

HUB Headlight

HUB Division Inc., Northeastern Region, National Model Railroad Association - www.hubdiv.org

Volume 38, Number 5, May - June, 2022

RAILFUN TIMETABLE

Presentation & Hands-On: Trees, Rocks, Ground Cover and Scenery - The Whole Ball of Wax

By Rudy Slovacek

8 PM Friday, May 20, 2022, Motherbrook Arts and Community Center, 123 High St, Dedham, MA 02026

In this clinic a number of tried-and-true scenery methods will be discussed as well as some of Rudy's tips for making believable scenes. We will start with how the locale affects your scenery options. Then we will cover track ballasting, the nitty-gritty dirt, grasses, weeds and bushes, then advance to the tree canopy. Water, rocks and roads will also be covered along with the importance of details.

In a surprise addition, a short hands-on clinic will be held to show participants how to make an iconic split-rail fence as used in New England. Participants are asked to bring a razor knife, small cutting board, ruler, white glue, a 1/16-inch drill in pin-vise and, of course, a small substrate for the structure. Wooden rail material will be supplied.

Presentation: Roofs and Visual Elements

By Jim Joubert and Paul St. Martin

8 PM Friday, June 17, 2022, Motherbrook Arts and Community Center, 123 High St, Dedham, MA 02026

As most of the viewing of our models is from a birds-eye-view, let's look at them from there! Some accuracy and illusion is necessary to complete a scene. Having been in the building trades and a carpenter experienced in many areas of construction for most of Jim's 75 years, he has some insights on this subject. Paul is a first-class modeler who, with colors and materials, does an excellent job of representing these details in miniature. Roofs and details on roofs come in many varied shapes and require certain elements to create a realistic illusion of the prototype. Jim will concentrate on real-life structures from the residential to commercial, and Paul will discuss and show techniques and materials to create the illusion in miniature.

Presentations: Member Updates

By Hub Members

8 PM Friday, September 23, 2022, Motherbrook Arts and Community Center, 123 High St, Dedham, MA 02026

Let's re-introduce ourselves to the members, by telling us about your interests, aspirations and what you have been working on over the summer. We are interested in having a complete update on where your interests lie in the hobby, and what your current projects and recently completed projects were. The HUB Division encourages you (and your guests) to bring in your models, dioramas, track plans, or vacation itinerary.

Please provide Andy Reynolds (Railfun.coordinator@hubdiv.org) in advance with pictures or pdf files, and we'll show things off to the members in a Power Point Presentation.



Valley Junction Railroad: a 2022 update Building my dream layout

By Bruce Robinson

Newsletter editors are always on the lookout for articles to publish, as is the case with our HUB Headlight editor Bill Barry. While swapping a couple of emails, Bill outlined what he would like to have published in the newsletter and at the top of his wish list were feature articles describing members home layouts with track plans. I took the bait and said I would update an article written for the Headlight back in the November, 1993 issue. A follow-on article was written for the NER Coupler in the January, 2013 issue. (You notice how fast I tend to move within the hobby ... 20 years between articles!)

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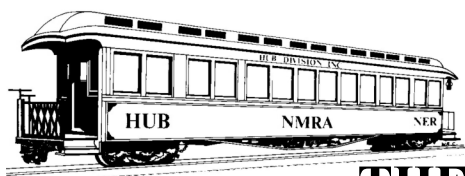
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RAILFUN Updates or cancellations will be posted on the division website (www.hubdiv.org) and issued via the HUB email list and via Constant Contact.



THE PRESIDENT'S CAR

By Manny Escobar

Spring has come with its occasional chill, but summer and warmer temperatures are just around the corner. It is time to plan your upcoming model railroad choices. On the cooler, rainier days, there is still time to update your layout, join some OPs sessions with friends or just sit back and catch-up reading past issues of model railroad magazines. On nicer days, you can get out and start doing activities like railfanning or riding dinner trains.

The HUB Division has had some existing events recently, a couple of modular displays and supporting Edaville's 75th Anniversary, April 23-24, in Carver, MA. We had a display at Edaville in conjunction with the host and event planner, *Maine Locomotive + Machine Works* from Alna, ME. The event was well-attended with families and spectators who came to see and ride the steam narrow-gauge locomotive around the cranberry bog. I would like to thank the volunteers who supported this last-minute event. Also, if you have not heard, Edaville Railroad and the Thomas Land amusement part are now up for sale.

RAILFUN had some great presenters and clinicians, including Timothy Towle's weathering clinic, James VanBokkelen's lineside signals presentation, Bruce Robinson's "Operation 101" and Malcolm Houck's "Locomotives of the Dickson Manufacturing Company." Please check out the next two RAILFUN sessions slated for May and June.

Prior to the April RAILFUN, we held our annual meeting that featured the election results, the annual report on the HUB Division's past year by Vice-President Malcolm Houck, and the Treasurer's report by Gerry Covino. Five well-qualified candidates vied for three positions on the Board of Directors. Bruce Robinson,

Pete Watson and Malcolm Houck were elected to three-year terms. Immediately after that, the Board of Directors re-elected me to be your President. I want to give a "big thanks" to Andy Reynolds for his support over the past years serving as a Director on the board and for his continued contributions to the operation of the HUB.

