

Twin Coach

BY E.R. FAGEOL KENT, OHIO



PATENTS PENDING

THE TWIN COACH

*Dedicated to the
Betterment of Transportation*

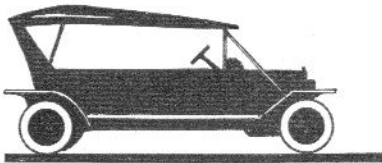
THE development of coach transportation and the efforts of Frank R. Fageol as a transportation engineer coincide—the one history is the other's history.

Frank R. Fageol has designed a new tool of transportation for America's fastest growing form of travel.

Just as the Safety Coach type excelled those coaches they replaced—so does the Twin Coach surpass present day equipment.



The Development of the Motor Coach

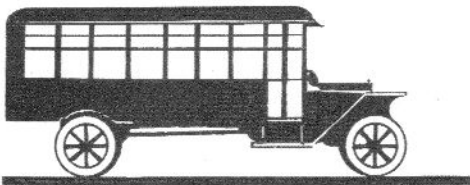


7 PASSENGERS

1916 to 1922

Cycle One:

The forerunners of the modern highway coach equipment were enlarged and rebuilt touring cars, and modified trucks altered to accommodate passengers. These makeshift devices served the infant motor transit industry satisfactorily as could be expected, until the traveling public became weary of their discomforts and the operators saw that they were less profitable than properly designed coaches.

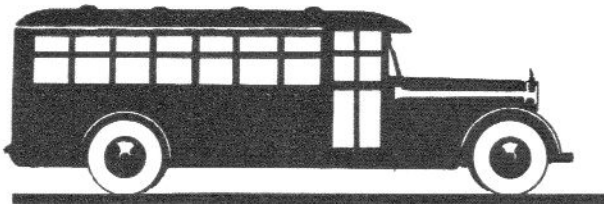


20 PASSENGERS

1922 to 1927

Cycle Two:

The second period in Motor Coach Transportation was ushered in by the designing of Safety type Coaches by Fageol. Here was a type of coach which more nearly satisfied the public's demand for safety, comfort and reliability. With rapid strides, motor transit grew in popularity. New routes—new companies sprang up with surprising rapidity. The advent of the Safety type Coach revolutionized the business.

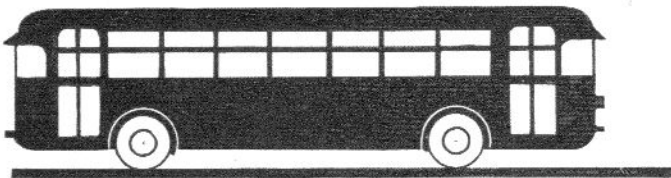


29 PASSENGERS

1927 to ?

Cycle Three:

But even the Safety Coach Type has been passed in the march of progress. The ideal of designers has been to design a motor coach wherein stresses and strains, set up by the inequalities of the road, could be equalized and distributed over the entire area of the coach. In the Twin Coach this has been accomplished and a new era opened—the third in the history of motor coach transportation and design.



40 PASSENGERS

Best of all in this new era the operators find an adequate Capacity—40 seats in the street car type and 37 in the interurban or parlor car.

The New Era in Motor Coach Transportation—Both Urban and Interurban

Now Comes the Greatest Rider Appeal of All Coaches

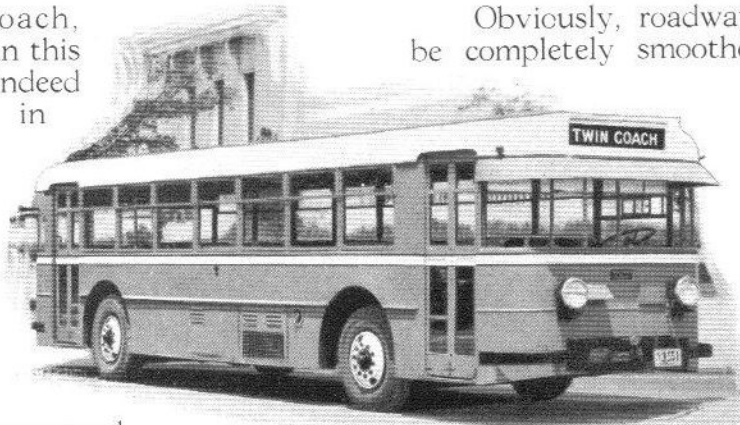
THE Twin Coach, which ushered in this third era, is indeed revolutionary in appearance and general construction. And yet, upon careful analysis, there is nothing experimental or untried about it. The Twin Coach uses standard type motors, standard three-speed transmissions, standard universal joints and drive shafts, standard worms for driving, standard air brakes—metal to metal, standard wheels, standard steering mechanism, standard type front axle, standard spring construction of latest type. In fact, there is not a single untried mechanical feature in the Twin Coach. They merely have been re-arranged and proportioned to suit modern motor coach operation.

These changes are the result of long experience and careful study of motor coach design. The history of the progress of motor transit equipment has shown the need of such a departure from old style practices.

With the increasing of sizes and carrying capacities in motor coaches came a tendency toward rigid and semi-rigid construction. This necessarily resulted in greater gross weight and greater weight per passenger.

The disadvantages of increased weight were not, however, offset by the advantages gained. For never yet has there been a rigid or semi-rigid design which succeeded in *completely* overcoming the stresses which a coach must meet as long as roadways and streets are what they are. To attain the absolute rigidity desired would necessitate carrying prohibitive weights.

