

The 100 class FT's

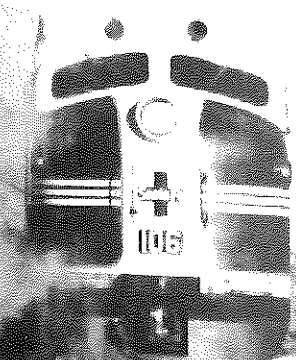
By Wally Abbey

Seeing a new Santa Fe FT out of the shop of Stewart Models, Inc., is the next best thing to seeing a Santa Fe FT in real life, which you can't do any more, of course.

Stewart's model represents a member of the Santa Fe's original 100 class of diesel-electrics. This class (of 1940-45) was composed of 80 of the locomotives that Electro-Motive billed as the first designed specifically for freight service — Electro-Motive Corporation's (and then, after January 1, 1941, Electro-Motive Division's) "Model F" or "FT," depending on whether the Engineering Department or the Sales Department was talking about them. The last Santa Fe FT unit, the 429B, was retired and returned to La Grange in 1966. It was 23 years old at its retirement. Given its age, not a whole lot of it was useful to the SD-40 for which it became an accounting credit.

All but forgotten by those who attended to this last unit in its last days — if they had ever known — was why the 100's had been so significant to the Santa Fe and to the fine art of moving freight trains under extreme conditions.

Stewart's FT follows faithfully the design of EMD's basic "Model F." Unfortunately, the Santa Fe's FT's themselves didn't do that. It's too bad that in its otherwise excellent models Stewart missed the big difference that set the Santa Fe's FT's apart from all but a few of the FT's EMD built for 22 other roads. With model kits right out of the boxes, it isn't easy to reproduce accurately about half of the Santa Fe's 80 FT's as they were configured when they left the EMD plant. And it's no less difficult to incorporate some of the modifications in loco-





Half of EMC 103, the experimental-demonstrator, at the plant before its famous tour of the country. The number in the box is the unit's serial number.

-EMD photo, courtesy Wally Abbey

motive-consists that came along later.

If the applicable records and recollections were still available, we'd doubtless learn that the Santa Fe was a strong influence on EMC's product line as it turned its attention to developing a locomotive for freight service. Santa Fe had been buying gas-electric cars and diesel-electric locomotives from Electro-Motive and its predecessors for 10 of EMC's formative years. It had been using EMC diesel-electrics in passenger and switching services since 1935. Several of the Santa Fe's early diesels were pioneering EMC models.

The Santa Fe was the second road — after the Burlington — to test the highly experimental, olive-and-gold 103. For most of the month of January and into February, 1940, the Santa Fe tested the 103 in regularly scheduled main-line freight service transcontinentally, but most frequently across New Mexico, Arizona, and California. For a round trip between Corwith and Clovis, the Santa Fe uncoupled the two halves of the 103 and pulled trains on tests with half the locomotive, just 2,700 horsepower. The other half went back to La Grange, doubtless to be modified. It was, after all, part of a prototype that was constantly being improved as it met the demands of real work.

The same thing would happen with the Santa Fe's own production models. Class distinctions and groupings by order number aside, probably no two of the Santa Fe's own FT's were precisely the same internally.

At some point, the entire 103, towing dynamometer car 29, appears to have made at least part of a transcontinental round trip with a passenger train, most likely the *California Limited*. Photos exist, but precise dates are something else again. No passenger runs show

up among the Test Department evaluations of January, 1940. Whatever the purpose of that exclusive passenger run, the Santa Fe caused one of its FT's to emerge from EMD dressed like a freight locomotive, but geared and gussied up like a passenger-puller.

The Santa Fe was the first buyer and first commercial user of production-model FT's. It bought a third of EMD's total production of the model. As quickly as it reasonably could, the Santa Fe ordered and received a total of 320 FT units — units enough to comprise 80 four-unit locomotives. But, it certainly wasn't as 80 A-B-B-A locomotives that these units arrived on the Santa Fe.

And it wasn't altogether as EMD had designed its built-for-mass-production "Model F" that the Santa Fe's locomotives were constructed, either. For its good customer, EMD rather materially reengineered its yet-to-be-built freight locomotive.

To explain how the Santa Fe's 100's differed from EMD's original intentions, we must first dissect the experimental 103. Internally, EMD authorized the development of a "Model F" freight locomotive — a 2,700-horsepower freight locomotive — on February 10, 1939. The locomotive would contain two 16-cylinder versions of the new 567 diesel engine, two main generators, and all the necessary accessories and implementia. The power out of the engine-generator sets would be routed to eight traction motors mounted in four two-axle trucks of the new design that later would be named after its developer, Martin Blomberg.

All of this machinery was too heavy for a truss-type carbody long enough to hold it. The Model F, therefore would have two separate carbodies fastened together with what EMD termed

a "permanent" drawbar. This link was so constructed and so installed that it could hardly be removed except in a backshop. Standard couplers would be mounted in steam-locomotive-tender draft gears under the nose and at the rear of each 2,700-horsepower locomotive, and thus in the center of a 5,400-horsepower consist. One set of batteries, mounted in the carbody section that sported the operating cab, would serve the electrical needs of both sections. The facing ends of the two sections would be open to each other. There would be no end doors; a canvas closure bolted to both sections would keep the weather out.

