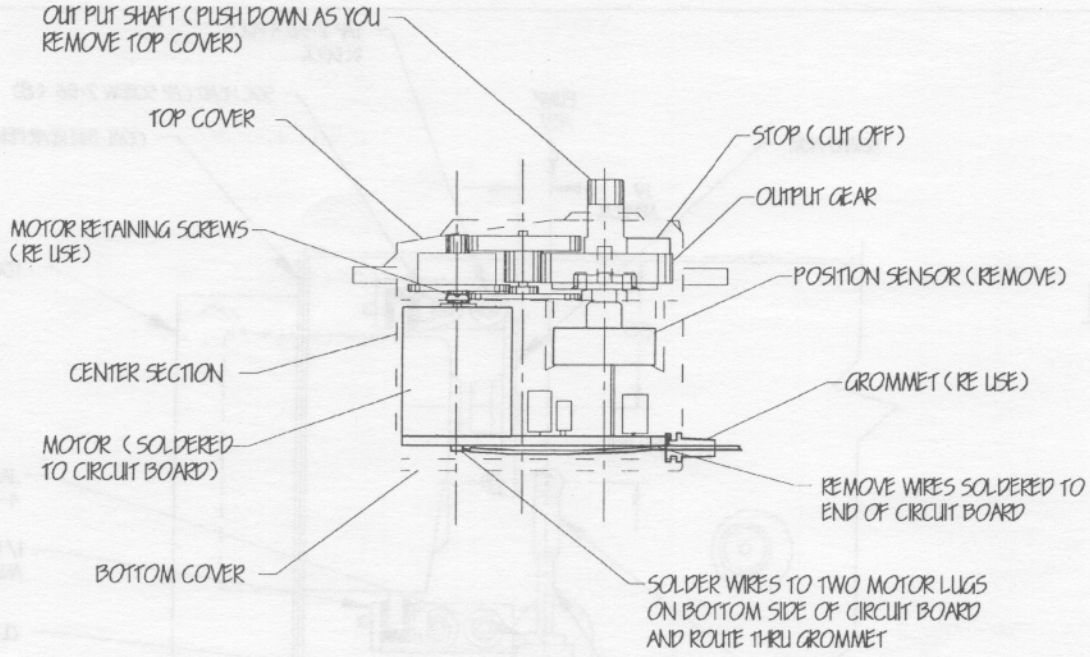
WATPUMP1



MODIFICATION OF AIRTRONICS SERVO P/N 94102

GEAR MOTOR - MOD 2

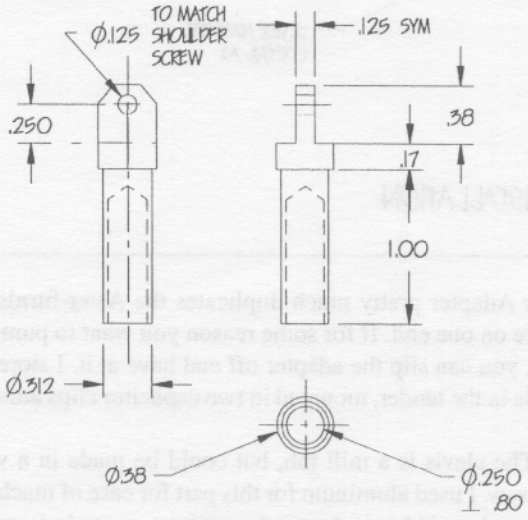
WATPUMP2



MODIFICATION OF FUTABA SERVO P/N FP-S148

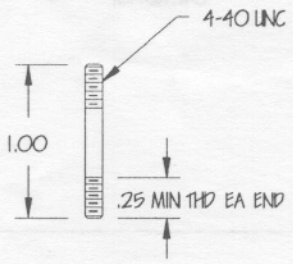
GEAR MOTOR - MOD 3

WATPUMP3



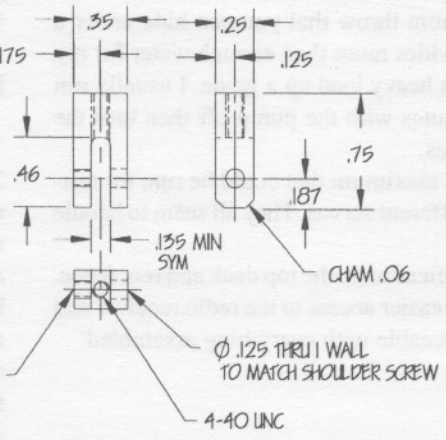
DETAIL A ADAPTER

MAKE FROM BRASS



DETAIL C PUMP ROD

MAKE FROM STEEL



DETAIL B CLEVIS

MAKE FROM ALUMINUM

WATPMP3B

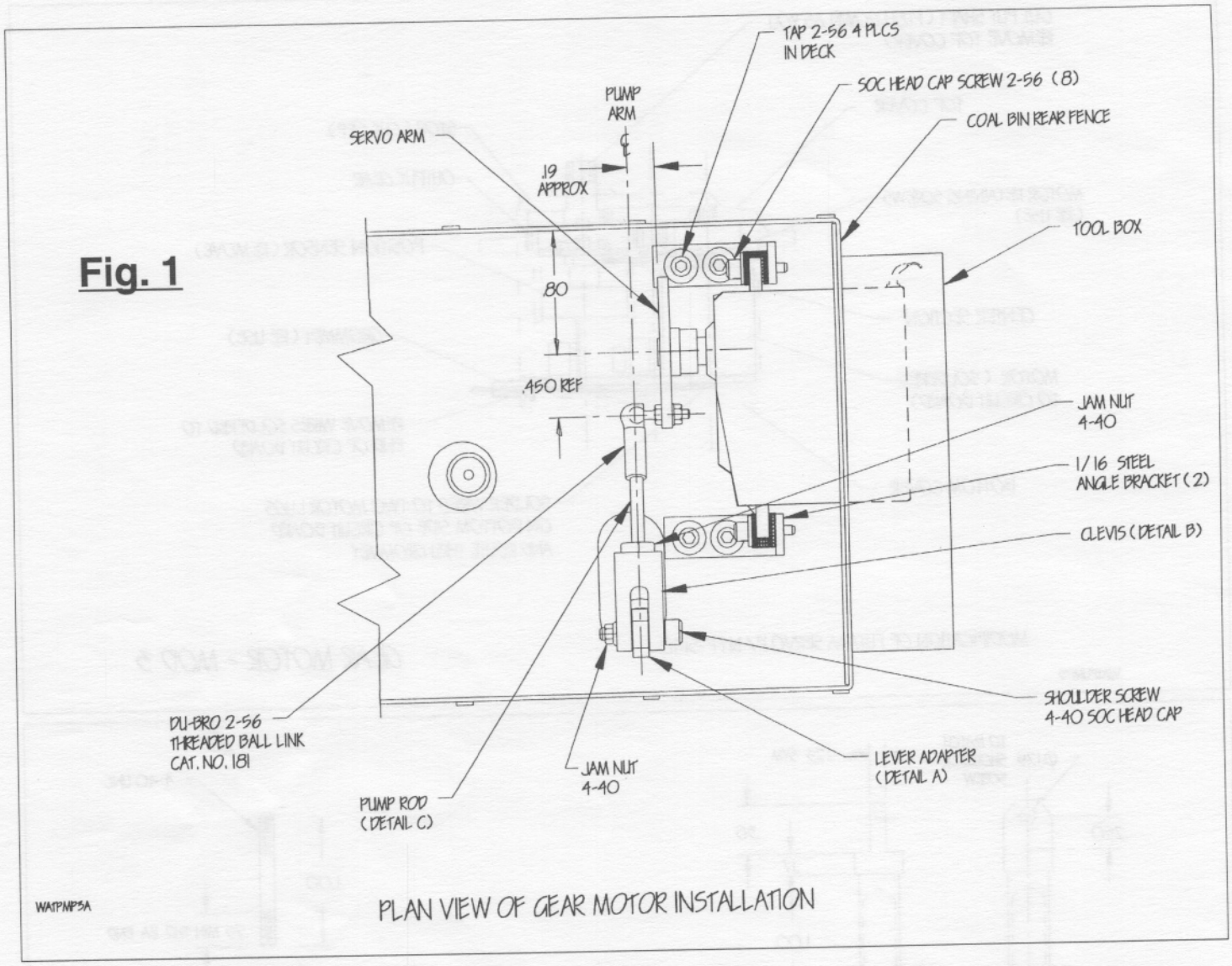


Fig. 1

PLAN VIEW OF GEAR MOTOR INSTALLATION

servos. These are not detailed because they will vary depending upon the servo type. I used 2-56 stainless socket head cap screws for mounting the servo and brackets. I also used the rubber mounts and eyelets furnished with the servos.

The DU-BRO ball links are set up for 2-56 threads. However, I felt more comfortable with a 4-40 thread for the pump rod, so I ran a 4-40 tap into the plastic socket.

The .450 dimension from the center of the servo arm to the ball link is about the maximum throw that you can hide under a load of coal. This throw provides more than enough water for my C&S Mogul, even working a heavy load up a grade. I usually run the engine for about 10 minutes with the pump off then turn the pump on for about 10 minutes.

I set the stroke up as the maximum that could be run, for testing the performance of the different servos. They all seem to handle it fine.

Figure 2 shows the modification to the top deck and rear fence. The two piece deck provides easier access to the radio receiver and wiring, and is not really noticeable with everything assembled.