Obviously, roadways and streets cannot be completely smoothed. So, racking and twisting stresses will continue to exist. How, then, shall they be met? Rigid construction only partially succeeds—and at the cost of excessive dead weight. Shall this handicap be accepted as inevitable or can coaches be designed on a radically different principle which will solve the problem?



Frank R. Fageol, who was so prominently connected with the designing of the Safety Coach, has studied this problem and sought a solution ever since it became apparent that present type Coaches could not satisfactorily overcome twisting and torsional strains.

He saw that the earlier Coaches, wherein capacities were smaller, weights lighter and the bodies were semi-flexible, were more successful in withstanding these strains than the later and heavier models.

Twisted front-ends of frames and distortion at the cowls were almost inevitable as weight, capacity and rigidity increased.

Discarding precedent, he has developed a motor coach which distributes torsional stresses evenly throughout a semi-flexible body—which seats 40 passengers, an increase of 40 per cent over old types, and which permits a weight saving of 30 per cent per passenger seat over old types.

So advantageous is this development that there can be little doubt a new era in motor coach building and operating is at hand.

Supported By Operating Features Which Guarantee Profits

All body and other parts on Twin Coaches are interchangeable—readily accessible—easily removed.

40-Passenger Twin Coaches weigh no more than the average 29-Passenger 6-cylinder conventional coach.

Because of balanced load on front and rear axles and the use of 60-inch spring front and rear, Twin Coach rides very easily.

All spring pins are interchangeable and are made of nickel steel, heat treated, hardened and ground, are $1\frac{1}{2}$ inches in diameter by 4 inches long.

Crank shafts in Twin Coach engines are interchangeable, $2\frac{3}{8}$ inches in diameter, made of chrome nickel steel and have seven bearings, the narrowest of which is $1\frac{1}{2}$ inches.

The well-known, efficient Ricardo head is used on Twin Coach engines. The engines are built by Waukesha from specifications by Frank R. Fageol.

The six-foot air compressor and 400-watt generators used on Twin Coaches are driven direct from end of crank shafts.

There are no midship drive shaft bearings in a Twin Coach.

Twin Coaches are equipped with 4-wheel Westinghouse air brakes and two propeller shaft brakes.

All brake drums, shoes and cams are interchangeable.

The brake drums on Twin Coaches are mounted on the outside of the hub flanges. This means brakes can be relined without disturbing the wheel bearings and this saves much time.

Twin Coach drive shafts are interchangeable, are both alike and of medium length and size.

All clutch, gear, universal joint and worm pressures are cut in half on Twin Coaches.

The Twin Coach has no differential.

Axles are Twin Coach Design, manufactured by Timken. The rear axle on the Twin Coach weighs about 500 lbs. less than differential type rear axles.

The gears on a Twin Coach are shifted with a single lever, just as easily and effectively as a single motor shift.

Either side of the Twin Coach rear axle can be removed in few minutes, including all bearings and working parts and without disturbing the rear springs or main section of the axle.

Frosting of windows in Twin Coach is greatly reduced due to rapid circulation of air through heater system.

The front entrance and rear exit of Twin Coaches, permitting a circulating load, speed up schedules.

Twin Coaches can be washed and cleaned quicker because of symmetrical lines, and lack of hoods, fenders, etc.

Head room of 6 feet $5\frac{1}{2}$ inches is provided throughout entire length of Twin Coach. Also a level floor.

The Twin Coach body and chassis are fabricated into one unit—assuring long life and low depreciation.

Twin Coaches have a total of 110 horsepower—divided to make its application the least wearing upon the component parts of the entire vehicle.



*A Real Advance in Coach Design for Hauling Peak Loads—Man Size
Room For Rush Hours—No More "Doubling" For Interurban Operators*

The New Twin Coach

by Frank R. Fageol

Every Operator Owes It
to His Property to Know
and See This New Vehicle



THE body of the Twin Coach resembles a Pullman car in appearance. It is 31', 2" long, including bumpers and visors, 8', 7" in overall height, and 7', 10½" in width. The front and rear ends are shaped exactly alike. The over-hang is the same in front and rear, 83" from the front axle to the foremost part of the coach, and from the rear axle to the rear end.

Body and chassis are built as one complete unit with two main channel beams or sills running full length and serving as the "back-bone" for the entire coach. Cross members, of specially formed channel section, are riveted to these sills to support the body frame. The body posts are 1¼" T-iron and begin at the bottom of the body, continuing above the window line as the window posts and curving at the top to form the sides and ends of the roof. The whole structure is re-inforced with ample gusset plates and all joints are hot riveted.

The floor, of ¾" laminated wood, is perfectly flat and made in four large sections. Paneling of sturdy plymetal with metal on both sides covers the sides and ends of the body from the bottom up to the window belt. The upper curved ends of the body posts are covered with sheet steel on the outside and lined with aluminum on the inside. This forms the sides and ends of the roof. The center section of the roof, 42" wide and 24' long, is made of ¼" plymetal with metal on both sides. This roof construction is strong and light and provides good insulation to keep heat within the body and cold from entering from outside.

The floor, the side paneling and the roof covering brace the frame laterally and provide a bridge construction possessing great strength with a lightness not possible in a standard type of coach.