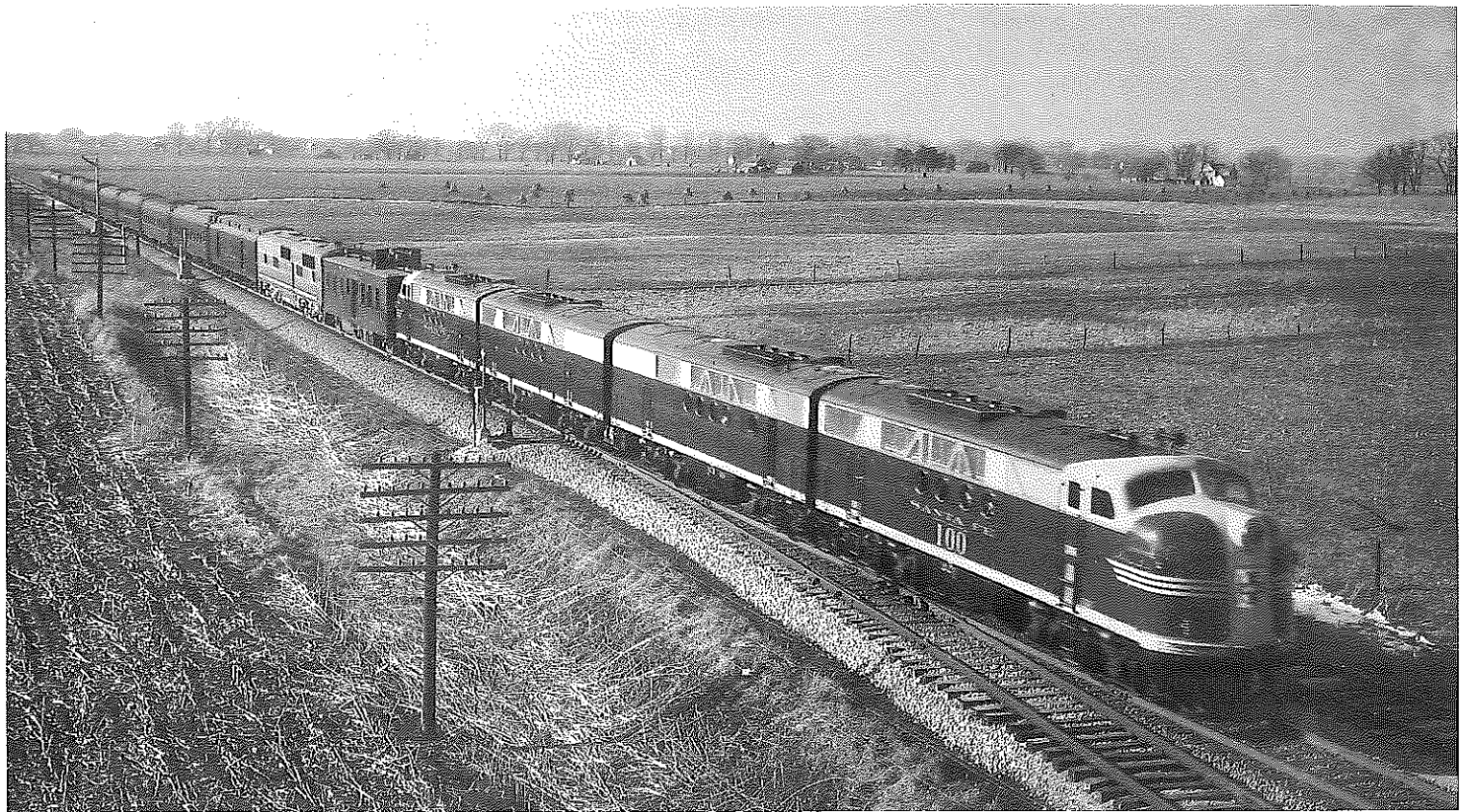
The Model F, therefore, was not a pair of forshortened passenger E units with a "bull-dog" snout. It was, in a way, a lengthened, more powerful, higher-horsepower E unit with its carbody hinged in the middle. Forward of the link, the carbody would be known as the A section; the part behind the link would be called the B section. Together, the two sections comprised a locomotive "unit."

To these specifications, the experimental 103 was constructed. To these specifications, the majority of FT locomotives were built. But it was not to these specifications, however, that the Santa Fe's FT's were finished and delivered.

The findings of the Santa Fe's Engineer Tests showed that the 103, either in half or in whole, was quite a locomotive:

"The performance of locomotive 103 during tests was highly creditable. The two-unit [5,400-horsepower] locomotive showed a hauling capacity superior to that of the heaviest steam freight locomotives. Excepting for unusual delays, heavier trains were handled in running time equal to, or superior to, that of expedite [sic] trains. The use of the single-unit [2,700-horsepower] locomotive on the lighter trains demonstrated the flexibility of having multiple-unit power, with the consequent possibility of reducing or increasing the size of [the] power unit to fit the train to be handled. Diesel locomotive 103 handled all test trains without helpers and is capable of handling without helpers the maximum tonnage allowed over all districts, excepting San Bernardino to Summit, Mojave to Eric, Bakersfield to Summit Switch, Ash Fork to Supai, and Belen to Mountainair, over the freight line by way of the Southern District."

Be that as it might, the Santa Fe's Test Department still found reason to close its report on the 103 with 26 itemized "suggested improvements in construction and operation." Its comments ranged from "exhaust gases discharged at roof under certain conditions are drawn back into engine room through ventila-



After hosting a "Freight Diesel Luncheon," Santa Fe operated a special for shippers from Topeka to Kansas City, seen here at Tecumseh behind its first four FT's in early February, 1941. The passenger B unit was added for steam heat. -H. E. Naill, courtesy Stan Kistler

tors" to this:

"It would be desirable to use AAR couplers with heavy safety chains between sections instead of drawbars, and make each power plant self-sustaining by providing batteries for each section... Control circuits and air-brake piping should be arranged to conform to present passenger diesel locomotive units. If so arranged, the only change required to permit use in passenger service would be in the gear ratio."

In other words, recommended the Santa Fe, make the Model F an aggregation of two free-standing "lead" units with cabs and two free-standing "booster" units without cabs. (And was there a hint even this early that the 100's might have a future leading passenger trains?)

On June 25, 1940, the Santa Fe's Board of Directors authorized the purchase of two 5,400-horsepower locomotives at a cost of about a million dollars. EMD got an order September 10 for four 2,700-horsepower locomotives to be numbered 100-100A, 101-101A, 102-102A, and 103-103A. With this proviso: Following the recommendation of its Test Department, the Santa Fe wanted its new locomotives in the form of free-standing, individually operable units, not in semipermanently coupled pairs.

EMD sent its engineers back to the drawing boards to redesign the rear end of the A section and the front end of the B section so that there would indeed be a rear end into which a door and a diaphragm could be installed; to provide batteries in the B sections; and — perhaps the greatest challenge — to develop a coupler on a gooseneck shank that would fasten directly to the frame where the link would have been attached and that would wrap around the top of a traction motor. The rear truck of the A section and the front truck of the B section rode inches from the ends of the car bodies and frames. No room had been provided in the original plan of the Model F for a standard coupler, nor for a draft gear to contain and cushion the end of the coupler's shank.

Make note of this little bit of engineering legerdemain. Not only did it make possible the Santa Fe's practice of buying many of its 100's in the configuration of one cab unit and three boosters, it made the practice necessary.

EMD sold the first two units of the first locomotive, then numbered 100 and 100A, to the Santa Fe on December 30, 1940. The units were sent immediately to Topeka to be weighed and wondered at. The other two units, then numbered 101 and 101A, arrived at Shopton

on January 3, 1941. They were moved quickly to Argentine. The 100 and 100A were brought back to Argentine from Topeka, and at 11:08 a.m. on Saturday, January 4, the four-unit locomotive left Argentine with dynamometer car 29, a tank car filled with diesel fuel, two business cars, and the 2,000 tons of First 43. Destination: San Bernardino, with an unheralded test run of what appeared to be a movement of through freight on an expedited schedule.

The 100 and 101 were back at Argentine by January 14. On February 4, 1941, the Santa Fe announced and promoted its new locomotive with what it called its first use in regular service, a promotional trip that was about as much a publicity stunt as it was a revenue run.

By that time, the numbers game had begun...

Since about 1903, there had been an agreement between the Santa Fe and the Order of Railway Conductors and the Brotherhood of Railroad Trainman called the "doubleheader rule." This effectively prohibited the Santa Fe (and any railroad in the west that employed members of the ORC or the BRT) from doubleheading a freight train if the tonnage of the train exceeded the rating of the largest of its locomotives. On the Santa Fe's Coast Lines,

doubleheaders were permitted on steep grades between Winslow and Needles, but they were limited to 2,900 tons in either direction. The doubleheader rule arose originally out of union efforts to limit the length of freight trains to as few as 30 cars.

