THE NEXT WAR AT SEA

POPULAR MECHANICS MAGAZINE

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MARCH
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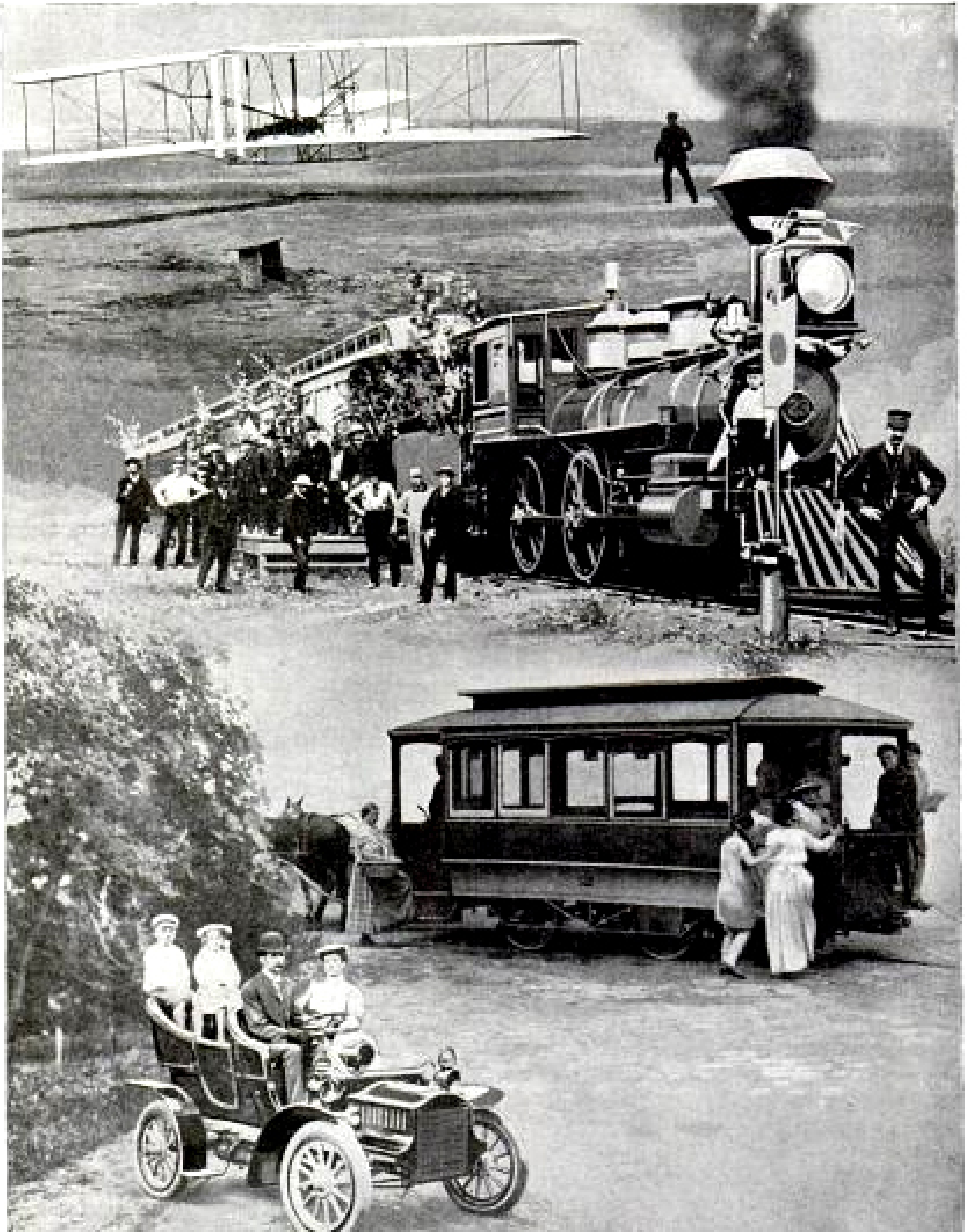
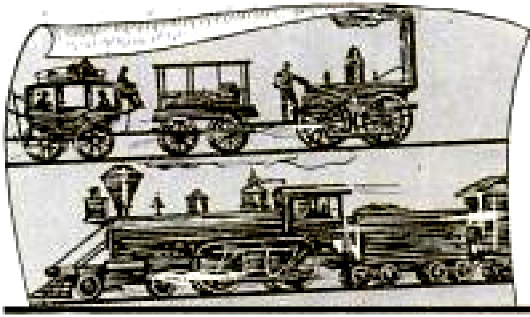
MAGIC in "MAN-MADE STONE"

