THE DIESEL LOCOMOTIVE

One of the miracles born of oil was the Diesel-electric locomotive.

The Diesel principal dates back to 1897, when Dr. Rudolf Diesel, of Germany, completed the first workable Diesel engine.

The first American Diesel was built in St. Louis in 1898, and slowly passed through many stages before reaching its present state of perfection. Of the some 120 streamlined trains in operation in 1942, about three-fourths were drawn by Diesel-electric locomotives. The present Diesel is proving its worth in main-line freight service.

There are two principal roots of the modern Diesel main-line locomotive. One goes back to the desire of engineers—both in the railroad and automotive fields—to apply the economies of the internal-combustion engine to rail transportation, following in the wake of the birth of motor truck and bus. The other springs from World War I, and was created through necessity.

The earliest worth-while application of the internal-combustion engine to the task of propelling a standard railroad car came in 1905 when the first rail motorcar was built by the Union Pacific.

This led to the founding of the McKeen Motor Car industry. In this same early babyhood of the internal-combustion engine, the General Electric Company was working at Schenectady on a gasoline motorcar with electric drive for the Delaware and Hudson Railway Company. Work was started on this car late in 1904. Records indicate that it was brought out on February 1, 1906, thus giving McKeen the honor of being the first motorcar to ride the steel rail.

Between 1906 and America's entry into World War I, the McKeen company put 155 motorcars on the rails. During the same general period, General Electric built some 90 cars, which went into service on branch lines. These gasoline-electric cars went loping down the track with a husky *plunkety-plunk*, and when they whistled it sounded as though they had a cold.

When World War I came along, McKeen and General Electric quit building these cars.

About that time the idea that the internal-combustion engine could be applied to a knotty and unusual transportation problem took root in the fertile brain of a Mr. H. L. Hamilton, now a vice-president of General Motors.

Ed Drake was a railroad man; so was H. L. Hamilton. Funny, what a steel rail does to a man. Mr. Hamilton had been a fireman, an engineer, and then a minor railroad official. Finally he turned to the automotive field, the pastures of which seemed a bit greener about that time. Eventually he became manager of a prominent motor-truck manufacturer's Denver office.

One day the home office tossed a little problem his way—a problem that was to result in the development of the Diesel-electric locomotive.

As in World War II, critical material shortages developed back there in 1917. For instance, a certain alloy was desperately needed in the manufacture of war products. It was discovered that steel rails purchased in Great Britain during an earlier period were high in content of this alloy.

Miles of these rails lay on old logging roads, mining roads, and other abandonments. For the most part, this track was in rough and inaccessible country. A contractor in Minnesota, employed to tear up fifteen miles of an old lumbering road, made a survey. Roadbed and bridges were in poor shape. The track might sustain the weight of a flatcar and a few rails, but not much more. Getting to a railhead with a truck was out of the question, and a truck alone wouldn't do the job anyway.

The contractor puzzled over the matter. A motor truck with flanged wheels to ride the rails, pushing a flatcar in ahead of it might do the trick. He appealed to a truck manufacturer in Cleveland, and was referred to Mr. Hamilton.

Mr. Hamilton looked the situation over. He said that no truck transmission of that time would stand up, but, in view of the urgency, the contractor's scheme was worth trying. The job was undertaken. As Mr. Hamilton had predicted, the transmission soon played out. Frequent replacements, however, kept the equipment going until the last rail had been salvaged.

For a long time, Mr. Hamilton had been toying with the idea of rail motorcar transport. He was familiar with the McKeen and General Electric developments. His experience with the motor truck on that old logging road revived the half-formed patterns of things. The result was that he quit his job, and, out of savings, hired a staff of assistants.

And so there was created the first gasoline-engined rail car of the present great Electro-Motive Company.

The car developed by H. L. Hamilton worked. And there, in its swaddling clothes, stood the forerunner of the mighty, present-day Diesel-electric locomotive.