Details

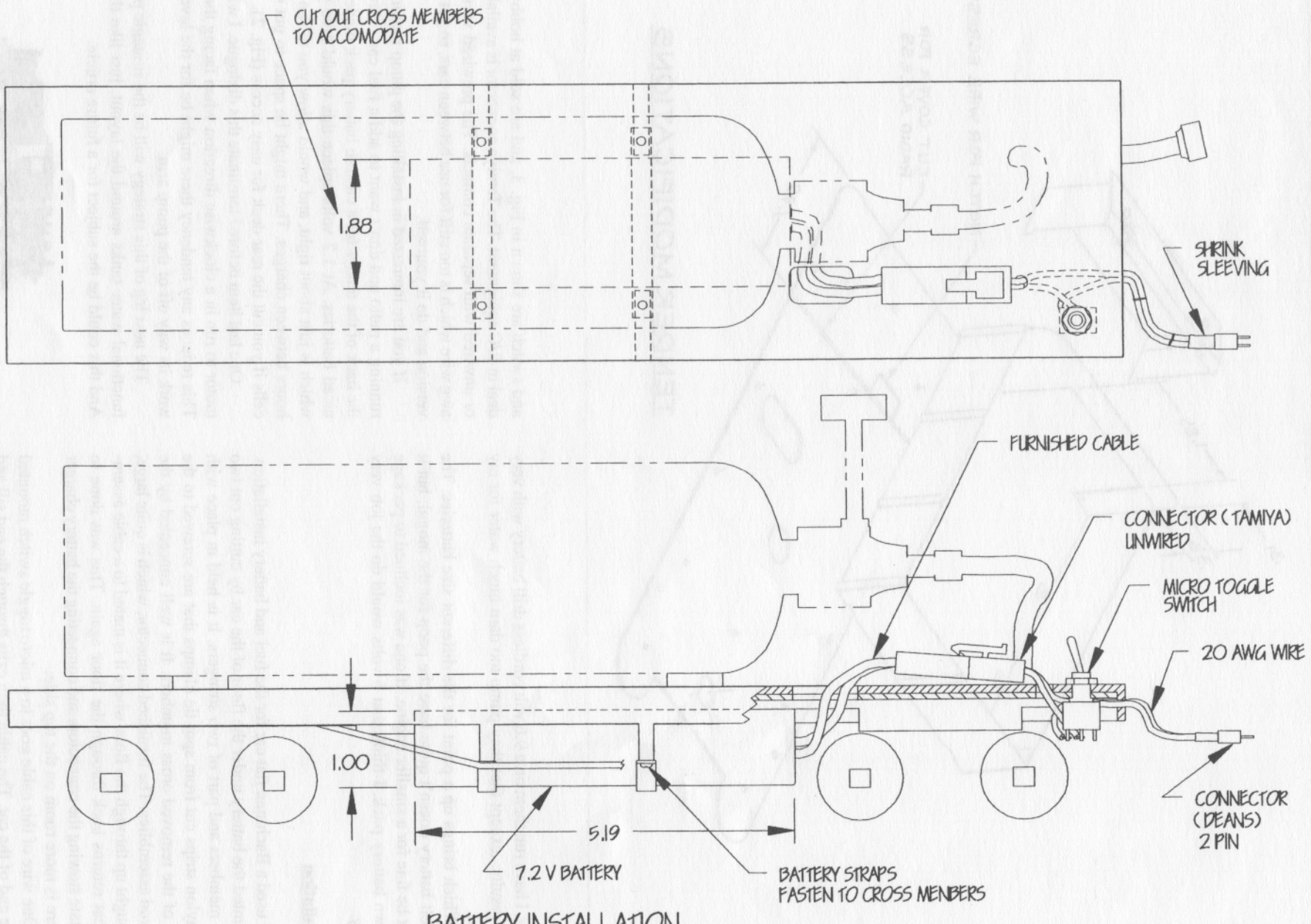
The machined parts are shown in details A, B, and C. The Lever Adapter pretty much duplicates the Aster-furnished pump handle on one end. If for some reason you want to pump water by hand, you can slip the adapter off and have at it. I store the pump handle in the tender, mounted in two capacitor clips attached to the deck.

The clevis is a mill job, but could be made in a vise with a hack saw. I used aluminum for this part for ease of machining. The pump rod could be cut from a long screw, or made from a piece of 4-40 all-thread.

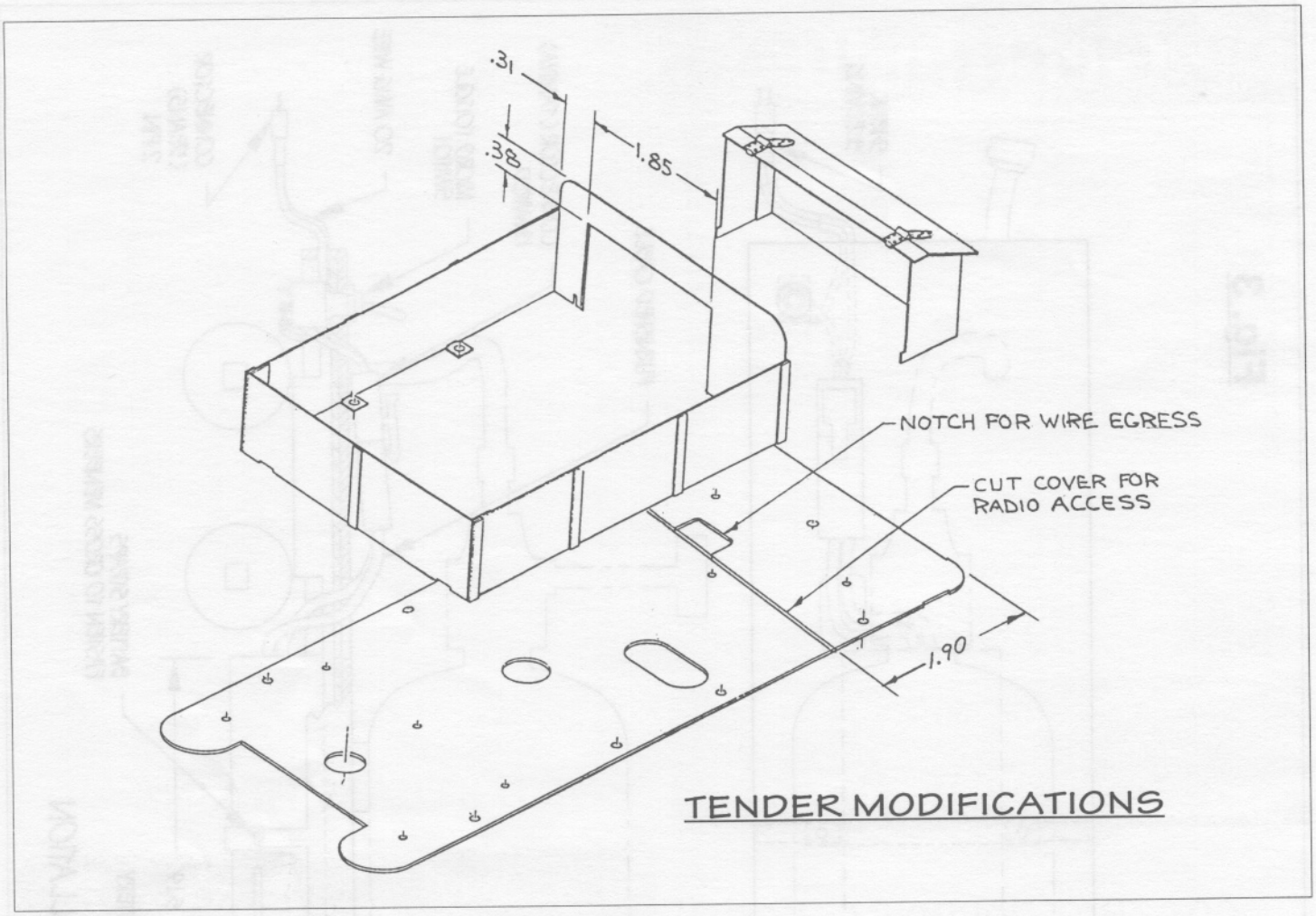
Battery

I tried several battery types and voltages before choosing the 7.2 volt, 1700 mah battery that I am now running. This is a common battery used in the R/C car hobby, and will allow approximately 12 hours of running between charges. Quick chargers are available at a reasonable price. I expect that some eyebrows may be raised at running a servo on that high a voltage. I know most manufacturers warn against running their servos at higher voltages than the 4.8 volt battery that is supplied with the radio, but I think that their concern is more for the electronics than the motor. Small d.c. motors in general are tolerant of a wide range of voltages. I suspect that the 4.8 volt supply is about midrange for this type of

Fig. 3



BATTERY INSTALLATION



motor. I have run them on a 9.6 volt cordless drill battery with very good results...except that they pump too darn much water for my mogul.

Which brings up a point for the different size batteries. The 4.8 volt battery doesn't quite have the poop for the mogul, but it might be fine for a smaller engine. If one was inclined to package his own battery pack, I think that 6 volts would do the job very nicely.

Installation

I used a Bachman flat car for the fuel and battery installation. I mounted the battery under the floor of the car by cutting out two cross members and part of two stringers. It is held in place with two nylon strips cut from spot tie clamps that are screwed to the stubs of the removed cross members. It is well concealed by the truss rod assemblies. The furnished connector, which is quite large, is brought up through the floor where it is mated to a cable assembly that returns back through the floor again. This was done to facilitate stowing the connectors and connecting the battery charger as there is more room on the top side.

One wire of this cable goes to a micro toggle switch mounted on the end of the car. The cable then exits through the end sill and terminates in a small 2 pin connector which serves as the disconnect between the car and the tender. The battery, connectors, cable and switch are shown in Fig. 3, and are sold at hobby stores that deal in R/C equipment. The Tamiya connector is available prewired or unwired with separate contacts. The prewired version uses 16 awg wire which is too stiff for use between cars, so get the unwired version and do it yourself.