Pioneering Achievements in the Age of Speed

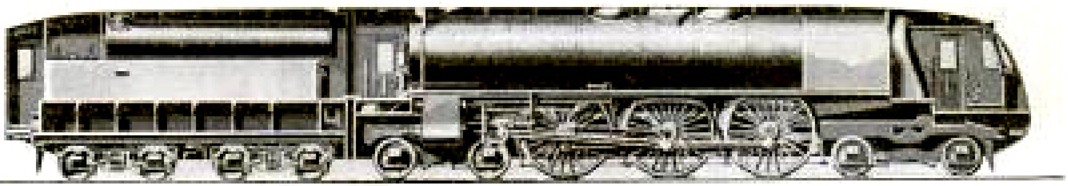


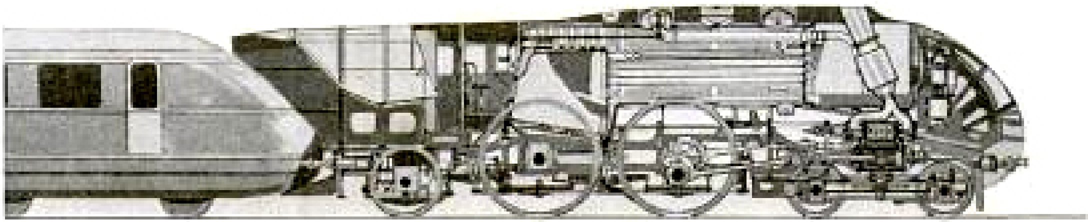
Early Results of Man's Desire for Speed: Top, Scene of Orville Wright's First Flight at Kitty Hawk, N. C., in 1903; Second, First Great Northern Train Entering the Frontier Town of Devil's Lake, N. D., as That Railway Extended Its Line toward the West Coast; This Picture Was Made on June 17, 1883; Third, New Yorkers Boarding Horse Car, as They Did in Dim Past, as Feature of Philadelphia Sesquicentennial Exposition; Bottom, Clarence Chamberlin, the Pilot, with His Sister in Back Seat of Family Car in 1902; It Was First Auto in Their Home Town of Denison, Iowa

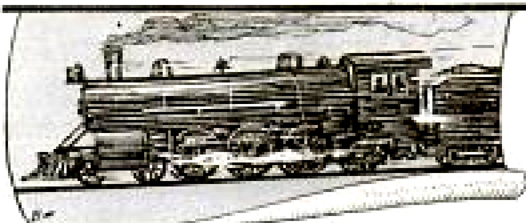
Streamlines to Increase Speed of Locomotives



Streamlined covers for locomotives are being employed in Germany to increase train speed. The covers or hoods are designed with flowing lines to reduce wind resistance,thus permitting faster operation without increasing the power. Speeds of 100 to 125 miles per hour are expected. One design places the engineer's cab at the front, resulting in improved vision.



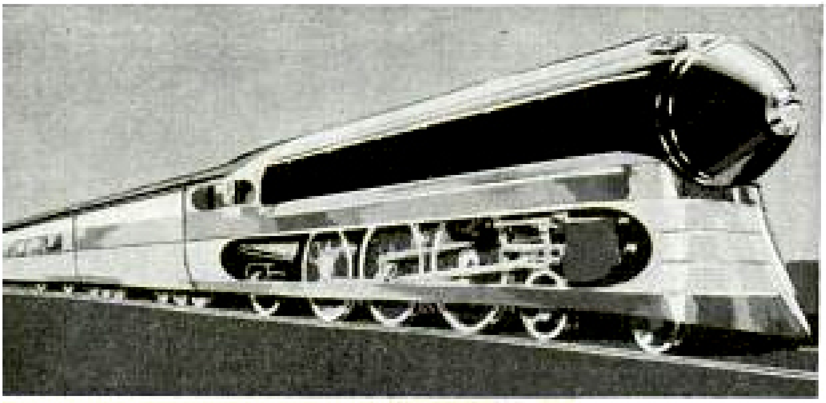




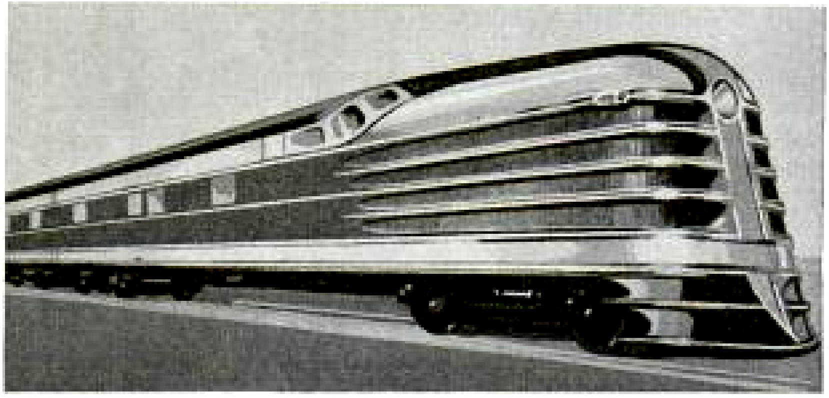
Top and Bottom, Three Steps in Evolution of the Steam Locomotive; Center, Two Streamlined Locomotives, Upper View Showing Driver's Cab Located at Front; Lower View Shows Method of Articulation

Another provides for a cover which will fit in with covers on the coaches so that the entire train becomes a streamlined unit.

Locomotive Like Bullet Styled for Tomorrow



Left, practical design for streamline steam locomotive allowing ready access to wheels for inspection and maintenance and preserving "personality" of iron horse

