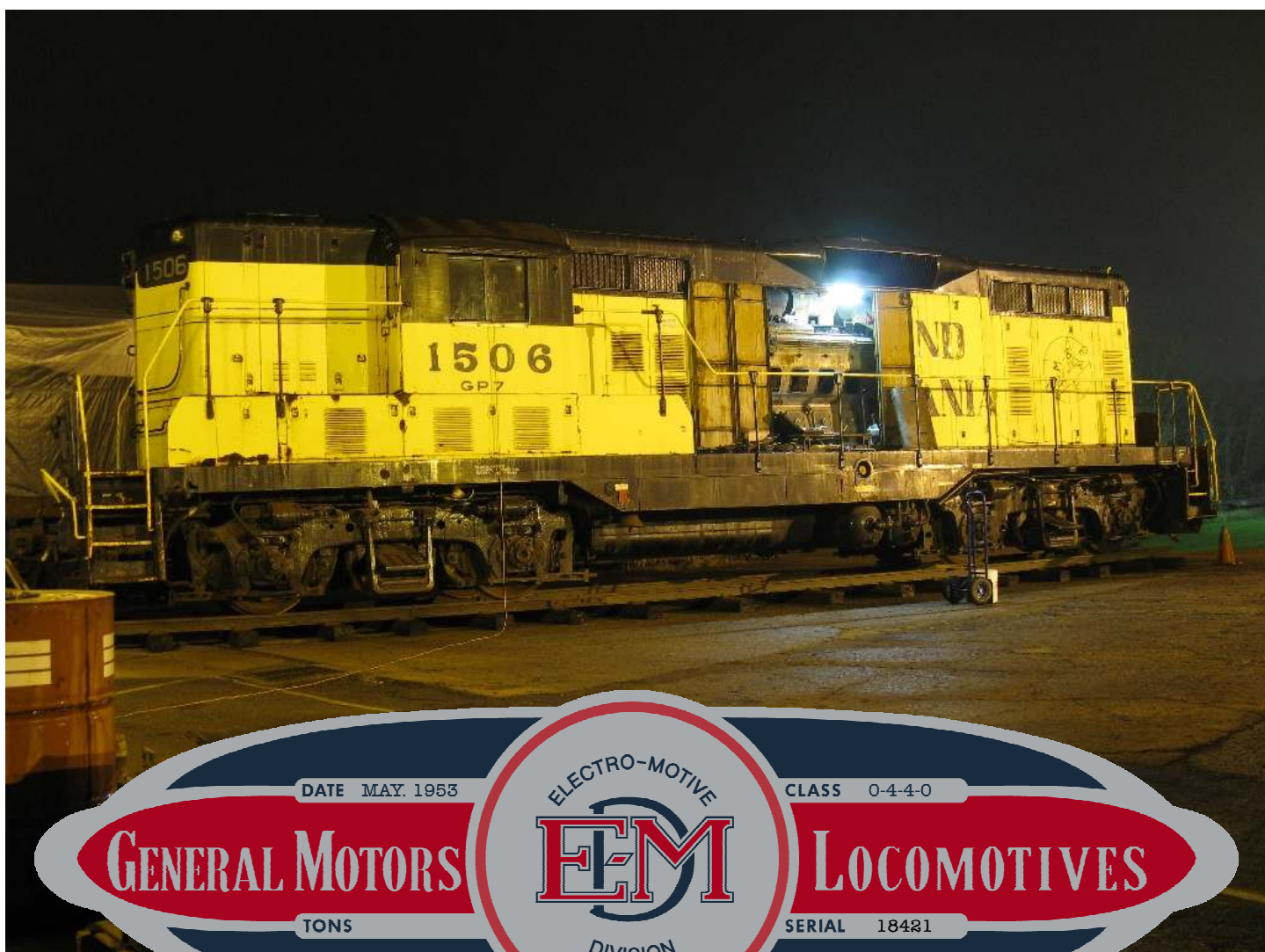




The 'Shop Talk' logo consists of a stylized pair of scissors icon positioned above the text. The word 'Shop' is written in a bold, black, serif font with a double underline, while the word 'Talk' is written in a black, italicized serif font.

Regasketing Reading Company GP7 621: *Cylinder Head & Cylinder Liner Removal*





The MP&RE Department of the RCT&HS is now producing an update newsletter of its own. The purpose of *MP&RE Shop Talk* is to inform and educate the membership as well as the general public about the work done by the dedicated and talented members of the MP&RE crew. The MP&RE decided to go with an e-