If you are interested in installing the pump motor, but are not running a radio and don't want to add a fuel car, there is room in the back of the tender for a custom battery pack made up of 5 AA nicad batteries. At 1.2 volts apiece this would give you 6 volts, which is just about right, and would allow you to run about three hours between charges. There might be space to put 4 alkaline C cells if you cut the rear deck for easy access (Fig. 2).

One last item before I terminate this dialogue. I wired the gear motor to run in a clockwise direction when facing the servo arm. This reduces any tendency there might be for the lever adapter to work its way off of the pump arm.

The next leg of this strategy will be the strategic placement of functional water tanks around the layout, just like the big guys. And this could be the subject for a future article.

Loco Review – Pearse Locomotives' "NEVADA"

by Ron Brown

Technical Specifications

Description:	2-6-0 Mogul, based on a 3 ft. narrow gauge prototype that ran between California & Nevada
Scale:	1:20 (15mm/1 foot)
Gauge:	gauge 1 (45mm)
Dimensions:	length 26.5" overall – width 4.5" – height 6.5"
Cylinders:	15mm bore x 17mm stroke – equipped with piston valves
Valve gear:	driven from eccentrics on the center axle via rocking levers in the frames
Boiler:	internally gas fired, center flue type - fitted with safety valve and water level check valve - no water glass...fuel tank designed to run out of fuel with a reserve of water in the boiler
Lubrication:	displacement type, fitted with underfloor drain
Duration:	approximately 25-30 minutes
Couplers, etc:	Kadee knuckle couplers - insulated wheels included
Color:	satin black (Rio Pecos painted the smoke box silver on our review loco)
Control:	factory installed R/C control of speed and direction (40mhz U.K. – 27mhz U.S.A.)
Minimum radius:	4' 6"
Price:	$2655.00 (includes shipping)
Available from:	Rio Pecos Garden Railroad Co., 27136 Edenbridge Court, Bonita Springs FL 34135
	phone 941-495-0491, fax 941-495-7264

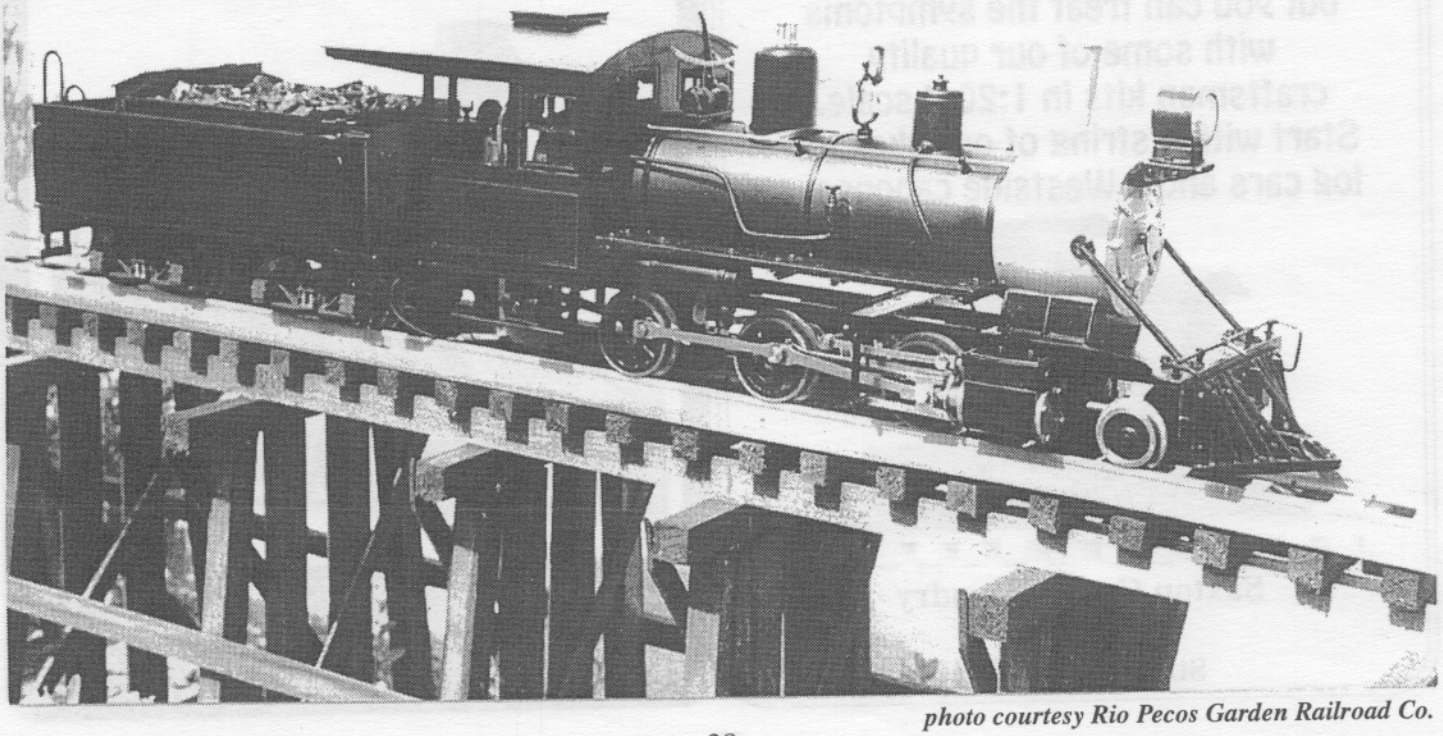


photo courtesy Rio Pecos Garden Railroad Co.

"Nevada", the new loco from Pearse Locomotives, looked good right out of the box, just as expected. The shared heritage with the very popular Pearse "Colorado" was immediately obvious. After all, they share many parts, including the boiler, cab and tender. On "Colorado", two inches of the boiler is inside the smokebox, which makes it appear shorter.

The big differences were obvious when we placed the two locos side by side – "Nevada" has a longer wheelbase, and it drives the center driver, rather than the rear. This gives "Nevada" more of a long, lean mainline look, and gives the impression of a much larger locomotive than it actually is.

The well-packed box arrived from Rio Pecos, Pearse's North American agent, just before we were due to leave for Jim & Jo Anne Stapleton's steamup in Virginia, so naturally we took it with us.

After surviving some harrowing experiences while driving through Hurricane Fran on our way, which included losing the exhaust system on our classic '82 Merc station wagon, we arrived in Virginia to clearing skies and a beautiful weekend ahead of us.

Preparing "Nevada" for a run is straightforward. Oil all moving parts with light machine oil, top up the boiler with distilled water, drain the displacement lubricator and refill with steam oil, and fill the fuel tank with butane gas. Pearse has made life a bit easier – and cleaner – by fitting the lubricator with an underfloor drain, which is itself fitted with a "tommy-bar" for tool-free operation.

Lighting a fire in its belly is accomplished by cracking the gas valve open slightly and applying a flame or spark to the top of the stack. The flame will "pop" back onto the burner in the center flue and "Nevada" settles right down to the job of raising steam.

The water level valve in the cab must be opened while filling the boiler to allow excess water to drain. Like the lubricator drain under the floor on the engineer's side of the cab, the water level valve (located under the floor on the fireman's side) is easily opened and closed by means of a tommy bar.

As the water in the boiler warms, excess water drains to make the necessary steam space in the boiler. This important operation also ensures that there will be no priming of the cylinders when the throttle is finally opened. This is particularly important on cylinders fitted with piston valves, so don't forget!

When a steady stream of steam (say ***that*** 3 times real fast!) is hissing through the water level valve, the driver can close the valve and wait for pressure to come up.

One of the nice touches noted on this loco is the condensate deflector fitted to the exhaust tube in the top of the stack. This allows exhaust steam to exit from the stack, but directs the condensate back down and out the bottom of the smokebox, keeping your engine, rolling stock, lineside structures and landscaping clean and dry. If you've ever gotten a shot of hot, oily gunk in your face (or on your favorite shirt) when starting up your steamer, you will appreciate this feature!

The safety valve on "Nevada" is enclosed and hidden from view, just like on "Colorado". The safety valve has been improved since we reviewed the latter engine, and we noticed no unwanted trickle of steam from the safety during our testing. When the safety does lift, the steam plume looks just great as it issues from the scale safety valves on the steam dome. Very nice touch, Mr. Pearse!

Operating pressure was reached in short order, and we switched on the radio control and opened the throttle slowly. For some reason, possibly the geometry of the servo linkage or the steam port alignment in the throttle valve, nothing much happens during the first 50% of the stick travel. We just kept advancing the throttle slowly and finally "Nevada" began to move. Once we got used to this it was okay, but we'd like to see the control range spread evenly over the whole range of stick movement.

It's always impressive to watch a steam engine of any size start up, and "Nevada" was no disappointment in the slow, smooth start department. No jackrabbit starts here! The wheels slowly start to turn, and with elegance and grace the massive machine comes to life and moves down the track.

We ran light engine for the first few minutes, just to get a feel for the controls and to make sure that everything was working properly. Satisfied that all was in order and impressed with the smoothness of this new engine, we coupled up to a train and moved out of the yard and onto the main line.

Our "Nevada" had plenty of power, even though it was brand new and fresh from the factory, and it had no problem pulling whatever we coupled up behind it.

We experienced some radio glitching (unwanted servo movement) when we got too far away from "Nevada" with the transmitter, but since this has nothing to do with the locomotive itself, we're addressing radio control as a separate issue in the sidebar accompanying this article.

Throughout our testing "Nevada" responded to our control inputs crisply, reliably, predictably and as smooth as cream, and it was a real pleasure to operate.