The windows are mounted in special patented non-rattling metal sash, and are

easily adjusted to any height up to 15". Curved glass windows are provided at the four corners of the coach, although at the customer's option plymetal rear corners are furnished. The windshield and the rear window are in two sections, each of which is $23\frac{3}{16}$ " x 28".

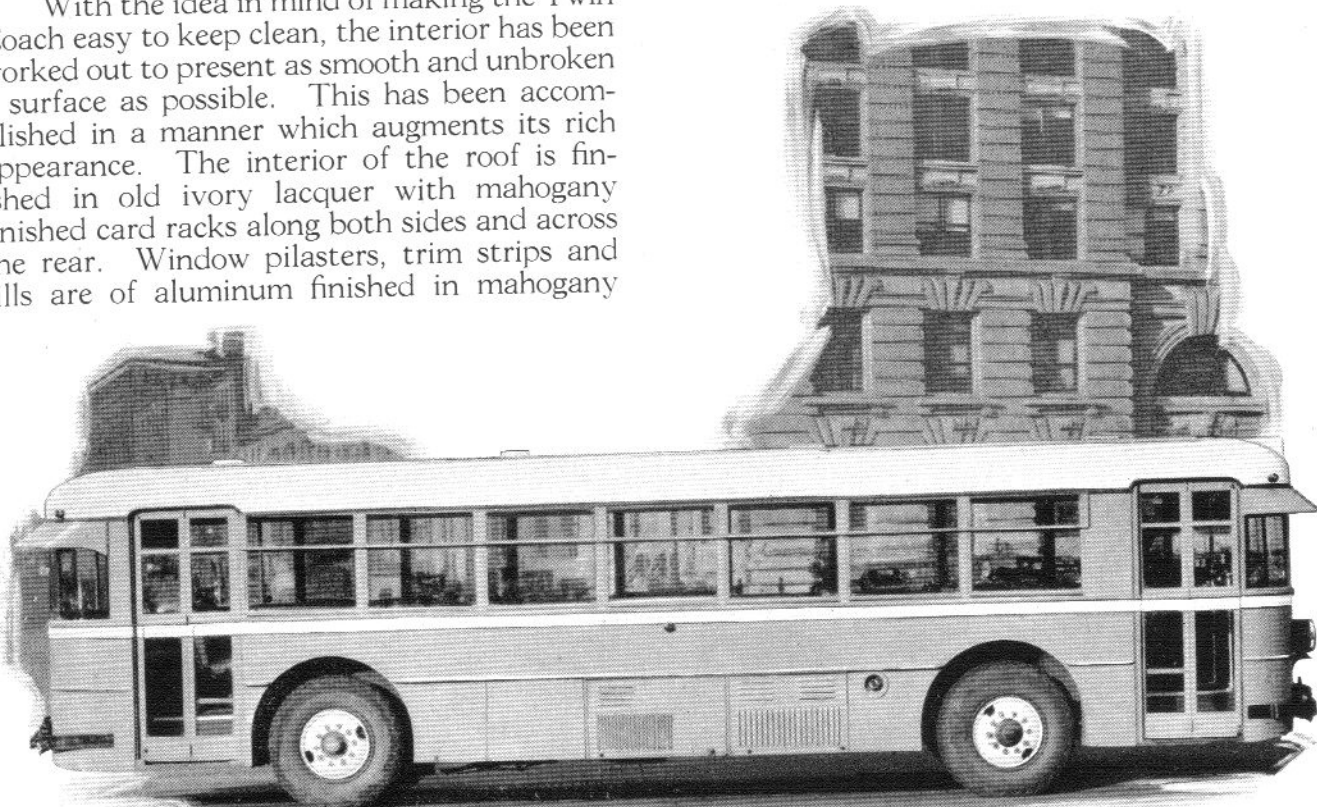
The entrance door is on the right side at the front and the exit door on the right side at the rear. Both doors are air operated on Urban models. They are of the four-leaf, fold out type in two sections and provide a clear opening of 28". Especial care has been taken in working out a method of weather-stripping these doors so as to efficiently exclude cold, rain and dust. The height of the entrance and exit steps is 13" from the ground and the coach floor is $12\frac{1}{2}$ " above the steps. The wide door opening and the easy step height facilitate rapid loading and unloading. Ample floor space inside both doors is provided for standing passengers who have just entered or are about to leave the coach.

With the idea in mind of making the Twin Coach easy to keep clean, the interior has been worked out to present as smooth and unbroken a surface as possible. This has been accomplished in a manner which augments its rich appearance. The interior of the roof is finished in old ivory lacquer with mahogany finished card racks along both sides and across the rear. Window pilasters, trim strips and sills are of aluminum finished in mahogany

and the plymetal paneling below the windows is painted a soft warm gray. The floor is covered with Battleship Linoleum, with the edges metal bound. The absence of heater pipes and other obstructions and the level surface of the floor prevent the accumulation of dirt and rubbish in inaccessible places. The entire inside surface of the coach can be easily washed without damage to the lacquer finish.

The driver's seat is placed in the extreme left front corner with an unobstructed view through the front and to both sides. The curved glass corners eliminate the usual "blind spot" and his range of vision is far wider than in old type coaches. Sitting in the extreme front end of the coach, the driver can most easily judge clearances and avoid collision.