EMD, the Santa Fe, and the other western roads interested in FT's had all been aware of the doubleheader rule as the Model F was being developed and tested, of course. All recognized that, by its design and its purpose in life, a 5,400-horsepower Model F could be construed to be two identical 2,700-horsepower locomotives coupled — a sitting duck that, should conductors and trainmen so desire, might readily be shot down with a volley of time claims based on violations of the doubleheader rule.

(A note for all who have long understood that the underlying labor problem was with the engineers and firemen: Sorry. Those demands were for additional men in each unit of a multiple-unit locomotive, regardless of the presence or absence of an operating cab. They'd arisen long before the FT came into existence. They were resolved in the First Diesel Case in 1944.)

But EMD was ready for the trainmen. From early in the production and sale of its FT, EMD had offered a rigid drawbar that could be installed between the two B sections in place of the standard couplers. This drawbar, far different and far simpler than the link that attached the B section to the A section, able to be fitted directly into the standard draft gear, would convert two 2,700-horsepower Model F's into one inseparable locomotive. The problem of the doubleheader rule could thus be mitigated.

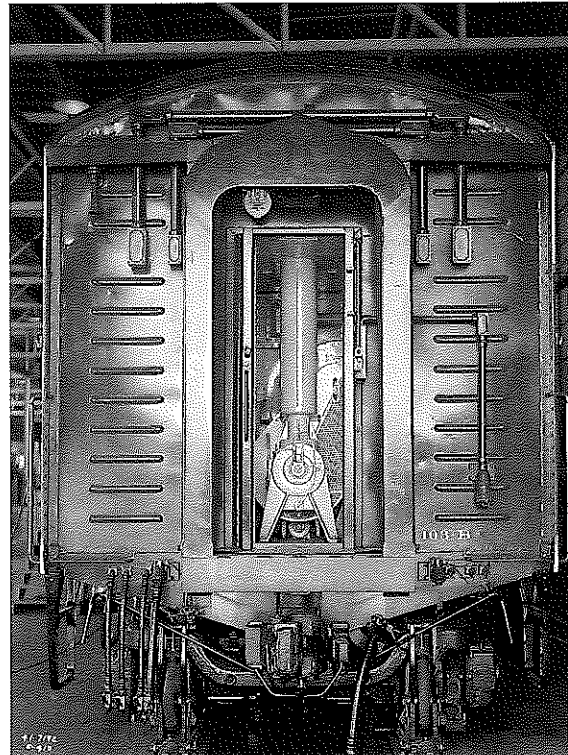
Most western railroads opted for the drawbar. Most FT's acquired by most western lines came out of EMD as four permanently coupled sections — except, of course, the FT's of the Santa Fe. The Santa Fe had EMD reengineer out of existence the drawbars that held the A and B sections together. The Santa Fe couldn't use EMD's quick fix.

There was only one way that the Santa Fe could avoid the potentially immense train-crew costs of the doubleheader rule if it wanted to get its investment out of its new diesels: The second cab unit had to go. And so as quickly as it could, the Santa Fe made it go away.

On February 19, 1941, the Santa Fe ordered eight units, boosters all. When they

arrived in August and September, 1941, they carried the road numbers 100C, 101C, 102A, 102B, 102C, 103A, 103B, and 103C.

At Shopton on March 15, 1941, lead unit 101 and booster 101A from the first set were renumbered 100C and 100B, respectively. Look at early photos of the 100, such as those made at the time of its February publicity run to the Coast. No number at all shows on the rear cab unit. A late revision to the order for the first two locomotives had added internal "dark slides" that could be dropped over the large illuminated numbers on the flanks of the A units. The number boxes behind the classifi-



Front end of booster unit 103B at EMD plant in LaGrange. — EMD photo, courtesy Wally Abbey

cation lights on the nose had been numberless from the day of delivery.

Not until very late in the life of the FT's were "lead" units designated with the letter "L," either in paper records, or on their noses. This practice may have begun when F3's and F7's began to show up in quantity. Later units tended to be built into consists irrespective of road number far more often than were the FT's in their early days.

The second locomotive out of the first order, which was to have been numbered 102, 102A, 103A, and 103, left EMD March 19, 1941, but with different numbers: 101, 101A, 101B, and 101C. This locomotive of course had a cab, or lead, unit at each end. Instructions

were issued that it was to be considered, and to be operated as, a single-ended locomotive.

Two more orders went from the Santa Fe to EMD on March 25, 1941. One was for one lead unit, the other for three boosters. The four units emerged from the La Grange plant in November, 1941, as the 104, the first of what would become a fleet of 52 single-ended locomotives.

As EMD was readying for delivery the eight boosters the Santa Fe had ordered in February, 1941, the rear cab units from the first two locomotives arrived back in La Grange to be regeared, renumbered, and mated each with three of the new boosters. In August and September, eight units — six new boosters and two modified lead units — left the plant as single-ended locomotives 102 and 103. About the same time, too, the new boosters 100C and 101C were coupled onto the consists of the original two locomotives.

Thus, after September 1941, the Santa Fe's FT fleet consisted of five 5,400-horsepower locomotives, each with but one cab.

In May and December of 1941 and in April of 1942, the Santa Fe went again to EMD. In total, its orders specified 38 lead units and 114 boosters. When all of these locomotives would finally be delivered in April 1944 — note the long lead time — the 100 class would contain 43 members. Another order for 60 units followed in June, 1942.

Then on September 11, 1942, when the Santa Fe had five four-unit, one-cab 100's in service and enough units on order but undelivered to make 53 more single-ended loco-

motives, the Interstate Commerce Commission issued Service Order No. 85. A powerful order affecting all railroads which went into effect four days later, Order No. 85 set aside for the duration a variety of inhibitions — state laws, union agreements, etc. — to the way railroads were attempting to handle the wartime freight load. The order said nothing specifically about how diesel-electric locomotives should be configured, nor did it mention the doubleheader rule nor, for that matter, any specific labor provision. It and its companion orders were directed at all laws and regulations that arbitrarily limited the full utilization of locomotives and rolling stock.

The doubleheader rule thus was set aside



Right side and left side of the 100-100A at EMC before delivery. This, not the 5,400-horsepower consist, is what EMC termed a "Model F."
 -EMD photos, courtesy Wally Abbey

for the duration. The need for single-ended FT's went with it. The Santa Fe promptly negotiated new agreements with its conductors and trainmen agreeing to pay them "arbitrarics" in return for the removal of train-limit work rules that stood in the way of getting the most out of the new FT's.

At this time, the Santa Fe's June 1942 orders for the 15 cab units and 45 boosters of what were to become the 143-157 were awaiting fulfillment at EMD. Before the locomotives were constructed, however, the Santa Fe modified its order so 18 units planned as boosters emerged from the plant as lead units.