Today they ride the rails all over America—on the Santa Fe's Arizona Divide, on the high steel of the Denver and Rio Grande Western, there on the roof of the continent in the Colorado Rockies, on the Mechanicsville run on the Boston & Maine, on the rails of the Atlantic Coast line, the Seaboard, Western Pacific, the Baltimore and Ohio, New Haven, Rock Island, Milwaukee, Southern, Union Pacific, Southern Pacific, Chicago & North Western, Illinois Central, Great Northern, Burlington, Northern Pacific, New York Central, Kansas City Southern, Florida East Coast, Missouri Pacific, and Louisville and Nashville.

Hamilton's first car sold. A second was built, and H. L. Hamilton was on his way. Between 1923 and 1930, Electro-Motive put more than five hundred of these cars on the rails, most of which are still in operation on branch lines.

Mr. Hamilton and his associates in Electro-Motive amassed a wealth of valuable information concerning the problem of applying the power of the gasoline engine to the steel rail through electric transmission. They learned, too, about car construction.

Meanwhile, a third important phase of the development of the Diesel locomotive had been in incubation. Charles F. Kettering, vice-president of General Motors in charge of research, and his associates had been working since 1928 on the development of a Diesel engine—an engine that would be free of the high disadvantages of excessive weight and size, which had held down the application of the Diesel's higher thermal efficiencies to many applications since the invention of this engine by Rudolf Diesel in 1896.

General Motors' engineers joined forces with the engineers of the Winton Company at Cleveland. Winton was one of America's leading Diesel-engine builders, and at that time supplied gasoline engines for the Electro-Motive rail cars. This liaison was welded into a complete union in 1930 when General Motors purchased both Winton and Electro-Motive for the purpose of equipping the corporation with broader facilities with which to develop and prove Diesel engines.

There was no intent to build a Diesel locomotive at that time. Rather, the thought was that there might be use for Diesels in rail motorcars, as well as in the marine field in which Winton occupied a high place.

General Motors placed its first Diesel of the new design on display as a partial source of power for the Chevrolet assembly line in the General Motors' building at the Chicago Century of Progress Exposition in 1933. Kettering and his associates had successfully applied the two-cycle principle to a high-speed engine—that is, high speed compared with the previous, lumbering Diesels. The result was a reduction to about one-fifth the weight and one-fourth the size of the best previous Diesel in the high-horsepower ranges.

Here, at last, was the internal-combustion power plant that would make possible the dream of a streamlined train—the train that progressive railroad men long had visioned.

Soon there appeared the Union Pacific's M-10001, as sparkling as a new dipper, and the Burlington Zephyrs. Other railroads, notably the Santa Fe and Baltimore and Ohio, put pressure on Electro-Motive to make the new power available in separate locomotives. The result was that in 1936 the Santa Fe *Super Chief* and the Baltimore and Ohio *Royal Blue* were powered with the first real road locomotives.

And the Diesel parade was on.

DIESEL ADVANTAGES

From the standpoint of railroad-operating departments, the advantages of Diesel locomotives that have become apparent through more than ten years of service follow:

Faster scheduled operation.
Fifty per cent decrease in operating costs.
Fifty per cent decrease in maintenance costs.
Higher availability.
Greater flexibility.
Freedom from costly supporting services such as ash-dumping and removal, water treatment and storage, boiler-washing, and the like.

Less wear on track due to elimination of hammer blow inherent in steam locomotive.

Important contraction of back-shopping facilities due to far longer periods between major overhauls and the fact that the Diesel is a collection of small, standardized, prefitted parts.

Uniform operation in all variations of weather, climate, and terrain.

To examine these advantages more in detail:

The decrease in operating costs by roughly fifty per cent accumulates largely from: saving in fuel, due both to the inherent thermal efficiency of the Diesel engine and in the transportation and handling of fuel.