The only other minor problem we encountered was with the burner. The gas control valve on the engine supplied for review had a rather narrow range of adjustment. It wasn't the on-off toggle we've seen on some other engines, but if opened a bit too far the increased gas velocity would blow out the fire. This was an anomaly, unique to our review sample and not due to a poorly designed valve. None of the "Colorado" locomotives we've seen have exhibited this problem, and "Nevada" uses the same fuel system as its smaller sibling.

There you have it...only a couple of minor (and easily resolved) annoyances on a fine running locomotive of excellent quality and craftsmanship. We are impressed with the engineering and workmanship on the product line from Pearse Locomotives, and we are particularly pleased that Ian Pearse has seen fit to offer locomotives based on North American prototypes. Highly recommended!

The Despicable Glitch

by Ron Brown

"Glitching" is a common occurrence in radio controlled steam locomotives, and is the result of interference from various sources sending unwanted signals to the servo and making the engine stop, start, reverse direction or blow the whistle on its own.

The receiver antenna is a critical part of the radio system, and for maximum range it should be extended to its full length and kept away from large metal masses. This isn't a problem on aircraft, boats or other models, but it can be a problem on model railroad engines, where it is often found coiled up in a toolbox or inside the tender body. This may be esthetically more pleasing, but it will certainly have an adverse effect on the range of the R/C unit.

Local conditions can also have a significant effect on R/C range and performance. Trees, fences, buildings, and even large boulders can reflect or block signals, causing radio problems.

Metal-to-metal contact is a real problem to radio control systems, as it generates spurious signals that can confuse the receiver. A steam locomotive, being made of metal and running on metal rails, is a nightmare of metal-to-metal contact.

Another R/C problem that is common on steam engines built outside of North America is the radio itself. Because legal frequencies vary from one country to another, builders in the U.K., for example, cannot purchase radio sets on frequencies that are legal in North America...except the 27MHz band. Knowledgeable R/C users here have long ago abandoned this frequency range because of interference. Technically, 27MHz is still a legal frequency for model operation, but the Federal Communications Commission (FCC) has also opened it up to citizen's band radio, garage door openers, and other radio transmissions.

According to a spokesman at Futaba Corporation, the biggest supplier of radio control sets to the hobby industry, Futaba long ago stopped selling radio control units on 27MHz in North America (with the exception of the small, pistol-grip sets designed for indoor model car use) because of interference problems on that frequency band.

More important to us, Futaba will no longer support or repair any of the 2-stick R/C units on the 27MHz band...not even warranty repairs.

The FCC has allocated the 75MHz frequency band exclusively for operation of ground-based remote controlled models in North America, and we strongly recommend that if any of your R/C units are on 27MHz, consider an upgrade to 75MHz The cost of a replacement transmitter and receiver on 75MHz (the servos work with any frequency, and would not need to be replaced) is very reasonable – typically well under $100 for a 2-stick AM unit.

You'll find that modern radios on the 75MHz band have a much tighter bandwidth than those on 27MHz, and thus are generally much less prone to glitching or loss of control caused by interference from outside sources. While you're upgrading, you might as well spend a few more bucks and opt for FM, rather than AM. If you're ***really*** in high clover, go all the way to PCM and enjoy the benefits of this top-of-the-line technology.

If you have any R/C-related problems or questions, please feel free to contact me here at SitG.

Bending Tubing

by Murray Wilson

drawings by Larry Bangham

Thin walled brass tubing can be tough to bend

I recently had to bend some thin wall 3/16" OD brass tube. I have bent quite a lot of copper tube in my time, but this was the first effort with brass. Perhaps this information might save some of you some time.

To prevent it from collapsing during the bending I decided to fill the tube with low melting point metal. This is not something I had tried before, but the method is confidently spoken of in books, so how hard could it be to do?

Well, harder than I had expected. The bending itself is easy, the difficulty is to get the molten metal into a small bore. The method I devised may be of help to others.

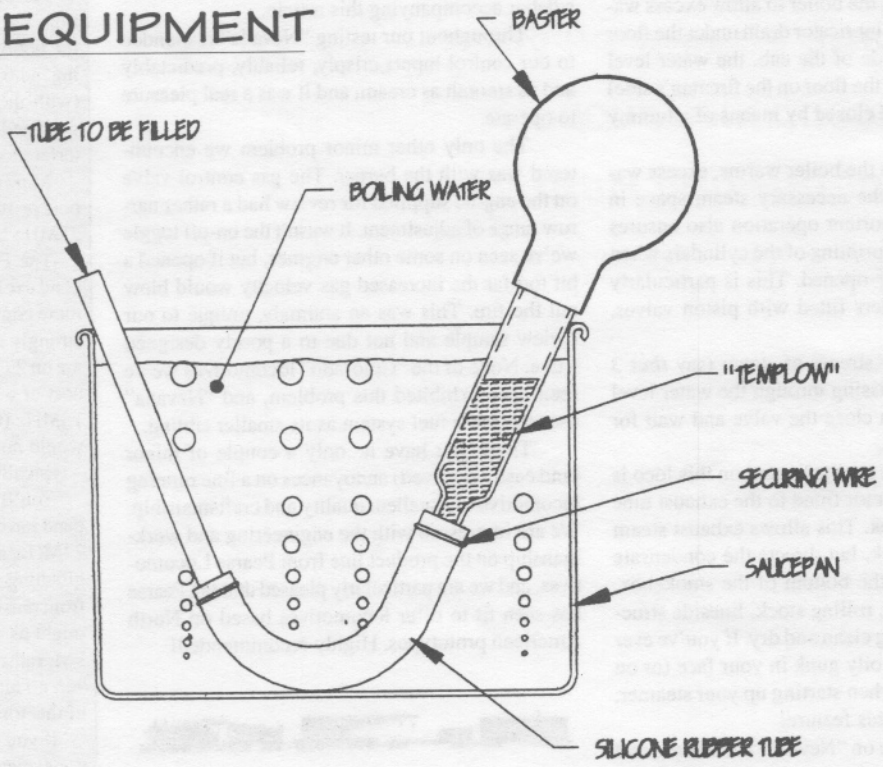
The equipment is simple, the sketch shows it. The baster is used to pressure inject the molten metal via a piece of silicone rubber tubing. The metal used is a eutectic bismuth alloy that melts below the boiling point of water. I bought mine from a model shop, where it is sold as "Templow", Walthers' #949-525.

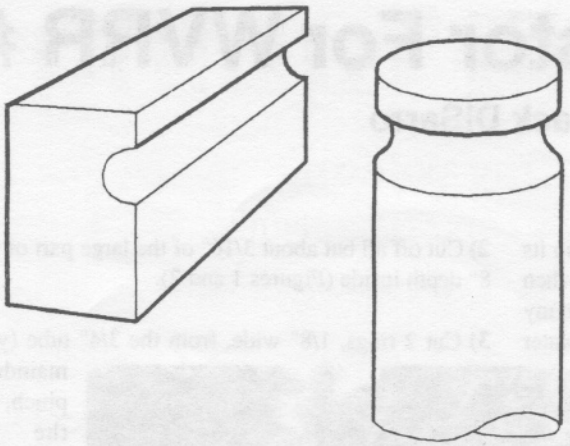
The metal has to be loaded into the baster, and this can be done with it in the liquid or solid form. Once the baster is loaded then the whole assembly is put in a pan of water and brought up to the boil. It is allowed to become thoroughly heat soaked and then the baster bulb is squeezed to force the metal into the tube. When the penetration is sufficient the assembly is withdrawn from the water and the tube cooled under the faucet.

For the actual bending I made up a two piece wooden former. Do not try to get too small a radius with brass tube as it breaks fairly easily. The minimum radius should not be much less than about two tube diameters. With this former bends can be made quite close to the end of the tube.

Copper tube can usually be bent in the fingers, as long as it has been annealed. Very thin wall copper might require the molten metal technique, though I have never had to use it.

LIQUID METAL INJECTION EQUIPMENT





THE MATERIAL IS WOOD.
MAKE TO SUIT THE PARTICULAR
TUBE OD. CLAMP BOTH PIECES
WITH THE TUBE IN A VICE.

