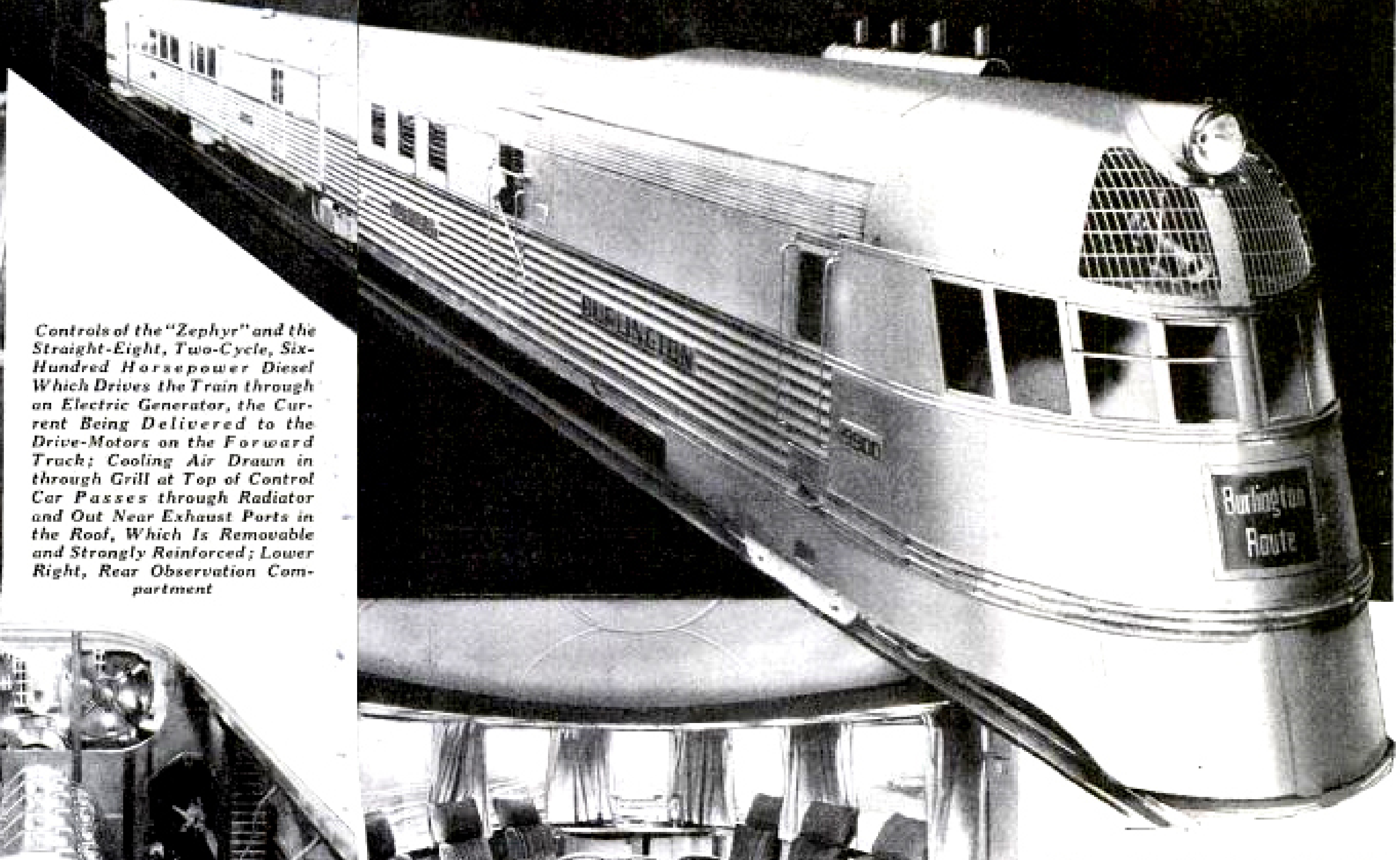
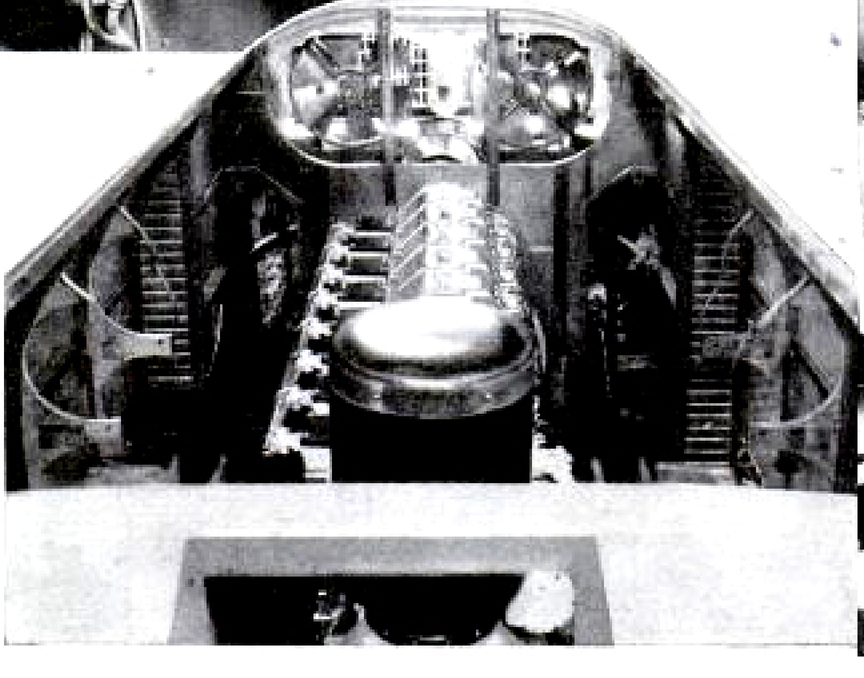
WINGS for the "IRON HORSE"



