

Denver Zephyrs Ready for Overnight Chicago Service

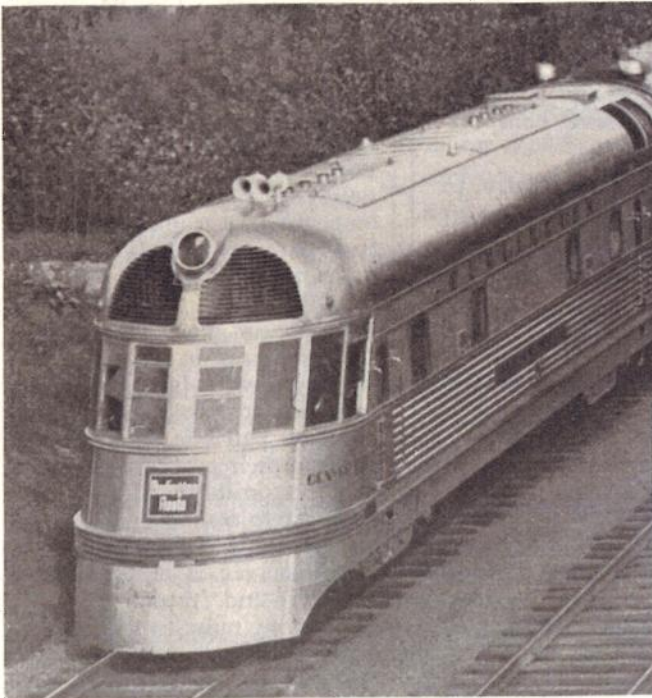
Ten-unit partially articulated trains seat 102 in coaches and provide 93 berths with complete lounge and dining facilities

TWO light-weight stainless-steel air-conditioned trains for overnight service between Chicago and Denver, Colo., were delivered during October to the Chicago, Burlington & Quincy by the Edward G. Budd Manufacturing Co., Philadelphia, Pa. These trains, known as the Denver Zephyrs, Nos. 9906 and 9907, will be placed in regular service on November 7 on a 16-hour overnight schedule between the two cities. Each train is made up of 10 revenue body units, of which four are sleeping cars, and is provided with a two-unit Diesel-electric locomotive with an engine rating of 3,000 hp., exclusive of auxiliaries. With the locomotive attached these trains present an appearance conforming to that of the earlier three- and four-unit Zephyrs furnished by the same builder. It was with six body units of one of these trains, carried on 10 trucks, that one of the locomotives made the run of 1,017 miles from Chicago to Denver in 12 hr. 12 min. 27 sec. on October 23.

Each train provides 102 coach seats, 93 upper and lower berths, 10 parlor-car seats, and 104 lounge and

unit which will supply 220-volt, 60-cycle, three-phase current for operation of lights, bar refrigeration and air-conditioning equipment. The equipment consists of four Diesel-driven generators, each with its own control panel. Back of the power unit is a 30-ft. railway post office and then a 24-ft. baggage space.

The second body unit is a two-truck car consisting of a 23-ft. baggage space and sleeping quarters for the



dining seats, with 31 additional seats in the men's and women's dressing rooms. Crew quarters are provided ahead of the cocktail lounge, with bunks for 12 persons.

Back of the locomotive each train consists of six independent vehicles, some of single-body units and others two and three-unit articulated vehicles. The first unit is a two-truck car comprising an auxiliary power

dining-car crew of 12 men. It contains a shower room and lockers.

In the same car and to the rear of the crew's quarters is a quarter-circle bar, a cocktail lounge and a cocktail-lounge annex. The bar has a mahogany top and is faced in mulberry. Back of it is a peach-colored etched edge-lighted mirror with metal trim. The refrigerators are faced with stainless steel in harmony with the balance of the metal trim of the bar. The lounge proper is furnished with six fixed tables, two fixed curved sofas and 10 movable small chairs, the sofas and chairs being upholstered in dark tan leather. The cocktail annex, which is separated from the lounge by an ornamental aluminum grille, contains accommodations for 16 passengers at tables between transverse leather-upholstered seats. A hinged cushion on the aisle seats provides easy access to the window seats.

The lighting in this entire compartment is furnished

by indirect lights mounted in a pair of overhead ducts and by direct lighting furnished by vertical column lights placed on the pier panels. The lighting over the bar is furnished by lights hidden in a cove and by the edge-lighted mirror. The interior walls are painted mulberry below the belt rail to match the face of the bar and are covered with quartered oak paneling between the belt rail and the upper window rail, above which the walls and ceilings are painted buff. Venetian blinds at the windows are green on the inside and silver on the outside to match the stainless-steel train. The floor is covered with a light brown linoleum.

The third body unit is a semi-articulated coach, seating 64 persons, with a vestibule at the forward end. The seats are the rotating type with three-position reclining backs, and removable center arm rests. They are

Dimensions and Data for the Denver Zephyr Trains

Length overall (including locomotives), ft. and in.....	883— 9
Width inside, ft. and in.....	9— 3¼
Width over bottom skid rails, ft. and in.....	10— ½
Height, rail to top of locomotive roof, ft. and in.....	13—10½
Height, rail to top of car roof, ft. and in.....	12—10¼
Height, rail to top of passenger floor, ft. and in.....	4— 9/16
Estimated weight of 10 body units ready to run, lb.....	831,000
Passenger accommodations:	
Coach	102
Section sleepers	72
Bedrooms	12
Compartments	6
Drawing room	3
Parlor	10
Observation lounge	22
Diner	40
Cocktail lounge	18
Cocktail annex	16
Card playing section.....	8
Grand total	309