As units from the June order were delivered between April and July, 1944, nine new single-ended locomotives, the 143-151, went into service. In October, November, and December, 1944, 24 individual lead units joined the roster. They were delivered to

Shopton four at a time. Coupled together, they were moved dead-in-tow to Winslow. There, the rear units of existing locomotives 120-131 were taken off and replaced with new lead units. The 12 boosters thus orphaned were sandwiched between the other 12 new lead units, two at a time, to form double-ended locomotives 152-157. What had started out to be an addition to the roster of 15 single-ended locomotives ended up being 9 single-ended and 18 double-ended locomotives. The revised consists were suitably renumbered.

By July 1945, subsequent orders principally for lead units, and the same sort of cab shuffle, would produce a final fleet of 75 double-ended 100's, plus the single-ended 100-104. Those earliest members of the fleet were so different electrically from their younger classmates that they had to be left as they were.

As the subsequent orders were delivered,

the new cab units were moved west out of Shopton in revenue service four at a time, multiplied with the help of a jumper cable through the noses of the center pair.

In a way, EMD's FT was something of a mechanical throwback. It wasn't as well equipped as had been pre-war passenger E units. Its cooling fans were manually operated, as, in the beginning, were its radiator shutters. Automatic transition wouldn't show up in EMD freight units until the F7's.

EMD's chief engineer, Dick Dilworth, is reputed to have claimed that he had the FT designed the way he did so that the fireman would have something to do — to walk back through the units once an hour or so, twist the handle on the Purolator fuel filter, adjust the radiator shutters, and start or stop the manual cooling fans. More likely, Dilworth's engineering department designed the FT so as to limit

How and when the 100-class units were acquired from EMD.

EMD Order	Date Ordered	Date Sold by EMD	Serial Numbers	Total In Order		Original Unit Assignments
				A	B	
E351	9/10/40	12/40-3/41	1198-1201	4		Cab units of original double-ended 100 and 101
E352	9/10/40	12/40-3/41	1202-1205	4		Booster units of original double-ended 100 and 101
E393	2/19/41	8/41-9/41	1340-1347	8		Booster units 100C, 101C, 102A, 102B, 102C, 103A, 103B, 103C
E409	3/25/41	11/41	1406	1		Cab unit 104
E410	3/25/41	11/41	1407-1409	3		Booster units 104A, 104B, 104C
E439	5/10/41	3/42-5/43	1477-1491	15		Cab units 105-119
E440	5/10/41	3/42-5/43	1492-1536	45		Booster units 105A-119A, 105B-119B, 105C-119C
E501	12/24/41	6/43-10/43	1779-1788	10		Cab units 120-129
E502	12/24/41	6/43-10/43	1789-1818	30		Booster units 120A-129A, 120B-129B, 120C-129C
E551	4/1/42	10/43-04/44	2024-2036	13		Cab units 130-142
E585	4/1/42	10/43-04/44	2037-2062 2338-2350	39		Booster units 130A-142A, 130B-142B, 140C-142C
E572	6/26/42	4/44-12/44	2224-2238 2266-2283	33		Cab units 143-151; cab units 152-157, 152C-157C; cab units 120C-131C (to replace booster units with same numbers)
E573	6/26/42	4/44-7/44	2239-2265	27		Booster units 143A-151A, 143B-151B, 143C-151C
E613	5/24/43	12/44-2/45	2573-2612	38	2	Cab units 158-166, 158C-166C; cab units 132C-149C (to replace booster units with same numbers); locomotive 167
E669	8/30/44	5/45-7/45	3299-3338	37	3	Cab units 168-177, 168C-177C; cab units 105C-119C and 150C-151C (to replace booster units with same numbers); booster units 176B, 177A, 177B
E709	6/13/45	7/45-8/45	3709-3716	4	4	Locomotives 178 and 179
Totals:				155	165	

-Compiled from EMD records by Wally Abbey

the parasitic load on the power plant by not connecting to it anything that could be left off.

Besides, as the production of Santa Fe's FT's went along, the units became better equipped. The last two locomotives, the 178 and 179, even had factory-applied automatic shutters. Santa Fe's own shops may have installed air-operated controls on the cooling-fan clutches on some of the passenger-service 158 class.

Little could be done, however, by either the manufacturer or the railroad to deal with the quality and quantity of cooling water available for the FT's - particularly when they were in service on the Coast Lines - except to treat the local water chemically. One of the diesels' advantages was that by eliminating much steam power in the territory, they reduced immensely the Santa Fe's need for water with which to make steam. Still, water coaxed up out of the desert could be so bad that it would corrode the metal parts it touched. Retired Santa Fe diesel men tell how it became necessary to rebore the top decks of the 567 engines and insert stainless-steel rings so that the water in the cylinder liners wouldn't corrode the crank cases.

One might conclude from the early publicity that the Santa Fe intended originally to use its FT's in high-speed transcontinental freight service. Ninety-six hour eastbound GFX schedules had been under consideration as early as 1939. The first two locomotives, the 100 and 101, were geared for a maximum speed of 80 miles an hour. The conclusion may be valid, but other evidence suggests that diesel-powered freight-carrying versions of the *Super Chief* were still some time in the future.

The 100's 80-mile-an-hour gearing matched that of the experimental 103, although the 100 had 40-inch-diameter wheels and the 103 had 36-inch wheels. In its test run from Argentine out to San Bernardino and back, the 100 had performed well. Its electrical system did heat up considerably on the heavier grades, though, and as a consequence its throttle now and again couldn't safely be advanced past run 6 or run 7.

When the 102 joined the roster in mid-August 1941, it was geared for 75 miles an hour. The hope was that the slower-speed gearing and the consequent higher pulling power would produce a locomotive better suited to the traffic and the terrain.