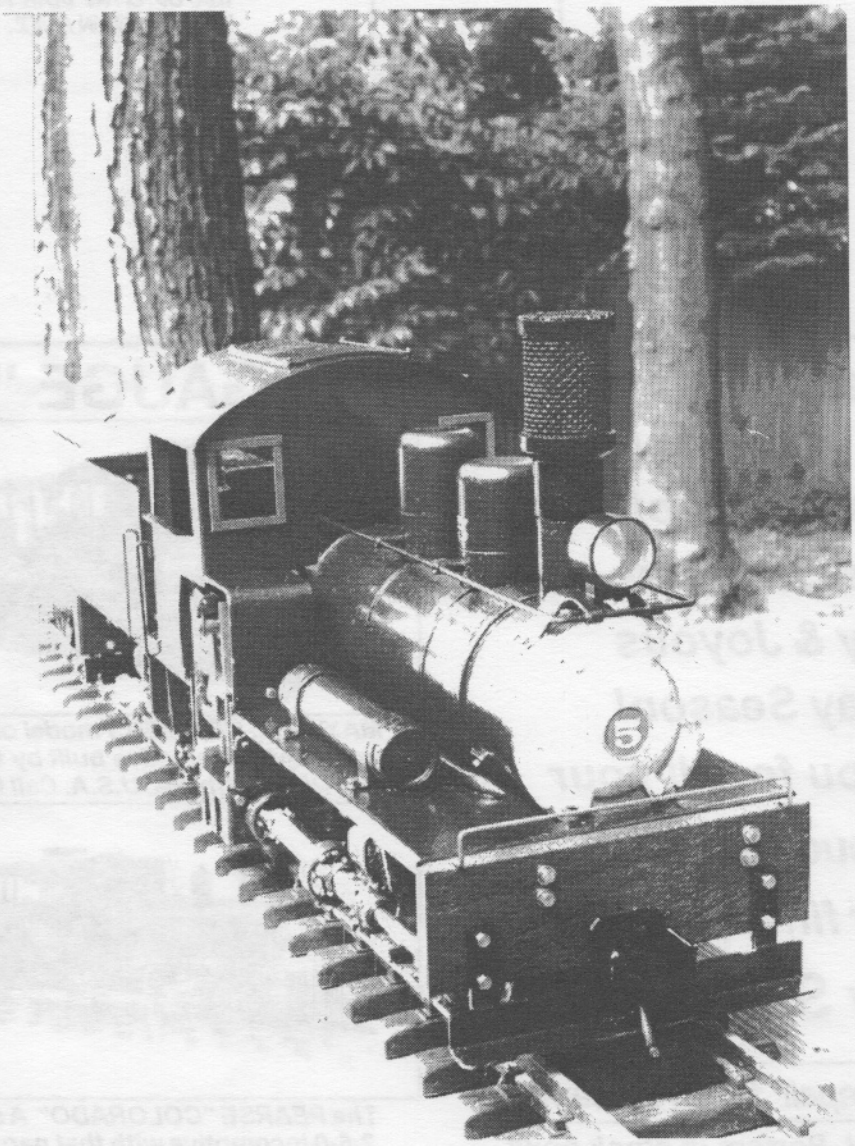
BENDING FORMER

A Spark Arrestor For WVRR #5

by Jack DiSarro

Although I enjoyed many pleasurable hours with my Shay in its first year, it had one nasty habit. At the beginning of each run, when clearing condensate from the cylinders, the exhaust pipe (which in my case extends up to the top of the stack), would spit steam oil and water up to several feet high. While I accepted this as one of the "charms" of operating a steam locomotive, it did tend to leave stubborn stains on my white t- shirts (frowns from the laundry room staff) and shower unsuspecting onlookers with its slippery discharge (a most antisocial tendency). To stop this, my choices were: partially disassemble the locomotive and cut down the exhaust pipe (no more nice tall plume of steam), wear brown clothes so the oil stains blend in (I don't own any), or find a means of deflecting or diffusing these "oil bullets".

I opted to build a device, disguised as a spark arrestor, to block the oily assault. Locomotives used by the U.S. logging industries were usually equipped with spark arrestors, which prevented hot cinders from starting fires in the forest and around the mill. They came in numerous shapes and sizes. Mine is modeled after the drum shaped affair atop the stack on Mich-Cal Shay #2.



All you need to build one is a copper reduction fitting for 3/4" i.d. to l/2" i.d. tube, a short (1" or so) offcut of 3/4"i.d. copper tubing, and some brass screen from the hobby store. I used Clover House 20 mesh screen. Avoid the finer mesh...it collects the oil/water exhaust and you lose the nice visual steam effects. You'll probably need some short sections of copper or brass telescoping tube (see the K & S display at your favorite hobby store) to custom fit the device to your particular locomotive.

Only basic hand tools are required to construct this spark arrestor. Here's how it's built:

1) Cut a 1/8" wide ring off the large portion of the reduction fitting (see Figure 1).

2) Cut off all but about 3/16" of the large part of the fitting, leaving 1/8" depth inside (Figures 1 and 2).

3) Cut 2 rings, 1/8" wide, from the 3/4" tube (you could use the remainder of the fitting in a pinch, but that would make the remaining steps tougher). Cut about 1/4" segments out of each ring, leaving C-shaped pieces. Figure 2 shows how these parts mate with the rest.

4) Cut a rectangle of brass screen about 2 3/4" by 1 1/4". Thesmaller dimension will determine the height-adjust to suit your preference.

5) Wrap the screen into a tube shape and slide it into the reduction fitting. There should be about 1/8" to 1/4" overlap. Squeeze the C-shaped tube piece in place so that it acts as a spring, clamping the screen against the inner wall of the fitting (I used needle nosed pliers to bend and reduce the diameter of C-1, making this task easier). This is a "fidgety" operation...it took me a while to get it in place correctly.

6) Slide the ring over the top of the screen "drum", and squeeze the remaining "C" inside of the screen so it acts as a clamp, as in step 5.

7) Cut out a round disk of brass screen to act as the top. Make it a little oversize and trim or file it off after soldering.

8) Disassemble and prepare all surfaces for soldering. I used soft solder, figuring (fortunately correctly) that the gas exhaust wouldn't be hot enough to melt the assembly.

9) Flux and assemble as in Step 5. With the top of the screen drum held together by an alligator clip (or similar), position the unit right side up and solder the bottom of the screen in between the reduction fitting and clamp.

FIGURE 1

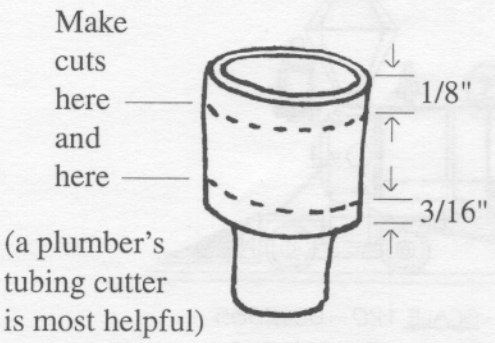
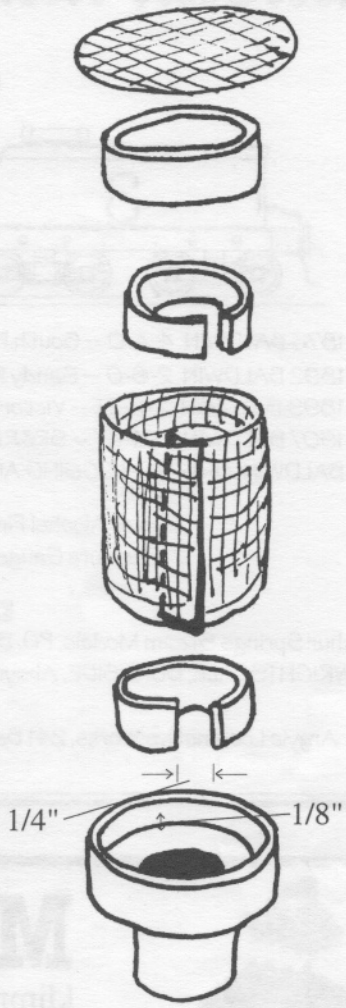


FIGURE 2



10) Flux and assemble the top of the unit. Rest it upside down on the screen disk and solder (on a flame proof surface, of course).

11) When cool, wash off the flux. Mask off the screen portions (so paint doesn't fill the openings) and paint the piece any color you like (as long as it's black). Unmask and lightly paint the screen.

12) Slide the assembly on over your existing stack. Don't fasten it permanently if your loco must be lit at the top of the stack (ala Roundhouse gas burners) – it must be slid off to light the burner, then replaced. Make adjustments and/or modifications to suit your particular locomotive's stack.

That's it. In an hour or so you can have an interesting and functional detail on your backwoods locomotive.

Product Review – Remote Control Systems Model #4A-2CHB Battery Powered R/C Throttle

by Mike Moore

(with apologies to Murray Wilson)

Even dedicated steam folk can use a battery loco!

Before my wife was so foolish as to buy me my first live steam locomotive, I ran electric locomotives with track power inside and battery power outside. Now the track powered trains run solely around the Christmas tree and the batteries only come out when there are children present who can't be trusted near hot locomotives.

There is a place for R/C battery power on any steam track, however. They are just the ticket to give demonstrations to those people who wouldn't recognize or appreciate a real steam locomotive, but they show up at your house and "...want to see the trains run...".

"A single channel of the R/C transmitter controls both speed and direction of the locomotive."

They are also great for use on ground level railroads when you are weeding, planting, creating a "scene" or some other task that won't allow you to devote your time and attention to a real steamer.....but you want a train passing by every now and then to give your task a "railroady" flavor.

And finally, though I admit this grudgingly, they can come in handy to run out and retrieve that dead steamer when you misjudged your fuel or water.

So.....keeping all this in mind, when our editor asked me if I had any experience with battery powered remote control, I had to admit that I had, and agreed to write the following review.

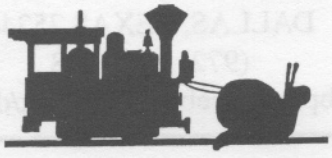
The RCS 4A-2CHB is a Variable Duty Cycle (VDC) radio control throttle available in either a 6-14V version or a 12-24V version. The version supplied for review is the 6-14V version. The throttle consists of two circuit boards connected by a 6 1/2" cable. The first circuit board is 1-3/4" w x 3-7/8" l x 5/8" d and makes up the VDC throttle. The second circuit board is the R/C interface and is 1-3/4" w x 1-7/8" l x 5/8" d. The purchaser must supply a model car type 2 channel radio control transmitter and receiver. A cable from the R/C interface board plugs into the receiver. One channel of the 2 channel radio control is used to control locomotive speed and direction. An optional second R/C interface circuit board can be added to blow whistles or ring bells of a sound system. The directions note that the VDC output of the throttle is compatible with most sound systems including those from DALEE ELECTRONICS, OMS, PH & CMI.

Also available from Remote Control Systems are trickle chargers, RF chokes for radio noise suppression, and an installation kit containing a suitably wired on/off switch, fuse, and battery connector. The cost of either the 6-14V or 12-24V throttle is $119.95.