The Urban model provides comfortable seats for forty passengers with ample aisle room for thirty-five standers. The seats are the DeLuxe Street Car type and are provided



*The Period Has Arrived When Every Prospective Buyer Must
Make Certain His Specifications Are Keeping Abreast of the Art*

with grab handles at the aisle end. Aluminum hand rails, for the accomodation of standees are attached to the ceiling and stanchions of the same material are conveniently located at the entrance and exit doors to assist passengers in entering or leaving the coach. All models have a minimum head room of 6', 5½" with a level floor throughout.

The Parlor Coach model seats 37 passengers comfortably. The seats are of the wicker chair type with high backs and combination spring and pneumatic cushions. The backs are provided with a soft head roll. The seat arrangement is such that each passenger has ample room.

The windows of the Parlor Coach are fitted with "Sunfast Silk" curtains attached to nickel-plated rods at top and bottom and tied back to the window pilasters at the middle. Substantial overhead baggage racks of large capacity run almost the full length of the coach. These are arranged on each side so as to preserve the full head room (6', 5½") in the aisle. Each passenger's baggage is easily accessible and, being inside the coach, it is protected from rain and dust.

The design of the Twin Coach makes it possible to employ what is known as an "indirect radiation" system of heating which not only ventilates the coach but also efficiently heats it, even in severe weather.

The fans provided for cooling the engines draw part of their air from the interior of the coach through openings under two of the seats. This, with fresh air taken from outside, is drawn through the engine radiators and, thus heated, is forced back into the coach through adjustable openings in the engine housings, escaping eventually through four ventilators in the roof.

In mild weather the hot air openings into the coach may be closed and louvers, in the

outside panels of the engine compartments, opened. The hot air is then blown out through these louvers. Fresh air is admitted to the coach through two ventilators in the front end and through the windows, the circulation being assisted by the engine fans as before.

Wiring for the interior lighting and signal buzzers is concealed under removable panels thus making it easy of access in case of trouble. All wiring is protected by flexible "loom" and soldered terminals are provided at all connections. The interior of the coach is lighted by ten dome lights fitted with 21 candlepower bulbs. Two "Tiltray" head lights are at-

tached to brackets on the front end of the coach 60" apart. Marker lights with colored lenses are mounted at each corner of the coach at the roof line and a combination stop and tail light with license plate bracket is attached to the rear. A "Hunter" illuminated destination sign with a glass opening 7¼" x 42½" is built into the coach at the front. The

sign roll will be lettered to suit the purchasers' specifications.

The front and rear ends of the coach are protected by rugged spring steel bumpers bolted through to the body frame. Pressed steel rub rails, extending the full length of the body, are riveted to the side panels about three feet from the ground.

The exterior of the coach is finished with pyroxylin lacquer in colors to suit the purchaser. This finish is extremely hard and durable and has been found to be most satisfactory for motor coach service. It is weather proof, quick dripping and can be easily patched in case of damage. A reasonable amount of lettering will be applied without extra cost to the purchaser.

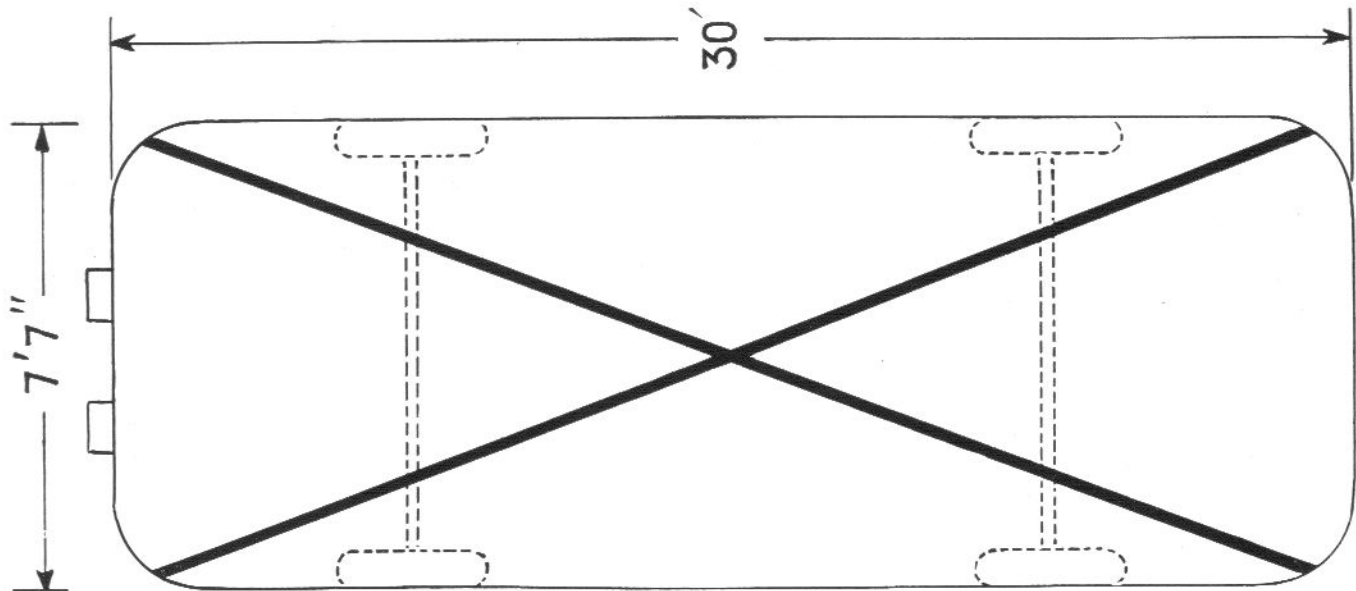
Turning Radius

THE Twin Coach will turn in a surprisingly small space. Placing the front wheels seven feet back from the front end shortens the wheel base to 104 inches as against 230 inches in old type coaches. This reduces the turning radius to 30 feet. A Twin Coach can be parked at the curb six feet behind the car in front and can be driven out without difficulty and without backing.