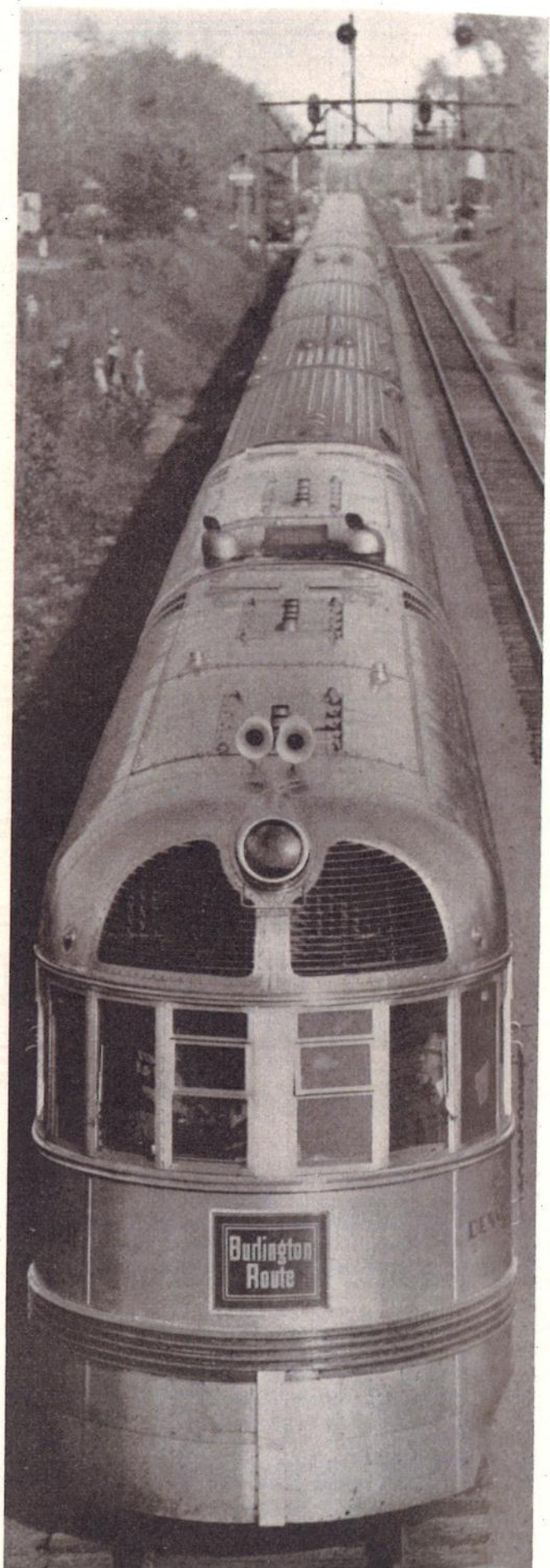
upholstered in a cheerful bluish-green striped plush and are provided with ash receivers which are built into the back accessible to the persons behind. Provision is made for setting tables between pairs of seats. Draperies are light olive green, roller curtains are sea green and the carpet is taupe. At the forward end of the car, just back of the vestibule, are placed ladies' and men's rooms and

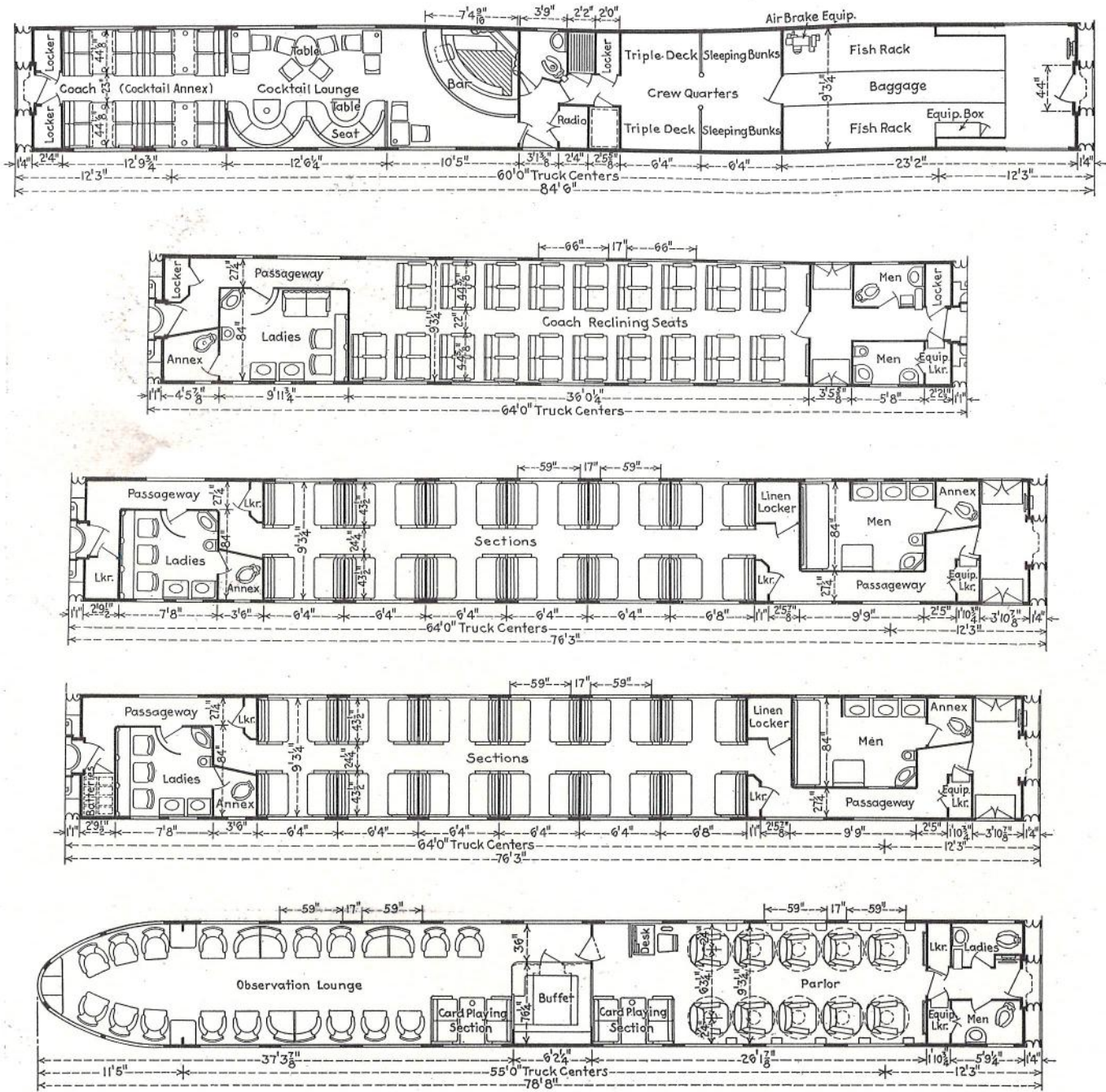
Names of the Denver Zephyr Units

No. 9906	No. 9907	
Locomotive	Unit A. Silver King	Silver Knight .1,800-hp. locomotive.
Locomotive	Unit B. Silver Queen	Silver Princess .1,200-hp. booster.
1	Silver Herald	Silver Courier .Aux. engines, mail and baggage compartments.
2	Silver Bar	Silver Lining ..Coach, cocktail room, crew quarters, crew shower bath, toilet, baggage compartment.
3	Silver Spruce	Silver City64-seat coach.
4	Silver Plume	Silver Lake ...38-seat coach.
5	Silver Service	Silver Grill ...40-seat diner.
6	Silver State	Silver Skates ..12-section sleeper.
7	Silver Tip	Silver Screen ..12-section sleeper.
8	Silver Tone	Silver Arrow ..12-section sleeper.
9	Silver Threads	Silver Sides ... Sleeper with six bedrooms, one drawing room, three compartments.
10	Silver Streak	Silver Flash ... Comb. parlor car and observation lounge.

at the rear of the car are two luggage lockers. Lower walls at the ends of the car and the pier panels are gray-green, while the upper walls and ceiling are cream.