Model railroading usually slows down in June, as people pursue outdoor activities or vacation travel. But don't forget our Summer Picnic (we've also called it a Cookout some years) at the Waushakum Live Steamers on Sunday July 17th in Holliston. The Waushakum group has a great time running their steam and 'diesel' locos and the site has plenty of places to get out in the sun or relax in the shade. I hope to see you there!

As we listen to the world news on the war in Ukraine, our own Stan Ames has done something about it. He has spearheaded the creation of The HUB Division, Inc. Ukraine Support Fund. This fund has been set up to help our fellow model railroaders and railroaders in Wolsztyn, Poland. This is where Stan has visited a number of times to learn how to operate steam locomotives. All funds donated go directly to help our friends in Poland support the Ukrainian refugee families who have arrived there. Please visit www.hubdiv.org/ukraine.html to learn more, and read about one of Wolsztyn's first events in this issue of the *Headlight*.

Looking ahead to the upcoming 2022-2023 model railroad season, we will be bringing back the Spring TRAINING Show that will be held in April 2023 at Manchester-by-the Sea. Planning and organization are in the works. Also, the Conway, NH, Railway Excursion is back on for June of 2023. So please keep checking our website, *Headlight* and emails for further details.

I am extremely honored to be able to serve as your President be in the company of some remarkable people from across the HUB Division's territory. The key to our organization is our ability to muster outstanding volunteer talent and keep fresh new faces in leadership positions. In the next month I will be reaching out to fill

open positions. If you would like to volunteer, please contact me and let's talk.

Please stay safe and healthy

"Keep 'Em Rolling"

2022 Election Results

The following members were elected to three-year terms on the HUB Division Board of Directors:

Peter Watson

Bruce Robinson

Malcolm Houck

New Members

The HUB Division welcomes the following new members

- John Petillo, Acton
 - Richard Barnes, Maynard
 - Deborah Barnes, Maynard
 - Al Neff, Groton
 - Johnathan Palazzo, Methuen
 - Jason Shuttle, Millis
 - Elizabeth Shuttle, Millis
 - Jacob Shuttle, Millis
- Student Members:
- Jacques Cauchon, Waltham

HUB Summer Picnic

July 17, 2022

The Summer Picnic is tentatively scheduled to take place at Waushakum Live Steamers in Holliston, MA, on Sunday, July 17 (rain or shine) from 11AM to 2PM. Visit www.waushakumlivesteamers.org More information will be emailed, or look for further details on the HUB website and Facebook page.





Shanty Talk:

RESEARCH

By Rudy Slovacek

In my prior column, I described building a Funaro and Camerlengo Butter Dish Milk car kit for Borden's. While complete instructions and pictures were included in the kit, I always like to do a bit of additional research on the prototype to aid in the modeling effort. To this end, I thought I'd mention a resource or two that I picked up off the Internet. Well, back in the November-December, 2019 issue of the *Headlight*, I described finishing off my brass NYC caboose number 20093 as it appeared on Page 81 of my copy of "Cabins, Crummies and Hacks Vol. 1, North and East" (See Figure 1).



Fig. 1: NYC 20093

Since then, I also picked up a Funaro and Camerlengo NYC caboose kit and I've begun work on that, too. However, the pictures it included appear to be the same as for the 20093, which I had already used on the brass model. After some further searching, I found a picture of NYC 20097 (See Figure 2) on the website for Canada Southern Railway (www.canadasouthern.com) that had a notation indicating that it was an ex-Ulster & Delaware hack. Specifically, it was one



JAY WILLIAMS COLLECTION

Fig. 2: NYC 20097

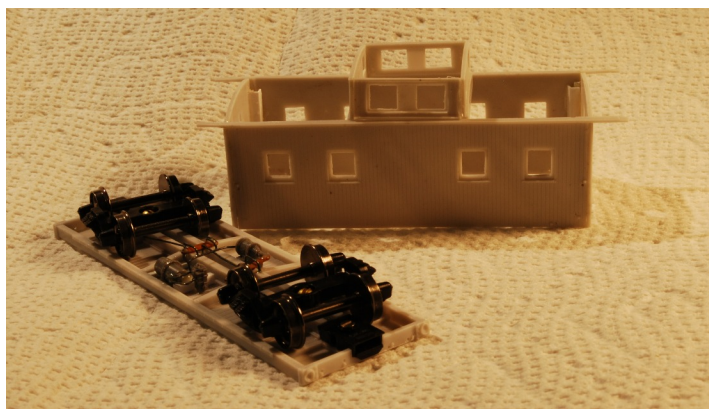


Fig. 3: NYC Kit Progress

of eight such cars numbered from 20090 to 20097. Thus, I will be supplementing my NYC fleet with that number when I'm finished building the kit whose progress is shown in Figure 3. This is my second such kit casting and I'm beginning to gain some proficiency. If you are a NYC modeler, the Canada Southern site is a real treasure. It is the same site where I found the picture of the 90-ton NYC depressed-center flat with an ALCO boiler load that I also covered in the November-December, 2019 *Headlight* issue.

