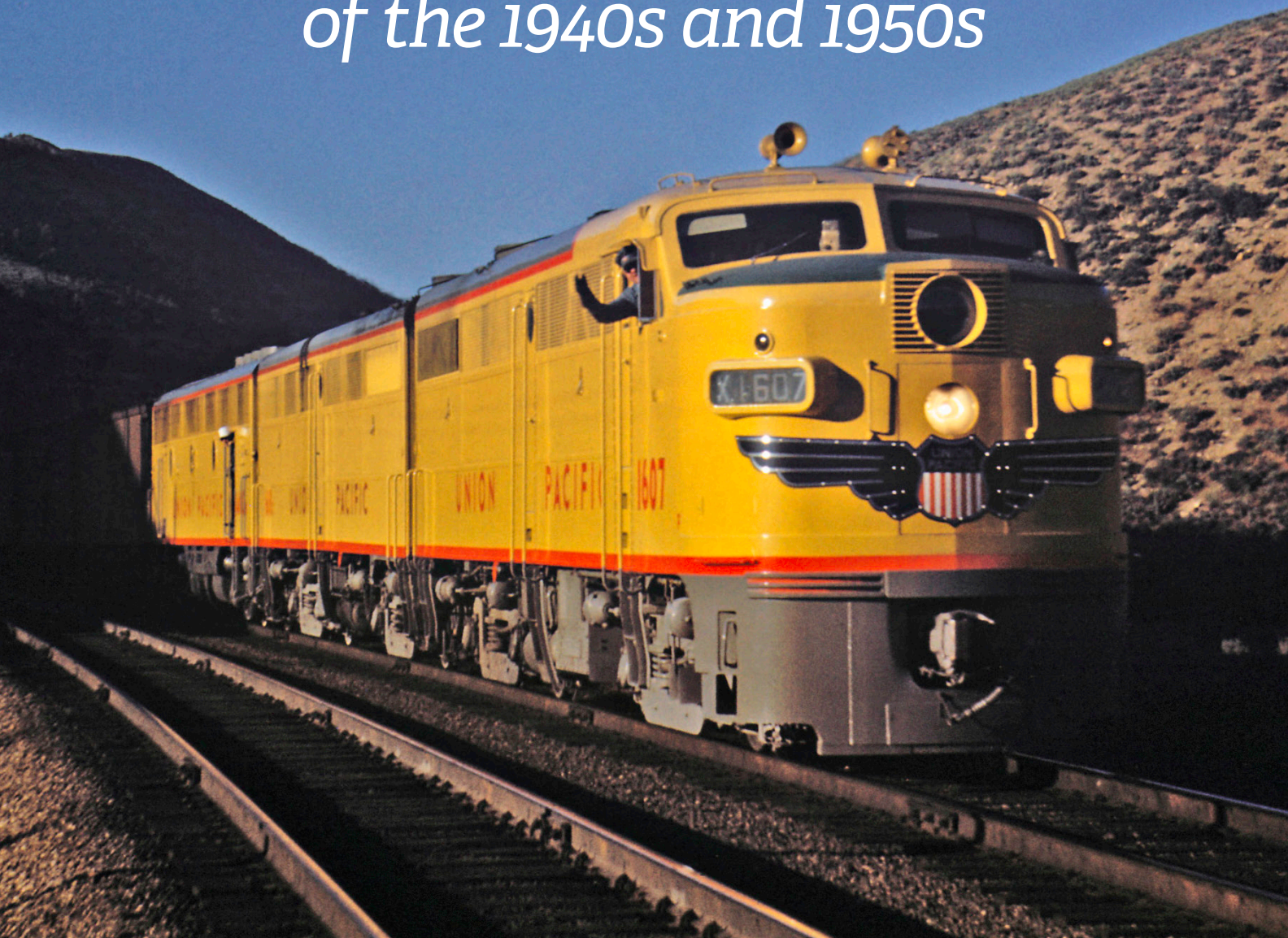


CLASSIC DIESEL BUILDERS

of the 1940s and 1950s





**BUILDER
PROFILES**

Electro



-Motive

From upstart to undisputed champ

When the last fires of revenue American Class 1 steam were dropped in 1960, 7 of every 10 diesels credited with the victory bore the EMD stamp

BY GREG McDONNELL

Steam was king, its supremacy uncontested, in 1922 when Harold L. Hamilton and associates rented office space at 17th and Euclid in Cleveland, Ohio, for their fledgling Electro-Motive Engineering Co. Established to design, market, and maintain gas-electric railcars for light-density passenger service, the modest enterprise could hardly be considered a threat to the Big Three locomotive builders, let alone to all of steam locomotion.

Why, the little upstart—its name abbreviated to simply the Electro-Motive Co. soon after its founding—had no factory, no shop, and not even a proprietary product line. EMC was reliant upon suppliers: Winton for most of its gas engines; General Electric for control and electrical systems; and carbuilders such as St. Louis Car and Pullman to assemble its self-propelled “doodlebugs.”

Sales of EMC’s gas-electric doodlebugs boomed at first, with several hundred cars delivered in the firm’s first few years of business. The Depres-

sion emptied the order books, though, and but for the intervention of General Motors, little Electro-Motive might have quietly withered away. Instead, GM purchased EMC, along with its major supplier, Winton Engine Co., in 1930.

With General Motors at the wheel, EMC moved beyond distillate and doodlebugs, providing prime movers and expertise in the construction of power cars for lightweight passenger trains, from Union Pacific’s bulbous *City* streamliners to Illinois Central’s *Green Diamond* and Burlington Route’s legendary *Zephyrs*. Meanwhile, Winton, under the tutelage of GM’s Charles F. Kettering, set to developing a diesel engine.

The result was the two-cycle, 750-rpm Winton 201, which soon found favor with the U.S. Navy as a lightweight diesel suitable for submarines. In 1934 the Winton was introduced to railroading when an 8-cylinder, 600 h.p. 201A was lowered into the slope-faced, stainless-steel power car of the Edward G. Budd Manufacturing Co.’s original Burlington *Zephyr*. Railroading would never be the same.

With a name honoring the Greek god of the west wind, the articulated three-car *Zephyr* set the world afire. A breathtaking vision of stainless steel and glass, the *Zephyr*, true to its name, could run

like the wind. On its inaugural tour, the train dashed from Denver to Chicago without stopping. While the public was seduced by the *Zephyr*’s good looks and speed, her greatest asset was the Winton 201A beneath her shiny skin. The rhythmic chant of a two-cycle Electro-Motive diesel was the sound of the future.

Even the steam builders took notice. It was one thing to build a business around lightweight doodlebugs and marginal back-road passenger operations, but quite another to steal premier passenger trade from the rightful province of Pacifics, Hudsons, and Northerns. The Big Three builders (Alco, Baldwin, and Lima) scowled and pointed fingers at the finite capacity and limited power of the lightweight speedsters. Electro-Motive, of course, had more up its sleeve than pocket streamliners.

Hot on the heels of the *Zephyr*, Electro-Motive boldly took on the steam establishment with Winton-powered diesel-electric locomotives. Still without a factory of its own, the brash newcomer contracted General Electric, St. Louis Car, and Bethlehem Steel to construct nine prototype locomotives in 1935-36.