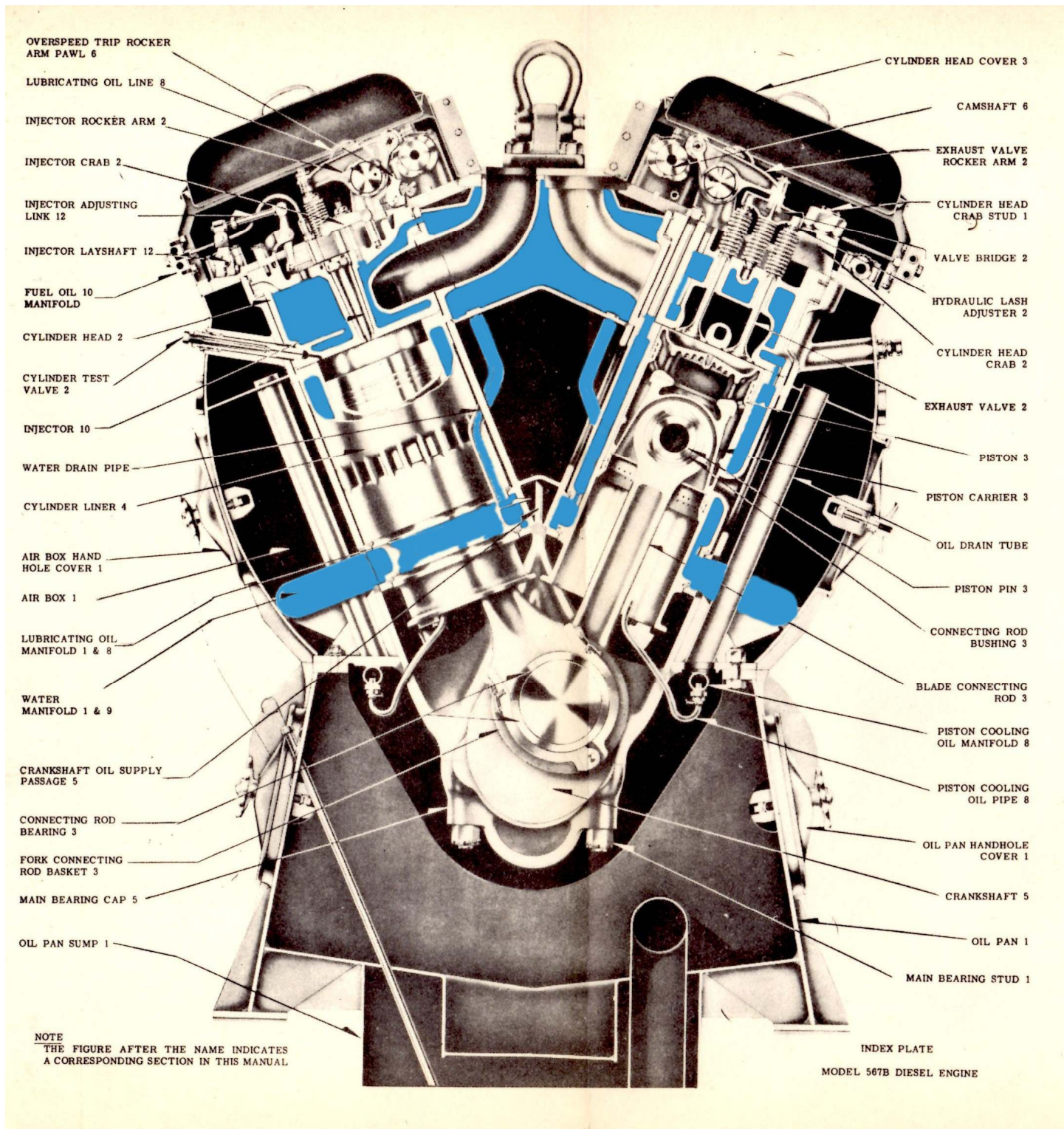
newsletter as a means of a committee report because we wanted to provide a more in-depth description and showcase the countless hours of hard work that our volunteers dedicate to restoration and maintenance of the RCT&HS collection. *Shop Talk* will not be published on any set timeframe and will be largely web-based. Though we do not wish to exclude any members from receiving updates, it would be cost-prohibitive to print and mail this publication. *Shop Talk* will be a learning experience for us all. We realize that we're likely to overlook a few things. Please know that it's not our intention to exclude anyone and we will gladly do what we can to work with members so that they can share the same experience if they do not have access to the internet.

For the second issue of *Shop Talk* we're going to take a look at some ongoing work we've been doing to our GP-7 Number 621. We've recently been working towards returning the 621 to service. Upon our initial inspections in 2009 we found that the engine's cooling system was compromised and that the gaskets which keep the coolant from leaking from the water jacket into the crankcase of the engine had dried out. This caused coolant to leak into the engine's oil. The fix for this is not overly expensive as far as materials go; However, there is a significant amount of labor that goes into removing all of the components from the engine to reach the leaky gaskets. After all the components are removed they need to be thoroughly cleaned and qualified before their reinstallation.

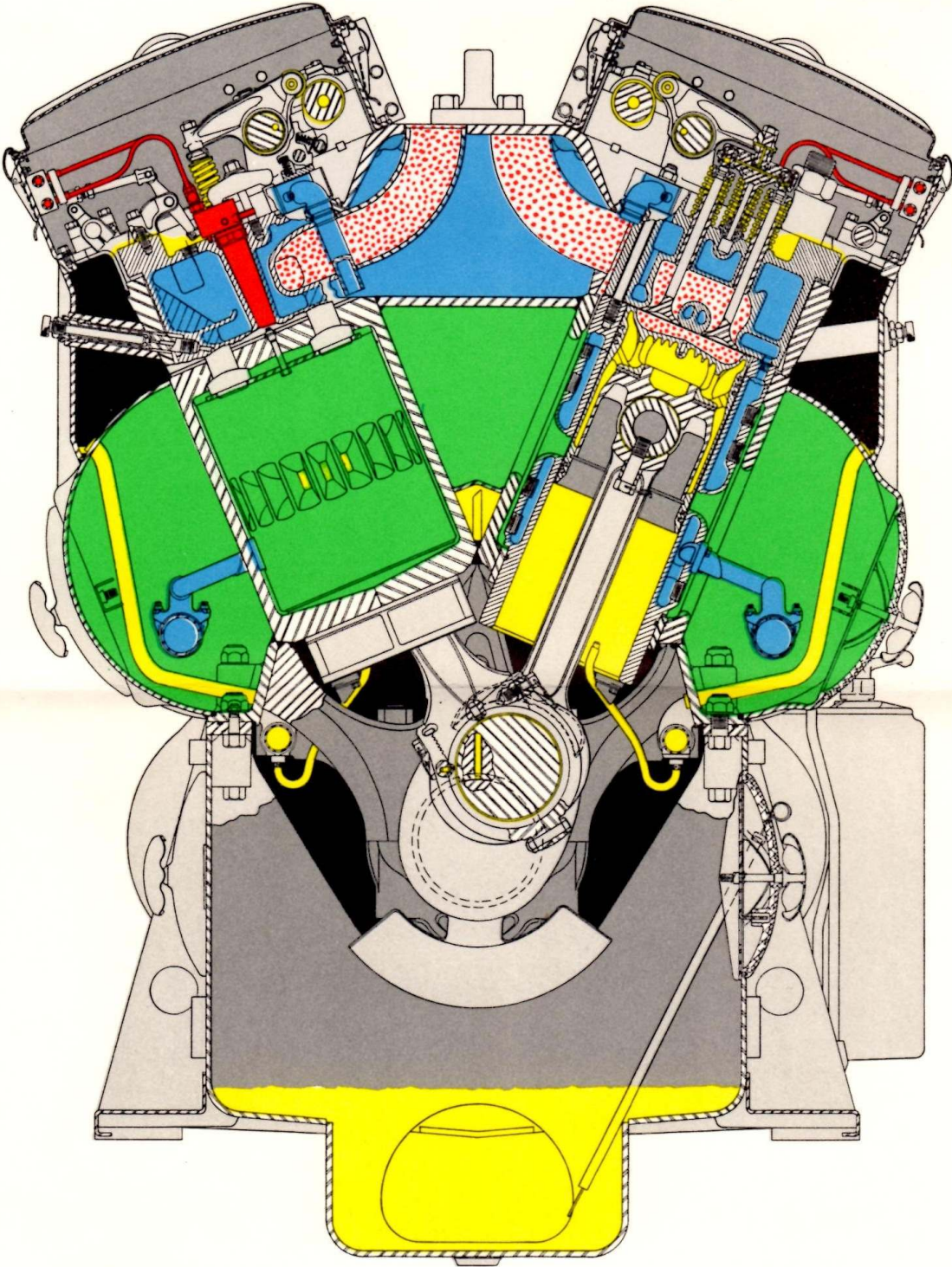
Our first step was to make an inventory of what tools would be needed to do the job. We then began custom-fabricating a large assortment of tools in order to disassemble the diesel engine itself. Some 26 custom tools have been made to date in order to perform our work on the 621.