It has not been just my own work that I'm tackling, as I've also been ballasting some trackwork on a yard module owned the Coastal Mountain Railroad. Figure 4 shows the very first step. The turnout points and any movable fixtures such as the point heels are covered in masking tape to prevent glue and ballast from gumming up the works. It is much easier to spend a bit of time on this first step than to try and clean up later. I'll be discussing this along with other tips when I give my clinic at the May RAILFUN. I've given clinics on well over 20 different topics but the ones that give me the most positive feedback are the hands-on clinics. They take more preparation work, but I think they help to spread the skills within the hobby quickly and are enjoyable for the participants. One of my favorite clinicians is Rich Pitter, our former editor of the *Headlight*. Based on some wood blocks and scribed wood siding sheets, he had us constructing the ubiquitous platforms found on many a railroad siding and team tracks.



Fig. 4 Water Tower Stop for Rutland # 73

Thus, while I turned in my clinic blurb to Andy months ago, I have decided to supplement my clinic on scenery with a little project for the attendees. Please see the May RAILFUN description for the tools needed if you wish to participate. With that in mind I'd better cut this column short while I gather up my materials. See you there.

Valley Junction Railroad: a 2022 update

(Continued from Page 1)

From the beginning

The VJRR began as a Marx train set received for Christmas in 1958. At first, track was set up on a ping-pong table that also came on that Christmas morning, but soon moved to a 4x8 sheet of bare plywood. The year 1958 saw the launch of the 28-foot Hereschoff ketch (that's a sailboat) that my father built in the back yard in Concord, Massachusetts. From mid-March through November all my time was spent with the boat, but reading model railroad magazines while cruising along the Atlantic coast from Bath, Maine, to Cape Cod kept the train interest alive. Planning and dreaming of someday building that model railroad empire continued through high school, college, military service, family, work and adult Scouting activities.

Finally, in 1988, the big move came to the "basement-with-a-house-on-top" in Sandown, New Hampshire. For the first six months after moving in, work to finish off the basement space moved along with sheet rock walls, drop ceiling, vinyl floor tiles and painting to match the rest of the house. While construction was ongoing, my drafting table was set up in the basement and many, many track plans were drawn, discarded and drawn again, until a workable plan was in hand. Actually, two plans were drawn: a track plan and a benchwork plan. Knowing where the joists were, helped in locating turn-tables and switch machines. One very important criteria for me was to have the layout space completely finished BEFORE any layout construction began. Then, during the week between Christmas and New Year's, the first lumber was brought into the basement and benchwork construction began.

Benchwork is L-girder with plywood used under yard/town areas. Splines were used with ½ inch homosote roadbed to run track between plywood areas. All other roadbed is Homabed.

The track plan was created from a long list of layout features that I deemed were necessary for a successful model railroad designed to support an operating scheme. Twenty years of experience with waybills and train operations meant my primary task was to design and build model railroad infrastructure to support the operating scheme. With the design drawings in hand, a five-year construction plan was established and work began. Five years after starting construction the first op session was held. Since that first session in 1994, work on the layout has focused on building track, buildings and the control system to support the operating system.

VJRR- Today (1993 to 2022)

The article written in the November 1993 Headlight said:

The Valley Junction Railroad is located in New Hampshire, running northwest from the coastal city of Portsmouth to its connection with the Central Vermont at Valley Junction on the Connecticut River. Along the route are the towns of Tiverton,



Annual Tour de Chooch 25th Anniversary car



Franklin Depot

(where traffic is interchanged with the Boston & Maine), Franklin (interchange with the wholly owned subsidiary Valley Branch Lines), Canterbury, South Royalton and Northfield. All locomotives and rolling stock are examples from the decade 1955-1965.

Operation is point-to-point between the terminal cities. Over-head through trains, passenger and freight, operate from Montreal (points north via the Central Vermont) over the VJRR to Boston (points south via the B&M). Local passenger and freight trains operate from either Portsmouth or Valley Junction and return.

All this traffic is handled by an operating crew of eight: dispatcher, Portsmouth yard master, Valley Junction yard master, four mainline engineers, and the Valley Branch Lines operator. Mainline operators move along their routes utilizing hand-held momentum throttles {now NCE DCC} to follow their trains.

All track work on the VJRR (600 feet of rail to date {now 700+ feet}), including the diamond where the B&M mainline crosses the VJRR mainline at grade, is hand-laid code-83 using pre-weathered rail that is given an additional coat of Floquil rail brown. Mainline turnout control uses slow-motion switch machines operated from the dispatcher's desk while all yard and industrial turnouts are hand thrown by local crews.

The motive power is a mix of RS-11's for local work, GP-30's and C-420's for mainline duties, an F-7 A&B set and SD-9 for

(Continued on Page 5)

Valley Junction Railroad: a 2022 update

(Continued from Page 4)

special movements, E-7's for through passenger runs, RDC's for local passenger traffic and both Alco and EMD switchers for yard assignments. For variety, the Valley Branch Lines rosters an Alco S-4 for its yard work and a Baldwin AS-16 for road work. Locomotives lettered for the Boston & Maine, Central Vermont, Duluth, Winnipeg and Pacific and Canadian National are also seen on the through trains representing their owner's pooling of power.



Switcher at Essex Yard

There have been a few pieces of motive power and rolling stock added to fill the needs of specific trains.