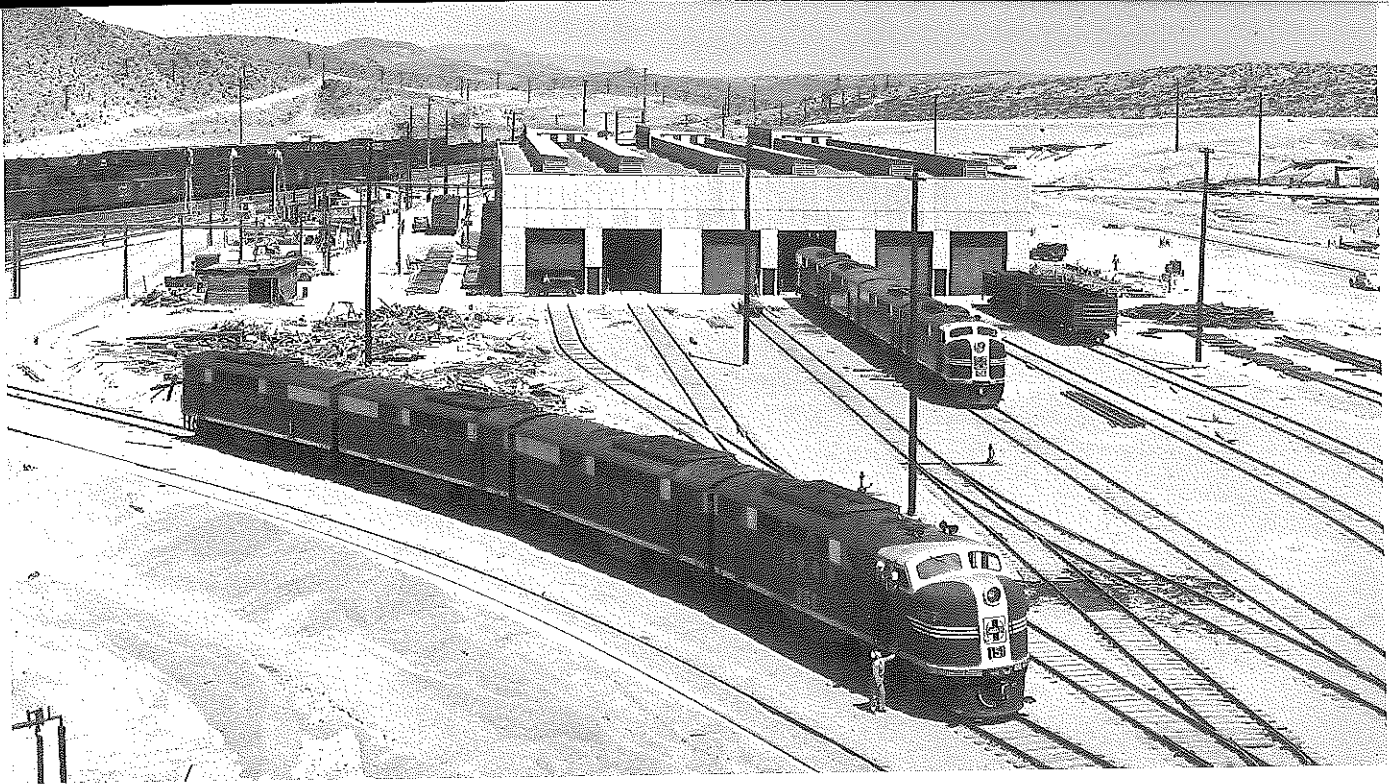
The 102 took the 83 loads, 9 empties,

and 3,347 tons of train 33 out of Clovis early on the morning of September 4, 1941, on a test to see if the hope could be realized. The new diesel handled the train through to San Bernardino. It made two round trips between San Bernardino and Barstow and then took a GFX from San Bernardino's Precooler Yard back to Clovis.

The subsequent Test Department report affirmed the hope. The change in gear ratio had increased the hauling capacity of the 102 over that of the 100 by 350 tons on a 2.2 percent grade and by 550 tons on a 1.4 percent grade. It hadn't affected over-all running time by more than a few minutes. It had eliminated the danger of overheating the electrical equipment. The 102 could handle a 2,900-ton train either way between Winslow and San Bernardino without doubleheading or the need for a helper, except over Cajon Pass and up to the summit of the Arizona Divide.

The test of the 102 was also a test of the FT's "electric holding brake." This device was being applied to all of the Santa Fe's FT's, and it soon would be superseded on new units with a brake that truly deserved the adjective "dynamic."

As primitive as it was, the low-speed holding brake so reduced the need and intensi-



FT's pause in front of the new Barstow diesel shop, above, completed in March 1945. From the outset, Barstow was designed to be the principal diesel shop on the system. Fueling, sanding and washing procedures, right and below, were accomplished at new outdoor facilities as passenger-assigned 164 is undergoing in 1947.
-Above, Santa Fe collection, Kansas State Historical Society; right and below right, Stan Kisler collection

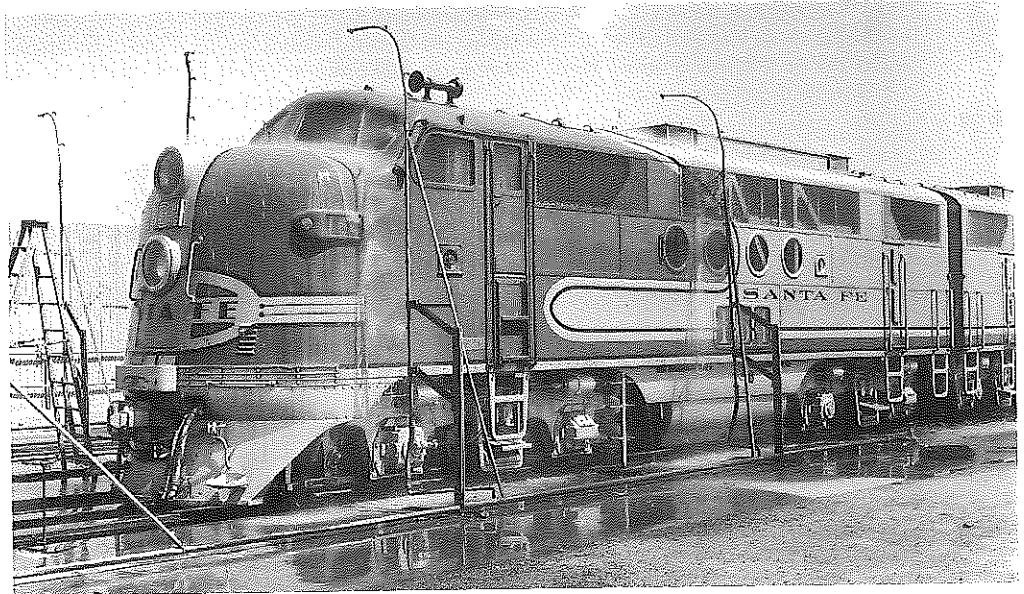
ty of air-brake applications on steep descending grades that the Test Department felt comfortable in estimating the reduction in wheel and brake-shoe wear at 75 percent. Use of the holding brake also eliminated an hour's delay time to allow wheels to cool.

Finally, the Test Department offered the suggestion that a further change in the gear ratio to 62:15 from the 61:16 of the 102 would eliminate the need for helpers eastbound to the Arizona Divide, yet the FT could still handle heavier tonnages at up to 65 miles an hour.

The 103 had also been geared for a 75 mile-an-hour maximum speed. But when the 104 went into service in November, 1941, it maxxed out at 65. Its gear ratio was, expectedly, 62:15. It began to appear that the 100's were not to be fleet-footed movers of merchandise, but simply more powerful, easier-to-maintain, additions to the Santa Fe's motive-power fleet.

And there was another reason why the FT's wouldn't be permitted to strut their stuff in the transcontinental trade.

Laws of the State of Arizona effectively emasculated the big diesels. Freight trains had





The 116 is turned on the table at Winslow, Arizona, sometime during the war. By 1944, 68 FT's were handling all through freights across the Albuquerque and Arizona Divisions, and some were even able to work east from Winslow to Belen. -Santa Fe photo, courtesy Stan Kistler

forth across the eastern end of the system, handling from Shopton or Argentine to Wellington, Waynoka, or Clovis trains considerably longer and heavier than they'd have been permitted to handle across Arizona.