While Electro-Motive’s first locomotives took shape in Erie, Pa.; St. Louis, Mo.; and Bethlehem, Pa., EMC broke

ground for its own factory in the Chicago suburb of McCook, Ill. Better known for its mailing address in adjacent La Grange, the 200,000-square-foot plant would soon be celebrated as “the home of the diesel locomotive.” At the time, the groundbreaking was little more than local news, but history would prove that the fate of American steam was sealed when a polished steel shovel cut into the cold earth of a farm field next to Route 66 and the Indiana Harbor Belt/B&OCT belt line in McCook on March 27, 1935.

General Electric’s Erie works (which also supplied electrical equipment for early EMC’s) completed Electro-Motive’s first diesels, Lackawanna 600 h.p. end-cab SC switchers 425 and 426, in February and March 1935. Also in March, EMD 518, a 900 h.p., off-center-cab switcher, was built by Bethlehem Steel at Wilmington, Del., and sold shortly thereafter to subsidiary Philadelphia, Bethlehem & New England.

Lacking the glamour of the *Zephyr* were EMC’s passenger prototypes, 511 and 512. The twin-engined, 1,800 h.p., B-B box-cabs were the brainchild of EMC designer Dick Dilworth, who chose function over form in creating a “four-axle boxcar” designed to match the performance of such steam thoroughbreds as New York

FT set No. 101 of the Santa Fe, the first customer for EMD’s pioneer road-freight diesel, speeds a train west at Willow Springs, Ill., in November 1946.

C. H. KERRIGAN PHOTO



E8 No. 811, lettered for GM/EMD but bearing the livery of future owner Lackawanna, pulls out of Hoboken with DL&W train 11 in early 1951.

Central's J-1 Hudsons. The two demonstrators were completed at Erie in May 1935, followed by Baltimore & Ohio 50, a nearly identical unit finished in August for service on the *Royal Blue*. St. Louis Car turned out a final pair of passenger box-cabs, Santa Fe 1 and 1A, for the all-Pullman Chicago-Los Angeles *Super Chief*.

The oddball in EMC's early lineup was an 1,800 h.p., twin-engined, articulated-frame center-cab transfer locomotive outshopped by St. Louis Car in May 1936, Illinois Central

9201. It remained a one-of-a-kind but presaged drawbar-connected "TR" duos that IC would commission from EMC a few years later. The ungainly center-cab unit would also mark the end of EMC's dependence on other builders. Even as IC 9201 came together, the erecting floor of the brand-new EMC La Grange plant was crowded with SC switchers . . . and drafting boards stacked with drawings of bigger and better things to come.

Among those things was a sleek, slant-nosed, twin-engined, 1,800 h.p. A1A-A1A passenger diesel that bore no external resemblance to Dilworth's boxy prototypes. B&O signed up for the first production models, designated EA for

cabs and EB for boosters.

Possessed of "the most famous face in dieseldom," the Electro-Motive E unit became the standard passenger locomotive of American railroading, and would be such for generations. Evolving from EA to E1 through E9, trading Winton 201A's for successor 567's and shaving its elegant slanted nose to a pug bulldog style, the E unit reigned supreme over American varnish, dethroning the monarchs of steam.

Elegance defined, the E unit was just the beginning. In 1938, EMC introduced a successor to the pioneer Winton 201A, the two-cycle, V-type 567. The engine would power a new line of locomotive models,

from the 6-cylinder, 600 h.p. SW1 to the 12-cylinder, 1,000 h.p. NW2 and the twin-V12, 2,000 h.p. E3. A road-freight diesel was the only thing missing from the lineup.

But not for long. Enter the FT, a 1,350 h.p. B-B road locomotive offered singly, in cab and booster versions, or in multiples, from 2,700 h.p. A-A or A-B sets to a 5,400-h.p. A-B-B-A configuration. The FT debuted in November 1939 as EMC 103, an A-B-B-A demonstrator set that embarked on an 11-month, 35-state, 83,764-mile barnstorming tour [pages 102-105] that would sound the death knell for steam.

Spearheading the first wave in the assault on steam, the FT sold 1,096 units to 23 carriers



EDWARD THEISINGER



DAN POPE COLLECTION



J. DAVID INGLES

by 1945. The FT, wrote TRAINS magazine Editor David P. Morgan, “must be ranked as perhaps the most influential piece of motive power since Stevenson’s *Rocket*, for in one stroke, it broke steam’s historic monopoly of freight traffic and thereby forecast total dieselization . . .”

General Motors formally merged Electro-Motive and Winton Engine Co. to form its Electro-Motive Division in 1941. No longer “the new kid on the block,” EMD was a force to be reckoned with. Packing a full arsenal of ever-improving and more powerful models, EMD catapulted to the top.

By the end of World War II, steam was doomed. Dieselization was no longer a question

of if, but when. And La Grange led the way, outselling all the other builders combined.

EMD wasn’t perfect. It was uncharacteristically slow, for instance, to respond to the road-switcher, an innovative concept introduced in 1941 by the Alco RS1 and adopted right after the war by Baldwin. After briefly stumbling with the “Branch Line” locomotive, though, La Grange got it right as the 1949 introduction of the GP7, Dick Dilworth’s “Ugly Duckling,” delivered the *coup de grace* to steam.

After that, there was no stopping Electro-Motive. Production spilled out of La Grange, forcing EMD to establish a second assembly plant in Cleveland [pages 54-

Chicago & North Western bought the three EMD GP7 demonstrators, and had a substantial fleet into the 1990’s; No. 1558 is at DeKalb, Ill., in December 1957. Burlington Route, an early and loyal Electro-Motive customer, had two EMC NW1’s; Winton-engined No. 9201 is south of Chicago Union Station in June 1961.

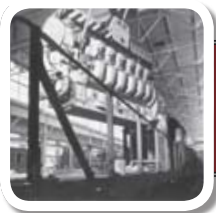
63] and a Canadian subsidiary in London, Ontario. By the early 1950’s, EMD had steam on the ropes and the Big Three builders playing a life-or-death game of catch-up that left Alco fighting for survival and delivered Baldwin and Lima a knockout punch from which neither would recover.

EMD turned up the heat as the 1,500 h.p. F7/GP7 line gave way to 1,750 h.p. F9/GP9 line in 1954. One by one, the great steam bastions fell—more often than not, to diesels bearing the words ELECTRO-MOTIVE

DIVISION on their oval-shaped builder’s plates.

The builder would retain its supremacy until 1983, when, after more than two decades of effort, General Electric unseated EMD as the top U.S. locomotive builder. Following years of lukewarm feelings for its La Grange subsidiary, GM finally sold off EMD in 2005.

But when the last fires of revenue American Class 1 steam were dropped in 1960, 7 of every 10 diesels credited with the victory bore the EMD stamp. ■



BUILDER PROFILES

Alco

BY GREG McDONNELL

Alco should have known better. The largest of the Big Three steam builders, the American Locomotive Company was the first to embrace the diesel. It was first to catalog a line of standardized diesel-electric locomotives: 60- and 100-ton box-cabs with General Electric electrical equipment and Ingersoll-Rand diesels. It was first, again with GE and I-R, to build a commercially successful diesel-electric locomotive: Central Railroad of New Jersey 1000, a 60-ton, 300 h.p. box-cab put to work in the Bronx in 1925. It was first to have a diesel prime mover of its own, a feat accomplished with the purchase of engine builder McIntosh & Seymour of Auburn, N.Y., in 1929. It was first with the road-switcher, the RS1 of 1941.

Nevertheless, Alco underestimated the diesel and lost its early lead to upstart Electro-Motive. Things may have been different had the Depression not evaporated funds that might otherwise have been directed to diesel development, and had the War Production Board not stifled diesel production and design work during World War II.

