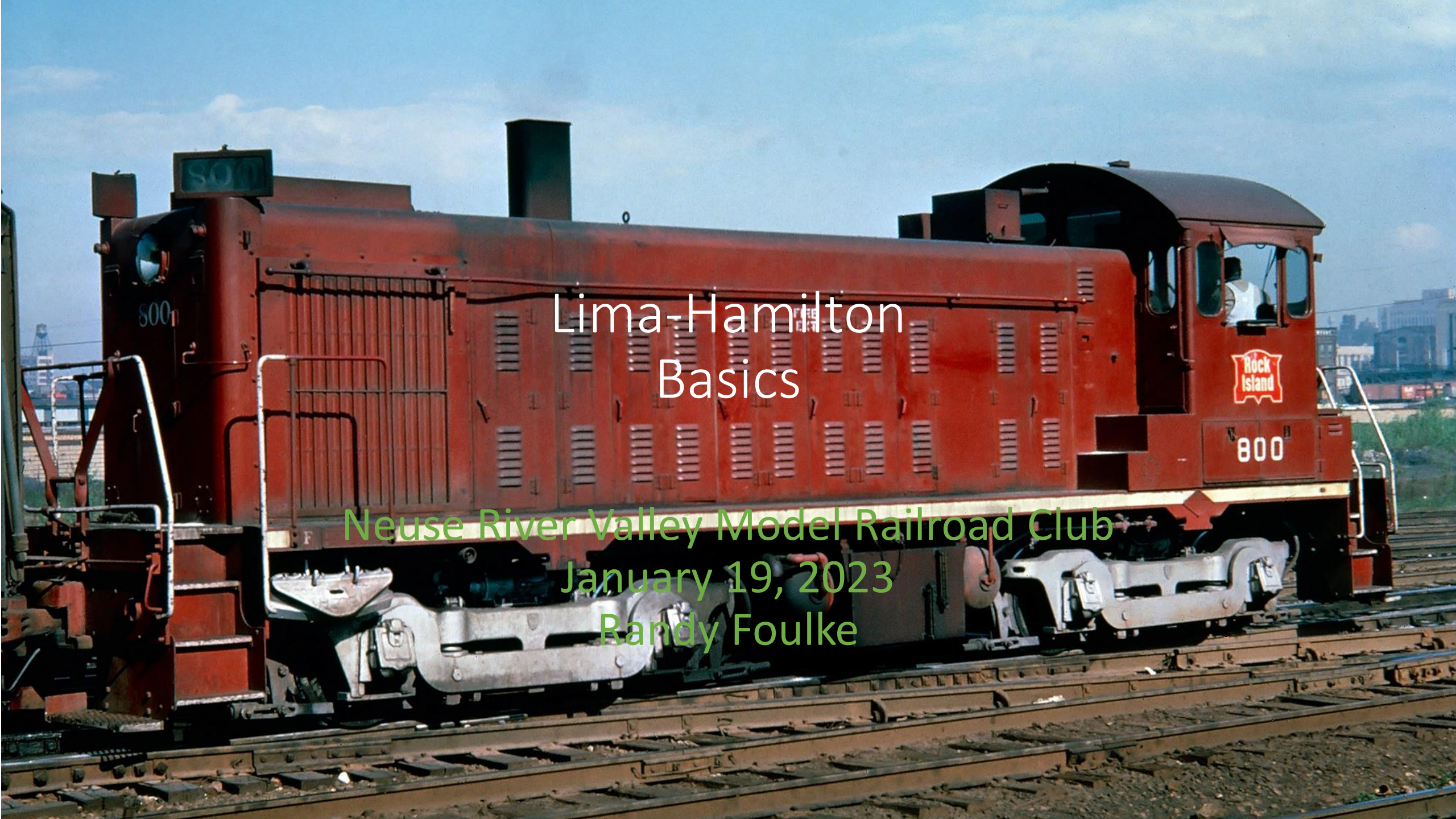


Lima-Hamilton Basics

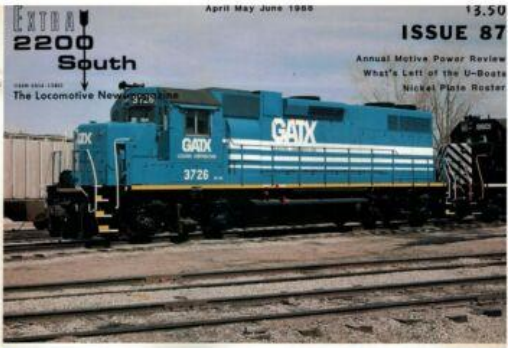
Neuse River Valley Model Railroad Club

January 19, 2023

Randy Foulke

Tonight's Presentation

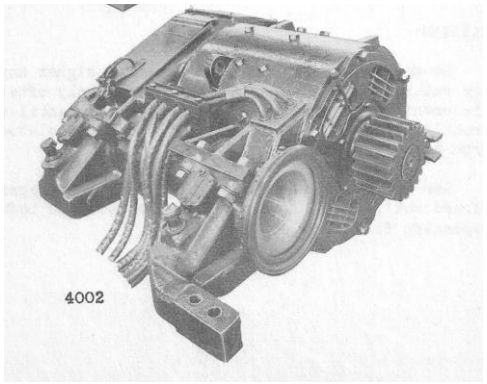
- Lima-Hamilton Basics



Locomotive Phases

- No locomotive manufacturer ever used the term phase for its locomotive or any of its parts
  - Changes that occurred during production of a particular model were just evolutionary steps
- The term phase was originally used by the publication, *Extra 2200 South,* started by rail historian and enthusiast Jerry Pinkepank, to identify changes in specific models
  - For example, there were 6 different phases of EMD F3s
- The use of phases to identify different characteristics of the same model was expanded by other rail historians

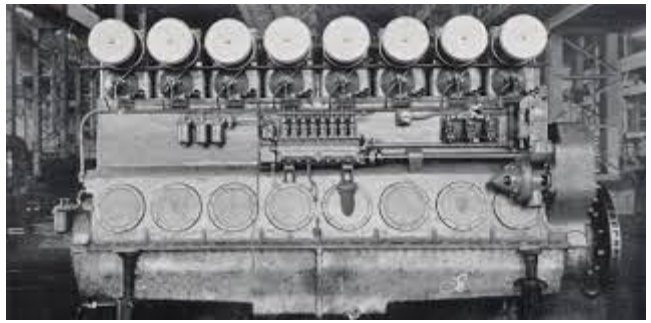
DC Traction Motors



- Best to Worst
  - Westinghouse 360 to 370 Series
    - Introduced in the late 1920s
    - Westinghouse exited the locomotive traction business in 1955
  - General Electric 752 Series
    - Evolution of the 726 to 746 series
    - Introduced in the late 1940s
    - Last produced domestically for new locomotives in 2015, still produced for international customers
  - EMD D Series (D7 – D100)
    - Based on the GE 716 traction motor, which EMD bought the rights for production
    - Introduced in 1938
    - Last produced domestically for new locomotives in 2011, still produced for international customers
  - MPI/MK Rail MK 1000 Series
    - Based on EMD traction motors
    - Introduced in the early 1990s, still produced upon request
- Durability – Length of time to run with excessive amps
  - Based on amount of copper wiring in motor
  - Southern Pacific performed study to confirm