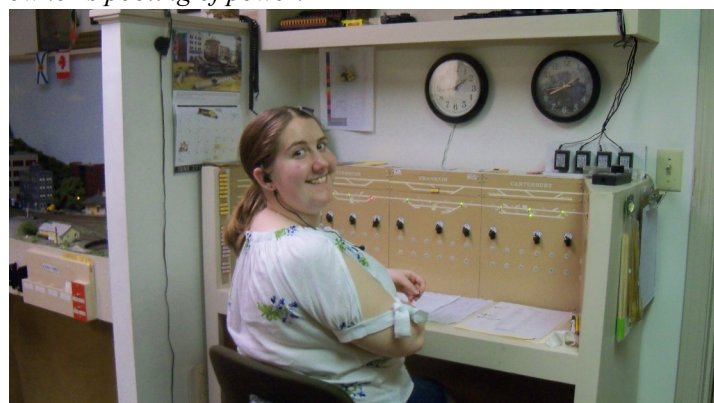
The biggest change came when, after 20 years of procrastination and three nights in a hotel room in Chantilly, VA, with a red pencil, a blue pencil and some yellow trace paper, the string line diagram for the train schedule was completed. Putting the VJRR operating scheme on a schedule was the final dream to be fulfilled. Since 2007 the railroad has run on a 6:1 fast clock covering 24 hours in four real-time hours.

Today the VJRR continues to host monthly operating sessions for a crew of eight who come together to relax, run trains and enjoy the social aspect of this great hobby. Since that first operating session in 1994 the VJRR has hosted 350 op sessions.

The last paragraph from that 1993 article stated:

In 1958 a youngster was introduced to a ping-pong table and a train set. It is now 35 (now 64 years!) later and the trains still endure.

The Valley Junction Railroad has provided Scouts an opportunity to earn the Railroading Merit Badge, a few (now a number exceeding 200!) adults an evening of enjoyment running trains, the opportunity to meet some lifelong friends and a lot of very happy hours while working on a life-time hobby. Along the way six Chief Dispatcher certificates in the NMRA Achievement Program have been awarded utilizing the VJRR's infrastructure.



Brenna Whitney at the Dispatcher's desk

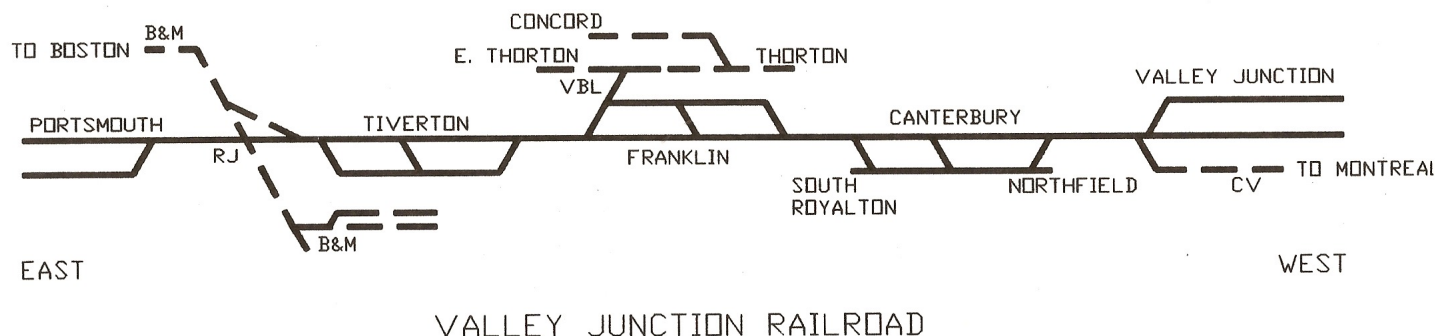
Rolling stock on the system comes primarily from the New England area with 40' and 50' box cars in adequate numbers to serve the customers on the line. Special duty cars are assigned to captive quarry service and piggy-back cars are just starting to be seen. Passenger equipment on the run-through trains is a mix of their owner's representative cars.

VJRR- What has changed since that 1993 article

Twenty-nine years have passed since that first article was written and it is kind of fun to see what has changed and where the railroad has gone.

First, the basic design philosophy did not change and the railroad was built very closely to the original track plan. Track layout changes over the years amounted to revisions measured in inches and not to any great extent. With the operating scheme driving the track plan the railroad functions as designed.