After the tools were made it was then time to actually begin disassembling the EMD 567B diesel engine that gives the 621 life. The 567B was a successor to the 567U, 567V, and 567A models of the 567 engine series. The 567 was first used in 1938 to replace the Winton series of engines that EMD previously used for power. The 567B began production in 1945 and was used in EMD locomotives till around 1954. The 621, built in May 1953, was among the last of the locomotives produced by EMD to use the 567B. Many 567B engines were later retrofitted throughout their service lives with the more modern and reliable 567C water jacket system. These are known as 567BC engines and use a 567B head and a 567C liner. The 621 was not one of these engines.

One of the major improvements EMD made to the 567 engine series with the 567C engine is the coolant delivery system. The photo below show a 567B engine. The early 567 engines, including the 567U, V, A , and B, used a slip fit liner assembly where each gasket surface of the liner or head slips onto a gasket seat and is held in place by crab studs. Each gasket surface is slightly smaller than the previous as you work toward the last gasket between the liner and crankcase. This set-up was prone to failure as gaskets dried out. The gaskets are large O-rings that slip onto the liner or head. We'll look at the gaskets in greater detail later. The advances of the 567C are shown on page 4 and illustrate the mechanical flanged fittings used in all EMD engines after the 567C. This design is much easier to repair and provides a superior means of connection.



ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U. S. A.



SCAVENGING AIR LUBRICATING OIL EXHAUST WATER FUEL OIL

MODEL 567C SERIES DIESEL ENGINE



This is not to say that the old way is impractical to maintain. It only means that when the gaskets start to leak there's a lot more work involved to fix them.

(TOP LEFT) This view shows what the air box looks like in RDG 621's 567B 1500 HP roots blown variant of the 567 engine series. You can see the water manifold feeder pipe about halfway down the air box turning inwards toward the block. This feeds inlet water to the manifold which runs the length of the diesel engine, supplying the liners and heads with coolant. The liners seat onto the top and bottom of the water manifold with the slip fit style gaskets mentioned on page 3.

(BOTTOM RIGHT) This view looks into RDG 3640's air box. The 3640 has the 567D3A, a 2500 HP turbo-charged variant of the 567 engines series. The difference in engineering designs for water supply are quite visible. In 567C or later versions like the 567D3A seen here, EMD ran the water manifold supply inside the air box and used the small jumper pipes with flanged fittings to supply the liners with coolant. This proved to be much less maintenance-intensive; if one of the jumpers began to leak, only the jumper pipe had to be removed and regasketed and not the entire power assembly.



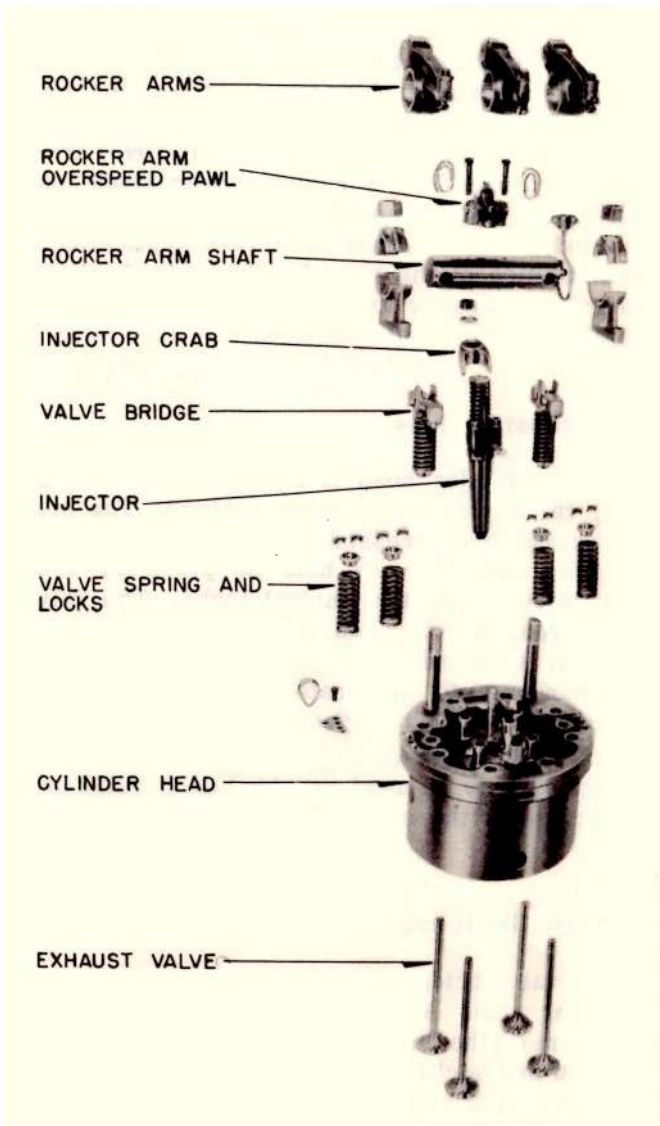


(TOP LEFT) This is looking directly at the side of one of the 567B liners through the air box inspection cover.

(TOP RIGHT) In this view, you can see the difference when looking at the 567D3A's liner through the air box inspection cover.

(BOTTOM RIGHT) Here we see one of the 567B liners hanging from the top deck crane, ready to be reinstalled into the engine block after being cleaned and qualified. The two orange O-rings toward the bottom of the liner bracket the water intake for the 567B. These are the gaskets that failed on the 621's engine. The old gaskets came off in multiple pieces. It was no wonder they no longer sealed properly and allowed water to leak in to the crankcase.