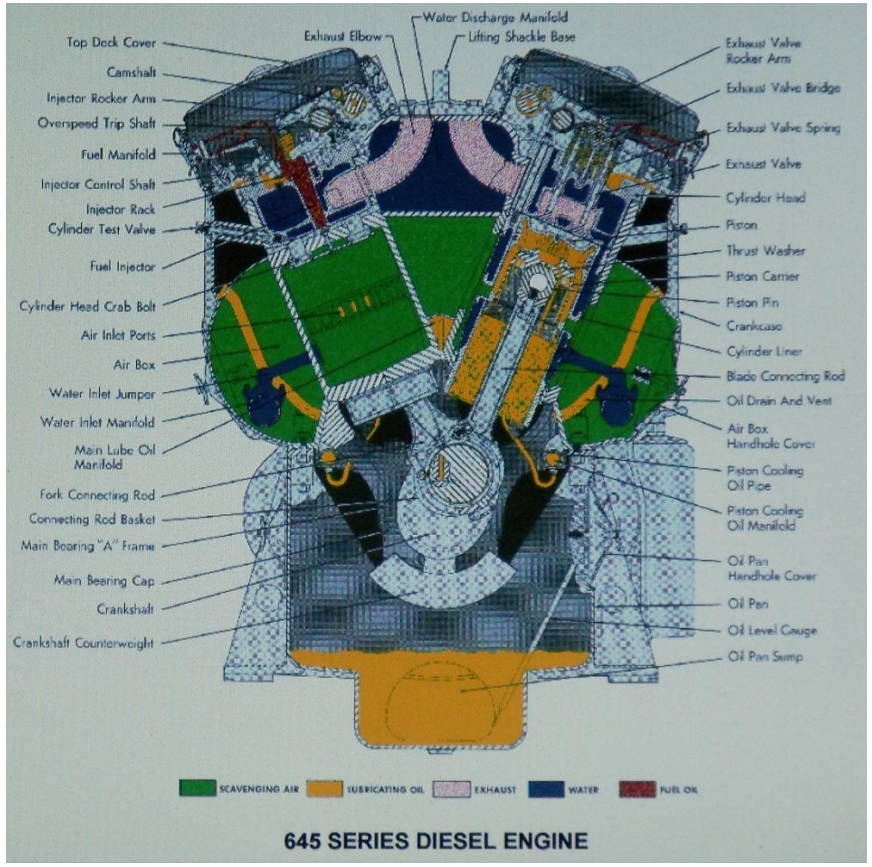
Manufacturers' Diesel Engines

- Only 2 of the major diesel locomotive manufacturers developed and built their own diesel engines
  - EMD
  - Fairbanks-Morse
- Origins of diesel engines for other manufacturers
  - Alco – purchased McIntosh & Seymour in 1929
    - Prior to 1929, Alco used Ingersoll-Rand diesel engines
  - Baldwin – purchased I. P. Morris & De La Vergne in 1931
    - Prior to 1931, Baldwin used Krupp and Knudsen diesel engines in locomotive development
    - The last 3 locomotives built used Maybach diesel engines
  - General Electric – rights for the 7FDL diesel engine purchased from Cooper-Bessemer in 1956
    - Prior to 1956, GE used Buda, Busch-Sulzer, Caterpillar, Cooper-Bessemer, Cummins, Hercules, and Ingersoll-Rand, depending upon model and buyer
    - 44-ton used Caterpillar engines, and the 70-ton used the Cooper-Bessemer FWL-6T
  - Lima – merged with General Machinery Corp of Hamilton, Ohio in 1947
  - MPI/MK Rail – Primarily used EMD, but also Caterpillar, Cummins, General Electric, and Sulzer (Swiss)
  - Others – Krauss-Maffei (Maybach), Siemens (Cummins), Budd RDC (GM Detroit Diesel), Alstom (EMD)
  - Small industrial switchers – variety of domestic gasoline and diesel engines, including truck type



Locomotive Statistics

- Model number (if there is a number)
- Horsepower
- Type of trucks
- Traffic effort (if known)
- Prime mover and engine type
- Traction motors (if known)
- Total quantity built
  - Operator w/largest number of locomotives
  - Operator w/smallest number of locomotives
- Phases
- Any other relevant information