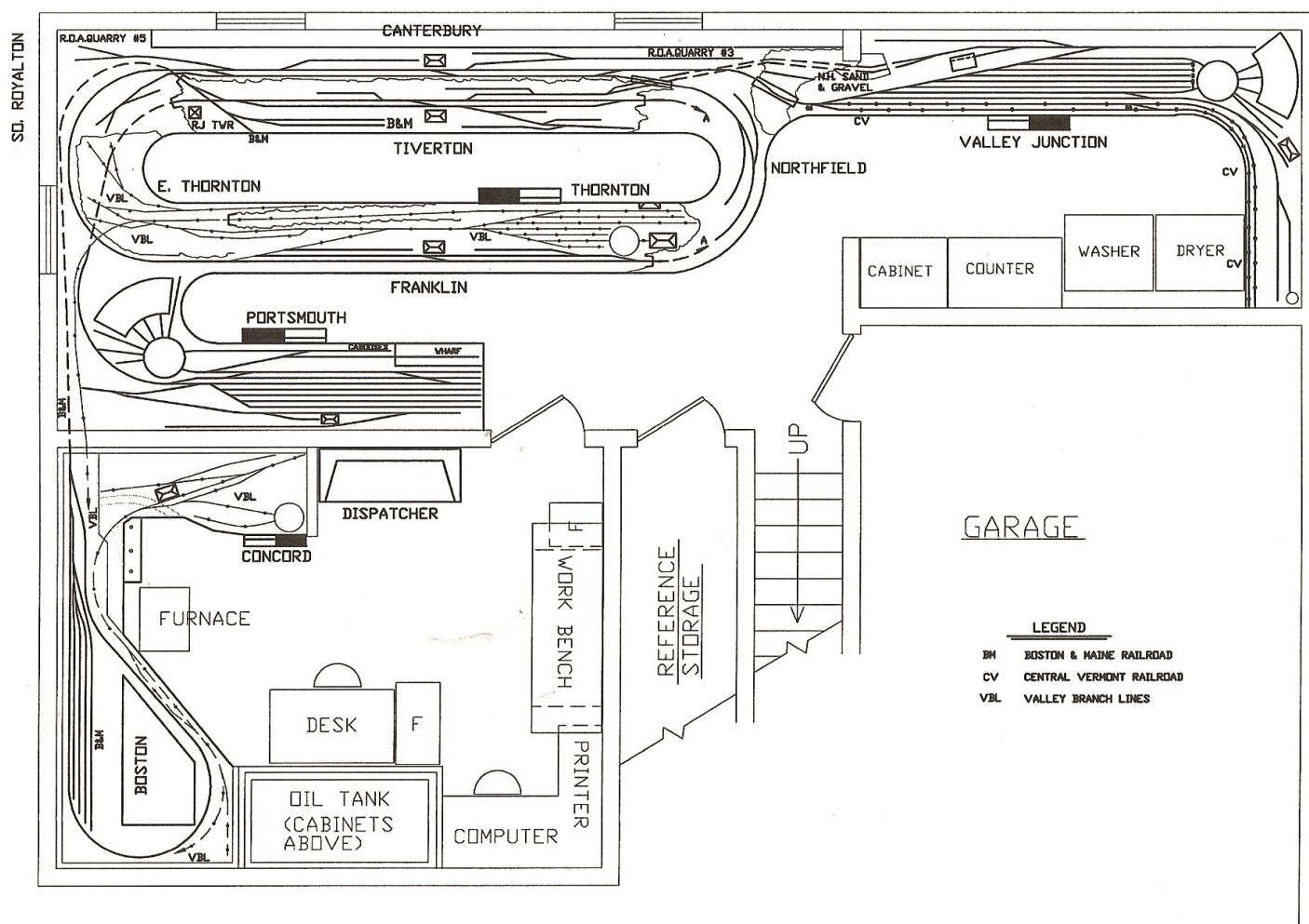
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Work will continue on NMRA Achievement Program certificates with six in-hand and two in-the-works. I envision the railroad continuing to host op sessions and a never-ending parade of modelers gathering in the basement for socializing, eating cookies and running trains. Maybe there will be an evening or two tweaking scenery, adding details or writing another article about how the model railroad has provided so many hours of “Sharing the fun of Model Railroading?”



VJRR in three spaces



VALLEY JUNCTION RAILROAD

Achievement

Dick Towle - Honorary Life Member



From left, Tim Towle, Rick Towle, Dick Towle and Peter Watson, MMR after Dick was presented his Honorary Life Member plaque at the March RAILFUN. The HUB BOD voted to present this to Dick in recognition of his efforts to support the Division over the years.

Photo provided by Peter Watson

Achievement



Mal Houck (right) received his Master Model Railroader Certificate from Peter Watson, MMR at the February RAILFUN.

Photo by Erich Whitney

HUB Division Calendar of Events

(Subject to Change)

2022

- | | |
|----------------------|---|
| May 20 (Fri) | HUB RAILFUN Meeting, 8 PM, Motherbrook Arts and Community Center, 123 High Street, Dedham, MA 02026 |
| Jun 17 (Fri) | HUB RAILFUN Meeting, 8 PM, Motherbrook Arts and Community Center, 123 High Street, Dedham, MA 02026 |
| Jul 15 (Fri) | Submissions deadline for the HUB <i>Headlight</i> Sep-Oct issue |
| Jul 17 (Sun) | HUB Summer Picnic, Waushakum Live Steamers, Holliston, MA |
| Aug 7-14 (Sun-Sun) | 2022 NMRA National Convention, Gateway 2022, St. Louis, MO, www.gateway2022.org |
| Sept 15-18 (Thu-Sun) | NER Convention, The Connecticut Yankee, Windsor, CT, www.ner-conventions.org/connecticut-yankee |
| Sep 23 (Fri) | HUB RAILFUN Meeting, 8 PM, Motherbrook Arts and Community Center, 123 High Street, Dedham, MA 02026 |



Bruce Robinson (left) receives his Model Railroad Author Certificate from Peter Watson, MMR at the February RAILFUN.

Photo by Erich Whitney



Support Your Division!