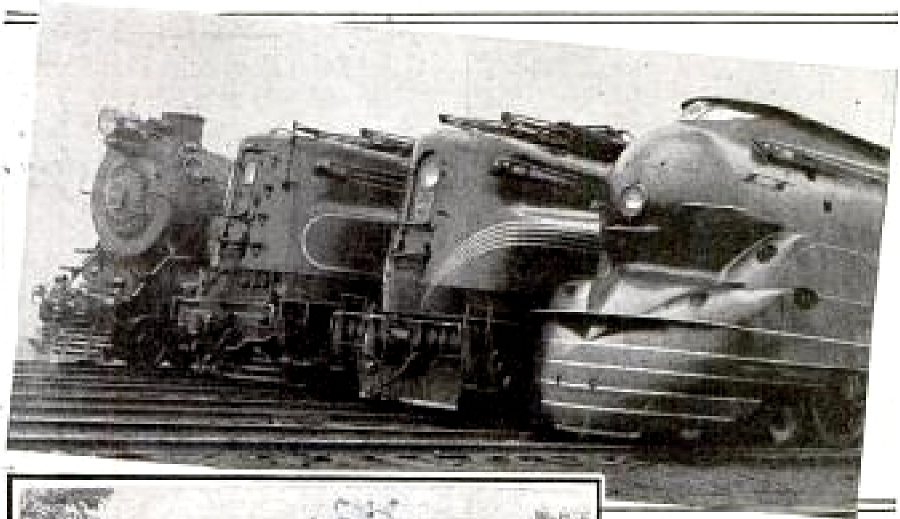


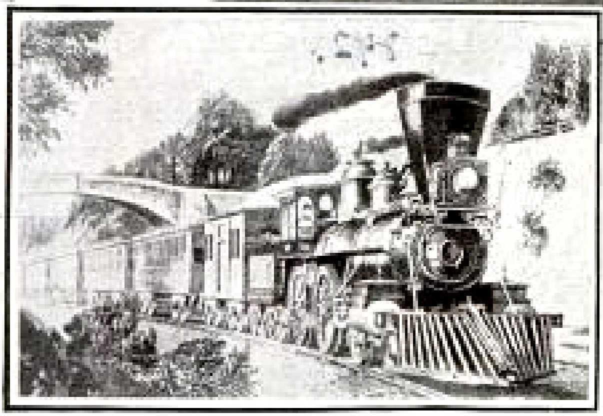
Right, sketch of a streamline Diesel locomotive demonstrating how engines can be mounted in front of engineer's cab without obstructing his view ahead

What is the next step in the evolution of the streamline train? A suggestion of tomorrow's styles is presented by Otto Kuhler, industrial engineer, in sketches of a steam locomotive with bullet-shaped boiler and open-side shrouding, and a Diesel-electric car with its power plant mounted ahead of the engineer's cab. Mr. Kuhler believes many streamline engines today are freaks, badly conceived in outline, and he prefers to retain the "personality" of the old iron horse in its new dress. Trains must be re-styled rather for public appeal than for aerodynamic reasons, he says, but the ultimate in streamlining is impractical for locomotives because of the need for easy access for inspection and maintenance during short stops. Thus he leaves the "skirt" open at the side. Germany's "Flying Hamburger" locomotive is, Mr. Kuhler thinks, the "most perfect shape" but its underslung bullet nose would not meet conditions in this country, where the traditional "cowcatcher" is retained on the latest streamstyled types to shove stalled obstacles off the track. Technical evolution of steam locomotives has all but streamlined them, for the high balloon stack of the 1860 engine would have thwarted any effort to streamline by shrouding, while the modern steam engine with its low overhead projections is readily adapted to thorough streamstyling. Five requirements for good streamline designing are 1, easy identification for public appeal and for vision at crossings; 2, visibility radius of almost 270 degrees for the engineer; 3, sturdy construction; 4, good aerodynamics, and 5, pleasing appearance. In 1935, fifteen new steam engines were built, more or less streamstyled, three new Diesel, and twelve lightweight Diesel-electric articulated trains.

Streamline Cowcatchers 'Ease' Cars Off Track

Rounded Design Intended to Push Autos Off Right of Way

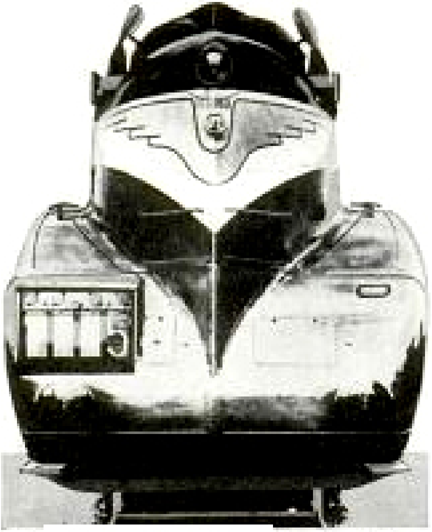




The line of locomotives above shows how the cowcatcher has gradually disappeared behind a solid wall of steel as streamlining has advanced. Left, an early cowcatcher

High-speed, streamline locomotives still retain the cowcatcher, a distinctly American contribution to railroad design, although its purpose is no longer to catch cows. The "iron fence" at the front of the modern locomotive is intended primarily to cope with automobiles. As a result, the cowcatcher, like the rest of the iron horse, has been streamlined, partly for appearance, but also because it has been found that this streamline design pushes obstructions off the right of way with less damage than the old-fashioned set of bars. Modern cowcatchers present a smooth, rounded steel surface, almost like a snowplow. When an obstacle is struck it is pushed aside, rather than tossed into the air. Coupling blocks, which often jammed into an auto and held it until the car was ground under the wheels, are being inclosed and, when not in use, covered by sliding doors. Some locomotives hide real old-fashioned cowcatchers back of solid steel plates but the guard remains in one form or another. The cowcatcher is about 100 years old and was intended not to "catch" cattle, but to push them from the tracks. Early light locomotives suffered almost as much damage when they struck a heifer as the animal itself did. Early cowcatchers were mounted on two wheels and extended far in front of the engine. Strangely enough, as locomotives became heavier and faster, the original design did not change greatly until the era of streamlining arrived.