Lima-Hamilton

- Merger of an old-line builder of steam locomotives, Lima Locomotive Works, and an experienced diesel engine manufacturer, General Machinery Corp. of Hamilton, Ohio
- Lima Locomotive Works was formed in 1869 as the Carnes, Harper & Co. by five Ohio businessmen
  - Went through four name changes until it became Lima Locomotive Works in 1916
  - Was recognized for its innovation and high quality, was the smallest of the “big three” locomotive manufacturers (Alco and Baldwin the other 2)
  - Because Lima sold various steam powered logging equipment, was contacted by Ephraim Shay, a MI logger, to build the gear-driven steam locomotive he invented
    - Went on to build 2,761 Shay locomotives of various sizes from 1878 to 1945
- Became famous for its “superpower” locomotives with enlarged fireboxes and higher steam pressures
  - The 1st was a 2-8-4 demonstrator in February 1925, eventually sold to IC, and the last was a 2-8-4 for NKP on May 13, 1949, one day before the completion of its first diesel electric
  - Most powerful superpower locomotive was 12 coal burners of the SP, AC-9 2-8-8-4, and the heaviest were the 2-6-6-6 Alleghenies of the C&O and the Virginian
- Lima completed 7,752 locomotives of all types before terminating production in 1951
- Plant located in Lima. OH between the Erie RR mainline and the B&O Cincy to Toledo main line

Lima-Hamilton

- General Machinery Corp. of Hamilton, Ohio
  - Was formed in 1928 from 5 different companies, but one of its predecessor goes back to 1841 in NH, with other companies in MI, NJ, and OH
    - Roots are in foundry, machining and welding of manufacturing equipment and presses
    - Began the manufacture of diesel engines and construction equipment in the 1930s
    - Took over an idle government ordinance plant in 1940 to forge and machine large gun barrels
    - Through a subsidiary, in 1942, won a contract to complete a shipyard and construct Liberty Ships for the US Navy – completed over 80 Liberty Ships by the end of 1944
    - Built over 40,000 anti-aircraft guns through the American Oerlikon Company in WW2 and after
    - Built both steam and diesel engines for maritime use in WW2 for both the USA the British Government
    - Diesel engines were based on the MAN engine from Germany, which General Machinery had purchased a license from
  - With WW2 coming to a close, was looking for uses for its production capacity, approached Lima about possible merger
  - In 1930s had worked with both Davenport and Plymouth to develop diesel hydraulic locomotives
  - In the only known instance of repowering of EMD locomotives, Hamilton 68SA diesel engines were installed in place of Winton engines in 4 baggage locomotives and 1 rail motor car in 1940-1942 constructed for RI
  - Hamilton, OH is only 120 miles from Lima, OH