Still, it was Alco's own decision—despite its early involvement with the diesel—to stick with the steam standard, subscribing at first to the common belief that the diesel's place was only within

yard limits and in territory governed by smoke-abatement laws. No one in his right mind would contend that the diesel could ever compete with the likes of Schenectady's finest: Milwaukee *Hiawatha* 4-4-2's; New York Central Hudsons, Mohawks, and Niagaras; Union Pacific Challengers and Big Boys.

None of which is to imply that Alco sat on its laurels while H. L. Hamilton, Boss Kettering, Dick Dilworth, and associates plotted to beat the nation's biggest locomotive builders at their own game. Alco led the way in the development and perfection of the diesel switcher and even dabbled in road and passenger diesels, along with tri-power diesel-battery-electrics for New York Central as early as 1928. Indeed, NYC 1550, a 750 h.p.

Ingersoll-Rand-powered 2-D-2 freight box-cab completed by Alco in October 1928, is considered the first successful road diesel in the U.S.

By 1932, Alco was building a standardized line of high-hood, end-cab diesel switchers powered by 600 h.p. McIntosh & Seymour 531-series engines and outfitted with customer-specified General Electric or Westinghouse electrical equipment. Otto Kuhler restyled the design in 1934, and Alco added a turbocharged 1,000 h.p. version to the lineup in 1937. Two years later, Alco unveiled what became the S-series switcher, with a low-profile hood, GE electricals, and a 539 engine available in 660 h.p. normally aspirated and 1,000 h.p. turbocharged versions.

The quintessential yard engines, the S1, 2, 3, and 4,

with their nearly indestructible 539 and rugged GE electrical gear, ravaged the ranks of steam in yard, transfer, and local service. One of Alco's most successful diesel designs, the S's gave even Electro-Motive a run for its money.

Beyond yard limits, the tables were turned. Not even Alco could ignore the sleek, slant-nosed EMC E's that were stealing not only the spotlight, but serious business in the passenger trade. Forced to play catch-up, Alco followed EMC's lead, commissioning Otto Kuhler to design a striking streamlined carbody for its

Great grilled hope: Launched with great fanfare in 1946, the PA was ultimately a disappointment for Alco, though few ever questioned its aesthetics.



Notched hood corners and long noses characterized Alco's big road-switchers. Nickel Plate 328, at Toledo, Ohio, in 1966, is an 1,800 h.p. RSD12.

J. DAVID INGLES

Tougher than the rest

The only steam builder to survive the transition to diesel put up a good fight



DAN POPE COLLECTION



EMIL ALBRECHT

Union Pacific FA1 1607 leads an FB1 and an EMD F3B on a freight in Utah's Echo Canyon in June 1950. UP had 44 FA1's and 44 FB1's, all built 1947-48.

D&H, on-line to the Schenectady plant, dieselized entirely with Alco switchers and RS's. Here, RS2 4015 leaves Lake George, N.Y., for Fort Edward.



BARNEY L. STONE PHOTO, KRAMBLES-PETERSON ARCHIVE

2,000 h.p., twin-engined passenger diesel that debuted in January 1940 with Rock Island DL103b 624.

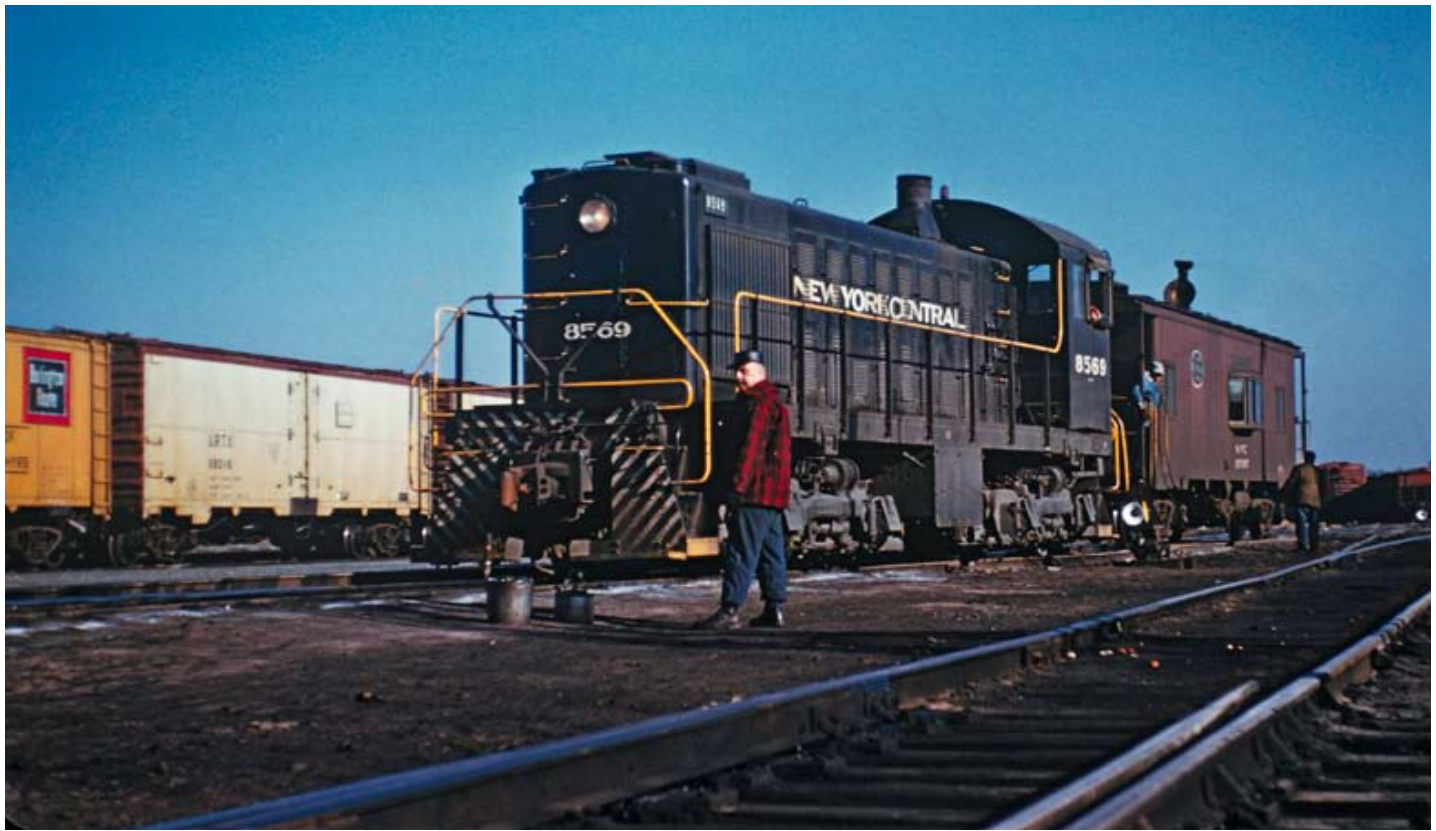
The DL was a work in progress that evolved externally and internally with nearly every order. Turbocharged 538-series diesels in RI 624 gave way to

539's in subsequent models from DL105 to 109 and 110. A mere 78 were built during 1940-45, with New Haven's 60 DL109's accounting for the lion's share. Wartime restrictions were partially to blame, but the DL's were no match for Electro-Motive's E units.