But by the time an improved class of FT's beginning with the 105 began to arrive in March, 1942, the United States was at war, and the qualities of diesels that countered the arduousness of moving men and war materiel across Southwestern deserts and mountains in monumental quantities had prompted the Santa Fe to concentrate its 100's west of Winslow.

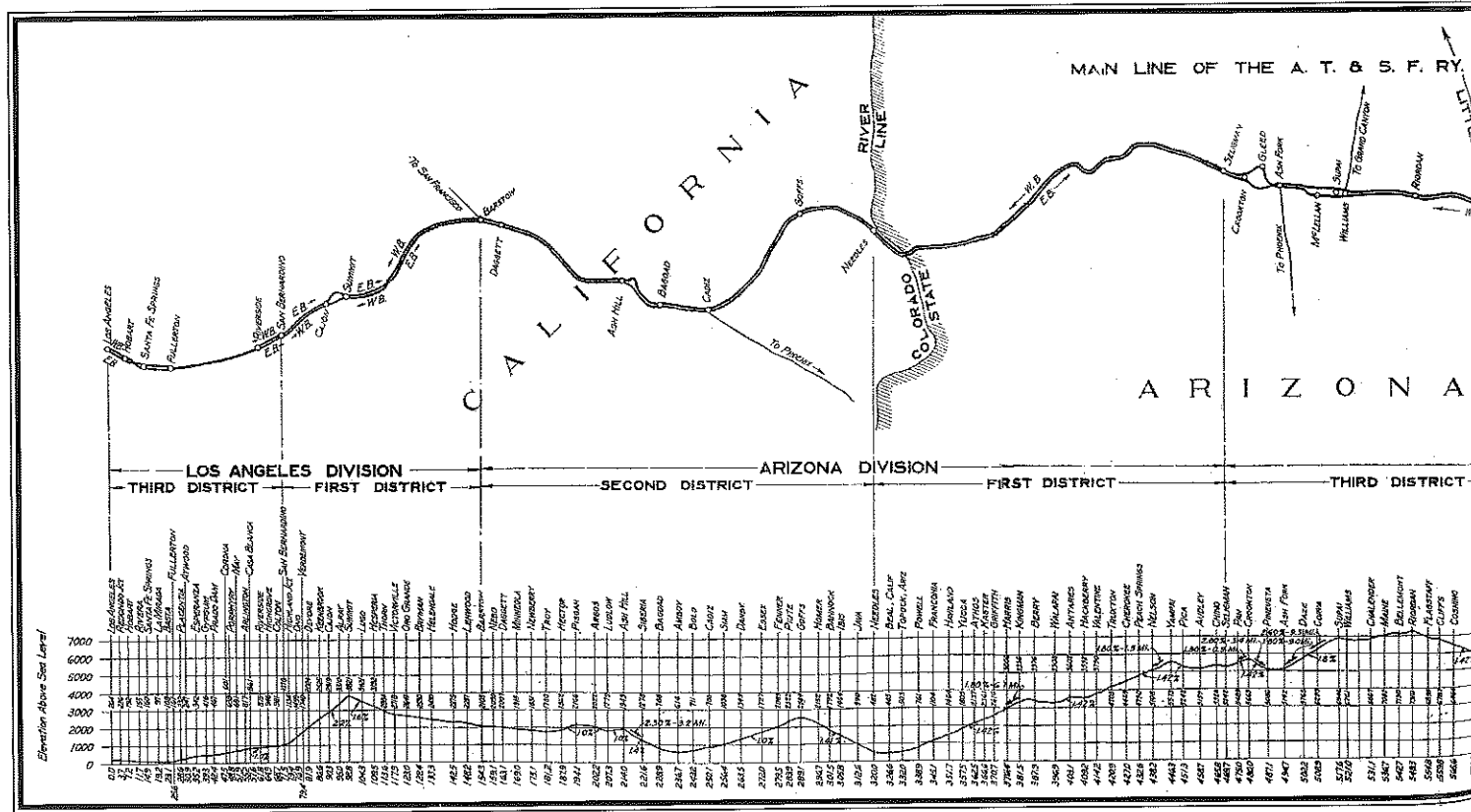
Deliveries of FT's to the Coast Lines began in May, 1942. Work began on converting the roundhouse and associated facilities for steam power at Winslow into a servicing and running-repair station for the most highly concentrated diesel operation in the world. And when ICC Service Order 85 became effective September 15, 1942, the Arizona inhibitions, as well as laws of similar intent in Missouri, Oklahoma, and California, disappeared for the duration of the war. Most of these restrictions were repealed or were declared unconstitutional around 1945.

been limited by law to 70 cars, passenger trains to 14, since 1912. Between the state train-limit law and the 2,900-ton doubleheader limit, the physical development of the Coast Lines had been effectively frozen to the 2,200-ton rating of a 3800-class 2-10-2 on the 1.42-

percent grades. That was about 58 average cars. Sidings and yard tracks all the way across the state were just long enough to handle 70-car trains.

The FT's could do better than that. So in their first years, the FT's pedaled back and

The 105 differed from its predecessors mainly in the quality of its dynamic brake. EMD had perfected and installed a true variable brake that could be applied at speeds up to 65, yet still be effective in the low-speed range in which the original "holding brake" was supposed to oper-



ate. All locomotives that followed the 105 incorporated this brake. As had been the 104, the 105 was geared for a maximum speed of 65.

Plans were to test the 105, but an accident at Fort Sumner involving the 105 forced Santa Fe to run tests on the next unit in line, the 106, which was tested in early April 1942, less than two weeks after it'd been delivered. This too was a better engine than were the 100 and 102, from the standpoint of what it would pull. But the big difference was in the effectiveness of the new dynamic brake.

The 106 could hold a train at 50 to 55 miles an hour on a 1-percent descending grade, to 40 miles an hour on a 1.4-percent grade, to 25 on a 2.2-percent grade, and to 15 to 20 on a 3-percent grade — without air. The brake was useful over 185 miles of line westbound and 130 miles eastbound between Winslow and San Bernardino, three times as much territory as the original holding brake was good for.