I used an LGB Rio Grande diesel to test the throttle since I had not previously installed any batteries into it and there is plenty of room under the hood for the throttle and batteries. The division of the throttle into two circuit boards connected by a cable should make it easier to install this throttle into tight places. I used an inexpensive 2 channel R/C transmitter and receiver and connected the throttle to channel 2 of the receiver. Since the locomotive does not include a sound system and the optional second R/C interface was not included with the test unit, that feature was not used. The directions include a wiring diagram and I was able to connect the throttle, battery and motor together in a short time with very little trouble. The directions recommend removing all of the track voltage pickups from the locomotive, but since this was a temporary installation I did not do this. After the throttle is installed, the R/C interface must be tuned to adjust the response of the throttle to the stick position of the transmitter. Two LEDs are installed on the R/C interface board to indicate when the throttle detects stick movement. In addition, it is possible to adjust the throttle's acceleration/deceleration rate.

A single channel of the R/C transmitter controls both speed and direction of the locomotive. As the stick is held in the forward direction, the locomotive begins to accelerate. Releasing the stick causes the locomotive to maintain the current speed. Pulling back on the stick will slow down the locomotive until it stops. If the stick continues to be held back after the locomotive stops, the locomotive will begin to move backward and will accelerate backwards until the stick is released or pushed forward. There is no emergency brake, although one could be added with an extra R/C interface board.

The locomotive responded as expected to movement of the transmitter stick and smoothly accelerated to full speed. Pulling the stick back slowed down the locomotive and a constant speed was maintained when the stick was returned to center position. I found the directions clear and complete. The throttle was easy to install and performed as advertised.

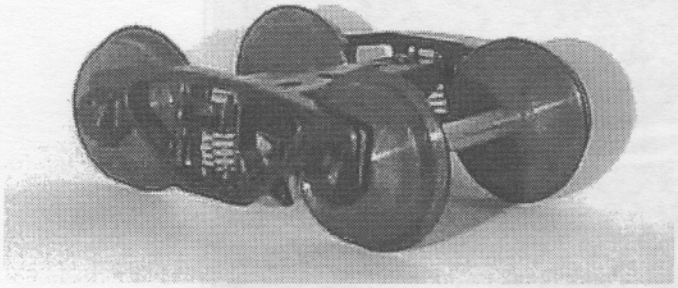


Product Review – ACCUCRAFT Trucks

Items reviewed: 1:24 scale archbar trucks - 1:32 scale Bettendorf trucks

Available from: ACCUCRAFT TRAINS, 2455-L Old Middlefield Rd., Mt. View, CA 94043
Phone (415) 966-1974 – Fax (415) 967-1504

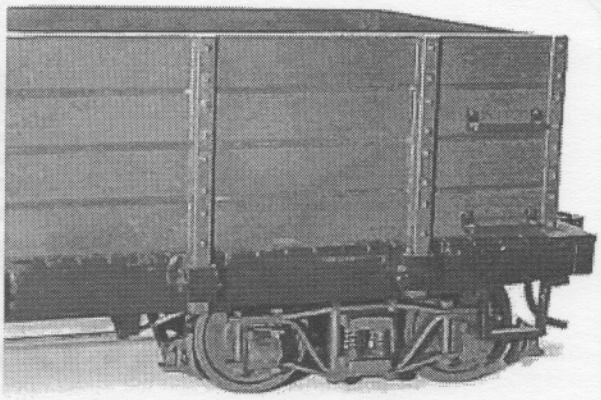
ACCUCRAFT offers two types archbar trucks for 1:24 scale and a Bettendorf truck in 1:32 scale. The archbar truck is available in two configurations: outside hung brakes and inside hung brakes. These have been upgraded recently with detailed brake shoe castings and softer springs. The visual difference of the new brake shoes is very noticeable, even if these photos don't do it justice.



ACCUCRAFT Bettendorf Truck

Journal lids open for access to the bearing surface, allowing access to lubricate the bearings. Three wheelset options are available: blackened brass ($32.95), stainless steel ($39.95), and stainless steel with ball bearings ($85.00). The built-up construction results in great looks and durability and consists of over 100 parts either bolted or soft soldered together. (Poor household communications resulted in two of my trucks becoming entangled in an oven preheat for pizza leftovers... I can attest to the fact that there are over 100 parts in each truck!)

Completely relevant to the appeal of these products is the price. The prices shown above include two assembled trucks, ready to paint. Bolster bolts are included but I ended up using nylon washers and the bolts/screws supplied with the rolling stock.



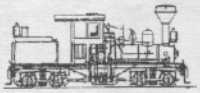
ACCUCRAFT Archbar Truck

ACCUCRAFT trucks will make any of your narrow gauge rolling stock really stand out, and the tracking and running performance on my much-less-than-perfect trackage has been as reliable as any other truck in the fleet, plastic or brass. In the case of the gondolas shown in the photograph, the added weight has improved the running of these cars through my turnout points.

The 1:32 scale Bettendorf truck should be welcomed by those who run Gauge One American prototypes. The truck frames are stamped brass attached to steel bolsters. The trucks are fully sprung. The same wheelset options are available: blackened brass ($39.95), stainless steel ($46.95), and stainless steel with ball bearings ($85.00). These trucks would dramatically improve not only the appearance but the performance of the few 1:32 injection molded cars available for this scale and practice. Maybe we can get ACCUCRAFT to donate a few pairs for trials on the Diamondhead MDC boxcar rake. I've been working on some simple 1:32 scale skeleton cars similar to those used on the Rayonier and Weyerhauser standard gauge logging operations for use with the Wada/Potomac Steam Industries GP9. These trucks will make my simple rolling stock look very nice as well as provide some mass to help keep them on the rails. The trucks come assembled and are painted black.

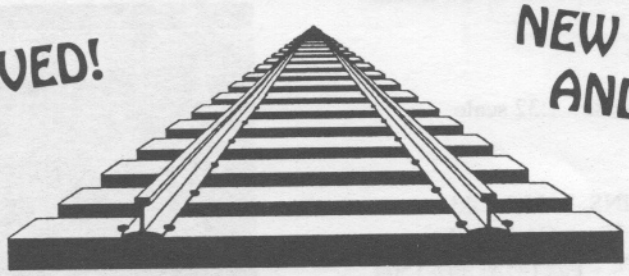
The price of these products alone will grab your attention, but the value is what will impress you.

Richard Finlayson



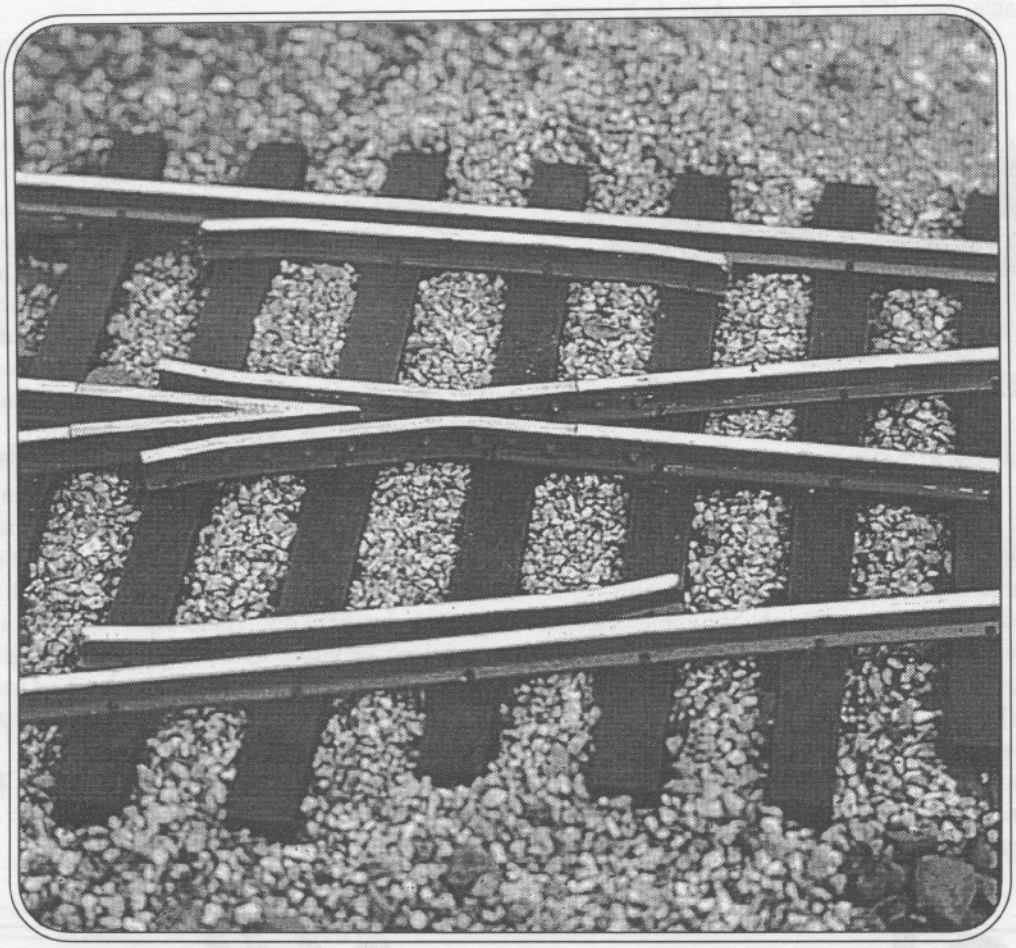
WE HAVE MOVED!

NEW LOCATION AND SHOWROOM



LLAGAS CREEK

Your source for 1:32, 1:22.5 and 1:20 scale, gauge 1 track.



For our latest catalog of Gauge 1 track and supplies,
please send LSASE with .52 postage.
For a sample of track (please specify scale) and catalog, send $2.00.