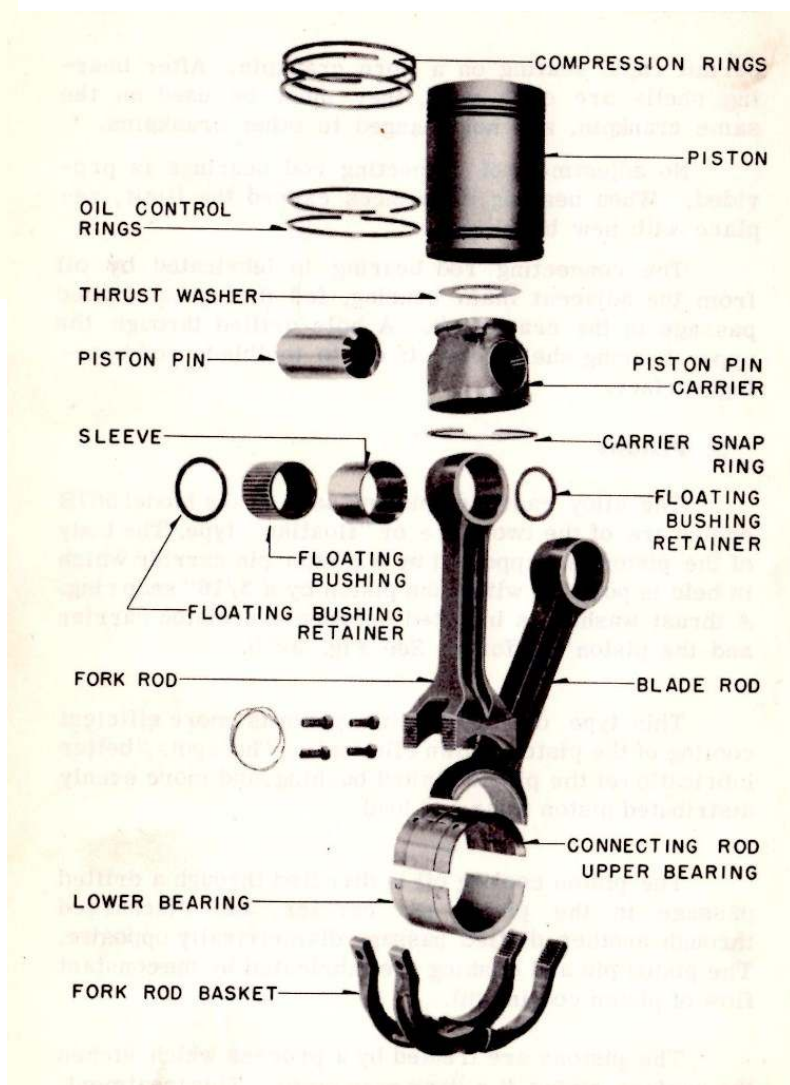




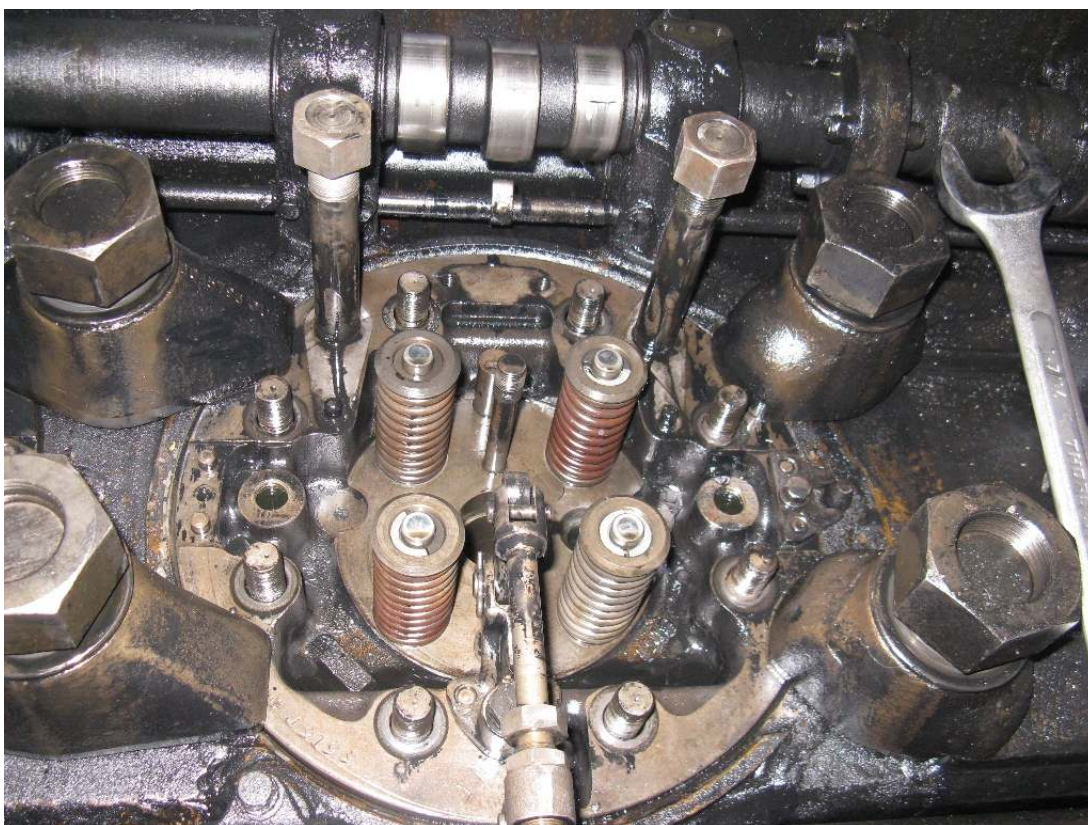
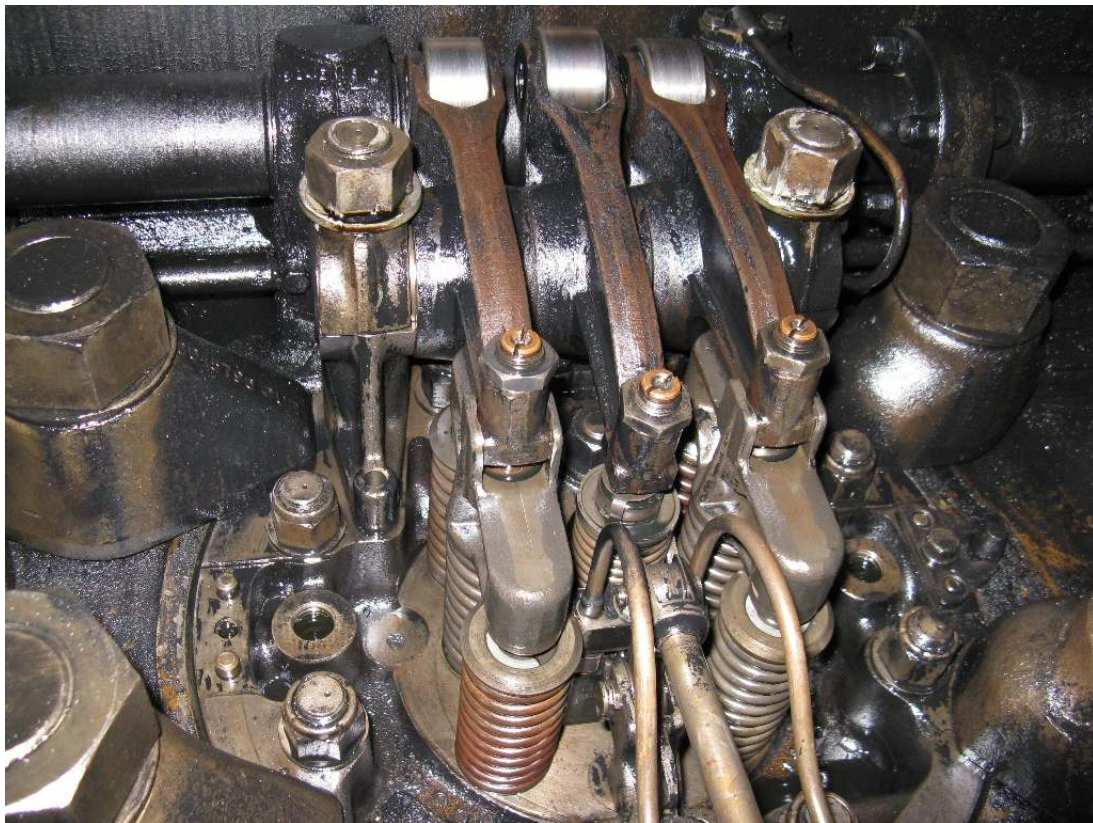
(TOP) This is a photo from the 567B service manual. It shows all the components that go with the cylinder head. After removal, we clean each part and inspect them individually to ensure they are suitable for use.