Generally speaking, *one* tank car of fuel oil does the same work in a Diesel locomotive that *twelve* cars of coal do in a steam locomotive. The saving in supporting services also is important. Diesel engines require no frequent watering service, and, due to their ability to run long distances without refueling—generally 650 miles for a passenger locomotive and 500 miles for a freight locomotive—require far less frequent fueling facilities.

The decrease in maintenance costs is largely due to the inherent design of the Diesel locomotive for ease of service. The locomotives are designed so that they are made up of relatively small, easily handled, quickly replaced parts, as contrasted with such pieces of a steam locomotive as boilers, drivers, driving wheels, et cetera. Parts are standardized so that no elaborate fitting operations are required in replacements. For example, a piston can be removed from the 600-horsepower engine in a GM switcher and be put into one of the 1,350-horsepower engines of a GM freight locomotive without fitting operations. As a result of the ease of service and the fact that they can be accomplished so rapidly, most repairs are actually "running repairs," performed between scheduled runs.

The fact that such repairs are accomplished as running repairs is one of the principal contributions to the high availability of Diesels.

Greater flexibility of Diesel locomotives is purely a matter of their inherent design. A 7,000-horsepower Articulated remains a 7,000-horsepower engine regardless of the load it has to pull. Since all main-line locomotives built, for instance, by General

Motors are in units that can be quickly coupled or uncoupled by the train crew, the locomotive horsepower can be "tailored" to the job to be done. As an example, a 5,400-horsepower freight locomotive, within fifteen minutes, can become two 2,700-horsepower locomotives, or one 4,050-horsepower locomotive with a spare unit resting.

The faster schedules which Diesel maintains, both in freight and passenger service, accrue from the following:

Faster acceleration, higher speed up grades—and down grades, in the case of the freight locomotive with electric holding brakes—ability to take curves at about ten miles per hour faster than steam locomotives due to Diesel's low center of gravity, minimum of service stops, elimination of locomotive changes.

As a matter of fact, the top speed of a Diesel locomotive probably is not as great as that recorded by some steam locomotives on demonstration runs—the top speed of a Diesel passenger locomotive being regarded as about 117 miles per hour. The Diesel advantage of ten hours under the fastest steam schedules between Chicago and the Pacific Coast is due to time saved by the before mentioned advantages, not excessive speed.

GENERAL MOTORS' DIESELS

All classes of regular railroad service are covered by General Motors' Diesel locomotives. General Motors has 1,200 locomotive units in service on 75 American railroads.

Some of the passenger units have been in continuous service on fast schedules since 1934. Certain passenger locomotives have accumulated more than two million miles in service. They have made outstanding records for availability and periods between motor overhaul. There has been no class of service, to date, on GM Diesel locomotives that could be called "back-shopping," in the sense of the term as used in steam practice.