The Secret of Long Vehicle Life

Weight and Stresses Evenly Distributed

And a Low Depreciation Charge

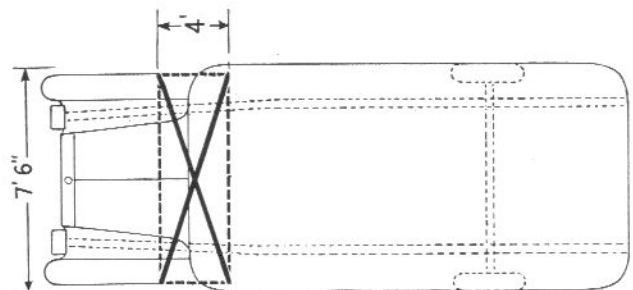


THE Twin Coach, by perfect balance, even distribution of weight and load, and by the use of semi-flexible construction, materially reduces the destruction caused by twisting, torsional stresses and road strain.

The sides of this coach are equal in length, strength and weight from the extreme front end to the extreme rear end. The over-hang is equal on both front and rear axles. And the over-hanging portions of the coach approximately equal in weight and size the portion suspended between the axles.

The axis of twisting is in a diagonal line through the center of the coach which means that all twisting stresses are distributed over an area equal to the length times the width—in a Twin Coach this area approximates 240 square feet.

With a current type coach the side sections are uneven, since the body ends at a point about six feet from the front end of the coach. Because of this and of the semi-rigid body construction, practically all the twisting stresses from road unevenness are concentrated within 24 inches of the dashboard

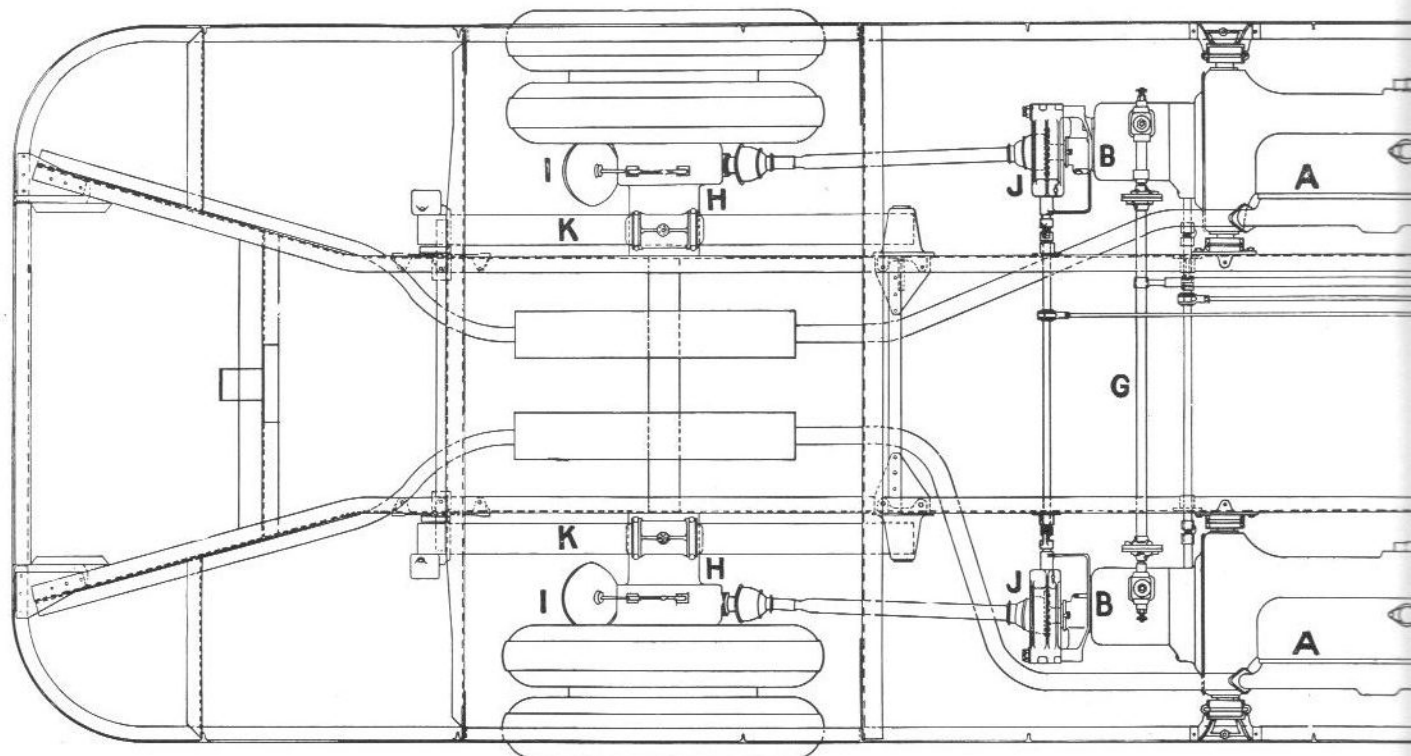


either before or behind. This means that an area about four feet by seven and one-half feet (30 square feet) absorbs most of the twisting stresses in the standard type coach.