Submissions Wanted

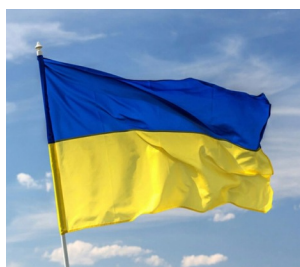
The *Headlight* is always accepting photos and articles relating to model and prototype railroading. Articles about model building or home layouts would be much appreciated. Earn credit towards your Author AP certificate. Please email editor@hubdiv.org.

Steam Special and Picnic for Ukrainian Refugees in Poland

By Stan Ames

On Saturday, April 16, 2022, the HUB Division of the NMRA Ukraine Support Fund, together with The Wolsztyn Experience Mutual Trust Society and the Wolsztyn Steam Shed Cultural Institute, ran a free steam special and picnic for nearly 300 Ukrainian refugees housed in the Wolsztyn Poland area.

The HUB's Ukraine Support Fund was set up to provide funding for food, housing, medical care and emotional support for these refugees. Saturday's events provided a fun-filled event for the children and their families and was enjoyed by all.



Please visit www.hubdiv.org/ukraine.html for more information about the fund.

Right: Stan and Doug Blain from Bachmann stand on the front of the OL49-69 locomotive adorned with a Welcome sign, in the colors of the Ukrainian flag. It translates to read "Welcome, Your friends on the steam train from Wolsztyn, USA and Great Britain"
Photo by Howard Jones



The crew from the US, UK and Poland includes, left to right: Tomasz, Yonous, Stan, Howard, Andre, Doug and Hendrick (in the cab window).
Photo by Alex Jones



Youngsters get a tour of the locomotive cab. The OL49-69 is a standard Polish 2-6-2 built in 1953/1954 and designed to pull six loaded passenger cars at 55mph.

Photo by Stan Ames



Folks check out the facility. A snow plow and crane are visible to the left.
Photo by Stan Ames



Some of the attendees pose for a group shot next to the turntable.
Photo by Tomasz Opaska

Erich's Electronics Notebook

By Erich Whitney

Crossing Gate Project - Part 2

The goal of this article is to explain the prototype railroad grade crossing track circuit used as the reference example for my implementation of this crossing gate model. I thought it might be interesting to look at how the railroads implemented these track circuits before they had the computer systems they use now. The model I built supports two tracks at the grade crossing. I'm only going to cover what happens on one track in this article; however, you can think of the two-track case as just two copies of the single track example described here.



Figure 1: Bruce Robinson's Franklin Station Road Crossing at Whitney Avenue

The idea for this project came from a conversation I had several years ago with Seacoast Division NMRA member Jon Miner about a grade crossing on his layout in Epsom, NH. Jon's layout has been on Tour de Chooch and he's a member of the Concord Model Railroad Club. He can often be found on the rails with his speeder with the Cotton Valley Rail Trail Club in Wolfboro, NH, or working the right of way on the New England Southern. Some of the information I am presenting here came from Jon and I'm using it with his permission. The prototype for this track circuit can be found on the old B&M line at the grade crossing of Granite Street in Manchester NH, near the Fisher Cats Stadium.

Anatomy of a Grade Crossing

Figure 2 shows the basic components for a railroad crossing that uses a separate track circuit for the section of the roadway that crosses the track, which is called the island. The approach circuits to either side of the island extend a relatively long distance that depends on the anticipated track speed of the trains. I should point out that modern grade crossing control can be much more sophisticated than what is shown here with current technology allowing for much more flexibility. Note that there are three distinct blocks in this diagram, each approach circuit is its own block and the island in the middle is also its own

block. This is important to the understanding of how the track circuit works. In the prototype, each of these blocks is completely isolated with gaps in the rails and any locomotive or car effectively shunts (short circuits) the two rails. This is how the train is detected on the prototype. The model can use the same type of block detection if all cars have resistive wheel sets. Other methods of detection can be used such as photo sensors, which is what I used on Bruce's installation because we didn't want to have to re-gap the rails. Each block has a battery connected across the rails through a series resistor on one end and relay connected across the rails on the other end. When the block is unoccupied, the battery supplies enough current to energize the relay coil that activates the relay. When a locomotive or car enters the block, its axles create a short circuit that de-energizes the relay. The actual circuit is a bit more complicated than that, so we'll look at that more closely in the next section.

The Grade Crossing Track Circuit

Since this track circuit is only protecting the grade crossing, it is assumed that whenever a train enters this section of track, it has permission to do so, with that permission conveyed by some other means. Presumably there are other railroad signals, a dispatcher, a timetable, or train order involved. In this scenario, a train enters either the left or right approach block and is detected by the approach circuit. This sets the chain of events in motion that we want to model. Once the approach circuit is activated, the lights at the grade crossing start to flash. If there's also a gate installed, it will start to lower after a delay time sufficient to give any vehicles that may be sitting on the tracks time to exit. The train continues towards the grade crossing, passes over the roadway, then on to the opposite approach block. Once the last car has cleared the island circuit, the gates will start to raise and when the gates are fully raised, the lights will stop flashing.