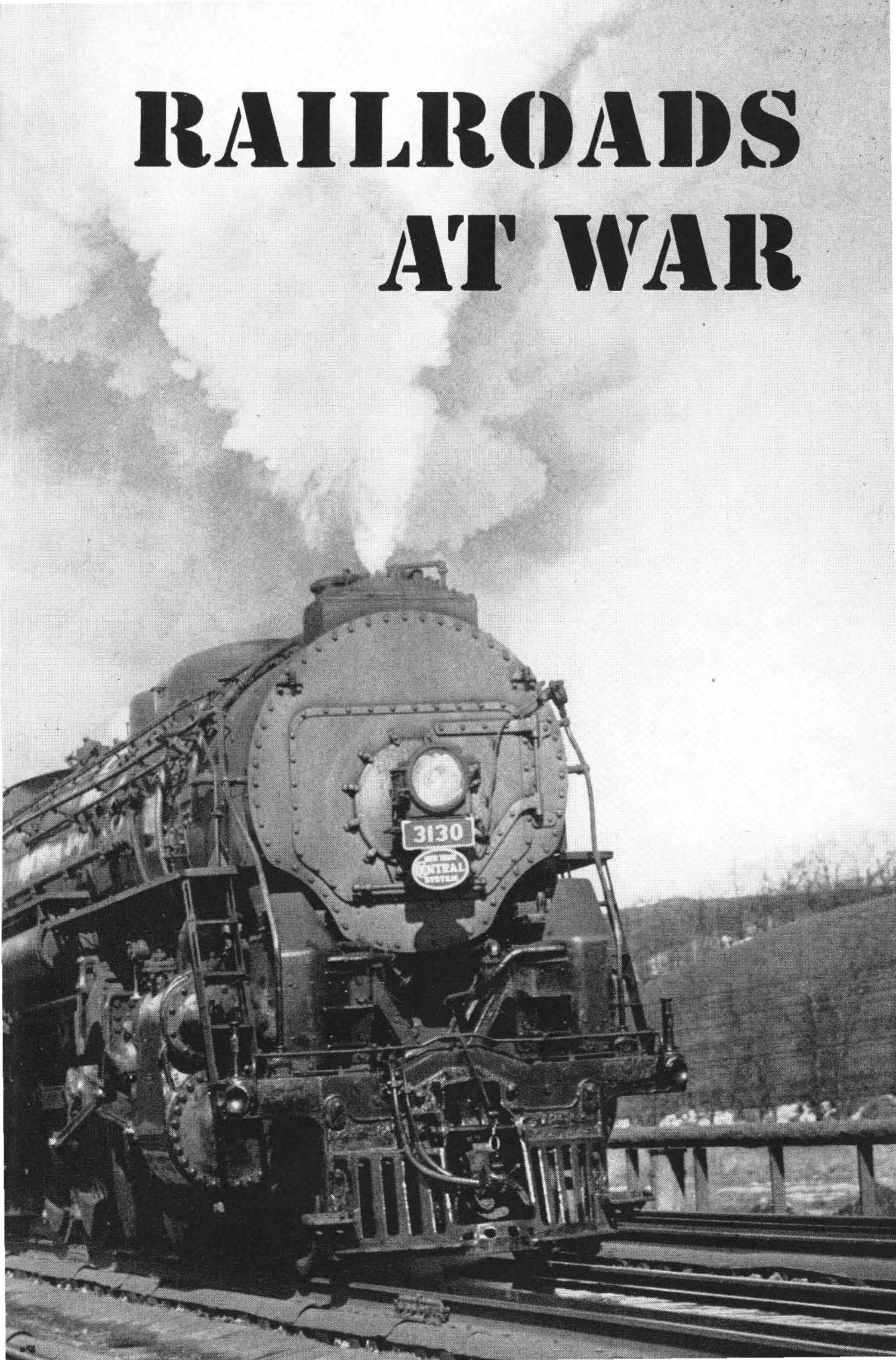
Among notable availability records are two 4,000-horsepower locomotives that the Chicago & North Western kept in continuous service, without missing a trip, for 733 days. Seven days a week each of these locomotives hauled the fast "400" one way and brought the 16- to 18-car Standard Pullman North Western

Limited back at night. This on the route between Chicago and St. Paul–Minneapolis. This meant an assignment of over eight hundred miles a day for each locomotive.

The national average all-time availability record for the 1,200 units in service is ninety-five per cent, compared with the traditional all-time record of thirty-three per cent for all classes of steam locomotives, and about sixty per cent for the most modern steam locomotives.

One of the outstanding contributions of the railroads and the locomotive builders in World War II will go down in the record books as—the mighty Diesel locomotive.

RAILROADS AT WAR



Government wartime restrictions on materials have made it essential that the amount of paper used in each book be reduced to a minimum. This volume is printed on lighter paper than would have been used before material limitations became necessary, and the number of words on each page has been substantially increased. The smaller bulk in no way indicates that the text has been shortened.

PRINTED IN THE UNITED STATES OF AMERICA

Designed by Robert Josephy

Third Impression