Controls of the "Zephyr" and the Straight-Eight, Two-Cycle, Six-Hundred Horsepower Diesel Which Drives the Train through an Electric Generator, the Current Being Delivered to the Drive-Motors on the Forward Truck; Cooling Air Drawn in through Grill at Top of Control Car Passes through Radiator and Out Near Exhaust Ports in the Roof, Which Is Removable and Strongly Reinforced; Lower Right, Rear Observation Compartment



RACING the sun in a history-making flight from Denver to Chicago—1,015 miles in 785 minutes without a single stop—the Burlington "Zephyr" gave the railway's answer to bus, automobile and air competition.

All the safety and dependability of the rails, plus the comfort of a fireside chair and the speed of an airplane, at a passenger cost below that of the least expensive private automobile!

In its run from Denver to Chicago, the "Zephyr" used 418 gallons of fuel oil at a total cost of $16.72. On the same run a locomotive would burn $255 worth of coal.

Air conditioned throughout, with concealed lighting, individually adjustable seats and broad, curtained windows, this three-coach articulated train rides as smoothly at 112 miles an hour as the ordinary Pullman does at forty-five miles. Into its building have gone years of scientific progress and research, and at least three of its features point the way for industrial achievement in many other lines. First, the material of which it is built—stainless steel, an alloy of low-carbon steel, eighteen per cent chromium and eight per cent nickel. Because of the greater strength of this metal and the fact that it is not subject to corrosion, tremendous savings in weight are made possible, more than compensating for its higher first cost.

Second, the "Shotwell" method of electric welding developed by Col. E. J. W. Ragsdale and the Edward G. Budd Manufacturing company. By this process a "shot" of electricity is precisely timed, resulting in absolute uniformity of the welds which occur as close together as the stitches in a seam.

Third, the two-cycle Diesel engine with its capacity for quick acceleration, dependable operation and exceedingly low operating costs. Engines of this type have made records of better than 600,000 miles without overhauling.