When Jon built his grade crossing, he researched how the railroads implemented the grade crossing logic and he replicated that logic in software. Figure 3 is a diagram of the prototype grade crossing logic implemented with a system of relays and 12-volt batteries. The labels B4 and N4 correspond to the 12-volt battery and series resistor circuit shown in Figure 2.

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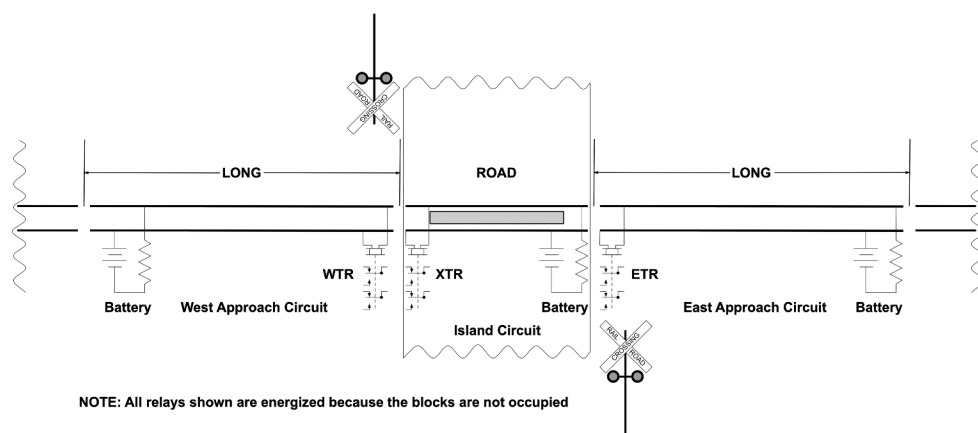


Figure 2: Example Grade Crossing Track Circuit¹

Erich's Electronic Notebook

(Continued from Page 9)

Table 1 shows the label, type, and function of each relay shown in Figure 3. Figure 4 is a simplified view of the grade crossing blocks where WT is the west track block, XT is the crossing track block, and ET is the east track block. The shaded circles at the grade crossing show where the flashing lights are located. Under “Normal Conditions,” meaning there are no trains anywhere in this track circuit, the batteries are energizing the relays XTR, ETR, and WTR. As shown, relays XTR, ETR, WTR, and XR are energized and relays WSR and ESR are inactive.

Relay Label	Relay Type	Relay Function	Description
ETR	Standard	SPDT+SPST	Energized until the east approach is occupied
XTR	Standard	SPDT	Energized until the island is occupied
WTR	Standard	SPDT+SPST	Energized until the west approach is occupied
ESR	Stick	DPST+SPDT	Energized when train is traveling east
WSR	Stick	DPST+SPDT	Energized when train is traveling west
XR	Standard	SPDT	Energized when crossing is not protected

Table 1: Grade Crossing Logic Relays

Switches

Switches are commonly referred to by the number of poles (circuits) and the number of throws (switch positions) for which it is configured. A single-pole, single-throw (SPST) switch is a simple on-off switch. It has two terminals and one contact closure, thus it's either on or off. The single-pole, double-throw (SPDT) switch, however, has one center contact and two positions that the switch can be thrown to. It has three contacts, and the center terminal connects to one or the other depending on which way the switch is thrown. A double-pole switch just has twice as many circuits as a single-pole switch and there can be either single-throw or double-throw versions. If a switch has more than two poles or throws, then the designation is just a number, i.e., a 3PDT switch has three poles (circuits) and two throws. In addition to the number of poles and throws a switch has, the switching mechanism can be a toggle i.e., it's either switched one way or the other, a momentary switch where the contacts only close while you hold them and that can be configured as Normally Open (N.O.) or Normally Closed (N.C.) which indicates what position the switch stays in when you let go of the lever. Toggle switches can also be configured in the Center Off state meaning that none of the contacts are closed when the switch lever is in the center position.

Relays

A relay is an electromechanical switch device that gets its name from how it works. A change in the input current to the coil creates a magnetic field that moves the contacts that turn other circuits on or off, essentially relaying an input action to an output action with no electrical connection needed between the two. Relays use a coil of wire wrapped around a metal core made of some type of ferromagnetic material such as steel, soft iron, and may be laminated depending on the application. The switch contacts may be Normally Open, Normally Closed, or Transfer (i.e. double throw). The latter connects one (center) contact to either of two contacts. Each set of contacts corresponds to a “Pole,” as used to describe toggle switches. At the end of this