In 1940, Alco partnered with Schenectady neighbor General Electric, already its exclusive supplier of electrical gear, to jointly market diesels under the Alco-GE name. The partnership was a logical extension of a relationship that traced back to 1906 when the

two collaborated on construction of electric locomotives for New York Central's Manhattan electrification. The marriage would last until the companies parted ways in 1953, but Alco would continue to purchase GE electrical equipment for all its diesels.

Alco might have lagged behind in the passenger-diesel trade, but it beat everyone to the punch with one of the most innovative designs of diesel-dom: the road-switcher. The simple genius of the RS1 design involved placing the machinery of a 1,000 h.p. S2 switcher on an elongated frame, adding a short hood to accommodate an optional steam generator for passenger



ROBERT SPRAGUE PHOTO, J. DAVID INGLES COLLECTION

service, and placing the whole works on road trucks in lieu of the S2's rough-riding Blunt trucks.

The RS1 was an immediate success. Indeed, the first 13 built were drafted for the war effort, outfitted with six-axle trucks, given close-clearance cabs, and shipped for duty overseas. The military ordered 144 similarly outfitted units, and once those orders were filled, production of domestic RS1's resumed in 1943, not to cease until 1960, long after successor models had been introduced.

Meanwhile, Alco and the other builders had been blindsided by the phenomenal performance of Electro-Motive's FT. Alco had nothing to compete with the revolutionary road freighter, and wartime restrictions hobbled its efforts to respond. It would take Alco until well after VJ Day to fire a return salvo.

By 1946, Alco had a new engine, the four-stroke, V-type 244, and a catalog of passenger and freight road locomotives to go with it. Housed in a

distinctive flat-nosed, GE-designed carbody, the 1,500 h.p. B-B-trucked road-freight cab and booster units, which came to be known as FA's and FB's (all model designations for early Alcos were latter-day creations), and their A1A-A1A big brothers, the 2,000 h.p. PA1/PB1 passenger locomotives, were created in direct response to EMD's popular E and F units. Less glamorous, but like nothing in EMD's showroom, was the RS2 road-switcher (along with an A1A-A1A version, the RSC2).

In that passenger-conscious era, the PA was Alco's great grilled hope, packing a V16 244 that achieved with one engine the 2,000 h.p. rating that required two 567's in the competition's vaunted E unit. Alas, the 244 was afflicted with mechanical flaws, including a weak crankshaft, that made it a less than stellar performer. Alco ultimately remedied most of the 244's ills, but its reputation never fully recovered, and the problems put the first serious chink in Alco's armor. Nevertheless,

Alco managed to garner 42 percent of the diesel market in 1947, when orders were running at flood tide.

As convinced as some at Alco might have been of the diesel's superiority, the company did not give up easily on steam. As late as 1946, steam accounted for three-quarters of Alco's locomotive production. Its 100th year in the locomotive building business also was when it completed its last steam locomotive, a Pittsburgh & Lake Erie 2-8-4, on June 16, 1948.

A tough competitor, Alco fought tooth-and-nail against EMD's seemingly unstoppable market domination, adding the C-C RSD4 and RSD5 to its arsenal in 1951-52 and replacing the troubled 244 with the new 251 engine and an all-new model line in 1956.

Of the Big Three steam builders, only Alco managed to survive the transition to the diesel. By the end of 1956, Lima was long gone, Baldwin had built its last big diesel, and the American Locomotive Company had formally become

Alco's top seller was the S2 switcher; 1,502 units went to customers in the U.S., Canada, and Mexico. NYC 8569 is at West Springfield, Mass., in '62.

Alco Products. It was a humbled Alco, though, that duked it out with EMD as dieselization hit the home stretch in the late 1950's. Despite another model line, the Century series of 1963, Alco still ran a distant second. Some said Alco didn't follow up in the field with trouble-shooting like EMD did; some ascribed EMD's dominance to being part of General Motors. Both were factors, undoubtedly among others, but regardless, Alco could not beat Electro-Motive.

As steam diminished and the diesel market tightened, only the strongest would survive, and that was EMD. Alco, a tough competitor to the end, finally threw in the towel, exiting the new-locomotive market in 1969, although its Canadian affiliate, Montreal Locomotive Works, would carry on into the 1990's. ■



**BUILDER
PROFILES**

Baldwin



The bigger they are, the harder they fall



GEORGE KRAMBLES PHOTO, KRAMBLES-PETERSON ARCHIVE

The oldest steam
builder died when
diesels came

BY GREG McDONNELL

Samuel M. Vauclain, president of the Baldwin Locomotive Works, was not amused. Standing at the table of a young draftsman in 1923 or '24, Baldwin's boss examined drawings for the company's first "oil electric" locomotive. Baldwin, builder of more than 50,000 steam locomotives since Philadelphia, Germantown & Norristown's *Old Ironsides* rolled out of Mathias Baldwin's Philadelphia shop in 1832, was ready to embrace the diesel. However, the proposed 300 h.p. prototype inked on the diagrams unfurled before Vauclain were far from his ambitious visions of high-horsepower diesels.

Steam was the company's stock and trade, but Baldwin was no stranger to internal-combustion power, having built small gas-mechanical locomotives for industrial plants as early as 1910. Vauclain saw the potential of diesel technology and understood the stakes. He swept the drawings from the board, declaring, "Young man, Baldwin never builds horsepower in the hundreds; we build in the thousands."

Mighty Baldwin stumbled out of the gate, however. Its first efforts, 1,000 h.p., A1A-A1A box-cab 58501 of 1925, and B-B 61000 of 1929, were powerful

Kennecott Copper DRS-6-4-1500 No. 901, built as Baldwin demo 1501, is at Bingham, Utah, in September 1950. A few tracks over, steam is being scrapped.



J. DAVID INGLES COLLECTION

Baldwin did best with switchers like Southern 2294 (at Greensboro, N.C., in 1962), one of 451 sturdy S12's built at Eddystone between 1951 and '56.

"Babyface" was the term given to Baldwin's cab units of 1945-48. Jersey Central 78, a 1,500 h.p. freighter usually part of an A-B-A set, is at Bayonne in '52.

for their time, but they failed to live up to expectations. Neither the Knudsen Motor Corp. V-12 diesel employed by BLW 58501, nor the 61000's 4-cycle, German-built, 6-cylinder Krupp, was deemed satisfactory.

Road tests with 58501 on the Reading, and 61000's 1929-31 tour of Midwestern roads were successful enough, however, to convince Baldwin to invest precious Depression-era dollars in the 1931 purchase of I. P. Morris & De La Vergne, Inc. With experience in oil and diesel engines dating to 1893 and a line of stationary and marine diesels, De La Vergne was just what the doctor ordered. Baldwin, by this time located in Eddystone, Pa., commenced a development program that would ultimately spawn the VO diesel engine and production-model diesel locomotives.

Eddystone mated the new 660 h.p. De La Vergne VO diesel with the cast frame of its first end-cab switcher, test bed-



EDWARD THEISINGER

demonstrator 62000, in fall 1936. The paint on BLW 62000 was barely dry when Baldwin accepted its first order for conventional diesel switchers, three m.u.-equipped 900 h.p. units for New Orleans Public Belt. Carrying model designation 8 DE 900/1, NOPB 31-33 marked a decisive diesel victory, as the New Orleans terminal road had considered 0-8-0's and 0-10-0's before choosing Baldwin diesels to work its heavy transfers over the new 4.35-mile Huey P. Long Bridge spanning the Mississippi River.