The fourth body unit is a fully articulated coach, seating 38 passengers, fitted with three-position reclining seats. The seats are upholstered in henna with a two-tone striped pattern, the draperies are golden tan, the lower walls rust, the upper walls and ceiling flesh color, and the floor carpeted in mahogany. Between the forward end of the car and the entrance doors are two men's rooms, one a lavatory room and the other a toilet room. In the rear of the car is a spacious and luxuriously furnished ladies' lounge and annex. The lounge contains leather-upholstered chairs and sofa dressing





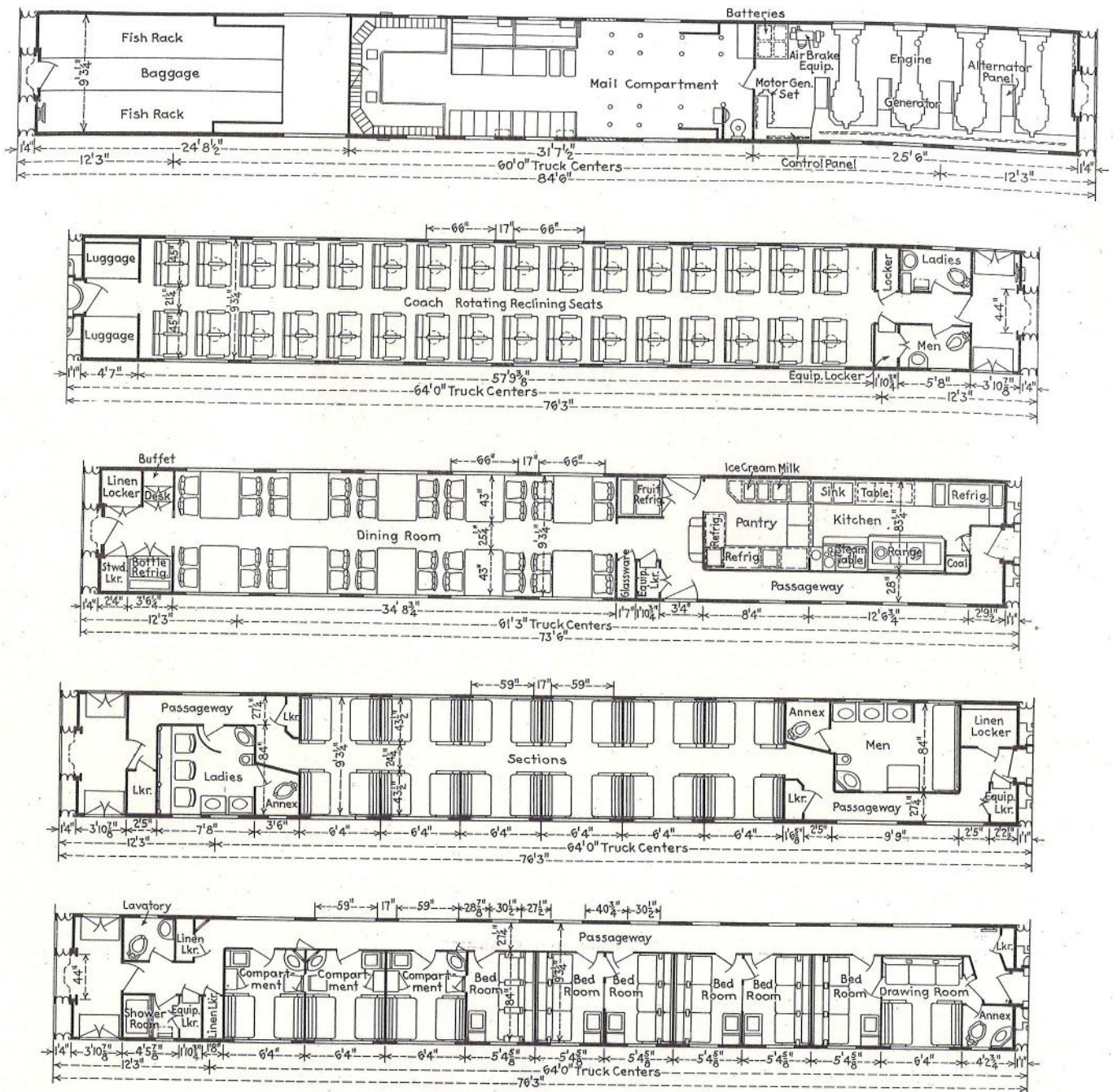
Arrangement of Facilities

table, electrically lighted mirrors, wall clock, dental fountain and three blue porcelain wash stands.

The fifth body unit is a semi-articulated 40-passenger diner, with a kitchen 23 ft. long. Just back of the kitchen are fruit refrigerators on the one side and a pair of lockers on the other, one for storage of bread, glassware, etc., and the other to house equipment. At the rear of the car is the steward's compartment, in which are linen locker, steward's locker, a bottle refrigerator, a buffet and a steward's desk. The desk is furnished with a telephone by which he can communicate with the bar at the forward end and the buffet in the rear car. The chairs have comfortable leather upholstery and the tables have ample room for four persons.

The sixth and seventh body units constitute an articulated pair of section sleepers, each of which has 12 sections with a men's room at the forward end and a ladies' room at the rear end. The seats in one of the

cars are upholstered in a dark brown with a light tan figure design. The lower and end walls are in greenish gray-blue and the section partitions and ceiling are drab. Section curtains are brown, as is the carpet. The roller curtains are chocolate. In the other car the walls and ends are in dark brown and the ceiling and section partitions in a bluish tint. The seats are upholstered in blue with tan stripes and the section curtains are in Copenhagen blue. The roller curtains are chocolate and the carpet brown. Items of noteworthy interest in this and the following section sleeper unit are the four "tall men" berths which measure 6 ft. 8 in. long. The other berths are 1½ in. longer and slightly wider than those on conventional trains. Wide windows offer an unobstructed view to the passenger. At each lower-berth seat adjacent is placed a small mirror. An air-conditioning outlet is placed at the foot of each lower berth and is exposed only when the berth is made up.



in the "Denver Zephyr" Trains

The air-conditioning outlet for the upper berth is placed at the side of the overhead duct. These outlets are furnished with a shutter control.