(BOTTOM) This is also a photo from the 567B service manual. It shows all the components that go with the pistons and connecting rods. We only removed the carrier snap ring. This allowed us to leave the piston in the liner when we removed it. This was a great time-saver, and by doing this we didn't have to build a ring compressor or have to worry about honing any of the cylinder liners. The piston pin carrier stays attached to the connecting rod and just the piston itself is removed. Another interesting part of the EMD design seen in this photo are the fork and blade rods designed to ride together on the crankshaft. Because of this, the cylinders on the EMD engine are directly across from each other, not slightly offset as is common with most engines.



(TOP) This is a view of what the top of a cylinder head looks like with all the valve bridges, fuel jumpers, overspeed trip rocker arm pawl, injector, and rocker arms installed. The crab studs can also be seen holding the four corners of the power assembly securely in the block.



(BOTTOM) This view shows the first step of disassembly. First we removed all of the “jewelry” from the top of the head, as well as the liner stud nuts. We also loosened the crab nuts, which are tightened to 1,800 ft-lbs of torque. All that remains on the head is the rocker arm shaft studs and the valves themselves.



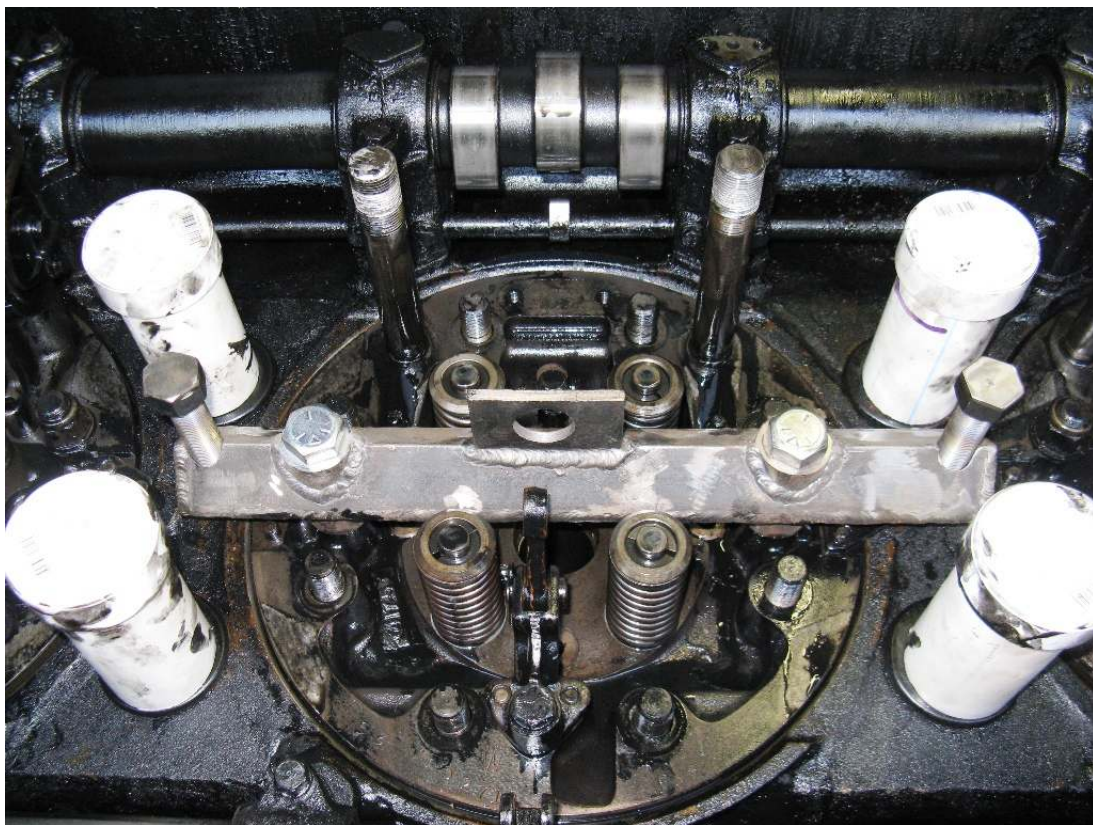
(TOP) After all the “jewelry” was removed from the heads, we loosened the crab nuts. These are torqued up to 1,800 ft-lbs of torque. The crabs are what keep the power assemblies in the engine block. A torque multiplier is used to loosen the nuts. The one seen here is a 4:1 ratio.

(BOTTOM) Another view of another set-up for removing the crabs. Note the PVC crab stud protectors we created to ensure we didn’t accidentally damage any of the crab studs as they remained in the engine block.



(TOP) Next we install our custom-made head jacking tool. This is designed to jack the head free of the liner. It attaches to the head and uses jacking screws to lift the head out of the liner's seat.