High-Speed French Engine Has a Streamline Face

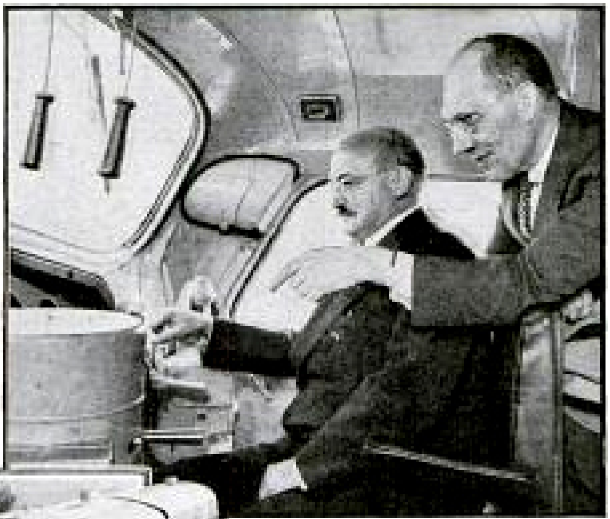


Striking head-on view of streamline locomotive on French railroad, upper part resembling speedboat

Built for fast passenger service on the Nord railway, a French locomotive shows the world a new streamline face. Its design embodies the latest European ideas of aerodynamic lines and speed-train construction. The upper part of the locomotive resembles the prow of a speedboat.

Diesel Streamliners Now Link Coast to Coast

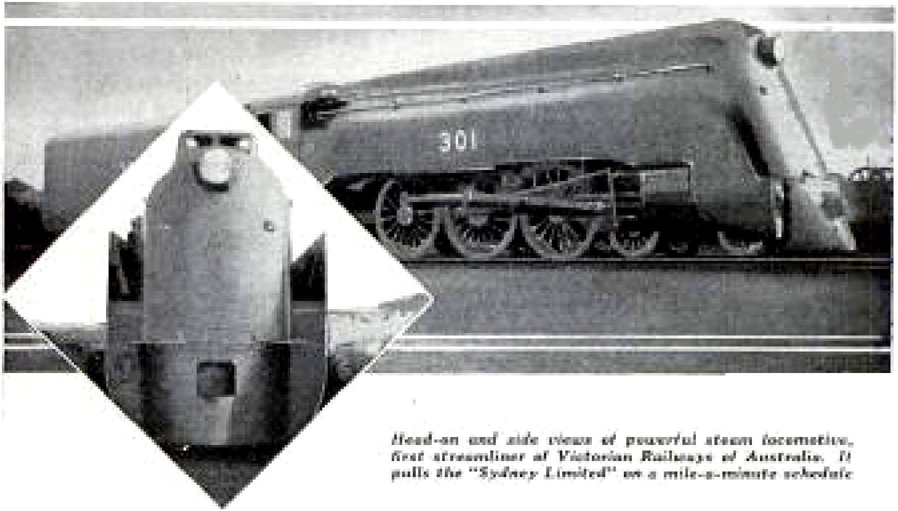
With the assignment of two new streamline Diesel-electric locomotives to the Capitol Limited of the Baltimore and Ohio railroad, Diesel trains for the first time span the continent. These two powerful locomotives, running daily in each direction between Chicago and Washington, are the first of their kind on any trunk line from Chicago eastward. Three years ago the first Diesel-electric streamliner streaked across the country to pioneer a new type of railway passenger service, and today a score of these trains are in service, covering a total of 13,000 miles daily. Four trains operate between the Pacific cities and Chicago on thirty-nine and three-quarter hour schedules, and with the Baltimore and Ohio streamliners connecting at Chicago you can ride from San Francisco to Washington in fifty-four hours and ten minutes running time by Diesel. These newest engines are twin-unit power cars delivering a total of 3,600 horsepower. The operator sits in a comfortable adjustable seat in the cab and drives the train with three levers—main throttle, reverse lever and air brake handle. Slanting, automotive-type windshields of thick safety glass, with windshield wipers and hot-air defrosters, give the driver good vision. The cab is steam-heated, with adjustable side windows and no-draft ventilators. To the usual instruments such as the indicating and recording speedometer, air brake gauges and motor dials has been added a "wheel slip" indicator which flashes a red light when any driving wheels slip because of poor track conditions. In the engine room the attendant is warned by four colored lights and an electric gong whenever the engine overheats, oil pressure is low or a boiler is failing.



Streamline dual power car at left, built to haul Baltimore and Ohio railroad's Capitol Limited, completes eastern link of Diesel-electric passenger service from coast to coast. Officials are shown in locomotive's control cab above

¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information, inclosing return postage.

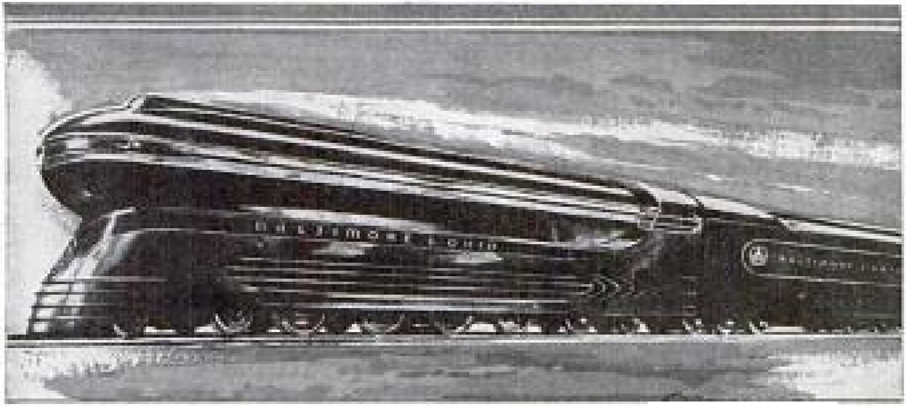
Fast Streamliner Hauls Australian "Limited"



Head-on and side views of powerful steam locomotive, first streamliner of Victorian Railways of Australia. It pulls the "Sydney Limited" on a mile-a-minute schedule

First streamline locomotive on the Victorian Railways of Australia is the steam-driven "S 301," built to haul the "Sydney Limited" between Albury and Melbourne. It will cover the 200-mile run in three and one-half hours, fast time for the grades on that route. The engine is a three-cylinder Pacific type developing 2,100 horsepower, its six driving wheels each six feet one inch in diameter. The locomotive itself is thirty-five feet long and its tender, thirty-three and one-half feet long, carries thirteen thousand gallons of water and eight tons of coal.