The eighth and ninth body units constitute another two-unit articulated vehicle, the forward one being a 12-section sleeper and the other one containing one drawing room, three compartments and six bedrooms. The section sleeper, which has men's and women's lounges, has walls and ends in dark green-blue, and ceiling and section partitions in robin's-egg blue. Seats are upholstered in taupe with a dark-brown checkered plaid. Section curtains are Copenhagen blue. The carpet is brown and the roller curtains chocolate.

In the room car each room has an individual decorative treatment in which Flexwood is used freely with carefully selected upholstery and drapes. Each room has a small illuminated clock and is fitted for a portable radio which can be obtained from the porter. Another

feature of these rooms is an electric outlet for electric razors, curling irons, or other electric appliances. There are similar outlets and clocks in all sleeper and coach wash rooms.

The tenth body unit is a two-truck, combination parlor and observation lounge car with a buffet placed mid length. The front end of this car contains 10 revolving parlor chairs upholstered in fawn. The lower walls are cocoanut brown, the upper walls are sand, and the ceiling oyster white. The draperies are brilliant rose with white stripes and the roller curtains are fawn. The floor is carpeted in a reddish brown border-line pattern in sand color with large spots of peach. At the end of the car adjoining the parlor section there is a toilet at either side. Just behind the parlor-car section is an ebony writing desk with stainless-steel legs and trim, and two card sections of four seats each.

The observation lounge contains 16 single seats and



One of the Coaches — Indirect Light from the Ceiling is Supplemented by Prismatic Lights under the Luggage Racks

three love seats upholstered in various colors and patterns. The walls and draperies are the same as those in the parlor section, but the oyster-white ceiling has stripes of tangerine. The woodwork of the chairs is silver-gray walnut. The floor is the same as that in the parlor section. The buffet is mahogany with the top of stainless steel and glass. An ornamental ceiling fixture extends from the buffet toward the rear. The large windows at the sides and the curved windows at the rear enable the passengers to see the surrounding country from all angles.

All body units in each train, including the two locomotive units, are named. The schedule of names for the two trains is shown in a table.

Construction

All car sheathing and structure, except the end under-

frames, needle beams and articulated end sills are stainless steel, known as 18-8. While this material is available in a wide range of physicals, those used in the construction of these cars are either high-tensile (150,000 lb. tensile strength), which is used for those parts where light-weight strength is most important, or low-tensile (100,000 lb. tensile strength), which is used where ductility or special finish is most important.

Fundamentally, the roof and under structure (floor stringers and belly side) serve as compression and tension chords of a beam. They are connected by a Pratt truss, modified as necessary for doors and windows. The longitudinal moldings serve to reinforce against localized stresses due to eccentricities. Necessary reinforcements are applied in accordance with determinations made in the analysis of the various components of the structure. In the vicinity of door openings which



Interior of One of the Twelve-Section Sleepers

The Parlor-Car Section of the
Last Car



occur between truck centers the reinforcements are in the form of additional carlines and flat sheets welded inside the corrugated roof sheets. Reinforcements of this type have proved most efficient in resisting shear at these points.

The end structure is properly analyzed to withstand buffing, traction, vertical and lateral loads that are to be expected in service and as specified by the Railway Mail Service. At the articulating joints the car body is riveted to an extended center plate made of annealed cast steel in which the side bearings are incorporated. The points of connection are amply reinforced to permit a satisfactory riveted joint, and the strength in effect tapered from this heavy casting to the light structure. The design of these end sills is such that the male casting on one car rests in a pocket in the female casting of the

adjoining car and the female casting in turn rests in a pocket in the truck center plate. Vertical loads are withstood by the end truss of the car structure. The bending moment due to inherent articulation eccentricity is resisted by the sill casting, which extends into and is attached to a Cromansil needle beam and the stainless-steel center sill, and by a vertical beam extending to the roof on either side of the passageway. These vertical beams serve also as anti-telescoping members meeting the Railway Mail Service specifications for full strength. The extended attachment of these beams to the roof is designed to withstand the shear developed at the upper end of the beams.

At non-articulating ends, the under car structure consists of an end underframe made of Cromansil welded into a unit and subsequently stress relieved. The design

The Lounge at the Rear of the
Train





The Dining Car Photographed by
Its Own Lighting

of this unit is such that it serves as body bolster, side bearings, draft-gear housing, and end sill and center sill back to the stainless-steel center sill. This member is likewise riveted to the reinforced stainless-steel body structure.

The entire exterior is sheathed in stainless steel selected for finish. The combination of full finished paneling and bright finished moldings presents a pleasing appearance which can be maintained by ordinary shop washing. The surface is unpainted except for lettering on letter board and name plates.

The doors throughout this train are so constructed

as to fit flush and present a continuation of the body appearance when closed. The rails and the fluted panels and all other moldings which are interrupted at the door opening are applied on the door so that when the doors are closed there is no apparent break in the car contour. The baggage and mail doors are suspended from an overhead track and are guided by a floor track which leads the door from a flush closed position to an open position inside the car body. Passenger doors are double type hinged on either side. In addition to the vertical split, certain of the doors are split horizontally approximately at the belt rail to permit the train crew to pick up train dispatches.

The interior doors are hinged in such a way that there is no possibility of pinching, although anti-pinch plates are not applied.

Outside passenger doors are fitted with folding steps which, when not in use, are folded into the car body and present an appearance similar to the body proper. A novel feature is a light mounted in the lower riser of these steps which is operated automatically by the trap mechanism. The steps themselves are faced with aluminum Diamondette treads with a nosing of punched and formed stainless steel as a guard against slipping.

The side windows at passenger seats are of generous size. They are composed of two thicknesses of shatter-proof glass with a hermetically sealed, dehydrated air space between them. This dehydrated air space precludes the possibility of condensation on the inner glass when it is subjected to temperature drop. The hermetically sealed air space cannot change its water vapor content, nor can its dust content increase. The double glazing reduced the heat transfer. All sashes are inserted in stainless-steel frames which are securely attached to the side frames with stainless-steel screws. The glass itself is cushioned from the frames by the generous use of rubber.

The insulation of the passenger cars is Flame-Proofed Dry Zero applied as blankets to fit the voids between the inner and outer walls. The side-wall material is 3 in. thick and the roof and end material is 2 in. thick. The underside of the floor over the trucks is insulated by a corrugated or undulating layer of 1/2-in. Thermo-felt, which is retained and protected on the underside by stainless-steel sheets attached to the floor stringers.