(BOTTOM RIGHT) Here we see a head jacked up and free of the head gasket and liner.



(BOTTOM LEFT) In order for the head jacking tool to work, the liner itself needs to be properly secured in its seat, so we designed another tool, our own custom liner anchor tool. This tool keeps the liner in its seat and allows the head to be jacked free of the liner.





(TOP LEFT) Once the head is free of the liner, the top deck crane is fastened to the crab studs.

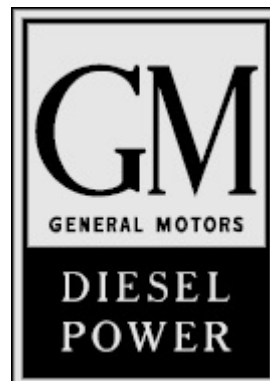
(TOP RIGHT) With the crane installed, the head can be lifted and swung clear of the engine block.



(BOTTOM) A custom head lifting tool was made in order to lift the heads out of the block. They are then set down on the running board and picked up by the handrail crane to be lowered to the ground.



(TOP) The head being lowered to the running board by the top deck crane. All the engine parts are set on a protective piece of cardboard to make sure none of the surfaces are damaged.



(BOTTOM) After the head is lowered to the running board by the top deck crane, it is then picked up by the handrail crane. The handrail crane is then used to lower the head to the ground where we can then use a hand truck to move it into our work area. The handrail crane is an invention of the MP&RE Department and was shown in the first issue of MP&RE *Shop Talk* being used to remove the 103's reverser.





(TOP LEFT) After the head is moved inside to our work area, it can be picked up again by the multipurpose crane now being used as a work bench crane. Here, a head is seen hanging a few inches off the shop floor.

(TOP RIGHT) Once lifted by the crane, the head can be swung and dipped into the parts washer to soak in cleaning solution for cleaning.

(BOTTOM LEFT) The head can then be swung over to the work bench to be disassembled and cleaned.





(TOP) With the head removed, we also removed the liner anchor tool. Then the liner jacking tool is used to jack the liner free of its gasket seats.

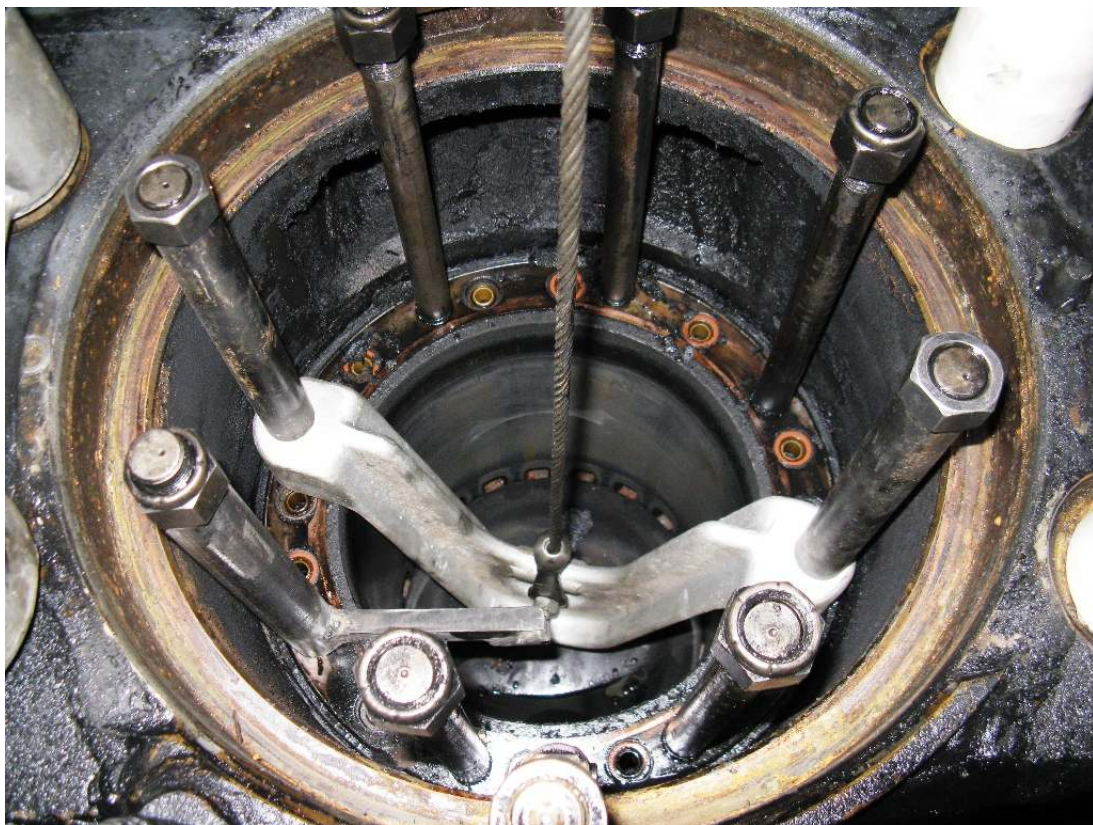
(BOTTOM) Also installed where the pee-pipe had been is the piston blanking plate. This custom-made plate is designed to keep the piston in the liner while allowing the piston pin carrier to pass by after the carrier snap ring has been removed. Leaving the pistons in the liners saved us a lot of time.



(TOP) With the liner free and the piston secured, the top deck crane is hooked up to the liner with the liner lifting tool.

(BOTTOM LEFT) The liner is manipulated out with another tool invented by the MP&RE Dept., the liner maneuvering tool.

(BOTTOM RIGHT) Swinging the liner clear of the top deck of the engine.





(TOP LEFT) After it's clear of the block, the liner is lowered to the running board and picked up by the hand-rail crane.

(TOP RIGHT) The hand-rail crane swings the liner from the running board out over the edge of the engine to be lowered to the ground.

(BOTTOM) Two liners removed and hanging from both the top deck and handrail cranes.





(TOP LEFT) After the liners are removed and moved into our work area, they are then cleaned while hanging from the shop crane.

(TOP RIGHT) Here volunteer Rich cleans a liner's gasket seat. This is a very important part of the process. When the old gaskets come off in multiple pieces, they leave chunks behind still adhered to the liner. All those remnants need to be removed to ensure proper seating of the new gaskets.

(BOTTOM) Volunteer Monika scrapes away years of build-up from the outside of the liner's intake ports. Because the EMD is a two-stroke engine, the piston acts as its own intake valve when it clears these ports. Build-up around these ports will naturally starve the engine from proper intake air flow.