DoodleBug Hobbies Ltd.

HOURS 10-6
THURS - MON

106 3rd Street, San Juan Bautista, CA 95045
Phone: 408-623-1088 ● Fax: 408-623-9162
e-mail: doodlebug@pnet.net

MasterCard VISA

NATIONAL STEAMUP – 1997 EDITION

Jerry Reshew informs us that the speakers for the Steam Seminars at the National Steamup are all from the United Kingdom, which is in keeping with the theme –

The Golden Anniversary
of the
Gauge One Model Railway Association

Speakers at this World Class event will be:

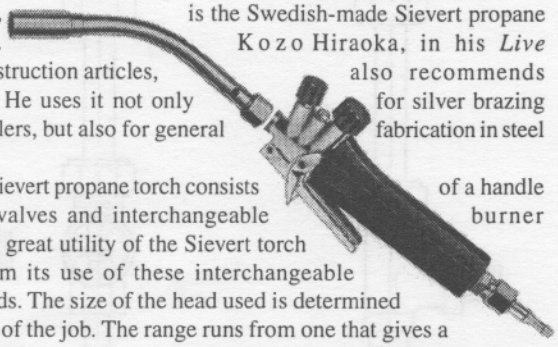
- Andrew Pullen, Secretary of the Association
- Mel Ridley, High Noon Loco Works
- Neil Rose, Finescale Locomotive Company
- Richard Longley, Brandbright
- John Shawe, Shawe Steam Services
- Malcolm Wright, Wrightscale Engineering

For more information about the National Steamup, held each January in Diamondhead, Mississippi, USA – contact Jerry Reshew at (601) 255-1747.

THIS MONTH'S FEATURED PRODUCT: SIEVERT PROPANE TORCHES

SIEVERT

Arc or acetylene welding of boilers is not for everyone. Acetylene torches are, if anything, too hot for brazing copper boilers. Gas tanks are expensive to rent. Welding requires considerable skill. The alternative, advocated by writers in the English publication, *Model Engineer*, is the Swedish-made Sievert propane torch. Kozo Hiraoka, in his *Live Steam* construction articles, also recommends this torch. He uses it not only for silver brazing copper boilers, but also for general fabrication in steel and brass.



The Sievert propane torch consists of a handle with two valves and interchangeable burner heads. The great utility of the Sievert torch comes from its use of these interchangeable burner heads. The size of the head used is determined by the size of the job. The range runs from one that gives a flame smaller than that for a typical hardware store torch to one that is a real barn burner!

Could a live steamer find this torch useful enough to justify the purchase? Based on my experience, the answer is yes. You definitely should consider the Sievert alternative.

A Sievert propane torch would be great for that Vest Pocket Climax project...put it on your Christmas "wish list"!

Excerpted from a review in "The Pilot"

SWAP SHOP

For Sale: Aster BR 86 live steam loco, carefully built by owner (me). Loco has been air tested, is in A-1 condition, and has never been run. Best offer over $2250.00, which includes UPS shipping to lower 48 from Colorado. John Pedersen. Tel (303) 444-7555 – Fax (303) 417-9880. (36)

For Exchange: Two 7-1/4" gauge locos - a coal fired 2-truck, 2-cylinder SHAY based on Molino Timber Co's 30" gauge No. 1 (Const. No. 2590) of Loma Prieta, California.....and a 50cc petrol driven HUNSLET Industrial 0-6-0. Can't lift them anymore so will trade the pair for about the price of an Aster Big Boy (preferably a kit if one still exists), or will consider possible sale or trade for other U.S. outline locos. No freelance or European. Write Mel Ridley, High Noon Loco Works, Teignmouth, Devon, UK, or phone/fax 01626 779908. (34)

Wanted: Aster OUEST 0-6-0T, Climax and 2-cylinder Americanized Mogul. Reply to: Kevin O'Connor, PO Box 161631, Sacramento CA 95816-1631 - (916) 447-5433. (34)

For Sale: FRANK S, brand new, never out of the box. $1,300, postpaid within the lower 48. Marc Horovitz, 1040 S. Gaylord, #203, Denver CO 80209. Phone & Fax: 303-733-4779. E-mail: gr@indra.com. (35)

For Sale: Roundhouse Billy 0-4-0 locomotive with R/C. Excellent condition - $875.00. Tom MacConnell, 6024 Dolomite Drive, El Dorado, CA 95623. Phone 916-626-3640. (35)

For Sale or Trade: #1 - Pacific 1/4" scale; 4-8-4, complete w/factory machined cylinder blocks & wheels; all valves, fittings, fixtures & fasteners; four assembly manuals w/plans; in original shipping box and have original invoices ($400.00+, in 1977). All in mint condition. **#2 -** Marine triple expansion engine - O.B. Bolton original design and plans, w/J.P. Bertinat's plans & Model Engineers articles for modifications to improve performance. Appears complete w/all castings, raw stock, fittings, fixtures & fasteners - all in mint condition. **#3 -** Stewart D-10 Twin Steam Engine w/Reverser. Appears incomplete (only EVIDENT shortages: fasteners & plans - has one plan sheet for 10-V). All other components appear to be present. Much machine work completed. I also acquired some Plans (w/no parts), as follows: Octura Models Triple Expansion Stationary Engine (1.750/1/250/0.750:1.000), 4 Sheets of 4. 3-1/2" Contractors Loco by LBSC & L. Clarke: 11 Sheets (1968), w/MAP Technical Publications' *Simple Model Locomotive Building...introducing LBSC's TICH*, Second Edition (1972), Orig. Copyright 1968. Could/would anyone have the knowledge and time to communicate w/me concerning the relative value(s) of the above and whether my idea to trade or swap for a combination lathe/milling machine is practical? Please contact me (Mike Davis) direct at: abilitec@iglobal.net. (35)

For Sale or Trade: #1 - Aster Big Boy #4002 (electric), test run only...$13,900. **#2** - Aster Western Maryland Shay (electric), test run only...$4,500. **#3** - Aster Baldwin 0-4-2T "Russian Iron" (steam - unfired)...$1,400. **#4** - Aster V&T 4-4-0 "Reno" (steam - unfired). Professionally repainted prior to assembly...$3,500. Photos available on request. Will consider trades for gauge 1 live steam engines. Contact Allan Starry, 23907 141st Drive SE, Snohomish WA 98296. Phone 206-485-1865. (35)

Wanted: Unbuilt Aster kits; all models. Please call with price and condition: 619-756-1323 or FAX 756-1811. Patrick Smiekel, PO Box 1665, Rancho Santa Fe CA 92067. (35)

Wanted: J&M blue and ivory CIWL cars; Fine Arts Models Pennsy N5C Caboose; Aster K-4 kit. J. Hyde, 614-946-6611. (36)

For Sale: Build your own turnouts! Point and stub manuals and step by step video, $25 plus $3 SH. Satisfied customers all over the world. See the review in SitG July 96 page 40. Send checks to Jerry Wilson, 2118 Judson, Longmont, CO 80501. Phone 303-772-5399 or e-mail to jjwilson@bvsd.co.us for more information. (36)

Wanted: British profile, live steam, gauge 1 engines, rolling stock and accessories. Bob Uhrmann, 935 Seasounds Ave., Marmora NJ 08223-1061. Phone 609-390-1259. (36)

IF YOU ARE BROWSING YOUR SITG BACK ISSUES FOR INFORMATION ON A SPECIFIC SUBJECT, YOU NEED THIS INDEX! Index to first 5 volumes of SitG, indexed by author, subject & contents. Send $5 (cash, check or money order) to Ricky Morningstar, 11 Kimberly St., Riverview NB, CANADA E1B-3P8.

Wanted: Distressed or incomplete gauge 0 or gauge 1 live steamers. Will not be resold. All correspondence answered. Murray Wilson, 604 N. Chester Rd., Swarthmore PA 19081 - 610-604-0444. (36)

For Sale: I have the following engines & parts for sale. **#1 -** Clishay, 7.5" gauge...needs work - $2,000; **#2 -** 0-4-0 vertical boiler, 7.5" gauge...needs work - $1500; **#3 -** Shan, $200; **#4 -** Miss, $175; **#5 -** Dodi - $60; **#6 -** Ann, $60; **#7 -** Lucy, $35; **#8 -** Dotty, $275; **#9 -** Small vertical boiler, $100; **#10 -** Wheels, $5.00. Ed Warren, 11996 Gast Road, Bridgman, MI 49106 - phone 616-426-3596. (36)

For Sale: Aster Pannier BR Tanker (Black). Never run, mint condition – $2,000.00. Peter, (212) 927-1696 (6:00 p.m. – 9:00 p.m.). (36)

Swap Shop listings are offered at no charge as space permits. No phone-in ads, please! Send your listings to SitG, P0 Box 335, Newark Valley NY 13811, or fax to 607-642-8978 (24 hours), or e-mail to <docsteam@servtech.com>. Ads must contain sellers name, plus address and/or phone number.