Delivered in December 1937, NOPB 31-33 presented a case study in the advantages of dieselization. Running 'round the clock, they paired up to drag

tonnage over the bridge, worked solo on yard assignments, and patrolled tight-curved industrial spurs off-limits to eight-coupled steam power. During the units' first full year of service, the operating costs (including engine crew wages, fuel, lubricants, and maintenance) for the Baldwins averaged just \$3.17 per hour.

Baldwin kept a close eye on the New Orleans trio, as well as former demo 62000, which had been sold to the Santa Fe in spring 1937 and employed in Chicago as ATSF 2200. Based on the performance of its diesel pioneers, Eddystone refined designs and implemented several major changes, including replacing the troublesome cast-



frame VO engine block with a fabricated steel design less prone to leaks and stress cracks in the rigors of railroad service.

In 1939, Baldwin unveiled a standardized line of "Model VO" switchers powered by 660 and 1000 h.p. versions of the VO and outfitted with Westinghouse electricals. Westinghouse, which had partnered with Baldwin since 1899 in the construction of electric locomotives, would be Baldwin's exclusive supplier of electrical equipment until 1953.

The VO was a rugged machine that lived up to the Baldwin reputation and earned the respect of railroaders from the Pennsy iron just beyond the Eddystone gates to the logging roads of the Pacific Northwest. Cast frames, oval-shaped radiator grilles, pointed noses, and a confusing array of exhaust-stack configurations gave way to welded frames and simplified carbodies as Baldwin refined its switcher designs and models evolved from VO to DS to S-series designations. Under the hood, the VO was succeeded by normally aspirated and turbocharged versions of the 608 and 606 prime movers. Their horsepower measured in mere hun-



J. SCHMIDT PHOTO, KRAMBLES-PETERSON ARCHIVE

dreds, but to Vauclain's chagrin, the humble yard engine would prove to be Baldwin's best when it came to diesels.

Two decades after Vauclain ripped into the young draftsman, Baldwin had yet to produce a big road diesel. In the tradition of a builder whose contemporary steam achievements included Santa Fe 4-8-4's, B&O 2-8-8-4's, and SP cab-forward 4-8-8-2's, Eddystone's early efforts to create a diesel equivalent were similarly spectacular . . . and spectacularly unsuccessful.

A 6,000 h.p., 2-D+D-2 experimental cab unit, begun in 1940 and tested briefly in '43 with just half of its intended *eight* cross-mounted V8 engines installed, was a colossal failure. Its successor, the 3,000 h.p., twin 608SC-engined "Centipede" introduced in 1945, fared only slightly better, selling 54 units to three roads (Pennsy, Seaboard, National of Mexico).

Eddystone found better success with more conventional, but nonetheless distinctive, "baby-faced" and "shark-nosed" A1A-A1A passenger and B-B freight cab units, and hood units in 4- and 6-axle configurations. Conventional, of course,

Truly distinctive was the "Shark-nose" styling introduced in 1948 with PRR's 2,000 h.p. passenger units, two of which are at Englewood, Ill., early in their career.

Baldwin's biggest was the "Centipede," which PRR ran in pairs. Already off their intended passenger runs, two push a freight up Horseshoe Curve in 1951.

was a relative term when it came to Baldwin diesels, for among the models in the catalog were baby-faced, double-cab A1A-A1A passenger units built for Jersey Central, and mammoth double-engined, 2,000 to 2,400 h.p., six-motor center-cab transfer units first custom-built for Elgin, Joliet & Eastern.

In road-switchers, Baldwin beat even RS1 innovator Alco with the first six-axle version as Columbus & Greenville placed 1,500 h.p. A1A-trucked No. 601 in service on October 8, 1946, several weeks ahead of the first similar-sized Alcos. Being first wasn't enough, though. Eddystone's road-switchers, respected for their lugging capabilities yet unable to shed their Baldwin infirmities and idiosyncrasies, were soon left in the dust behind Alco and EMD products.



THOMAS J. McNAMARA

Baldwin, for all its success as a steam builder and effort and innovation with diesels, had it tough in the diesel business, consistently lagging far behind the competition. Its August 1950 merger with one-time competitor Lima-Hamilton was a move orchestrated more to acquire the latter's non-locomotive business, including industrial, construction, and mining equipment production.

As the dieselization boom faded in the 1950's, the new Baldwin-Lima-Hamilton, its fortunes built on a century-plus of steam power, saw its future slipping away. Unable to compete with EMD, Alco, and even

latecomer Fairbanks-Morse, BLH slipped to fourth place. Even Pennsy, one of Eddystone's most loyal customers, turned away in 1954.

Efforts to develop diesel hydraulics and locomotives for the short-lived lightweight passenger-train craze fizzled, and BLH delivered its last full-size (vs. industrial size) locomotive, Erie Mining S12 switcher 403, in fall 1956. Nearly four years before the last mainline U.S. steam fires were dropped, mighty Baldwin, once one of the world's most prestigious locomotive builders, called it quits, a collateral casualty of dieselization. ■



BUILDER PROFILES

Fairbanks



A unique power plant was at the heart of a family of innovative diesels

BY GREG McDONNELL

Fairbanks-Morse was no stranger to railroading, or to diesels, when Milwaukee Road 1,000 h.p. switcher 1802, the first FM-built locomotive, burst through a ceremonial paper banner at the Beloit, Wis., plant on August 8, 1944. FM had been supplying the railroad industry with everything from handcars and scales to water tanks and standpipes since the late 1830's, and had been working with gasoline and diesel engines for

stationary and marine applications since before World War I.

In the early 1930's, the same U.S. Navy submarine program that inspired development of the Winton 201A and the Cooper-Bessemer FW engine (an ancestor of the General Electric FDL), led FM to design its signature power plant, the two-cycle, opposed-piston diesel.

Meanwhile, Fairbanks-Morse tested the waters of the railroad diesel business, supplying a limited number of its pre-OP engines for use in railcars, as

well as the first FM-powered diesel locomotive. This was Reading 35, a 600 h.p. center-cab powered by a pair of 8-cylinder, in-line FM diesels, put together by St. Louis Car in 1939. FM had its eye on the locomotive market, and if the early efforts proved anything, it was that FM's fortunes would be best served by the opposed-piston diesel.

The OP hit the rails in 1939, powering six shovel-nosed railcars built by St. Louis Car for the Southern Railway. FM re-

portedly had a 2,000 h.p. cab unit and a 1,000 h.p. switcher on the drawing board by 1940, but the Navy conscripted the OP, requisitioning all Beloit diesel production for use in submarines. As the OP went to war, FM's locomotive plans were put on hold.

In 1943, FM got a green light to resume locomotive development, and Beloit tooled up to enter the market. In the months following the August 1944 unveiling of Milwaukee 1802, locomotive production at Beloit was

-Morse

A supplier's bid for the big time



WILLIS McCALIB PHOTO; KRAMBLES-PETERSON ARCHIVE

limited, in part by wartime restrictions. By May 1945, three more of the high-hood-style switchers, later tagged in FM parlance as H10-44's, had emerged from Beloit, one each for Chicago & North Western, Santa Fe, and Union Pacific. Milwaukee had 10 more on order, and FM's long-awaited road diesel was on the way.

Owing to space and capacity restrictions at Beloit, FM contracted with General Electric to assemble the 2,000 h.p. cab and booster units at GE's Erie, Pa., works. Dubbed "Erie-builds," the big dual-service units, with sleek Raymond Loewy-styled carbodies, 10-cylinder OP's, and A1A-A1A trucks, debuted

as an A-B-A set for Union Pacific in December 1945.