The Cocktail Lounge

Belly side insulation consists of ½-in. Hairinsul faced with Seisal Kraft paper, and the belly hatches are insulated with ½-in. Hairinsul protected with Mulehide. The insulation in the baggage rooms, railway postoffice and engine-roof sides and roof is Navy type Alfol applied in six layers.

The cars are fitted with automatic connectors made by the Ohio Brass Company. These connectors comprise air and steam, 220-volt power lines, telephone, control and signal circuits. They are mounted beneath the O-B Tight-Lock couplers and the semi-permanent drawbars, which are applied in place of couplers between certain cars. Tight-Lock couplers are placed between the two locomotive units, between the second locomotive unit and the first car, between the first and second cars, and between the fifth and sixth body units. The semi-permanent bolted drawbars are used between the second and third units, the seventh and eighth units, and the ninth and tenth units.

Train Power Supply

Power for air conditioning, lighting, battery charging, ventilating, blowers, refrigeration, radios, telephones and various accessories is generated by four Diesel engine-generator sets located in the first car. Each set consists of an 85-hp., 6-cylinder Cummins Diesel engine, driving a General-Electric 50-kw., 220-volt, 3-phase, 60-cycle generator.

The power from the generating units is distributed through the train by two three-wire train lines, one supplying the air-conditioning load and the other the lighting. Under normal conditions of operation the train lines are separated and supplied by separate generators, so that no flicker of the lights can be caused by the starting of air-compressor motors.

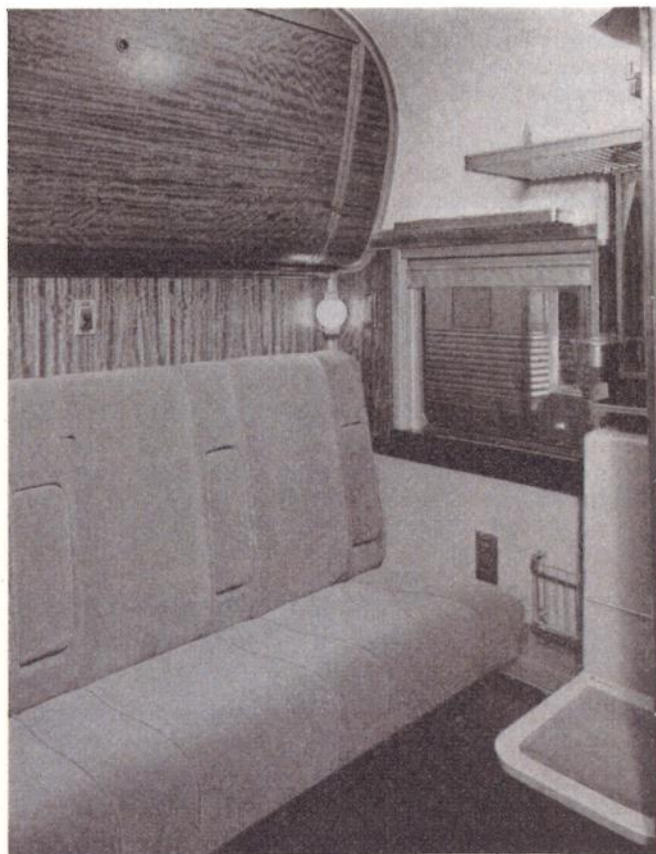
The connected load on the air-conditioning train line is about 75 kw., while that on the lighting train line is about 20 kw.

In addition, there is a two-wire battery train line. There is a 430-amp.-hr., 32-volt Exide MVAHT-25 battery in the auxiliary engine room, and another 217-amp.-hr., 32-volt, MVAHT-13 Exide battery in the eighth car. The battery train line is used for battery charging, air-conditioning and heating control, generator excitation, emergency lights, brake control and train signals.

Electrical connections between cars equipped with Tight-Lock couplers are made by the spring contacts in the connectors built into the couplers. The same method of electrical connections is used between cars having bolted drawbars. Between articulated units the electrical connections are carried from one unit to the other by flexible cables secured to studs on one body and plugs and receptacles on the one adjoining.

The connectors which form part of the couplers include two air connections, one 2-in. steam line, 11 power contacts and 30 control contacts. A drum switch which is mechanically interlocked with the air-line valves opens the control contacts which are normally energized. Separate connector isolating contactors de-energize exposed connector-line contacts when cars are separated.

Under usual conditions of operation two generators are used on the air-conditioning train line and one on the lighting train line. It is possible to put any generator on either train line, and, in any case, when two are connected together it is necessary to synchronize the second generator placed on the line. No synchroscope is required to connect the machines in parallel. When a second machine is to be put on the line it is brought up to speed by means of the engine, and when full speed is reached a centrifugal speed switch closes line con-



Interior of One of the Bedrooms

tactors which connects the second machine to the bus without field. The generator has an induction or amortisseur winding, which tends to hold the speeds together. The field is then applied which pulls the second machine into step. Generator excitation is obtained from the battery.

Each of the four power units in the auxiliary power car includes a Leece-Neville 1,500-watt, 38-volt d. c.



Ladies' Dressing Room in One of the Sleepers

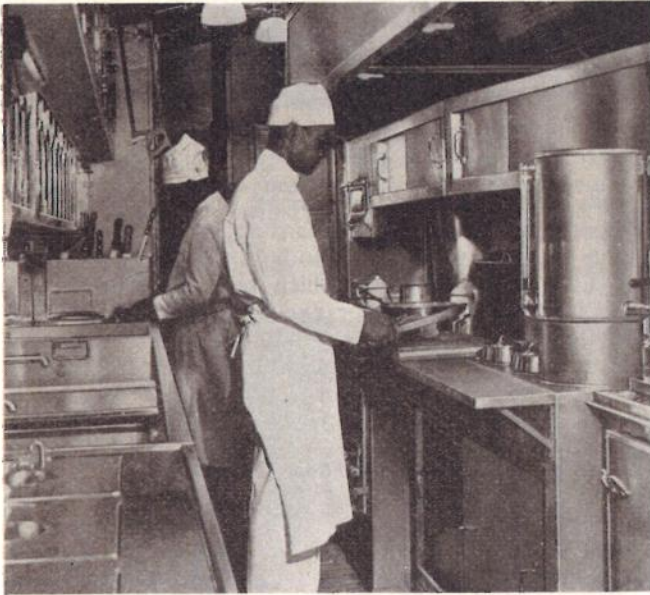
auxiliary generator. Normally the current developed by the auxiliary generators is used for battery charging. This power source may be supplemented by a motor-generator set, which derives its power from the a.c. train line. It consists of a General-Electric 220-volt, 3-phase, 60-cycle motor, driving a 5-kw., 38-volt d.c. generator.