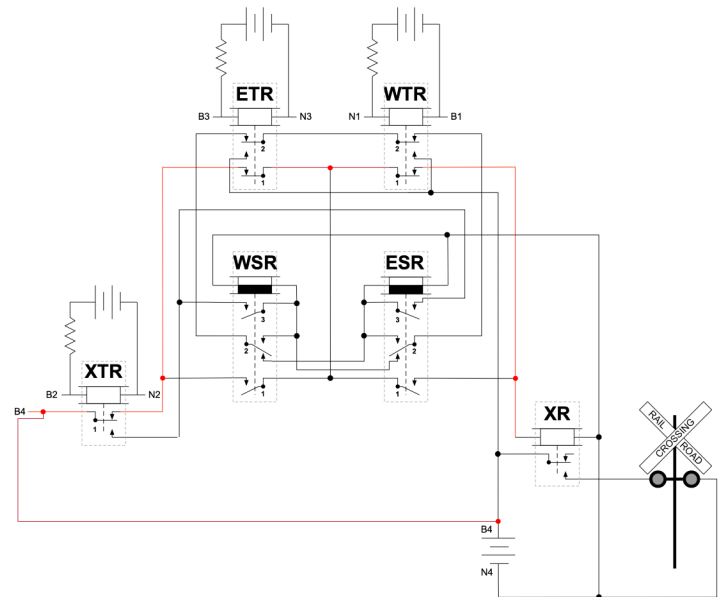


Figure 3: Prototype Grade Crossing Logic¹

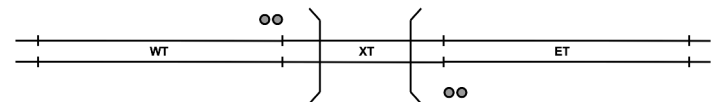


Figure 4: Figure 4 Simplified View of Grade Crossing Blocks¹

coil is a small magnet attached to the center pole of a switch. When the relay coil is energized by applying a current to it, the magnetic field pulls the switch closer towards the N.O. contact or to one side of the Transfer contact. When the relay is de-energized, a spring pulls the switch towards the N.C. contact or the opposite side of the Transfer contact. In Figure 3, the relays are drawn with their coils next to their label. The tiny numbers next to the switch contacts indicate the pole of the relay. Relays are commonly found as Double-Pole, Double-Throw (DPDT), but there are thousands of combinations available. The relays found in railroad track circuits are designed for the kind of all-weather, high-reliability, and long service life needed for the railroad.

Track Circuit Relays

There are two types of relays shown in Figure 3, the “Standard” relay will close the switch contact closest to the coil when it is energized and it will close the contact furthest from the coil when it is de-energized, typically via a spring mechanism. However, a “Stick” relay will latch its contact state based on the logic in the circuit. Stick relays are used when there is a need for the logic to “remember” something. In this case, stick relays are used to remember which way the train is traveling. Note that most of the relays in this diagram are complex types. The ETR/WTR relays have one SPDT switch (2) and one SPST switch (1). The ESR/WSR relays have one DPST (2) and one DPST (1 and 3) switches. The XR relay contacts control the lamp flasher circuit. Additional circuitry would be needed if this example also had a crossing gate because the gate cannot come down until the lights have been flashing to warn drivers to clear the island.

(Continued on Page 11)

HUB Headlight

Volume 38, Number 5

May - June, 2022

HUB Headlight, published by The HUB Division Inc., Northeastern Region, National Model Railroad Association, is issued in January, March, May, September and November. Contributions may be sent by email to the Editor or by mail to the Office Manager.

Editor Bill Barry - Editor@hubdiv.org

Chief Grammarian - Jay Stradal

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65 Branch Road, East Bridgewater, MA 02333-1601

Online Activities Coordinator

Erich Whitney - onlinecoordinator@hubdiv.org

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Headlight Printers

Versatile Printing Services, LLC, Burlington, MA

Erich's Electronic Notebook*(Continued from Page 10)*

I have created an online Tinkercad simulation of this circuit. You can access it here:

www.tinkercad.com/things/5znSH5W27KP

To run the simulation, click on the "Start Simulation" button in the upper right corner of the page. There's a slide switch in the middle of each block. Close the switch to simulate a train on each block and observe the light bulbs.

Operation

As an example, a train enters the west block heading east. As soon as the first axle enters the block WT, it shorts the rails, which causes the WTR relay to de-energize. This de-energizes the XR relay that activates the crossing lights. Also, the ESR stick relay energizes to indicate that this is an eastbound train. When the train enters the island block XT, the XTR relay de-energizes. The train continues to the east block ET, de-energizing the ETR relay and as the tail of the train leaves the west block, the WTR relay energizes. When the train exits the island block, the XTR relay energizes again and this, in-turn, energizes the XR relay and the crossing lights are de-activated. The ESR relay doesn't de-energize until the train finally exits the east block, completely clearing the circuit. The circuit works similarly with a train going in the opposite direction, just the east and west relays switch roles in the westbound direction. If a train enters an approach block and continues to the island block but does not proceed to the opposite approach block and backs out the way it came, the grade crossing logic still works, however, in this case the crossing lights will stay illuminated until the train completely clears the circuit.

In the next installment of this series, I will show how I built the hardware and the software for the model I installed in Bruce's layout. My model adds functioning crossing gates to the flashing lights and supports two tracks at the grade crossing instead of one. My circuit can accommodate either photocells or current-sensing block detectors and it is configurable for different types of LED or lamp signals. Have a great summer and I'll see you all again in the Fall.

Footnote 1: Jon Miner's draft article, "Controlling Signals with Micro-controllers", April 2012. He cited the source as "Matt Zont's Web Page - Signals - How Railroad Crossing Signals Work" but the website is unfortunately no longer online. I have redrawn his original artwork to make it more readable in this article.

Editor's Note: An archived version of the page is available at:

web.archive.org/web/20160314032607/http://signaldepartment.com/articles/xing-signals/default.html

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Please see the [March-April 2022 Headlight](#) for all order forms and module kit information along with information about the online HUB Branded Merchandise store.