There is no gainsaying the advantages which trains like the "Zephyr" afford when compared to the conventional steam

Driver at Controls, Motor and Generator; Similar Power Plants Have Records of More Than Six Hundred Thousand Miles without Overhaul

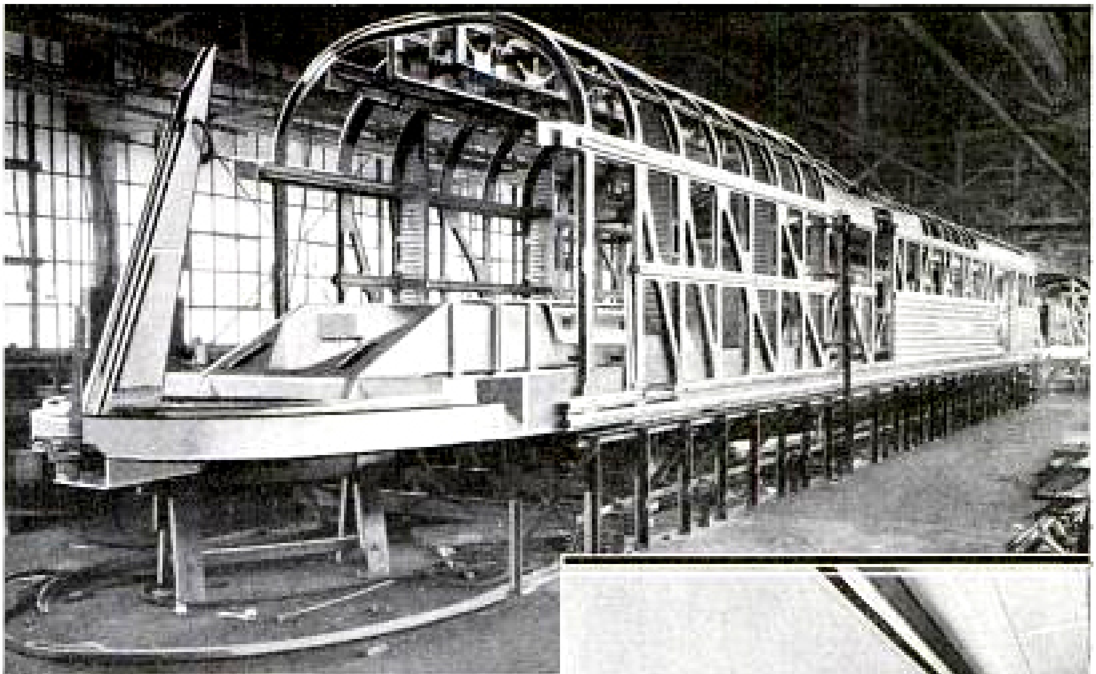
trains in service today. They are much lighter—a three-car unit weighing only about as much as one Pullman car. They are capable of high speeds at low cost and their lightness has not been secured by sacrificing strength. Also, the center of gravity is low, which improves their riding quality.

But where will all this leave the steam-propelled train and the faithful iron horse? Quite paradoxically, many rail executives believe, it will probably leave them at the threshold of a period of rapid progress such as they have never seen before. In the first place, those who see visions of the new streamlined trains throwing the locomotive on the scrap heap lose sight of the fact that the primary business of the railroads is to transport freight. In 1933, of all locomotives in service on Class 1 railroads, eighty-one per cent were used to pull freight trains and for shunting cars in yards.

The advantage of electric and internal-combustion traction is their higher available horsepower, as compared with steam, in quick starting and at lower speeds. Such propulsion, therefore, has definite advantages in switching and in local services with frequent stops and starts. As speed increases, however, the available horsepower of such units rapidly diminishes. With steam locomotives, by contrast, horsepower available at starting and at the lower speeds is comparatively low, but it increases with speed until about twenty-five miles per hour is reached, and thereafter declines very slowly. Steam locomotives also cost only about one-half as much as other motive-power units.