Volunteer *Spotlight*



This issue's MP&RE Volunteer Spotlight takes a look at Mike Nagy. Mike has been a member of the RCT&HS since 2003 and has been very active on a wide variety of MP&RE projects since that time. He and his dad Rich have been an invaluable team on our committee and put in long hours to ensure our vast collection of equipment is around for many years to come.

READING COMPANY TECHNICAL & HISTORICAL SOCIETY



Flash *Back*



(Above) Here 621 is seen with a local train in Hatboro, PA, in the early '70s. If you have any photos of our equipment from yesteryear and would like to see them in a future issue of *Shop Talk*, please contact us at mpre.rcth@att.net.

Our volunteers have put in hundreds of hours on the 621's engine work so far. In future issues of *Shop Talk* we'll dig deeper into the process of how we cleaned and repaired the components we removed. We'll also look at some worn-out parts that we found along the way while were doing our repairs. The engine work to 621 is a little over 3/4 of the way complete at this time and moving forward steadily. These repairs, with the amount of skilled labor involved, would be an outlay of upwards of \$20,000 to our organization. However, because of the tireless dedication and hard work of our volunteers, we were able to do this work for only the cost of material, which has been roughly around \$2,500 to date. As with any project, we began to find more things after we started work. An example of this was the injectors and cylinder test cocks. It was decided when these were removed that because both showed a fair amount of wear, we would replace all 16. This puts the cost of each power assembly to approximately \$180 instead of the projected \$100 for only the gaskets needed for the engine repairs. Had we used an outside contractor, each power assembly would have cost around \$1,200-\$1,500 to repair. Although the work is taking time, we can be assured our volunteers are paying attention to all the details to ensure the job is done right and that 621 runs for many years to come.



Other Projects

In addition to continuing our work on GP7 621's engine, we're making steady progress with the rewiring work on our **NW2 #103**. All of the lighting conduits in the long hood have been rewired and the lights have been re-terminated. Some circuit testing has also begun on circuits in the cab. We also removed the old batteries from 103. These were 20 years old and had finally failed, so we'll be looking to renew the batteries prior to returning the 103 to service.

Work is continuing on **GP35 #3640**. Some further electrical layout work has been done. Also, the speedometer is being rebuilt in preparation for reinstallation. To date a number of the cab appliances have been rebuilt, including the controller from the control stand and a number of switches and valves.

Work is continuing on reinstalling the sub floor in the last caboose built by the Reading Company, **#94074**. After the sub floor is in place, the installation of the windows can be completed and then the finished floor can be installed. After that the interior can start being reassembled.

Our fire train tender **#90691** is progressing nicely. The tank has begun to receive its finish coats of paint. After we're done with the finish painting, we plan to letter the car and finish prepping and painting the undercarriage. The first coat of black has already been applied to the top of the tender as well as the ends and one side.

We've also begun organizing the MP&RE parts boxcar. The goal is to remove all non-MP&RE objects from the car and start organizing our material in one car rather than being scattered in different storage areas.

Work continues on RDG **RS3 #485**, with new window glass gasketing being sealed. Also, work continues on cleaning up the running gear in preparation for painting.

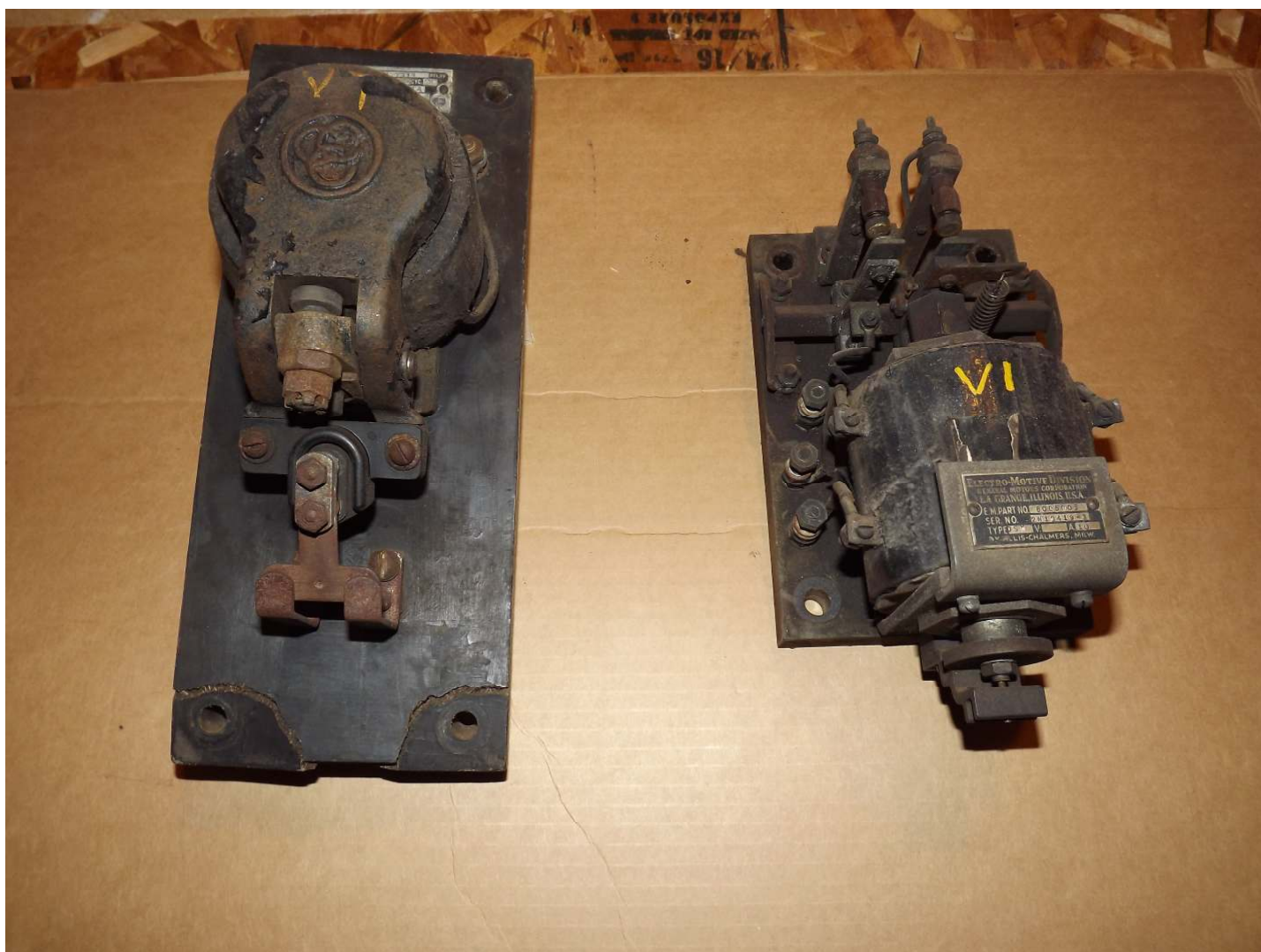
General preventative maintenance continues on the rest of the collection, but our main focus will continue to be the equipment mentioned above until the projects are finished. Once the 90691 is finished we plan to finish lettering the two hopper cars, offset hopper **#63921** and fishbelly hopper **#66418**. We're currently looking at creating stencils to aid in lettering our freight cars. It is our expectation that this will speed up the process significantly.