Standby power for operation of the air-conditioning equipment may be supplied to each car separately through a Pyle-National receptacle. There is a red pilot light adjoining each receptacle, which, when lighted, indicates to the electrician inserting the plug, first, that the connection is completed and, second, that phase rotation is correct. A phase-rotation relay on the power panel in each car holds the standby power circuit open if phase rotation is wrong.

There are also a.c. standby power receptacles on the third, fourth and eighth cars, which can be used to supply power to the lighting train line feeding all essential services. Each of the two cars equipped with batteries is also equipped with Pyle-National battery-charging receptacles.

Air Conditioning

The air-conditioning equipment is as made by the Frigidaire Corporation and consists of electrically driven compressors and condensers mounted beneath the floor of the cars with overhead thermostatically

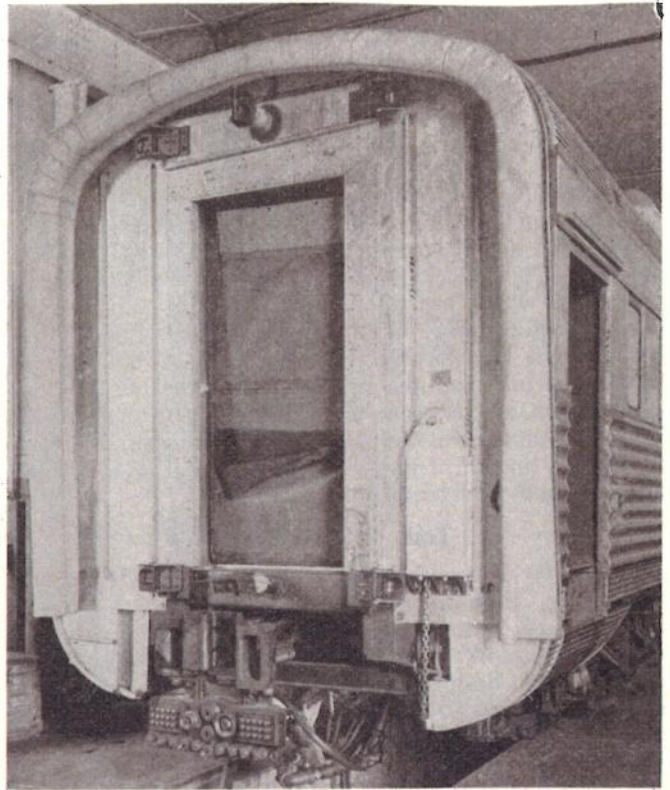


The Kitchen

controlled, combination cooling and heating units and blowers. Each of the air-conditioning compressors is driven by a 220-volt, 3-phase a.c. line-start induction motor, with a full-load current of 38 amperes and a starting current of 166 amperes. A device called a program starter makes it impossible for two or more motors to start simultaneously.

The air distribution is accomplished by openings in overhead ducts. The coaches, lounges, dining car and parlor car are fitted with overhead air ducts which deliver the conditioned air through an opening between the false ceiling and the underside of the lighting duct. The ducts are provided with vanes and other means for controlling delivery of air. In the section cars conditioned air is delivered by openings in the underside and on the side of the overhead ducts and, in addition, the air is conveyed to the lower berth by ducts built into the section headboards.

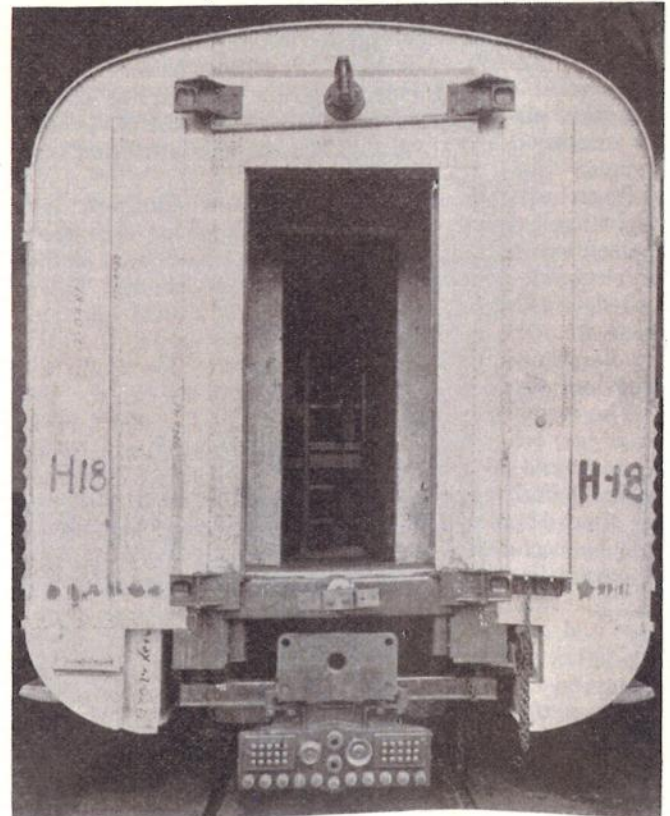
Filtered fresh air for the air-conditioning system is



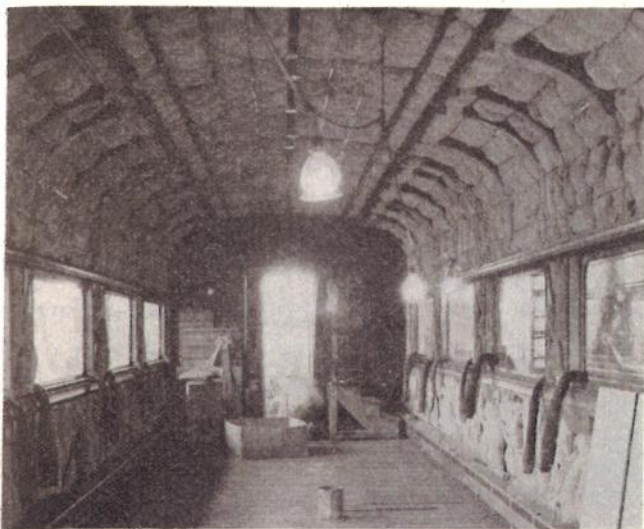
End of a Car—the Inner Diaphragm Is Not Yet in Place

taken through openings in the sides of the car roof. Side-wall radiators, under thermostatic control, are located close to the floor. The thermostatic control of the overhead and floor heat and cooling equipment is similar to existing installations on air-conditioned cars.