It was in large part on the Coast Lines, between the crossing of the Little Colorado at Winslow and the crossing of the much better-known Colorado River at Topock near Needles and on to Barstow and sometimes Bakersfield, that diesel-electrics in anything approaching a working majority first met U. S. main line railroad freight operations at their cruelest. EMC 103, the experimental, had been tested and evaluated here, too, as well as in many other challenging operating environments around the

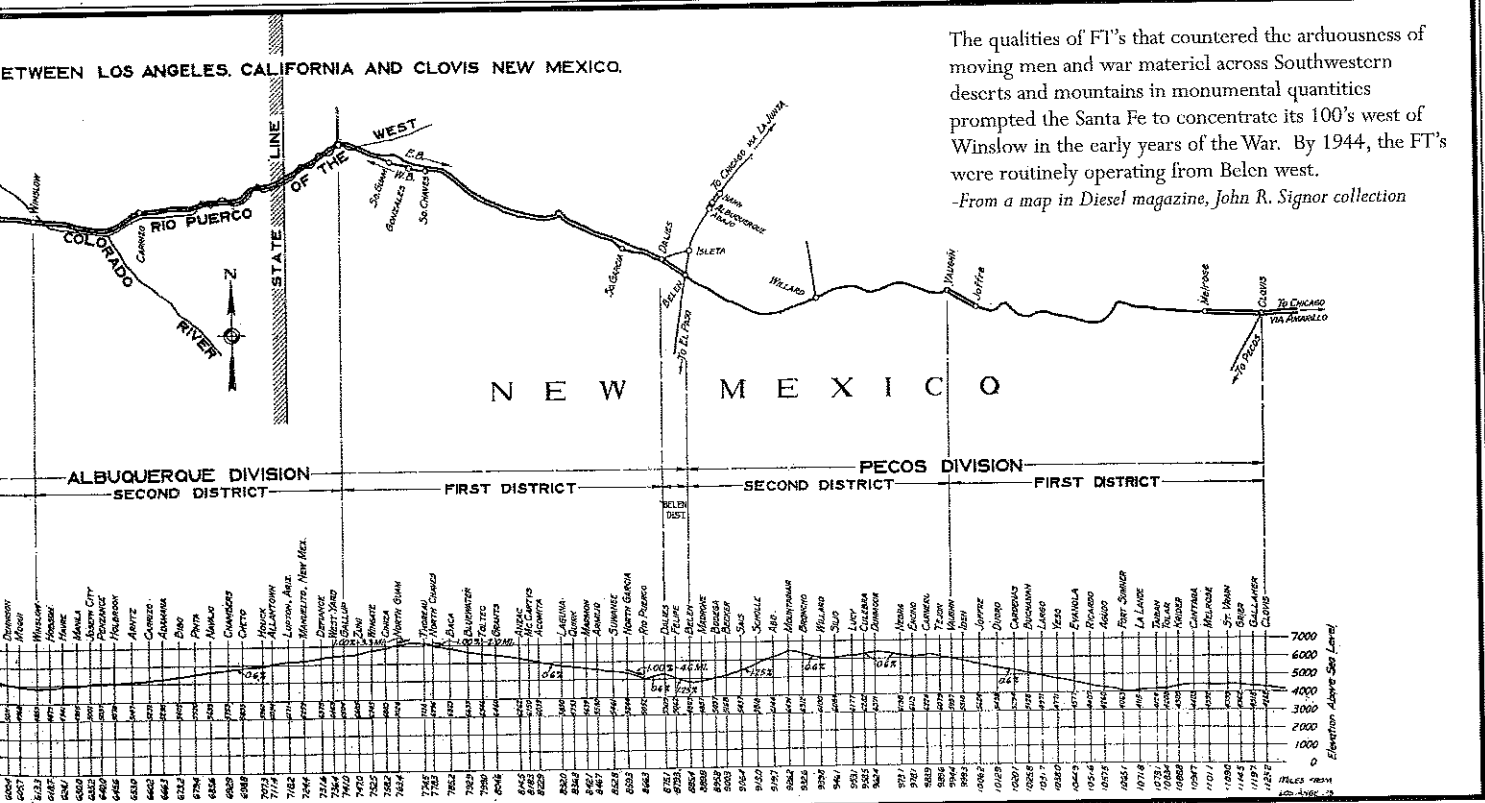


Following tests in January, 1946, ten FT's were assigned to passenger service, enough to dieselize the principal transcontinental streamliners and a few other trains, as well. But in May 1948, they began to be displaced by new F3's. Back in freight service and in a three-unit consist, the 160 comes by the westbound home signal at Willow Springs, Illinois, on August 22, 1948. Today, the big intermodal yard is right at this point - Wally Abbey

country. But wherever it went, the 103 had been shepherded, diligently pampered, and constantly tinkered with, as would have been any new locomotive — particularly the progenitor of what its godfathers hoped would be a tradition-shatterer.

Not that there weren't on hand specialists from Santa Fe's growing and increasingly experienced diesel staff — plus factory reps out of La Grange — to deal with the corrosion by the local waters of cylinder liners and radiator

cores, with the gremlins that mysteriously tripped ground relays, with the cantankerous dynamic brake, and with the delicate question of how to teach traditional steam-locomotive hoppers that when one is sitting in the padded engineer's chair of a diesel one mustn't yank the throttle wide open with the slack bunched or the brakes not fully released. But now there was a war on, and the 100's were front-line soldiers. The 100's were serviced and returned to work at Winslow as quickly as possible and



The qualities of FT's that countered the arduousness of moving men and war material across Southwestern deserts and mountains in monumental quantities prompted the Santa Fe to concentrate its 100's west of Winslow in the early years of the War. By 1944, the FT's were routinely operating from Beln west. -From a map in Diesel magazine, John R. Signor collection



The 101 clumps across the Rock Island at Joliet, above, with a westbound, displaying what no self-respecting FT model should be without: the white flags of an extra. Note that one (or both) of the boosters are running backward, not that it matters. And it appears on close inspection of the photo that the vermilion stripe stops at the cab door. August 2, 1949. -Wally Abbey

were pampered and tinkered with only as time permitted. And by one estimate, a train was whistling into, or out of, Winslow about every 12 minutes.

Through the early war years, and even into the time when war traffic was heaviest, the Santa Fe's fleet of 100's was limited to far fewer than had been ordered. Nor had they all arrived when they were most needed. Seventy-eight of the 320 units the Santa Fe desired weren't delivered until 1945, and of these 78, 67 were cab units. The fleet was limited because EMD had overestimated its productive capacity in the face of shortages of copper and other critical materials, and because the Navy all but took over EMD's production for many months, so that seagoing warcraft could have GM diesel engines.

The FT's that were on the property didn't handle all the wartime trains that struggled across the Arizona Divide, but they surely helped keep Santa Fe's main line fluid. Many a veteran of those days would claim that without the 100's the Santa Fe would have been unable to handle the traffic.

As America geared virtually its entire industrial might to the task of winning World War II, total domestic war production rose steadily finally peaking in February, 1944. Traffic across the Santa Fe remained high; in

one day, November 28, 1944, some 1,644 carloads moved west through Winslow. But sixty-eight FT's were handling all through freights across the Albuquerque and Arizona Divisions, now, and some were even able to work east from Winslow to Belen.

One FT, the 148, was farther east than that. In September, 1944, it was used in a series of tests between Argentine and Bellville Yard in south Texas. The Santa Fe wanted to see how well an FT would perform with its premium Texas trains, 39, 38, and 40. The test would take a diesel-electric locomotive south of Oklahoma City for the first time in any class of service.

The 148 did very well, although the fact was a little hard to discern from the test report. It could easily handle 3,500 tons on the published schedules and would have done so had the test runs not been marred by break-in-twins, slow orders through extra gangs, and other misfortunes.