Sixteen-Cylinder Locomotive Fast, But Quiet



Here is the latest thing in steam locomotives. Its sixteen cylinders give it the smooth flow of power common to the multi-cylinder automobile. The streamliner is rated at 5,000 horsepower

Designed to operate with the smoothness of a multi-cylinder automobile, a 5,000-horsepower locomotive will pull fourteen heavy coaches at 100 miles per hour for the Baltimore and Ohio railroad. It will have sixteen cylinders arranged for constant torque and will produce thirty-two power impulses for every revolution of the steam motors. Absence of reciprocating parts will reduce vibration and track pounding. The locomotive, of streamline design, will have a four-wheel front truck, four pairs of drivers, a four-wheel trailer truck and a tank mounted on two six-wheel trucks and carrying twenty-three tons of coal and 22,000 gallons of water. Each of the four driving axles will be driven by a steam motor, each of which will have four cylinders directly geared to its axle. All moving parts of the motors operate in a continuous bath of oil. Total weight will be about 400,000 pounds.

B&O Class W-1 Besler Type Locomotive
(Never Built)

See William Besler Patent No. 2,235,957 next page

Otto Kuhler designed the Shell

SEALED TWO CRANK LOCOMOTIVE UNIT

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Fig. 7.

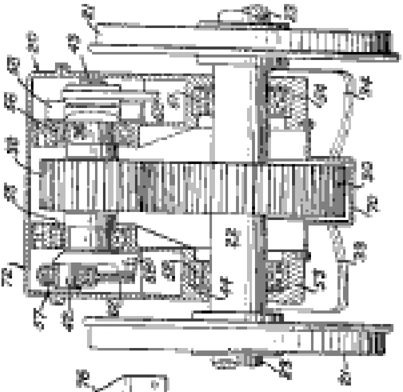
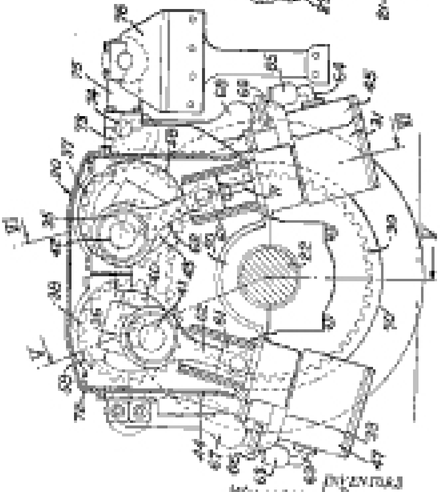


Fig. 8.



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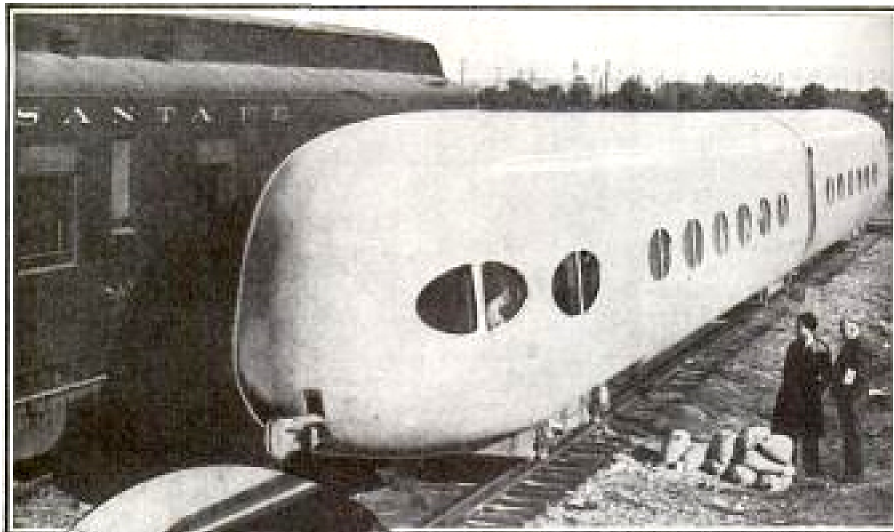
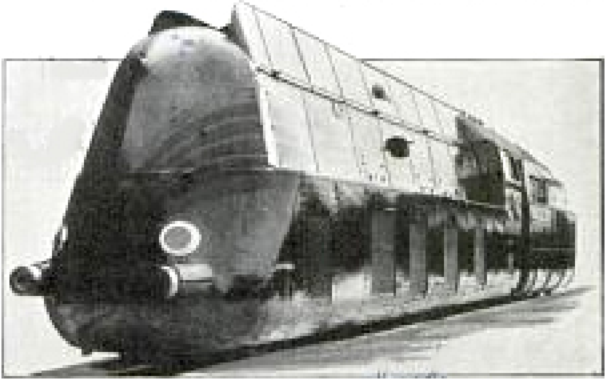
'Floating' Railway Cars Ride Like a Hammock