The kitchen ventilation comprises an air curtain to



A Semi-Permanent Drawbar Connection



Application of the Insulation

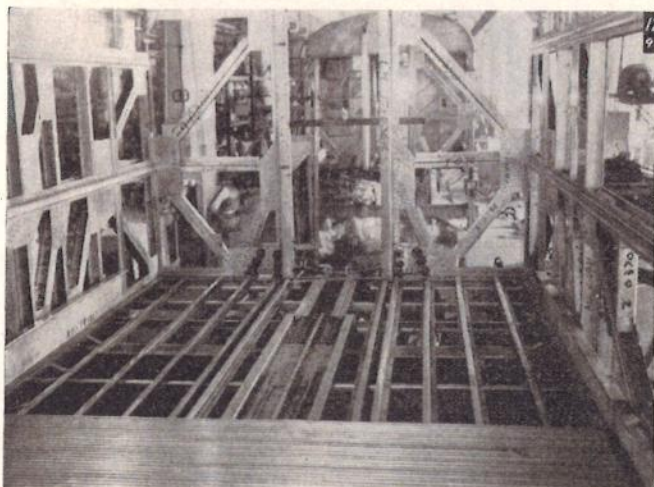
prevent kitchen odors from reaching the dining room, and three large Safety overhead exhaust fans. The air curtain is formed by outside air, taken through a grilled opening in the roof side, which is directed across the pantry-dining-room doorway in a layer from a duct constructed on either side of the doorway. The exhaust fans draw only a small amount of conditioned air from the dining room in excess of the air from the curtain.

Despite the lack of perceptible drafts the circulation of air in these cars is complete every two minutes. Enough fresh air is taken in during the operation of the air-conditioning equipment to provide a change of air in approximately seven minutes.

Lighting

Thirty-two-volt lighting is used throughout the train. There is a 5-kv.a. single-phase transformer in each car. These transformers are connected over the three phases of the lighting train line, so as to balance the load in each phase. In addition to the 32-volt secondary for lighting, the transformers have a 110-volt tap which supplies outlets in washrooms, drawing rooms, bedrooms and compartments for electric razors, heating pads, curling irons, etc.

Emergency lighting is supplied from the battery. In case there is no 220-volt a.c. power available, a relay



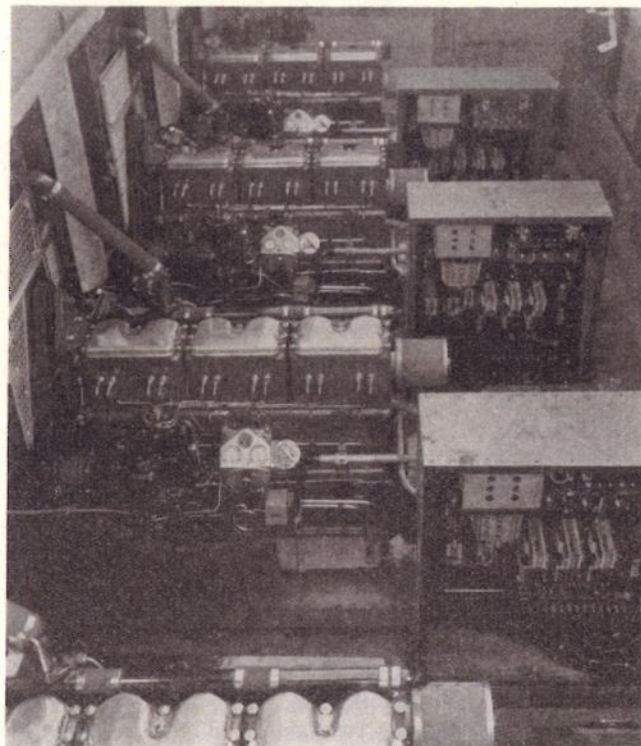
Details of the Frame and Floor Structure

connects certain interior car lights, passageway lights, markers, etc., to the d.c. train line. When the a.c. circuits are again energized the relay is restored automatically to its former position and all lights are again operated from the ac. power source.

All cars but sleepers and the observation-lounge section of the rear car have general indirect lighting provided by lighting troughs on either side of the central ceiling air-conditioning duct. The troughs are equipped with 25-watt lamps on 10-in. spacings, where the light is not augmented by baggage-rack fixtures.

Baggage-rack fixtures are used in coaches and in the parlor section of the rear car. These are Safety Car Heating & Lighting Company fixtures, having double prismatic light distribution control and individual toggle switches. There is one 25-watt lamp in each unit and there is one unit over each coach seat or over each chair in the parlor section. Where baggage-rack fixtures are used the ceiling ducts have 15-watt lamps on 15-in. centers.

Luminator lens-type lighting units with 25-watt



Four Diesel-Generator Sets Carry the Auxiliary and Lighting Loads

lamps are used in passageways, vestibules and in some washroom locations.

Two new types of Safety fixtures are used in the sleepers. The ceiling lights consist of an inverted white bowl, in which the light source is concealed by a longitudinal aluminum strip or band. Glass risers on either side of the band further diffuse the light. The unit is equipped with a 75-watt lamp.

The lower-berth lamps are also novel in form. They are spherical and are made of opal glass with a clear-glass circle or lens to furnish localized intensity for reading. One of them is fitted with a blue night light controlled by a toggle switch under the window sill. Each light has its own toggle switch for its 25-watt white light. The upper berths have two 15-watt fixtures of semi-spherical opal glass. The floor is lighted by aisle lights placed between alternate pairs of sections and staggered on opposite sides. Edge-lighted symbolic glass signs at the ends of the car show the location of

men's and ladies' washrooms. In the washrooms there are lights over the mirrors, and in the ladies' rooms there are four column lights on either side and between sections of the dressing-table mirror. The rooms in the bedroom car have ceiling, mirror and berth lights.

The observation section of the rear car has diffused lighting fixtures, making continuous cove lighting over the windows. These cove lights are fitted with double 25-watt receptacles on 20-in. spacing. General lighting and lighting decoration is provided by a central ceiling light of molded flashed opal glass. It is semi-cylindrical in form and is made in ribbed sections which provide a

All car piping is of copper tubing. The piping on the trucks is extra-heavy wrought steel. The staffless wheel type hand brakes are installed in vestibules of each train unit. These are so placed that only the wheels are exposed to passenger view. The wheels are finished in white bronze in harmony with the metal interior trim of the cars.