Compare this limited area of absorption with the 240 square feet over which these stresses are distributed in a Twin Coach, and you see why the Twin Coach is able to withstand strains which prove disastrous to old type equipment.

In this scientific design lies the reason why it is possible to use lighter construction in the Twin Coach since torsional stresses are not concentrated at any one point.

Interesting Details of the Finely



(A) ENGINES:

Each engine is mounted amidship with easy access from outside and from above inside. Each engine, with its corresponding rear wheel, transmission, radiator, etc., is a complete unit, independent of the unit on the opposite side.

(B) TRANSMISSIONS:

A three-speed and reverse sliding gear transmission attached to each engine with shift shaft connecting the two, so arranged that both shift together, or either one can be disconnected and left in neutral which permits operating coach on one engine. Each transmission has individual dry plate, self-cleaning, multiple disc clutch of ample size.

(C) RADIATORS:

There is a separate radiator for each engine, mounted directly in front thereof. Air is drawn by fan through louvers on side and from vent under seat in interior, thus effecting ventilation. Heated air from radiators can be directed into interior for warmth.

(D) GENERATOR:

The generator is driven direct from front end of crank shaft of right hand engine. It is of 12-volt 400-watt capacity.

(E) COMPRESSOR:

Compressed air is supplied by a two-cylinder Westinghouse air compressor of six cubic feet capacity. The compressor is direct driven off the front end of the left hand engine and crankshaft. Air is stored in two large capacity tanks slung between the two main body sills.

(F) GASOLINE FILLER

Filling the gasoline tank is made easy by running two pipes to the right outside wall, one for filling and one for vent. The cap covering the two pipes is conveniently situated for quick access. Tank is suspended between main body sills and is equipped with gasoline gauge. Feed is by vacuum system.

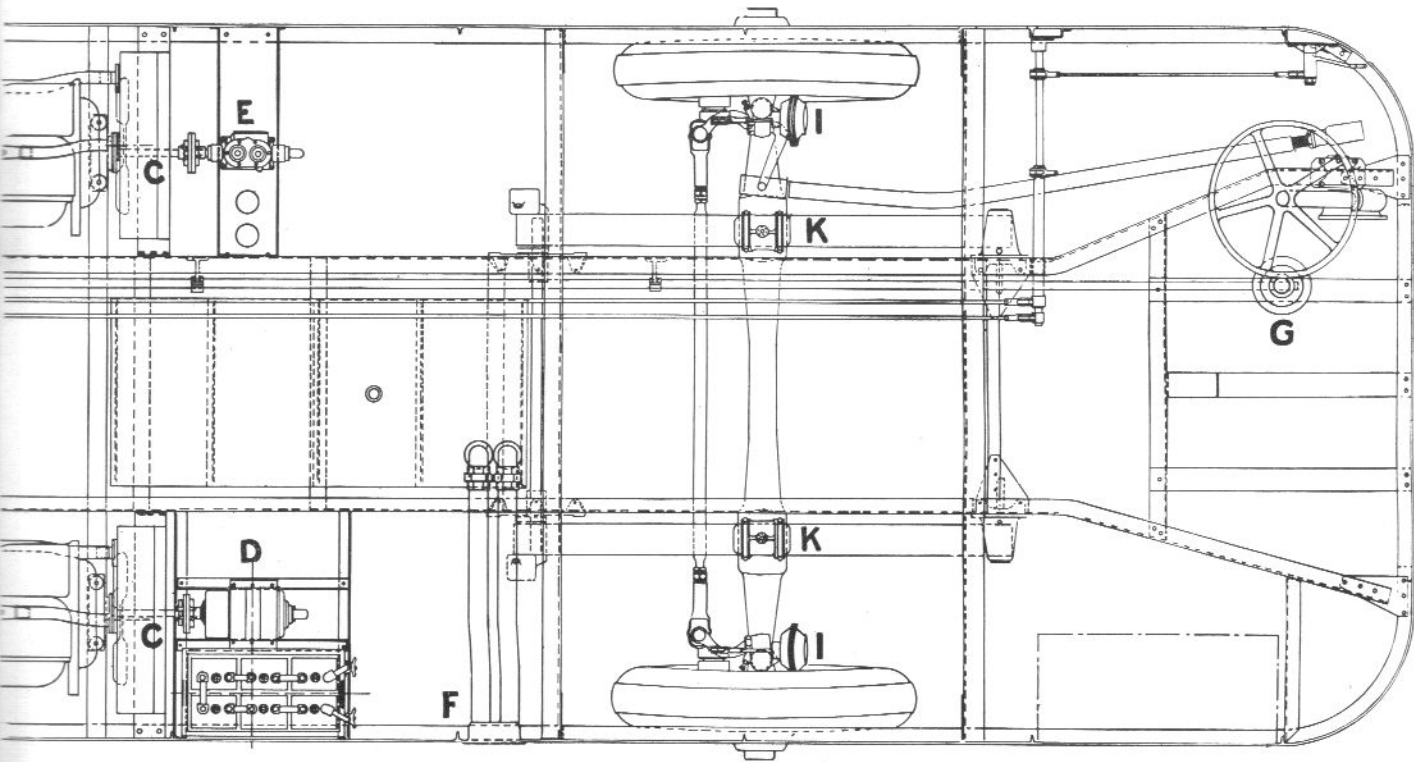
(G) SHIFT MECHANISM:

Synchronized shift control for both transmissions is achieved through one standard shift lever at driver's seat, and connecting rods to transmissions.