In Our Next Issue Of



Shop Talk

Continuing work on NW2 #103's Electrical Rebuild



Our next issue of *Shop Talk* takes a look at the removal, dismantling, and rebuilding of the relays in our NW2. A lot of painstaking work went into the rebuilding, and we're proud to show you a behind-the-scenes look at our progress. We'll also take a look at some custom fabrication of resistors that haven't been made in 40 years.



The MP&RE Committee would like to thank the following volunteers for all of their time and hard work preserving and maintaining the RCT&HS equipment collection.

Rick Bates	Rich Nagy
Chris Bost	Paul Payne
Mark Cain	Casey Quenzel
Don Crabtree	Carl Rettstadt
Steve Gilbert	Tom Rhoads
Ryan Lamm	Tami Schmutz
Frank Lancaster	Mike Soulia
Bruce Irvin	Mike Squitieri
Steve Mallon	John Stoudt Jr.
Dave McGuire	Pat Thompson
Nate Mengel	Tony Verbyla
Randy Mengel	Tim Weidner
Bob Morris	Harold Weinhold
Charlie Murphy	Monika Willett
Mike Nagy	



The MP&RE Department would like to thank the following corporations and vendors for their ongoing support.

Anthracite Railroads Historical Society, Inc.

Clark Filter

Derek Slifer Design

Durbin & Greenbrier Valley Railroad

East Penn Railroad, LLC

Edenburg Welding

Genesee Valley Transportation

Juniata Terminal Company

Morristown & Erie Railway

Norfolk Southern Foundation

Philadelphia Chapter, NRHS, Inc.

Print Lion

Railroad Museum of Pennsylvania

Reading Blue Mountain and Northern Railroad Company

RMDI

Southeastern Pennsylvania Transportation Authority

Steamtown National Historic Site

Strasburg Rail Road Company

Taylor Pneumatic Tool Company

Wabtec Corporation



Material needed for the 103 project

Item	Quantity	Price Each
Locoverter - 74V to 12V for Radio Power	1	\$210
AC Panel	1	\$60
DC Panel	1	\$60
AC Breakers	8	\$10
Ditch Lights	4	\$35
20 feet of 2x2x1/4" Angle	1	\$40
10X1 10-Gauge Sheet Metal	1	\$50
Battery Charger	1	\$510
74V Safety Switch for Charger	1	\$20
Pre-lube Pump Switch	1	\$20
Pre-lube Pump Terminal Board	1	\$10
Ditch Light Switch	1	\$20
Narrow Band Radio	1	\$500
Control Air Filter\Regulator\Lubricator	1	\$150
12v Inverter	1	\$30
Terminal Board for Ditch Lights	2	\$20
Aux Relays	4	\$10
Ditch Light Removable Mounts	4	\$30
Control Switches	4	\$20
Battery Spacer Plate	2	\$40
Headlight Glass	2	\$50
Alarm Bell	1	\$50
Alarm Lights	4	\$20
Alarm Sensors	4	\$30
Conduit	6	\$20
Conduit Fittings	4	\$10
Prelube Pump Relay	1	\$30
Hour Meter	1	\$20
DC Breakers	9	\$60
AC Connection Feed Receptacles	2	\$60
AC Power Receptacles	5	\$30



HELP US PRESERVE THE PAST FOR THE FUTURE

The MP&RE Dept. couldn't continue its important work of preserving the RCT&HS's collection of historic Reading Company motive power and rolling equipment without your support. That support can come in many different forms – it's not always just about money. We utilize a variety of resources when working on our projects and we urge you to think about how you can contribute to our restoration efforts. Our work wouldn't be possible without:

- **Blueprints and schematics** - Used to understand how equipment was built or wired during every step of the restoration process.
- **Manuals** - Used to obtain part numbers for replacement parts, to understand how components are constructed, and for technical specifications.
- **Vintage photos of Reading equipment** - Used extensively to ensure that our restoration work is as historically accurate as possible. Some projects, like the 3640 MU drop step, were fabricated solely using photos taken from a variety of angles. (Photos don't have to be of RCT&HS equipment. Sister models are just as helpful.)
- **Tools, spare parts, and material** – Tools are a critical part of our work, and spare parts are vital to replace worn-out or compromised components.
- **Volunteers of all skill levels** – Volunteers are the most important resource we have, and we welcome enthusiastic individuals from all backgrounds and with all skill levels. Part of our goal is to educate our volunteer crews about the equipment we're restoring and to learn from one another, so even those with no background or prior experience can contribute.
- **Financial contributions** – MP&RE volunteers make the most of every dollar donated to the Equipment Preservation Fund. We've saved the RCT&HS tens of thousands of dollars by doing technical repairs and rebuilds in-house and avoiding costly outside contractors.

If you have any questions about the MP&RE Dept., our work, or how you can get involved, please contact us at mpre.rcths@att.net. We also invite you to visit our Facebook page at <https://www.facebook.com/pages/MPRE-Dept-Reading-Co-Technical-Historical-Society/279477532069983>.

YES, I'd like to support the important work of the MP&RE Dept. and help preserve the equipment of the RCT&HS. Enclosed is my check, made payable to Reading Company Technical & Historical Society. Please designate my donation towards the following MP&RE priority project(s):

- Equipment Preservation Fund _____
 RDG 103 _____
 RDG 621 _____
 RDG 3640 _____
 RDG 90691 Tender _____
 RDG 94074 Caboose _____
 Other (Specify equipment no.) _____

YES, I am interested in supporting the work of the MP&RE Dept. beyond a financial contribution. Please contact me via Phone or E-Mail.

Name _____ E-Mail Address _____
 Mailing Address _____ City _____ State _____ Zip _____
 Phone _____ (I prefer to be contacted Days Evenings Weekends)

Mail to: MP&RE Dept, RCT&HS, PO Box 15143, Reading PA 19612-5143