Although FM's original contract with GE called for 30 of the units to be built at Erie, a total of 111 (82 A's and 29 B's) were completed before the model was discontinued in February 1949. The Erie helped FM get its foot in the door of round-houses and diesel shops nationwide, recording sales to Santa Fe, C&NW, Kansas City Southern, Milwaukee, NYC, Pennsy, and UP. Santa Fe got just one A-B-A set, while Pennsy had the most, 48. North Western took four A units, and KCS got three A-B-A trios for freight service.

Probably the Eries' brightest spotlight was on the Milwaukee,

where 10 cabs and 5 boosters initially worked the highly publicized Chicago-Tacoma *Olympian Hiawatha* without change. They were decked out with fluted stainless steel trim to match the train's streamlined equipment. If you suspect a trend with the Milwaukee, you're right—it was in some ways FM's best customer, and since it served the Beloit plant, also had a pact with FM to use the old "Southwestern" line through town as a test track.

The Beloit plant, meanwhile, was bursting at the seams as the postwar diesel boom heated up. In 1947, FM bolstered its catalog with a 1,500 h.p. road-switcher and a "Heavy Duty"

Sold! Gleaming at Decatur, Ill., in 1954, FM demos TM-1 and TM-2 have just become Wabash 550 and 551, first of the road's eight dual-service Train Masters.

locomotive, a 2,000 h.p. end-cab design that acquired the designation H20-44. Although FM lagged behind EMD, Alco, and Baldwin in sales, the Wisconsin builder had all the business it could handle, and it all but totally dieselized three small Class 1's (Akron, Canton & Youngstown; Pittsburgh & West Virginia; and Virginian).

Completion of new locomotive facilities at the Beloit plant in 1948 gave FM more production capacity, and licensing the



BARNEY L. STONE PHOTO, KRAMBLES-PETERSON ARCHIVE

Milwaukee Road Erie-built 22A is at Milwaukee with nameless Green Bay-Chicago train 10. Loyal customer MILW used FM switchers into the early 1980's.

Its high hood covering the tall FM opposed-piston engine, sharp-looking Kentucky & Indiana Terminal H12-44 No. 61 stands at Louisville in 1964.

manufacture of the OP engine and FM locomotive designs to Canadian Locomotive Co. of Kingston, Ontario, gave FM an international presence.

Riding high in 1948, FM announced its "Consolidation" line of freight and passenger units, available in cab and booster versions rated at 1,600, 2,000 and 2,400 h.p., and cataloged in 14 models with B-B and B-A1A wheel arrangements ["A New Dress for Opposed Pistons," Spring 2005 CLASSIC TRAINS].

New York Central ordered, sight unseen, eight 2,000 h.p. CFA20-4's, and FM dispatched two 2,400 h.p., B-A1A CPA24-5 demonstrators on a nationwide tour in spring 1950. Despite FM's enthusiasm, C-Line sales were disappointing, amounting to just 165 units in the U.S. and Canada. Part of the blame was timing—the cab unit was rapidly losing ground to the road-switcher. But also, FM's reputation had been damaged by early problems with its opposed-piston diesel ["Why the C-Line Fell on its Face," Spring 2005 CLASSIC TRAINS].

Undaunted, FM forged onward, upping the output of its switcher line to 1,200 h.p., boosting its road-switcher rating to 1,600 h.p., and adding a six-motor version to the lineup in 1951. But the builder's best was yet to come.

In 1953, FM unveiled the Train Master, a 2,400 h.p., C-C

unit, model H24-66, capable of hauling passengers or freight and pitched as "the most useful locomotive ever built." The most powerful single-engined diesel of its day, the Train Master acquitted itself well.

Lackawanna ordered 10 Train Masters before the first of four demonstrators was even built, and returned later for two more. Reading Co. signed up for nine on the merits of two demonstrators on display at the Railway Supply Manufacturers Association exhibit in Atlantic City, N.J., in June 1953. Barnstorming nationwide, four red-and-yellow TM demos came back to Beloit with enough orders to help FM overtake Baldwin as the No. 3 builder, albeit with just under 7 percent of the market share, for 1953.

"The Mr. Big of road-switchers," the Train Master could wheel passengers at 80 mph, work time freights, lug coal drags, shove hump cuts, shoulder helper duty, and endure the start-and-stop rigors of suburban commuter service.

The Train Master bumped Mallets from coal drags and mine runs on the Virginian, and after an ill-fated period in the New Mexico desert on SP, proved themselves perfect for commute service, banishing 4-8-2's and 4-8-4's from the start-and-stop San Francisco Peninsula duty. Jersey Central employed them in the same



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service, and they worked as helpers and on humps and drags on the Pennsy; pulled passengers, spliced F7's on freights, and labored on locals for the Wabash; lugged tonnage on Southern's Rat Hole; and handled hotshots and passenger trains with aplomb for the Reading and the Lackawanna, doubling as helpers for the latter on Scranton layovers.

What the Train Master couldn't do, though, was pull FM from the doldrums. "Mr. Big" was ahead of its time in horsepower, but too late in dieselization's first round to score big sales. In four years, the model sold only 127 units to eight U.S. and the two big Canadian roads. FM was struggling when Virginian received the last 7 in 1957. Earlier problems with the OP and electrical systems most-

ly had been resolved, and FM's switcher line did well (535 units to more than 30 buyers into 1958), but the diesel market was drying up, and FM's domestic sales for the year totaled only 46 units.

Four oddballs—lightweight, 1,200 h.p. P12-42 models, one unit for each end of two experimental ACF Talgo trains for Boston & Maine and New Haven—were among just 15 locomotives FM built in 1958. That October, just over 14 years after Milwaukee 1802 burst triumphantly through the banner, Beloit quietly finished its last domestic diesel, Tennessee Valley Authority H16-66 No. 24. Orders trickled in from Mexico's Chihuahua Pacific until March 1963, when FM finished its very last locomotives, CHP H16-44's 603 and 604. ■



BUILDER PROFILES

Lima



J. DAVID INGLES

The last true steam believer lasted less than three years as a diesel builder

BY GREG McDONNELL

Lima, the youngest and smallest of the Big Three steam builders, was synonymous with steam at its best, and it upheld the steam standard to the bitter end. Even as legions of steam-killing diesels were rolling off the erecting floors of five competitors, Lima Locomotive Works was espousing the advantages of modern steam power from its hometown of Lima, Ohio.

Even amid the postwar dieselization boom, while EMD engineers scrutinized designs

to hone the best-selling F3 into the better-selling F7, Lima men pored over the blueprints of a proposed double-Belpaire boiler, poppet-valve 4-8-6 they hoped would be the salvation of big steam. Designed to match diesel operating costs and availability, the 4-8-6 remained on Lima's books as late as 1949, but never achieved reality.

Lima's devotion to steam cost it dearly. While competitors' books bulged with diesel orders, Lima went hungry as steam orders dwindled. Being careful not to concede defeat or publicly compromise its steam loyalty,

Lima merged with the General Machinery Corp., of Hamilton, Ohio, to form the Lima-Hamilton Corp. on October 1, 1947. Having spurned a postwar proposal to produce diesel locomotives for Fairbanks-Morse, Lima was neither shopping for a diesel-building partner nor looking to head to the altar. Rather, the L-H marriage was instigated by General Machinery, which was in search of a postwar market for its Hamilton diesels as well as a gas turbine already under development.