(H) WORM DRIVES:

The worm and gear of each rear wheel is encased in a steel cast housing. The drive to the worms is through drive shafts 40" long, 3" in diameter with 400 series Spicer Joints on each end.

Balanced Twin Coach Chassis



(I) SERVICE BRAKES:

All four wheels are equipped with Westinghouse air operated brakes—actuated by the conventional type foot pedal through a Westinghouse brake valve. Brake drums are high carbon steel and wear to a hard glass surface. The brake shoes are of the "throw away" type—16½" in diameter with a 4" face. Brake drums, shoes, hinge-pins, etc., are interchangeable for front or rear wheels and right or left sides.

(J) EMERGENCY BRAKES:

Drive shaft brakes are installed on each of the two drive shafts. They are operated by synchronized control from the driver's seat. This provides three completely independent sets of brakes.

(K) SPRINGS:

The Twin Coach is carried on four chrome vanadium steel springs, each 60" long and 4" wide. These springs are practically flat under load and are mounted with the front ends higher than the rear so as to absorb the horizontal component of road shocks as well as the vertical.

The springs are attached to the main body sills by

special brackets at the front ends and by "shackle bars" extending clear across the body at the rear ends. These shackle bars, instead of passing through the body members, are clamped to the under sides of them to facilitate removal.

All four springs are exactly alike and are interchangeable, front and rear, as well as the attaching parts. This, manifestly, insures economical maintenance.

STEERING:

Ross gear of the worm and lever type. The worm is cut in such a manner that it has practically no pitch at the center but increases in pitch as the ends are approached. This produces a steering condition that is irreversible in a "straight ahead" position and, at the same time, permits quick action for a "hard over" turn.

FRONT AXLE:

Built by Timken especially for Twin Coach. It provides an extra wide tread (78") without increasing the over-all width of the coach. This insures stability on the road and freedom from "roll" and, at the same time, permits the maximum "cut under" of the front wheels and a small turning radius.



A REVOLUTION IN THE COACH

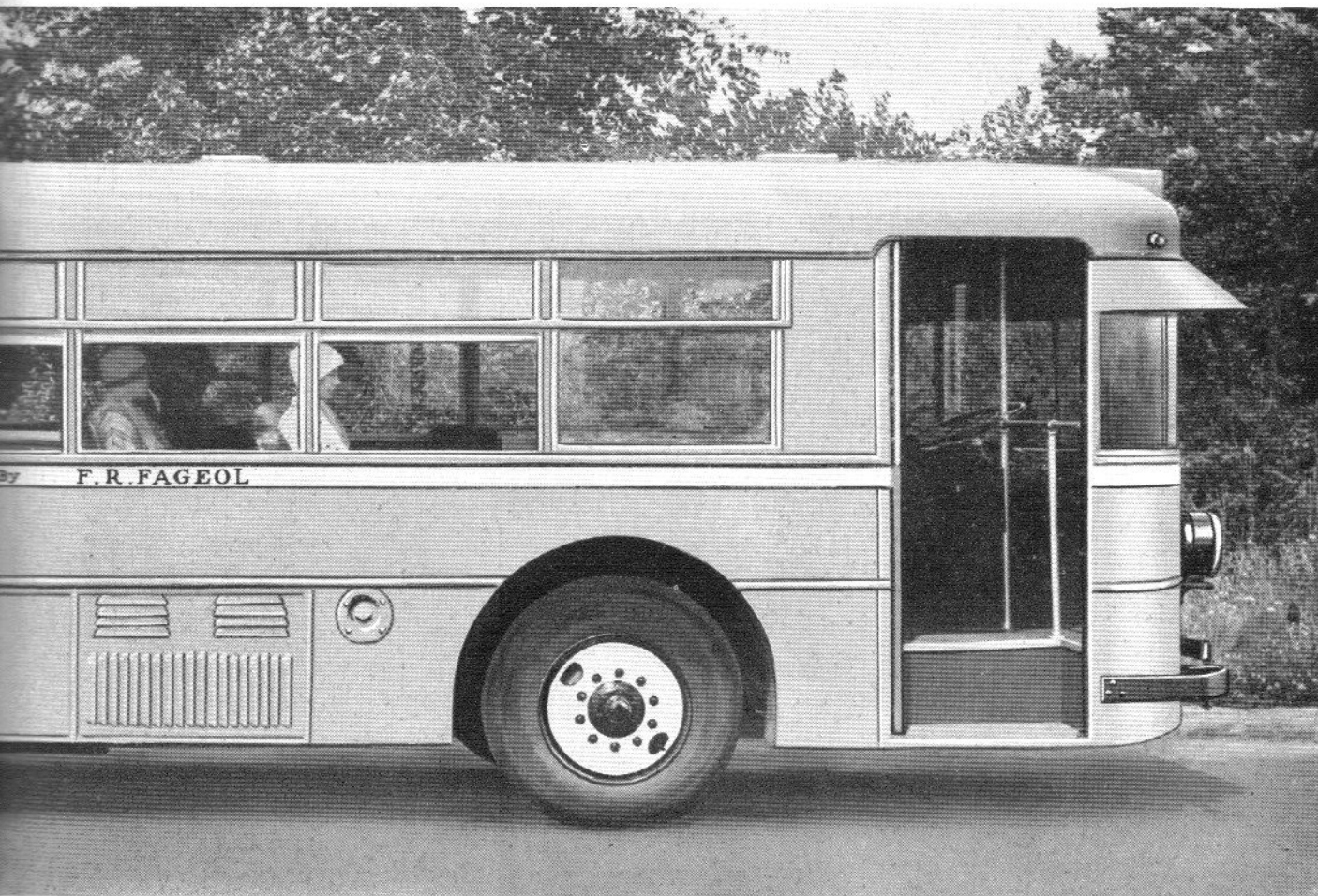
*I*N 1922 throughout the country sped the low-hung safety coach and in a few months there followed the cry, "There goes a Fageol." The Safety Coach did more to bring the advent of mass highway transport than any other single unit. It had rider appeal—a simple term but important to the operator facing competition.