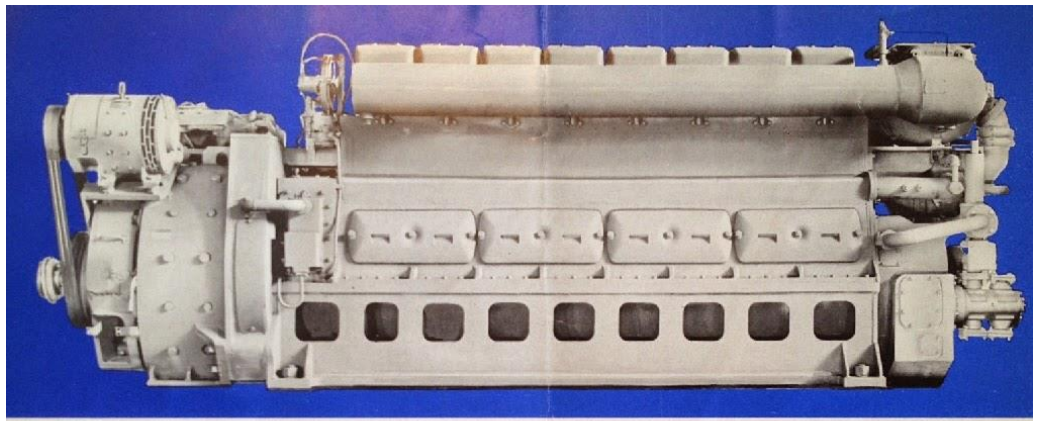
General Machinery Corp. of Hamilton, OH

- Notable individuals at time of merger
  - George Rentschler, President and CEO of General Machinery Corp.
    - Born in Ohio, graduate of Princeton University, grew the family foundry business into the multifaceted General Machinery Corp
    - Was architect of the merger with Lima Locomotive Works
    - Was architect of the merger of Lima-Hamilton with Baldwin
    - Chairman of the Board of BLH, then Chairman of the Executive Committee until 1965
  - Frederick Rentschler, brother of George Rentschler and member of the Board of Directors of General Machinery Corp
    - Founder and President of Pratt & Whitney and co-founder and Chairman of the Board of United Aircraft and Transportation Co., which was broken up into Boeing Airplane Company, United Air Lines, and United Aircraft Corp. (Pratt& Whitney, Chance Vought, and Sikorsky), Mr. Rentschler was the Chairman of the Board of United Aircraft Corp.
  - Walter Rentschler, nephew of Frederick and George, VP and General Manager of General Machinery Corp., was made of VP of Operations at Eddystone after merger

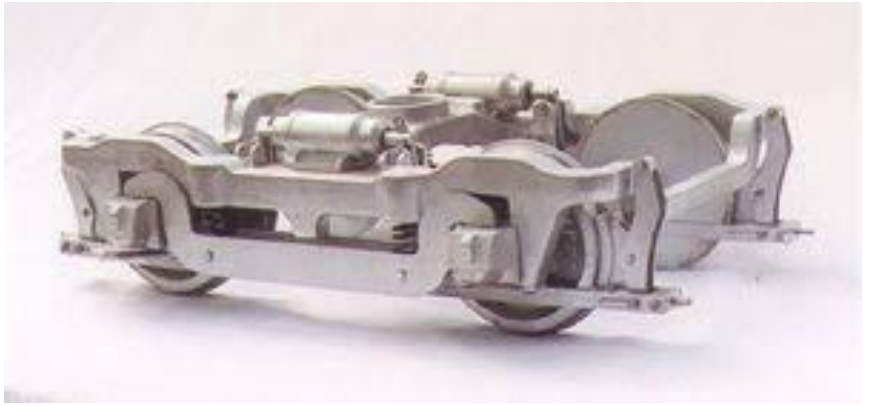
Gordon Rentschler, a brother to George and Frederick, was the Chairman of the Board of National City Bank of New York

Lima-Hamilton Locomotive Engines

- Based on the Hamilton 68SA engine that had been in production since 1936
  - Used WW2 for maritime use
- Engine was verticle in-line, 6 or 8 cylinder, 4-cycle, turbocharged, 9” bore x 12” stroke, 950 rpm
  - 6 cylinder – model T69SA – 750 hp (1949-1950), 800 hp (1950-1951)
  - 8 cylinder – model T89SA – 1,000 hp (1949-1950), 1,200 hp (1950-1951), 1,250 hp (1950-1951 special upgrade for PRR)
  - T = turbocharged, 6 or 8 = # of cylinders, 9 = bore size, SA = single acting



Lima-Hamilton Trucks



- Switchers – AAR Type A switcher truck
- Road Switchers – AAR Type B road truck
- Transfer Locomotives – cast frame, rigid bolster C-C truck

Lima-Hamilton Models

- After pre-standardized models, modular approach to be used with operating cab, electrical cabinet, engine compartment, and 2 designs for radiator compartment and engine-generator set, depending upon hp
- Lima-Hamilton did not use model numbers
- Switchers
  - Model 1,000-HP Switcher, Model 750-HP Switcher (Pre-standardized Production)
  - Model 800-HP Switcher, Model 1,200-HP Switcher
- Road Switchers
  - Model 1,200-HP Road Switcher
- Transfer Locomotives
  - Model 2,500-HP Transfer Locomotive

Lima-Hamilton Models Not Built

- 800-hp Road Switcher
- 1,600-hp Transfer with Rigid Bolster C-C
- 1,600-hp Transfer with Swing Bolster A1A-A1A
- 1,600-hp Road Switcher, Twin Engine with Rigid Bolster C-C
- 1,600-hp Road Switcher, Twin Engine with Swing Bolster A1A-A1A
- 2,400-hp Road Switcher, Twin Engine with Rigid Bolster C-C
- 2,400-hp Road Switcher, Twin Engine with Swing Bolster A1A-A1A
- 2,400-hp Transfer with Swing Bolster A1A-A1A
- 1,600-hp Transfer, Cow & Calf
- 2,400-hp Transfer, Cow & Calf