Although Lima had built a few diminutive gas-mechanical

locomotives in the 1920's and '30's, the company had virtually no experience with diesels. Meanwhile, General Machinery's 4-cycle Hamilton diesel, based on German MAN designs, had been introduced in 1936 and seen use in marine, industrial, and stationary applications. Hamilton diesels also had been employed in experimental locomotives built by Davenport and Plymouth, and to repower distillate and gas-electric motor cars.

As steam production at Lima plummeted, engineers at the Hamilton, Ohio, plant, 105 miles

Last in, first to leave



JOHN S. INGLES; J. DAVID INGLES COLLECTION

Switchers accounted for 78 percent of Lima's diesel production. CUT 23 (750 h.p., on lease to B&O) and B&O 9385 (1,000) are at Cincinnati in late 1965.

south on the B&O, worked to design an engine based on the proven Hamilton 68SA. In 1948, diamond-shaped Lima builder's plates, appended with the words LIMA-HAMILTON CORPORATION, were affixed to just 36 steam locomotives, including 20 for coal-hauler Chesapeake & Ohio. In 1949, Lima had just two orders on the books, both for 2-8-4 Berkshires (10 for Louisville & Nashville, 22 for Nickel Plate Road).

The Berks weren't the only locomotives taking shape at Lima, however. In spring 1949, a single diesel switcher with an 8-cylinder Hamilton T89SA engine and Westinghouse electrical gear was nearing completion in the Tank Shop. Finished on May 12, 1949, Lima's first diesel, 1,000 h.p. demonstrator No. 1000, wore solid black paint with simple LIMA-HAMILTON lettering on its hood.

Ironically, just one day later, Nickel Plate 779 was fired up for final inspection. Overshadowed by the formal unveiling of Lima's first diesel, the 2-8-4

left the plant with little notice, just one more of the 7,548 steam locomotives built by the works. History would prove her to be the last, however.

"We firmly believe that for a long, long time, there will continue to be a demand for steam locomotives," read a Lima advertisement carried that same month in *TRAINS* magazine. But it was not to be. Lima 1000, the first of five 1,000 h.p. switcher demos, ventured into a diesel-hungry world. The newest model on the market was attracting interest, and orders. Armco Steel 708, the first diesel Lima sold, was delivered June 27, 1949. Two days later, Lima shipped its first common-carrier diesel as NKP 305 followed demo 1000 out the gates.

By April 1950, Lima had built 38 1,000 h.p. switchers including 4 for NKP, 6 for New York Central, and 10 each for Erie and B&O. Toledo, Peoria & Western bought a single new switcher, plus demos 1000 and 1004, while Armco took demo 1001 and a second new unit.

In fall 1949, Lima added a 750 h.p. switcher to its lineup. Housed in the same carbody as its 1,000 h.p. big brother, it was powered by a 6-cylinder T69SA engine and, like all Lima diesels, outfitted with Westinghouse

electrical equipment. Only six were built, all for Cincinnati Union Terminal, between November 1949 and June '51.

Less than a year after building its first diesel, Lima expanded its catalog with a new line of 10 models in April 1950. Unlike other builders, Lima never assigned formal model designations to its diesels, referring to them simply by horsepower rating and configuration. Based on the 6- and 8-cylinder Hamilton engines, the new line ranged from 800 and 1,200 h.p. switchers to a 1,200 h.p. road-switcher and double-engine, center-cab transfer locomotives available in 1,600 and 2,400 h.p., C-C or A1A-A1A, versions. All had standardized components.

Although only 4 of the 10 models were ever built, Lima gained momentum through 1950 and early '51. Switcher sales were reasonably brisk, with repeat orders from B&O, Erie, Nickel Plate, NYC (under the auspices of subsidiary Chicago River & Indiana) and Armco Steel. Lima broke new ground with orders from Rock Island, the Terminal Railroad Association of St. Louis, New Haven, and Wabash, which augmented the purchase of 10 new 1,200 h.p. switchers by ac-

PRR transfer unit 5673, seen at Columbus, Ohio, in 1959, was from the last batch of locomotives built at Lima. Inside each hood was a 1,250 h.p. engine.

quiring demos 1002 and 1003.

Road-switcher sales were limited to 16 steam-generator-equipped 1,200 h.p. versions for NYC, and Pennsy purchased the only 22 Lima center-cab transfer locomotives. Rated at 2,500 h.p. and riding C-C trucks, some of these units had m.u., cab signals, trainphone, and dynamic brakes.

While gruff-sounding Hamilton diesels talked it up on the Lima test track, company officials were engaged in quiet conversation with their counterparts at Baldwin. Shock waves rolled through the Lima works as news of a merger of Lima-Hamilton and Baldwin Locomotive Works was formally announced. On November 30, 1950, they became the Baldwin-Lima-Hamilton Corp.

Baldwin wanted Lima not for its locomotive business, but for its non-rail product lines. With competition in the locomotive market heating up and demand cooling, Baldwin was looking to diversify, and Lima's crane and shovel division and other industrial concerns were just the ticket. On the eve of construction of the Interstate highway system, BLH planned to drop Lima's locomotive line and expand its shovel and crane production.

On September 11, 1951, Lima employees lined up for a formal portrait with PRR transfer diesel 5683, the final locomotive built at the Lima works. Not three years after the completion of its first diesel locomotive, Lima's 174th would be its last. The last of the Big Three steam builders to enter the diesel market was the first to leave. ■



**BUILDER
PROFILES**

General



Electric



M. L. POWELL PHOTO, J. DAVID INGLES COLLECTION

Backstage leader

Despite important early work, GE kept a low profile during the transition era

BY GREG McDONNELL

The engine bears the name of its inventor, Rudolph Diesel, but the rise in popularity of its application to locomotives lies foremost with one of America's oldest surviving industrial concerns: General Electric.

GE, in 1905, was the supplier of electrical apparatus for what many believe to be the very first diesel locomotive anywhere. GE's Hermann Lemp [pages 46-48] designed the control systems that made the diesel-electric locomotive practical. GE built its own diesel-electrics as early as 1918, and in 1923, partnered with Ingersoll-Rand and Alco to build the first commercially successful diesel locomotives in the U.S. GE not only provided electrical equipment for Electro-Motive's early diesels, but assembled several of EMC's first diesels at its Erie, Pa., works prior to the opening of the plant at La Grange. GE was the exclusive supplier of electrical equipment for Alco diesels, and a formal Alco partner in the diesel business from 1940 to 1953. Scratch the surface of almost every major diesel builder in the U.S., and you find GE.

GE, a pioneer in the develop-

ment of electric street railways and electric traction, built its first locomotive, a 30-ton electric, in 1893. By 1904, GE was investigating the potential of internal-combustion engines in railroad applications, and in 1905 provided electrical equipment for an experimental diesel designed by the International Power Co. for Southern Pacific. Powered by a pair of four-cylinder diesels from the Corliss Steam Engine Co., of Providence, R.I., in a carbody built by Alco, the locomotive tested in April 1905. Although the machine was apparently unsuccessful, it is nevertheless considered by many historians to be the first diesel locomotive.

Precursors of the diesel revolution, gas-electrics sparked GE's interest in internal-combustion power. GE completed its first gas-electric in 1906: Delaware & Hudson 1000, a combination baggage-coach powered by a 140 h.p., 6-cylinder Wolsley engine imported from Britain. The car operated on D&H for several months and served as a prototype for a line of GE gas-electric railcars.