Upper view shows how low the new streamliners are when compared with standard car on adjoining track. At left is a glimpse of coil spring on which car body "floats." Notice ample head room in unfinished interior, below

Streamline railroad cars that swing like a hammock, embodying radical changes from traditional design, have just undergone their first high-speed track tests. Banking themselves on curves, smoothing out the jolts in the track, these new cars "float" like a suspension bridge, for the bodies are hung from bulkhead assemblies in towers erected at the four corners. In the bulkheads are very soft springs, cushioned with rubber for a maximum of riding comfort. Conventional railway cars have their spring system in the trucks, below the center of gravity; with the springing above the center of gravity in the new coaches they bank like an airplane. The floor level is only thirty inches above the rails compared with fifty-two inches in conventional cars; the roof is eleven feet high, lower by three feet than

Streamline Rail Speedster Latest on Foreign Railways

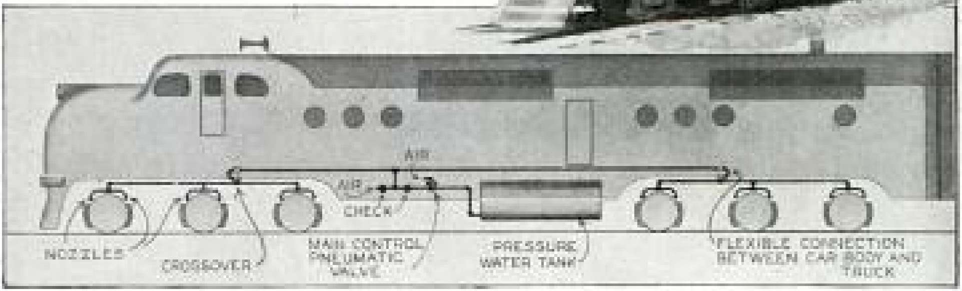


Latest of the foreign-made streamline locomotives. Note how the wheels have been covered and the pilot eliminated

Constructed with the smoothly flowing lines of many locomotives in the United States, a giant locomotive was placed in operation recently in Czechoslovakia. A hood or cover conceals practically all working parts, giving the locomotive a streamline appearance. This is the first streamliner to be put in service by the Czechoslovakian State railway.

Fast Train's Wheels Cooled by Spray System

To prevent overheating caused by prolonged application of brakes, the Southern Pacific company has installed a wheel-cooling device on its fast trains. It consists of an outlet from a water tank, operated by an air-controlled valve with longitudinal pipes and lateral branches at each wheel, terminating in spraying nozzles.

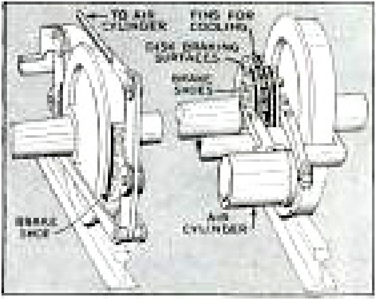


Top, one of the latest streamliners. Bottom, sketch of wheel spraying system designed to keep brakes cool. Note nozzles located to play stream of water directly on wheels

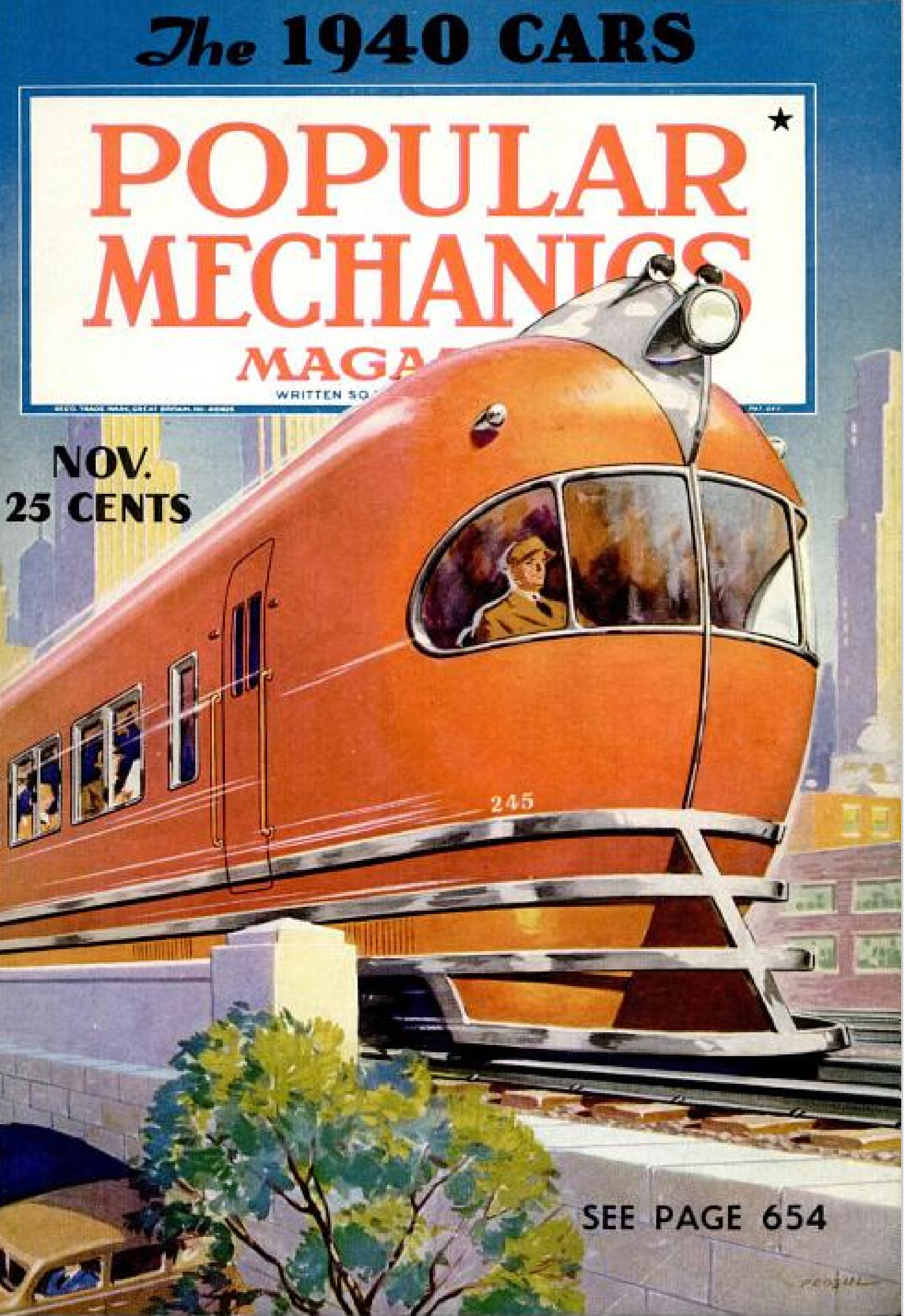
When the engineer applies the brakes, he also opens the control valves of the system, causing a sufficient amount of water to flow on the wheels to counteract the heating effects of the brake shoes. The system also works automatically by pneumatic or electrical means. The main control valve operates electrically from thermostats applied to the brake shoes when wheels have become heated to a predetermined temperature, or by air pressure each time air is applied to the brake cylinders. An electric relay allows for air from the brake system to blow water out of the pipes following each application to prevent water freezing in the pipes in cold weather. Use of the wheel-cooling system has resulted in a considerable saving in use of brake shoes. Another device to prevent operating delays consists of an arrangement by which roller-bearing boxes are equipped with odor bombs which discharge an obnoxious odor to warn trainmen when journal bearings run excessively hot.