Trucks

All car trucks are four-wheel, equalized swing-bolster type with 33-in. wheels on 8-ft. centers. Each truck is furnished with four hydraulic shock absorbers to dampen

Partial List of Specialties on the Chicago, Burlington & Quincy Denver Zephyrs

Diesel engine	Electro-Motive Corp., Cleveland, Ohio	Wire	Okonite Co., Passaic, N. J.
Auxiliary power plant.....	General Electric Co., Schenectady, N. Y.	Electrical fittings and charging receptacles	Pyle-National Co., Chicago
Stainless steel	Cummins Engine Co., Columbus, Ind.	Floors	Armstrong Cork Co., Lancaster, Pa.
	United States Steel Corp., Pittsburgh, Pa.	Carpets	L. C. Chase & Co., Inc., New York
	Youngstown Steel Corp., Youngstown, Ohio	Interior panels, wall and ceiling	Pantasote Co., Inc., New York
	Allegheny Steel Co., Brackenridge, Pa.		Masonite Corp., Chicago
Underframes	Lukenweld, Inc., Coatesville, Pa.	Occasional furniture and dining-room chairs	Pullman-Standard Car Mfg. Co., Chicago
End sill castings and truck castings	General Steel Castings Corp., Eddystone, Pa.	Dining-room chairs	Mandel Bros., Chicago
Wheels and axles.....	Bethlehem Steel Co., Bethlehem, Pa.	Seats	S. Karpen & Bros., Chicago
Rubber parts in trucks.....	United States Rubber Products, Inc., New York		Heywood-Wakefield Co., Gardner, Mass.
Side bearings in truck.....	A. Stucki Co., Pittsburgh, Pa.	Upholstery for seats.....	Massachusetts Mohair Plush Co., Boston
King pins in trucks.....	W. H. Miner, Inc., Chicago	Tables, etc.	Formica Insulation Co., Cincinnati, Ohio
Tight-Lock couplers	Ohio Brass Co., Mansfield, Ohio	Rubber seats and cushions.....	Dunlop Tire & Rubber Corp., Buffalo, N. Y.
Shock absorbers	Houde Engineering Corp., Buffalo, N. Y.	Window curtains	Railway Curtain Company, Chicago
Hand brakes	National Brake Co., Buffalo, N. Y.	Drapes	Orinoka Mills, New York
Foundation brakes and springs, both elliptical and coil	American Steel Foundries, Chicago	Venetian blinds	Kirsch Co., Sturgis, Mich.
Air brakes	Westinghouse Air Brake Co., Wilmerding, Pa.	Glass and paint.....	Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Bearings	Timken Roller Bearing Co., Canton, Ohio	Clocks	Chelsea Clock Co., Boston, Mass.
Diaphragms	Morton Mfg. Co., Chicago	Kitchen equipment	Angelo Colonna, Philadelphia, Pa.
Insulation	Alfol Insulation Co., New York	Various bars	Brunswick-Balke-Collender Co., Chicago
	American Hair & Felt Co., Chicago	Railway express	Railway Express Agency, New York
	Dry Zero Corporation, Chicago	Mail equipment	Bethlehem Steel Co., Bethlehem, Pa.
	Kimberly-Clark Corp., Kenah, Wis.	Locks	Russell & Erwin, New Britain, Conn.
Air conditioning	Frigidaire Corp., Dayton, Ohio	Water coolers	Henry Giessel & Co., Chicago
Ventilators and exhausts.....	Hart & Cooley Mfg. Co., Chicago	Water cups and dispensers.....	Logan Drinking Cup Co., Worcester, Mass.
Heating	Tuttle & Bailey, Inc., New Britain, Conn.		Individual Drinking Cup Co., Easton, Pa.
	Vapor Car Heating Co., Inc., Chicago	Lavatories	Crane Co., Chicago
Insulation, pipe	Johns-Manville Corp., New York	Toilets	Duner Co., Chicago
	Keasbey Mattison Co., Ambler, Pa.	Mixer pipes and fittings.....	Chase Brass & Copper Co., Inc., Waterbury
Lighting	Luminator, Inc., Chicago	Miscellaneous plumbing fixtures	Dayton Mfg. Co., Dayton, Ohio
Batteries	Safety Car Heating & Lighting Co., New York		
	Philadelphia Storage Battery Co., Phila., Pa.		

continuous line of light. The light source consists of Lumiline lamps. Sixteen vertically mounted Lumiline lamps are also used to light the rear sign.

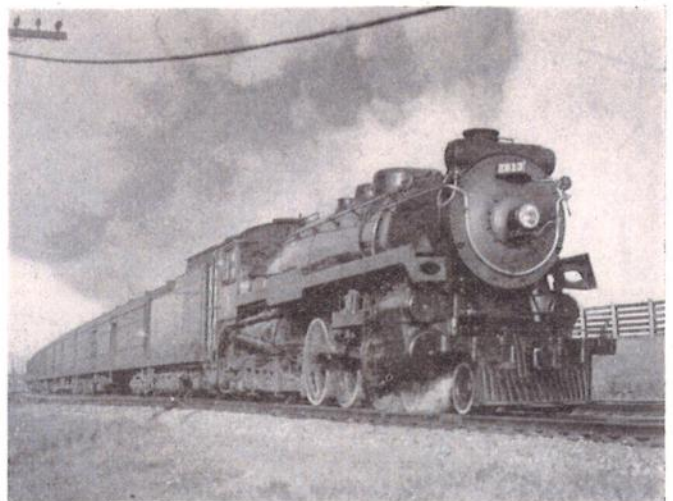
Braking

The operating brake is Westinghouse Air Brake Company's electro-pneumatic modified H.S.C., operated by air pressure supplied by the locomotive and controlled by electricity. The trains are equipped with retardation controls which function at four selected speeds and operate in conjunction with speed-control governors on the second and tenth trucks behind the locomotive. The large air reservoirs are made of stainless steel and the smaller ones of aluminum. In order that full advantage of this braking system may be taken the third and seventh body units are furnished with sand boxes and sanders. These sand boxes are placed at the rear of lockers in these cars and occupy space which is usually of little value. The filling door is on the outside panel and they can be filled by bucket or hose.

The communicating signal is electro-pneumatic up to the first car in which is placed a solenoid valve to reduce the pressure and to operate a charged signal pipe in the tractor unit. Push buttons are located throughout the train in vestibules and similarly important locations. In the table of the rear car there is a control box in which are train-signal push buttons, a back-up control valve, switch for the back-up light and valve for the back-up horn. This equipment is normally out of sight under the table top, but an easily operated trap door presents the entire set of controls for each operation.

the lateral swing action. The vibration and sound-deadening is controlled through the generous use of special low cold flow rubber at strategic points. The journal bearings are made by the Timken Roller Bearing Company and are provided with a special housing cover where the speed-control drive is taken. Castings are made of nickel steel, double annealed and drawn, and equalizers, spring-hanger safety straps, crossbar and swing hangers are made of forged steel.

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On the Canadian Pacific near Ste Anne de Bellevue, Que.