Lima-Hamilton Locomotives

- Model 750-Horsepower Switcher (Pre-standardized Production)
  - Specification # A-3149
  - Truck – B-B AAR Type A Switcher
  - Traffic effort – continuous 34,000 lbs
  - Engine – Hamilton T69SA 6-cylinder
  - Traction motors- Westinghouse 362D
  - Total quantity built – 6
    - Only one buyer – Cincinnati Union Terminal
  - Phases – 1
  - Period Produced – 11/49-6/51

Lima-Hamilton Locomotives

- Model 800-Horsepower Switcher
  - Specification #A-3171
  - Truck – B-B AAR Type A Switcher
  - Traffic effort – continuous 34,000 lbs
  - Engine – Hamilton T69SA 6-cylinder
  - Traction motors- Westinghouse 362D
  - Total quantity built – 23
    - Operator w/largest # of locomotives – Chicago River & Indiana (NYC System) – 21
    - Operator w/least # of locomotives – Rock Island – 2
  - Phases – 2 (RI units had battery box behind cab, CR&I had battery box ahead of cab and were shorter)
  - Period Produced – 9/50-6/51

Lima-Hamilton Locomotives

- Model 1,000-Horsepower Switcher (Pre-standardized Production)
  - Specification # A-3080
  - Truck – B-B AAR Type A Switcher
  - Traffic effort – continuous 34,000 lbs
  - Engine – Hamilton T89SA 8-cylinder
  - Traction motors- Westinghouse 362D
  - Total quantity built – 38
    - Total number of operators – 6
    - Operator w/largest # of locomotives – Tie – B&O & Erie – 10
    - Operator w/least # of locomotives – Armco Steel – 2
  - Phases – 1
  - Period Produced – 5/49-3/50

Lima-Hamilton Locomotives

- Model 1,200-Horsepower Switcher
  - Specification # A-3170
  - Truck – B-B AAR Type A Switcher
  - Traffic effort – continuous 34,000 lbs
  - Engine – Hamilton T89SA 8-cylinder
  - Traction motors- Westinghouse 362D
  - Total quantity built – 69
    - Total number of operators - 8
    - Operator w/largest # of locomotives – B&O – 24
    - Operator w/least # of locomotives – Wabash – 2
  - Phases – 1
  - Period Produced – 4/50-5/51
  - Lima locomotive with highest construction number, 9560, was Armco Steel #E110, delivered on August 15, 1951
  - SP ordered 60 of this type, but agreed to accept 84 BLH S-12s
  - 10 from Wabash and 4 from NKP to N&W

Lima-Hamilton Locomotives

- Model 1,200-Horsepower Road Switcher
  - Specification #3174
  - Truck – B-B AAR Type B Road
  - Traffic effort – continuous 34,000 lbs
  - Engine – Hamilton T89SA 8-cylinder
  - Traction motors- Westinghouse 362D
  - Total quantity built – 16
    - Only one buyer – New York Central
  - Phases – 1
  - Period Produced – 8/50-10/50
  - Used for commuter service
  - NYC ordered an additional 17, but agreed to accept 17 BLH RS-12s
  - 2 made it into Penn Central ownership before retirement
  - Steam generators included

Lima-Hamilton Locomotives

- Model 2,500-Horsepower Transfer
  - Specification # A-3177
  - Truck – C-C cast-frame, rigid-bolster
  - Traffic effort – continuous 73,000 lbs
  - Engine – 2 Hamilton T89SA 8-cylinder
  - Traction motors- Westinghouse 370G
  - Total quantity built – 22
    - Only one buyer – Pennsylvania
  - Phases – 2 (15 w/o dynamic brakes, and 7 w/dynamic brakes)
  - Period Produced – 5/50-9/51
  - Used for transfer and branch line service
  - PRR ordered an additional 22, but agreed to accept 23 BLH RT-24s