Disk Brakes for Streamliners Stop Fast Train Quickly

Since the birth of the railroads, trains have always been brought to a stop by braking force applied to the tread of the wheel. By manual power or compressed air a shoe was pressed against the rim or tread and dragged the car to a halt. But high-speed trains today are demanding more efficient braking methods, and the result is the appearance of a new system in which the brake shoes exert their drag upon cast-iron disks instead of the wheel tread, and the wheel itself reverts to its original function of being just a wheel. Developed by the E. G. Budd Manufacturing company, the disk brakes have their first installation on a new Burlington railroad "Zephyr" streamliner now being built. Tests showed they could bring a train to a halt from 100 miles an hour in 2,000 feet without locking the wheels. The danger in braking at such speed has been the high temperature caused by friction, sometimes nearly melting the wheel and fusing the brake shoe with the tread. In the new brakes, air pressure forces two brake shoes against the surfaces of two disks. Small fins separating the two disks create a blast of air that fans away the heat of friction. Further cooling is provided by spaces between the seven segments into which the brake shoe is divided, and these spaces also reduce the area of braking contact enough to prevent locking. The brakes reduce pressure instantly and automatically if the wheel begins to slide.



Left, a diagram of conventional air brake applying friction to wheel rim; right, the new disk brake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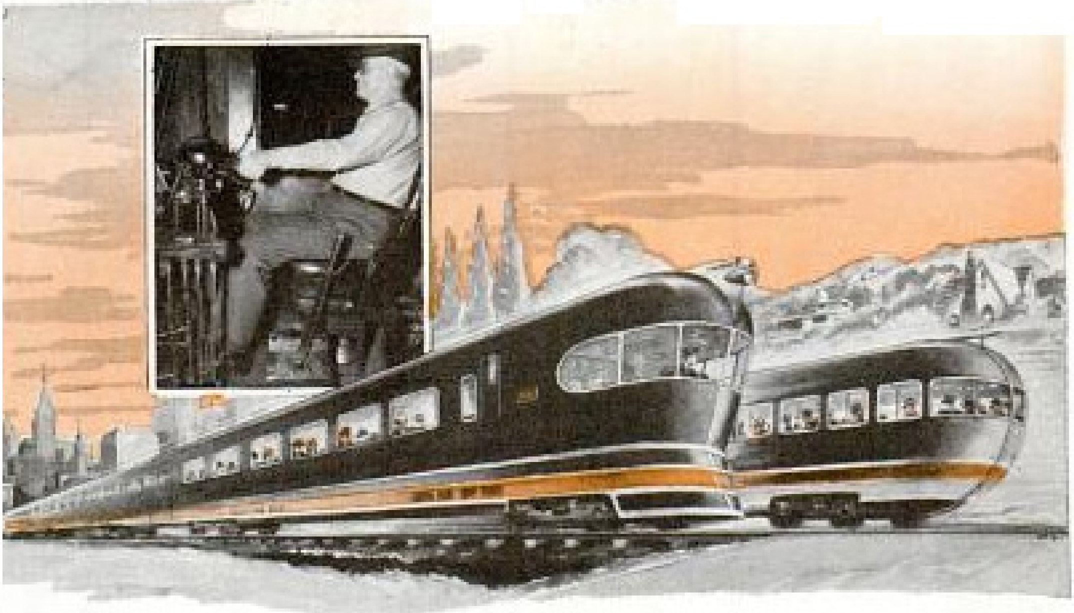
Streamliner Driven by Engine in Each Car