UNITED STATES POSTAL SERVICE™ **Statement of Ownership, Management, and Circulation** *(Required by 39 USC 3685)*

1. Publication Title	2. Publication Number	3. Filing Date
Steam in the Garden	0 1 1 - 8 8 5	10/8/96
4. Issue Frequency	**5. Number of Issues Published Annually**	**6. Annual Subscription Price**
bi-monthly	6	$27.00

7. Complete Mailing Address of Known Office of Publication *(Not printer) (Street, city, county, state, and ZIP+4)*: PO Box 335, Newark Valley NY 13811 — Contact Person: Ron Brown; Telephone: 607-642-8119

8. Complete Mailing Address of Headquarters or General Business Office of Publisher *(Not printer)*: SAME

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor *(Do not leave blank)*

Publisher *(Name and complete mailing address)*: George Ronald Brown PO Box 335, Newark Valley NY 13811

Editor *(Name and complete mailing address)*: SAME

Managing Editor *(Name and complete mailing address)*: SAME

10. Owner *(Do not leave blank. If the publication is owned by a corporation, give the name and address of the corporation immediately followed by the names and addresses of all stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, give the names and addresses of the individual owners. If owned by a partnership or other unincorporated firm, give its name and address as well as those of each individual owner. If the publication is published by a nonprofit organization, give its name and address.)*

Full Name	Complete Mailing Address
George Ronald Brown	same as above
Marie Elizabeth Brown	same as above

13. Publication Name: Steam in the Garden — 14. Issue Date for Circulation Data Below: Nov/Dec 1996

15. Extent and Nature of Circulation		Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies *(Net press run)*		1200	1200
b. Paid and/or Requested Circulation	(1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales *(Not mailed)*		
	(2) Paid or Requested Mail Subscriptions *(Include advertiser's proof copies and exchange copies)*	1043	1020
c. Total Paid and/or Requested Circulation *(Sum of 15b(1) and 15b(2))*		1043	1020
d. Free Distribution by Mail *(Samples, complimentary, and other free)*		36	24
e. Free Distribution Outside the Mail *(Carriers or other means)*		22	25
f. Total Free Distribution *(Sum of 15d and 15e)*		68	49
g. Total Distribution *(Sum of 15c and 15f)*		1111	1069
h. Copies not Distributed	(1) Office Use, Leftovers, Spoiled	69	131
	(2) Returns from News Agents	20	0
i. Total *(Sum of 15g, 15h(1), and 15h(2))*		1200	1200
Percent Paid and/or Requested Circulation *(15c / 15g x 100)*		94%	95%

16. Publication of Statement of Ownership ☐ Publication required. Will be printed in the Nov/Dec 1996 issue of this publication. ☐ Publication not required.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: GRBrown — Date: October 8, 1996

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including multiple damages and civil penalties).

End of the Line

On the Road Again

We recently traveled south for a steamup at Jim & Jo Anne Stapleton's beautiful estate in northern Virginia. The scenic, tranquil 5 hour drive was punctuated by about 20 minutes of sheer terror as we encountered Hurricane Fran at two different places. Definitely white knuckle moments, and my fingerprints in the steering wheel will attest to it!

Jim's promise of good weather was right on the mark, though, as the skies turned blue and the rain disappeared the moment we crossed the state line into Virginia. The Stapletons obviously have some very powerful connections in high places!

If you're new to real steam powered railroads, let me suggest to you that you get yourself out to a steamup at the first opportunity. Steamups are the best places to see for yourself what runs well, what appeals to your eye, and what appeals to your heart.

You can meet some kindred spirits and get some of your questions answered. You can also establish friendships that will last a lifetime.

Check out the calendar of events in this issue (and every issue, for that matter) and make plans to attend a steamup in your area...or get yourself to the National Steamup in Diamondhead in January. Just ask anyone who has been there. It's the event of the year for anyone interested in miniature steam powered railroads. You won't regret it.

Happy Holidays

It's that time of year again, and we want to take the opportunity to thank all those who have helped support SitG and our great hobby with articles, drawings, photos, letters and phone calls. And don't forget our advertisers. This wouldn't be much of a hobby without them! Be sure you let them know how much you appreciate their support of your hobby and your magazine.

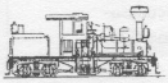
We wouldn't even think of trying to publish this magazine without everyone's help, and we ***really*** appreciate your support. We couldn't do it without all of you!

This is the final issue for Volume 6, and we'll begin 1997 with Volume 7, Issue № 1 (or № 37, if you prefer). We hope you noticed (and enjoyed) the additional 4 pages in this issue.....2 of them in color!

The coming year has plenty of great steam stuff in store, like Mel Ridley's outstanding series on building the Vest Pocket Climax; Lee Barrett's review of Aster's Stirling Single; coverage of steamup activities all over the globe; steam track construction and lots more. Keep those articles, photos, phone calls and letters coming – we enjoy every one!

Happy Holidays and Happy Steaming to all, and we'll see you at Diamondhead!

Ron



ADVERTISERS INDEX

Please tell our advertisers, "I saw it in SitG!"

O.S. LIVE STEAM LOCOMOTIVE

COMBINE THE PLEASURE OF BUILDING AN ENGINEERING MASTERPIECE WITH THE THRILL OF DRIVING YOUR OWN COAL-FIRED STEAM LOCO.

PORTER 2-6-0 Mogul 3 1/2-in. Gauge. Scale 1"=1'

This is a scale model of an American 2-6-0 Mogul class locomotive built by the H.K. Porter Locomotive Works at Pittsburg, Pennsylvania, in 1880. This historic and distinctively styled engine is typical of the locomotives used in the opening up of the vast railroad system of the United States, the largest in the world, in the nineteenth century.

Live Steam - The Ultimate Hobby

Notwithstanding the tremendous advances made in recent years in other types of working models - radio-controlled planes and helicopters, for example - the steam locomotive still takes pride of place in the eyes of many model engineers. O.S. live steam locomotives bring the hobby to a new and wider section of model enthusiasts. No longer is it necessary to possess an expensively equipped workshop and to spend years building a steam loco. Parts are ready machined and some sub-assemblies, such as the boiler, are ready built. An O.S. locomotive kit needs no more than a few simple tools and the true enthusiast's careful hand,to produce a superb model that duplicates a fullsize locomotive's operation in every respect' from raising steam to driving and maintenance procedures.

For more information, please write to:

O.S. ENGINES MFG.CO.,LTD.
6-15 3-chome Imagawa Higashisumiyoshi-ku Osaka 546, Japan. Tel: 81-6-702-0225 Fax: 81-6-704-2722

RIO PECOS GARDEN RAILROAD CO.
27136 Edenbridge Court, Bonita Springs Florida 33923
Tel: (941)495-0491 Fax: (941)495-7264 U.S.A.

Great Northern Railway Stirling Single No. 1

THE STIRLING SINGLE CLASS G 4-2-2

Officially known as the Class G, fifty-three locomotives of this type were built for the Great Northern Railway (GNR) during the time period spanning the years 1870 to 1895. Although similar in appearance, many small changes and improvements were made to each locomotive as operational experience dictated and, for many years during the late part of the 19th century, Stirling Singles worked the world's fastest trains, regularly attaining speeds of 110 km/hr while hauling loads of 200 tonnes. The 8 foot diameter drive wheel reflected Stirling's belief that better traction could be realized by putting a heavy load on a large single wheel, rather than spreading it out on several smaller ones. Another important factor in selecting a single wheel configuration was his wish to eliminate the need for coupling rods, since they had an intrinsic tendency to bind. One will soon notice, when studying the profile of this locomotive, that there is no steam dome. For economic reasons, Patrick Stirling elected to utilize a horizontal perforated stam collection pipe, located inside the boiler at the top and running its full length, instead of a more conventional steam dome. This unusual arrangement proved to be completely successful in practice, delivering a sufficient volume of dry steam to drive the cylinders at very high speeds for long time periods. The long boiler of the Class G was fitted with a beautifully shaped safety valve casing and running boards that swept over the huge drive wheels, becoming an integral part of the picturesque stotted splashier covers. These distinctive features, combined with their ethereal beauty and performance, have earned the Stirling 8 Footers an honored place among the most famous express locomotives in railway history. Unfortunately, after 1895 train loads had increased to the point that the Class Gs were no longer able to remain in first line service, and they were replaced by more modern designs.

Aster has chosen to model the first of these locomotives, the GNR #1 built at Doncaster in 1870, which is preserved in working condition at the National Railway Museum at York in the UK, and which can occasionally be seen in steam.

SPECIFICATIONS OF STIRLING SINGLE Nº 1

SCALE/GAUGE	1:32, GAUGE ONE
TOTAL WEIGHT	3.3 KG
DIMENSIONS:	
LENGTH	504 MM
WIDTH	78 MM
HEIGHT	127 MM
WHEEL ARRANGEMENT	4-2-2
DRIVING WHEELS	DIA. 76 MM
PILOT TRUCK WHEELS	DIA. 35 MM
TRAILER TRUCK WHEELS	DIA. 43 MM
TENDER WHEELS	DIA. 36 MM
ENGINE:	
CYLINDERS	2 X CYLINDERS OUTSIDE OF FRAME BORE 10 MM X STROKE 18 MM
VALVE GEAR	STEPHENSON VALVE CHEST INSIDE THE FRAME STEAM PORT 1.2 MM, CUT OFF 85% LAP 0.7 MM, TRAVEL 3.8 MM
BOILER TYPE	"C" TYPE FOR ALCOHOL BURNING
WATER CAP.	90 CC AT 80% FULL
PRESURE	3 KG/CM2 AT NORMAL WORKING
FITTINGS	1 X SAFETY VALVE, PRESSURE GAUGE, WATER GAUGE, THROTTLE VALVE, BLOWER VALVE, BYPASS VALVE
AXLE DRIVEN PUMP	MOUNTED ON THE LEADING DRIVER AXLE PUMP BORE 5 MM X RAM STROKE 4 MM
LUBRICATOR	ROSCOE DISPLACEMENT TYPE MOUNTED ON THE SMOKEBOX
BURNER	3 WICK TUBE ALCOHOL BURNER
WATER TANK CAPACITY	200 CC, HAND OPERATED PUMP MOUNTED
FUEL TANK CAPACITY	90 CC OF ALCOHOL
MINIMUM RADIUS	1.2 METER