Lima-Hamilton Legacy

- 174 diesel locomotives built
- Over 100 on order at the time of the merger with Baldwin
- All locomotives led very useful lives for their owners
  - Most were retired in the mid to late 1960s with a few that made into the 1970s
    - The last in service for a Class 1 believed to be a 1,200 HP Switcher retired in 1975 from Penn Central
  - 4 were rebuilt with EMD 567 engines, 2 1,200 HP Switchers and 2 1,200 HP Road Switchers, all from NYC
  - Nearly all customers considered them to be rugged and reliable, especially the Hamilton engines and the Westinghouse electrical gear
  - Most were traded to EMD or GE and scrapped, a few were sold second-hand to industry and short lines, but did not last long because of availability of parts
    - Nicholson Terminal and Dock (Michigan) still operates a 1,000 HP Switcher

Lima-Hamilton Merger with Baldwin

- Engine controversy
  - Longevity, reliability, and maintenance requirements were better with the Hamilton engine versus the De La Vergne engine
    - At merger, there was more experience with the De La Vergne engine
    - All production shifted to Baldwin's Eddystone plant, which was configured to build the De La Vergne engine
    - Hamilton engine brought to test stand at Eddystone and compared with the De La Vergne engine, overseen by the Chief Engineer of BLH who had been same position at LH
    - Test results were approved by the former CEO of General Machinery and was now Chairman of the Board of BLH (George Rentschler)
    - Mr. Rentschler approved decision to terminate production of the Hamilton engine
- Merger motivated by LH strong position in road construction equipment, but lack of adequate space to expand production for the Federal Interstate Highway System construction – shift construction equipment to Lima plant and locomotive production to Baldwin Eddystone's facility, abandon Hamilton's facilities
- Merger agreed to 12/4/1950 and completed 9/11/1951

Hamilton Engine Legacy

- Research and development continued on the Hamilton engine at Eddystone with 4-cylinder and 6-cylinder designs with increased displacement per cylinder and a 50% increase in the Brake Mean Effective Pressure, but BLH ceased locomotive production before development could be completed
- After merger, S.A. Cockerill-Ougree-Providence of Belgium entered into licensing agreements for the De La Vergne (Baldwin) and the Hamilton engines, and continued development
  - In 1968, Cockerill offered an uprated engine that was a hybrid of the Baldwin and Hamilton engines in straight 6 and 8, V-12 and V-16 supercharged configurations for stationary, marine, and locomotive uses
  - The V-16 was rated at 4,000 hp
  - Cockerill-Ougree-Providence diesel engines are still built by the Cockerill Sambre Group, owned by the multinational company, ArcelorMittal (headquartered in Luxembourg, but Indian owned)
  - Some replacement parts for Baldwin and Hamilton engines can be purchased from Cockerill Sambre as they still fit

The End of BLH

- BLH ceased locomotive production in 1956
- In 1965, BLH became a wholly owned subsidiary of Armour and Company
- Greyhound Company purchased Armour and Company in 1970
- In 1972, Greyhound closed BLH and ceased production of construction equipment

Lima-Hamilton Preservation

- 6 switchers are known to exist
  - 1 in active revenue service at Nicholson Dock
  - 1 in private ownership in storage
  - 1 at the Illinois Transportation Museum in deadline (inoperable)
  - 3 at the Whitewater Valley Railroad (Connersville, IN)
    - 750 HP Switcher is fully operable and is used in tourist excursion service (CUT)
    - 1,000 HP Switcher is being fully restored (Armco Steel)
    - 1,200 HP Switcher is currently in storage, but is planned to be restored (B&O)
    - Tourist railroad runs between Connersville and Metamora, IN

Modeling Lima-Hamilton Diesels

- Brass models from all prototypes have been produced by many modeling companies (i.e. Alco Models, Hallmark Models, Overland) in HO and O. Not sure about other scales
- MTH has produced a switcher and transfer locomotive in O scale (the transfer locomotive was produced in both non-dynamic brake and dynamic brake versions)
- Why have Lima-Hamilton diesel locomotives not been produced in plastic, especially since a good variety of railroads owned them?
  - None of the western and southern railroads owned any

Questions