Sketch shows front and rear end designs of proposed train. Inset, driver at the controls of an earlier type car. Streamlining will be employed to the greatest degree recognized as practicable

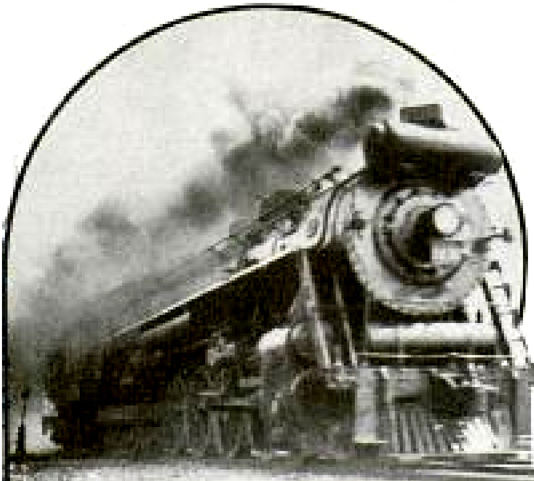
Powered by a horizontally mounted gasoline or oil-burning engine in each car, the latest streamliner will offer speed and unusual flexibility on even secondary runs. The power necessary under any condition may be used. The engine will be installed beneath the floor of the car and its power transmitted through a geared transmission or a hydraulic torque converter operated by remote-control devices. An advantage of the engine-under-floor car is that the entire floor area may be utilized for revenue. Another advantage is that passenger requirements may be fulfilled more accurately simply by adding one or more cars, each with its own engine, to the train as the passenger list increases. The front of the train is smoothly rounded, to reduce wind resistance, the lines being broken only by the "cowcatcher." Painted in striking colors, an articulated train of this type will present a pleasing appearance. It is designed by the American Car and Foundry company.

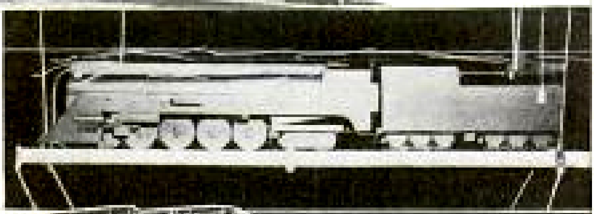
Streamliner's 'Earlaps' Blow the Smoke Away

Grotesquely unlike American streamliners, the newest locomotive of the State Railways of Germany has projecting fins like ear flaps to divert the smoke from its stack upward and away from the train. The engine has a top speed of 115 miles an hour and a cruising average of 100 miles an hour.

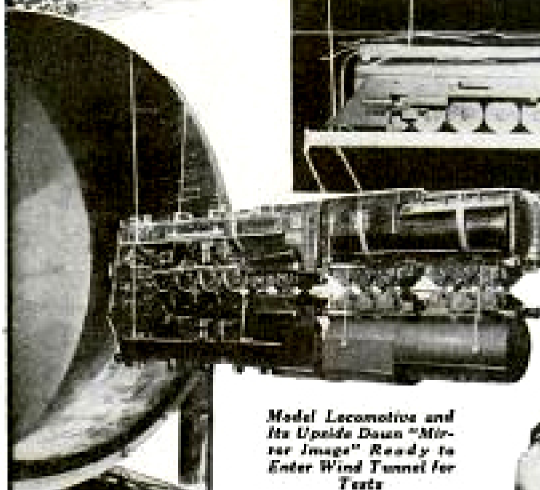
Smoke from streamliner is started upward and away from train by upturned fins that are worn on roof like a pair of earlaps

Wind Tunnel Shows Best Streamline Engine

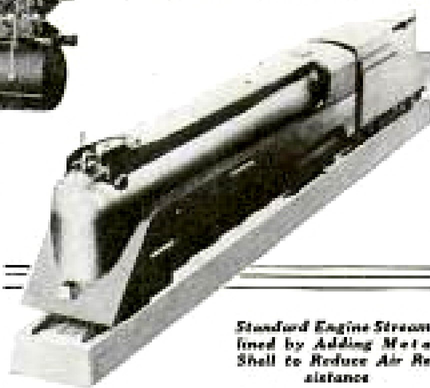




Top, Smoke from Standard Engine Obscures Cab; and Ribbons Showing Air Flow over Streamline Model



Model Locomotive and Its Upside Down "Mirror Image" Ready to Enter Wind Tunnel for Tests



Standard Engine Streamlined by Adding Metal Shell to Reduce Air Resistance

Wind tunnel tests have indicated a method for streamlining a standard locomotive to reduce air resistance forty-three per cent. A one-twelfth scale model of a Canadian National Railways standard locomotive, made of steel, was built for the tests. Due to the absence of the ground, resistance measurements on the model were not applicable to actual practice. However, the effect of a boundary surface on the air flow past a body in its neighborhood is the same as though the boundary were replaced by a second identical model, so placed as to constitute a "mirror image" of the first model. So an identical wooden model was built and the two were placed bottom to bottom in the windstream, and from the readings thus obtained, air resistance figures were computed and modifications to reduce r sistances were made. One of t changes was to add sheet me "side curtains" extending fr the pilot to the tender, thus assu ing a smooth air flow along t sides. A hemispherical nose w added to the front and a secti of sloping sheet metal extendi upward from the pilot prevented air entering underneath the model. A cowling covered protuberances on the boiler top, and a streamline "tail" was added to the smokestack, sloping up to join the cowling.