This higher cost is particularly important if electric traction is adopted, because, in such a case, there is a huge outlay not only for motive power but for powerhouse and wayside equipment as well. The development of the Diesel-electric locomotive, which, though costly compared with steam, does not entail the wayside plant necessary with electrification, has caused some railroad men to look to it as a possible alternative to electrification in cities.

There exists today also a great hope that the total weight of passenger trains may be materially decreased, making possible the use of lighter power. Such an opportunity does not exist in freight service, however, for, supposing the weight of freight cars is materially decreased—that will not bring a reduction in the total weight of freight trains, because alert railway managers will add paying load to take the place of the reduction in non-paying weight. They will not reduce the total weight of their trains, but rather will take



Skeleton of Train Showing Tremendous Strength of Front Exceeding That of a Locomotive, and Adjustable Seats in Day Coach

advantage of the reduced weight of cars—and their weight is going to be reduced by the use of lighter metals and by substituting welding for rivets—by adding to the pay load per car and per train.

In late years, the design of steam freight locomotives has been greatly improved to bring about low maintenance costs and greater fuel efficiency so that the locomotive builders might assert that many engines in service today might well be packed off either to the scrap heap or to museums. Locomotives which were built prior to 1915 are over sixty per cent of all locomotives. Those who have studied motive-power economics most thoroughly are pretty well agreed that locomotives as old as that would be of very doubtful economy in modern railroad operation, even if locomotive design had not been improved in that time, and it has been radically improved.

A few years ago one railroad purchased twenty-two modern freight locomotives to supplant units ranging from only eight to fourteen years old, and found that the new power earned thirty-eight per cent upon the investment—in lower fuel costs, lower maintenance costs and lower wage costs per ton-mile of traffic. A number of roads have kept their heads above water, financially speaking, during the depression largely because the decline in traffic has enabled them to move all their freight with their newer, economical engines, letting the older units which cost so much more to run stand idle. There are not a few roads today which are faced with the early alternative of acquiring new locomotives or else, by calling old engines into service,

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greatly increasing their per-train-mile cost of doing business.

Streamline design on the railroads probably does not justify the additional expense which it entails until speeds reach approximately sixty miles per hour. It is not likely, therefore, that there will be much incentive for some time to come to spend money on streamlining either freight cars or freight locomotives, but new freight locomotives are justifiable on a basis of economy of operation and low first cost and no other machine has yet been designed which promises to supplant them.

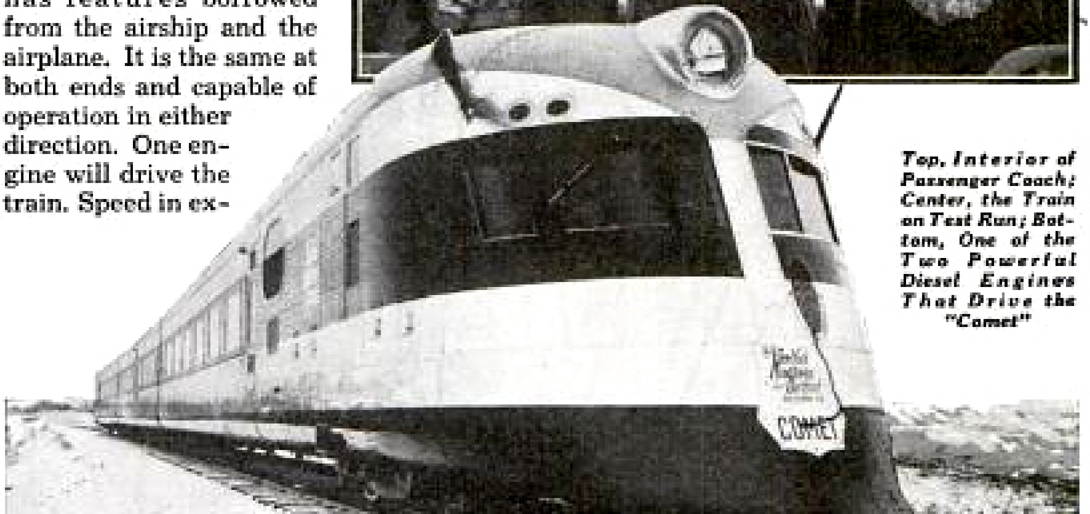
This does not dispose of the fact that the Burlington's "Zephyr" constitutes a definite challenge to the present overweight, regularly scheduled limited train and the locomotive which pulls it. It is a challenge in which the challenger may well be the victor in many cases if the characteristics expected of these units are achieved in practice. The fastest speeds usually attained in North America are well below sixty miles per hour; most of them indeed are below fifty miles per hour. It is proposed to operate the new trains at speeds as high as 100 miles per hour or more, and also to maintain terminal to terminal schedules with them of sixty miles per hour or even better.