In fact, the test report concluded, three-unit, 4,050-horsepower locomotives might be preferable for trains of normal through tonnage. The test trains had to be filled with drag freight to reach the 3,500-ton rating. The testers commented that while 39 and 38 were considered through trains to and from south Texas points, the number of cars that found

their way into their consists amounted to three or four changes in the entire train over the 800-mile run. Many through cars were set out short of their destinations.

Four-unit FT's soon went into service between Texas and the northern reaches of the Santa Fe. And the comment about three-unit FT's was certainly prophetic.

We should give special mention to the 167, the locomotive to which EMD attached the type, "special freight." Ordered on May 24, 1943, but not delivered until February 14, 1945, the 167 was a special FT, indeed. It gave testimony to the fact that the Santa Fe, if not EMD, had been thinking about whether something better than, or at least different from, EMD's long, graceful, double-power-planted, four-motored E units might be the ticket for passenger services where some speed could be sacrificed in return for more pulling force. A locomotive that could go right along with a passenger train yet obviate the need for helpers across the mountain passes would be more than welcome on the Santa Fe.

Inside the 167, concealed behind the blue-and-yellow livery that had adorned all earlier members of the 100 class, were two steam generators, boiler water carried in tanks under the B units designed originally for diesel fuel and in additional tanks that weren't on earlier



Following tests in September 1944 between Argentine and Bellville Yard in south Texas, FT's soon went into service between Texas and the northern reaches of the Santa Fe. Here the extra 184 west approaches the top of Edclstein Hill, above, west of Chillicothe, Illinois, on August 41, 1947. FT 176 shows off its roof lines, below, at Corwith in 1949. - Above, Wally Abbey. Below, Santa Fe photo, Kansas State Historical Society Collection

members of the class, and the piping and other implementia required to get the steam back to the train. The 167 was equipped with the automatic train control it needed to operate east of Fort Madison. It introduced Santa Fe's passenger operations to the dynamic brake. It could go 95 miles an hour. Which it did, often with the *Kansas Cityan* and the *Chicagoan* and not infrequently with the *Super Chief* and *El Capitan*.

The 167 had about 220,000 miles on it when, in early January, 1946, it powered a special train out of Kansas City for Houston. The train was composed of dynamometer car 29 and six business cars, tonnage enough to simulate a 12-car lightweight streamliner. The schedule for the special was designed to be moderately faster than was the schedule of the Rock Island's *Twin Star Rocket*. Clearly, the Santa Fe had a *Texas Chief* in mind. And even more clearly, the 167 was more than enough engine for the job. Most of the time, it ran at less than full load.

Three months after the test, the Santa Fe began converting 10 freight-service FT's to passenger service. Chosen for the honor were





X149 west charges up the east slope of Cajon Pass above Victorville with a 2-10-2 helper in September, 1947.

-Frank J. Peterson

An unidentified FT pushes at the rear of a freight rounding the curve into Summit, left, in the summer of 1950. The rear brakeman is ready to jump off and close the Summit siding switch. FT's used in Cajon helper service were usually operated in reverse to eliminate the need to wye the locomotives at Summit.

-Elmer Hall



On June 18, 1950, FT No. 137 rumbles through Colton, California, with a string of empty reefers bound for the packing sheds of Orange and San Diego counties. Note the special footboards applied to FT's in Cajon Pass helper service.

-Elmer Hall





Memorial Day 1954 found the photographer aboard the combine of Amarillo/Lajunta mixed No.37 at Castaneda, Oklahoma. FT 121 leads two FT B units on train No. 38 down the siding with the fireman looking toward the rear to see if his train is in the clear. FT's were regularly assigned to these trains at this time. -Elmer Hall

the units then being operated as the 158-166 and the 168, all of which which shared the same electrical diagram. By September, 1946, there were passenger FT's enough essentially to dieselize the principal transcontinental streamliners and a few other trains, as well.

The conversions were short-lived. In May, 1948, the 158 class began to disappear as its members began to be sent back to freight service. The reconversion took far longer than the five months that had been consumed in making passenger locomotives of them. The last of the passenger FT's went back to pulling freight trains in December, 1951. And by that time, the balance of the FT fleet had been living a different life for several years.

The big changes in the FT's assignments began in 1945. The 178 and 179 were hardly on the property when the junior members of the fleet, the 100-104, began handling Texas premium trains 39 and 40 all the way from Corwith to Bellville Yard. More and more members of the 100 class moved to the Gulf Lines.

By April 1946, only 50 locomotives were in service west out of Winslow. The 158 class was coming together. And on November 7, 1946, the first of perhaps three successors to the FT, passenger F3 No. 16, showed up for work.

On April 22, 1947, Argentine robbed the 100 and the 102 of its rearmost booster units, coupled them to the 117C, and created a

three-unit FT with a new road number: 180. The process of reducing four-unit locomotives to three units would continue until the remaining numbers in the 100 series were filled and FT's were running around behind numbers from 400 to 430. By then, it was early 1953. Cleburne became the mechanical home for these foreshortened members of the class. They ranged up to Chicago, out to Denver, and just about everywhere in Kansas, Oklahoma, and Texas. Among them, and among the few of their colleagues left in California, one could find consists of as many as five units or as few as one — and sometimes the single units would display footboard pilots, backup headlights, and other indications that suggested that soon they'd be replaced by real road-switchers. Which would begin to happen in October, 1950.

Freight-service F3's and F7's in the 200 series began arriving at the end of October, 1948. More and more, the FT's gathered at Cleburne, Argentine, and a few at Barstow, for service and solace. They no longer ruled the railroad.

Was the FT a revolutionary locomotive, and therefore were Santa Fe's 100's revolutionary locomotives? Conventional wisdom notwithstanding, we submit that the answer is no. The FT was a natural outgrowth and expansion of the type of locomotive Electro-Motive had been building for many years. It

was a perfectly natural adaptation of Electro-Motive's time-honored main-line product to a need that EMD had planned to serve at least since 1938, once it had developed the necessary prime mover and once it had the chance.

Did the FT's, and did Santa Fe's 100's, do something revolutionary for the entire railroad industry and for the Santa Fe in particular?

That's a totally different question. And yes, indeed, they did do just that. In fact, in a matter of just a few years they and their competitors almost completely changed the source of energy upon which the railroad industry relied. They made it possible for railroads to simplify their infrastructures and reduce their operating and maintenance costs markedly. They opened up vast new opportunities for railroad service. They created for the railroads, like it or not, a popular following that dwarfed the ranks of those faithful to steam. ❁

Wally Abbey, of Pueblo, Colorado, reached into the material for Class By Itself, the book he's writing on Santa Fe's FT's, to give us this perspective on some of the history of the 100 class. Wally's book isn't so far along that he wouldn't welcome hearing from readers who might have information about the 100's that he hasn't stumbled across — particularly the test report on the first test run of locomotive 100 from Argentine to San Bernardino in January, 1940. You can e-mail Wally at wabbey@rmi.net or, contact him through TheWarbonnet.... ed.