In 1910, the same year GE began work on its 700-acre plant on the outskirts of Erie, Pa., the company embarked on a serious quest for a diesel engine. The result, based on the German Junkers design, was the GM-50 employed in GE test-bed "Motor Car No. 4," in 1917, and in three 55-ton steeple-cab

Best-known of GE's pre-U25B designs is the 44-tonner; 373 were built 1940-56 for 16 Class 1's and many short lines. NKP 90 is at Bloomington, Ill., in '59.



EDWARD THEISINGER



Built by Brill in 1927, Lehigh Valley 101 (at Jersey City, 1950), is one of thousands of diesels for which GE supplied electrical equipment but did not build.

diesel-electrics in fall 1918. These units, for the Jay Street Connecting Railroad in Brooklyn, the City of Baltimore, and the U.S. Army, were not commercially successful, but they put GE one step closer to realizing its diesel dreams.

The dream became reality in 1923 with the marriage of GE electrical equipment, Lemp controls, a 300 h.p. Ingersoll-Rand diesel, and a round-ended box-cab demonstrator tagged 8835 for its GE serial number. In 1924, the 8835 embarked on a 13-month, 10-railroad, three-industry demonstration tour.

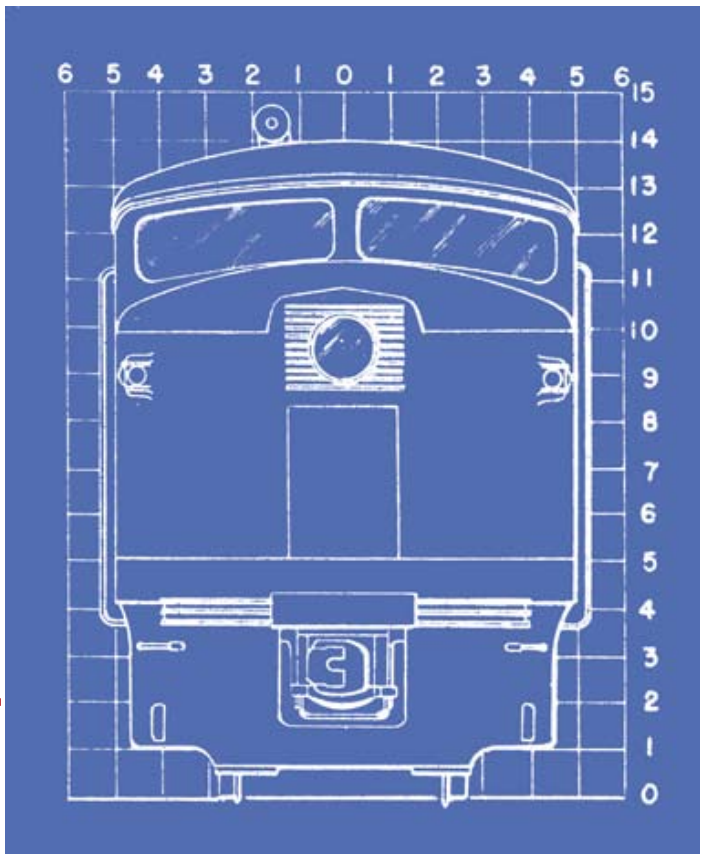
On the Jersey Central-Reading leg, it hauled a special two-car passenger train from Jersey City, N.J., to Harrisburg, Pa., becoming the first diesel-electric to be employed in road service in the U.S. More important, in day-to-day service for

more than a year, 8835 proved the diesel to be both economical and reliable. From that moment, steam was doomed.

On the heels of 8835's success, Alco joined the party in 1924 and the three companies formed a consortium to design, build, and market North America's first standardized line of diesel locomotives. Using Alco carbodies, IR engines, and GE electrical apparatus, the locomotives were assembled and tested at Erie. Initially, five 300 h.p. box-cabs were built as stock. In 1925, CNJ became the first customer, putting 60-ton box-cab No. 1000 to work in the Bronx in October and staking claim to operating the first commercially successful diesel-electric locomotive.

In 1928, GE began building the carbodies for the box-cab

The robust yet elegant styling of the flat-fronted FA and PA diesels was not the work of someone at Alco, but of Raymond Patten, a designer for GE.





J. DAVID INGLES

switchers, and in 1929, Alco struck off on its own (although continuing to purchase electrical gear from GE). In addition to conventional 60- and 100-ton box-cabs, GE built 44 more units equipped to operate as diesel-electrics, under battery power, and/or as straight electrics drawing power from an energized third rail or overhead catenary. Most of these units were delivered to NYC and subsidiary Michigan Central for New York City and Detroit operations; Lackawanna took two three-power units, and Rock Island acquired a two-power battery-equipped unit for switching in Chicago.

During the 1930's, GE employed Ingersoll-Rand diesels in a series of pioneering locomotives that presaged the hood-unit concept and came close to the road-switcher, still a decade in the future. Mechanically similar to CNJ 1000, but housed in an off-center-cab, hood-type carbody, the seven 300 h.p. B-B switchers went to the Bush Terminal in Brooklyn in 1931.

Even closer to the road-switcher in appearance were 10 600 h.p. B-B switchers built for New Haven in 1936. The first five units were powered by IR diesels, but the second five forecast more than the shape of things to come, with Cooper-Bessemer engines. The Cooper power plant would soon be GE's standard and would evolve to become the GE FDL engine.

While building its own locomotives, GE continued to supply electrical equipment to other builders, not just Alco but also Electro-Motive. GE's relationship with EMC dated to the days of gas-electric railcars, and when EMC needed a shop to assemble its first locomotives, GE obliged. In 1935, Erie assembled EMC's first two diesels, Lackawanna SC switchers 425 and 426, along with box-cab passenger prototypes EMC 511 and 512 and B&O 50. After La Grange opened, GE continued to supply EMC with electrical equipment until 1938, when EMC began producing its own gear, based on the GE designs.

As the drive toward dieselization intensified, GE seemed to segregate its activities. Erie continued to build mainline electrics but left the business of mainline diesels to other builders while developing its own line of light-duty diesels. In 1940, GE formalized its longstanding relationship with Alco to market diesels under the Alco-GE brand. GE contributed electrical gear and expertise, including styling the carbodies of the FA and PA cab-unit series, but the locomotives were built by Alco at Schenectady.

Meanwhile, GE introduced two of its signature diesels, the Caterpillar-powered center-cab 44-tonner in 1940 (specifically designed to be under the 90,000-lb. weight that required a fireman) and the Cooper-Bessemer-engined, end-cab 70-tonner in 1946. While EMD, Alco, Baldwin, FM, and Lima duked it out on the high iron, GE quietly dieselized short lines, branch lines, and industrial operations. Tired 4-4-0's and slide-valve Ten-Wheelers

In 1966, GE 70-tonners work at Raeford, N.C., on the 30-mile Laurinburg & Southern, a typical setting for a model aimed at short lines and Class 1 branches.

succumbed to shiny 44- and 70-tonners that often made the difference between survival and abandonment for their operators.

In 1953, GE withdrew from its partnership with Alco, but continued its role as supplier of electrical components, not only to Schenectady, but also to Baldwin and FM. While the Big Four builders finished off steam—and engaged one another in the fight for survival—GE withdrew quietly to the wings and focused its energies on developing a locomotive to do battle on the next frontier: Re-dieselization. That effort would see daylight in the late 1950's, a market entry that would ultimately, in 1983, see GE supplant GM's Electro-Motive Division as America's top diesel-electric locomotive builder, a status it still enjoys today. ■