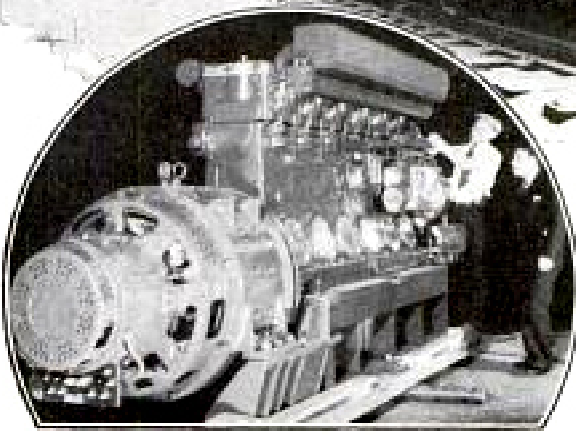
Some doubt has been expressed as to the feasibility or safety of such high maximum speeds, but it would appear that these fears are groundless as far as most main lines are concerned. There will, to be sure, even on the most highly developed lines, be occasional curves where reduced speed will be necessary, but there are plenty of stretches of main-line track, including some curvature, where maximum speeds as high as ninety miles per hour are made today with conventional equipment without discomfort to passengers. The lower weight of the new units should permit operation at high speeds around curves designed for much heavier weights at lower speeds without the necessity for strengthening the track structure.

Come what will, the effect of this new "Zephyr" will be seen in practically all future passenger equipment. Lighter passenger trains are coming and in many cases with higher speeds, greater comfort and lower costs.

Latest Diesel-Engine Train Built Like Airship

Powered by two 400-horsepower engines, the latest train will carry passengers over the forty-three mile stretch between Boston and Providence in forty-five minutes. The three-car train, built in the factory that produced the airships "Akron" and "Macon," has features borrowed from the airship and the airplane. It is the same at both ends and capable of operation in either direction. One engine will drive the train. Speed in excess of 100 miles per hour is possible, but the "rail Zeppelin" will not be operated above ninety miles per hour. There are accommodations for 160 passengers in the air-conditioned cars. One idea taken from the airship is in the construction of the cars. Each car is essentially a metal tube with two "skins," an inner and an outer covering. Between them is a network of beams and girders made of aluminum alloy. Another airship idea is found in the four keels running from one end of the car to the other at the corners. These serve as strengthening members and the upper ones house ducts used in air conditioning, and support illuminating equipment. The influence of the airplane is seen in the hydraulically controlled spring shock absorbers that take the place of leaf springs. They are installed so the cars literally float above the tracks. Rubber is used in large quantities to increase riding comfort and reduce noise. Weighing 126 tons, the train is slightly less than 208 feet long.





Top, Interior of Passenger Coach; Center, the Train on Test Run; Bottom, One of the Two Powerful Diesel Engines That Drive the "Comet"