In the following years highway transport was forcing its recognition while federal and state aid added thousands of miles of

paved roadway bidding for improved transport methods.

In the cities enterprising traction officials saw the advantage of the new tool. They sought to take advantage of it in the confines of their own activities. They tried courageously to adopt the half measure interurban coach development to their city service and rightfully declared the principle good but the capacity insufficient.

Every rail man searched for the bigger tool. In his heart he felt it was just around the corner.



BUILDING ART by FRANK R. FAGEOL

In the meantime Frank R. Fageol with his close association with operators began to lay down upon the drawing board, his conception of the tool to meet this urgent demand.

Today, his creation—The Twin Coach—is the center of attraction throughout the transportation world. Carriers everywhere are of one voice in declaring it the greatest contribution to coach operation yet developed.

As a group of the most forward looking operators remarked at a recent gathering:

"Every president and manager owes it to his property to test this new vehicle against his traffic demands."

Frank R. Fageol's maintenance of leadership is based upon that peculiar gift of mechanical analysis which ahead of all strikes through the confusion of practices straight to those elements of design which are suddenly, but none-the-less positively approved as standard—the synonym for "best suited."

The Twin Coach is a revolution in coach art.

KENT, OHIO.



Single Deck Street Car Capacity

Extra Seats—Lower Weight

Insures Operators Added Profit

THE Twin Coach will accommodate 40 per cent more passengers than the current Coach type with 30 per cent less weight per seat.

Practically *all* of the length and breadth of the Twin Coach can be utilized for the carrying of passengers. Therein lies the secret of the extra revenue which operators may expect. In the Urban Street Car Model, 40 passengers can be seated and 35 people can stand.

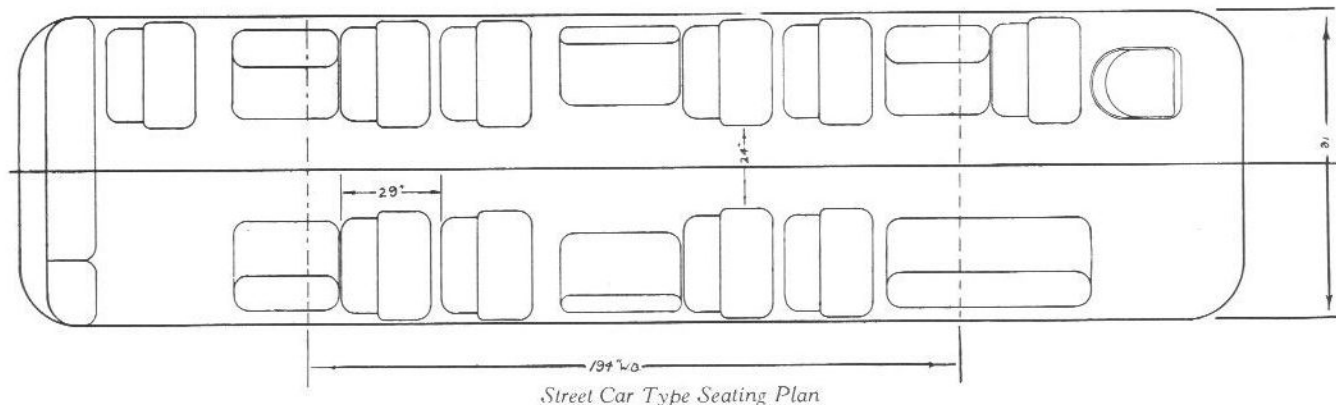
The driver sits at the left front corner. Back of him is a 2-passenger cross seat. Behind this, on the left side, is a 2-passenger longitudinal seat over front left wheelhousing. Back of that come two 2-passenger cross seats. Then a 2-passenger longitudinal seat over motor housing. Next on the left side are two 2-passenger cross seats followed by a 2-passenger longitudinal seat over rear left wheelhousing. Then comes a 2-passenger cross seat and last, a 6-passenger settee-type cross seat clear across the rear of the body.

At the right front is the entrance door, next comes a 4-passenger longitudinal seat



over right front wheelhousing, followed by two 2-passenger cross seats. Behind them is a 2-passenger longitudinal seat over right motor housing and then two 2-passenger cross seats. Next is a 2-passenger longitudinal seat over right rear wheelhousing after which comes the exit door and the long seat across rear end previously mentioned.

For interurban work, the Parlor Car type is generally arranged as shown on right but other plans may be made. There is



Street Car Type Seating Plan



Vision, Comfort and Quiet to Compete With Private Motor Cars

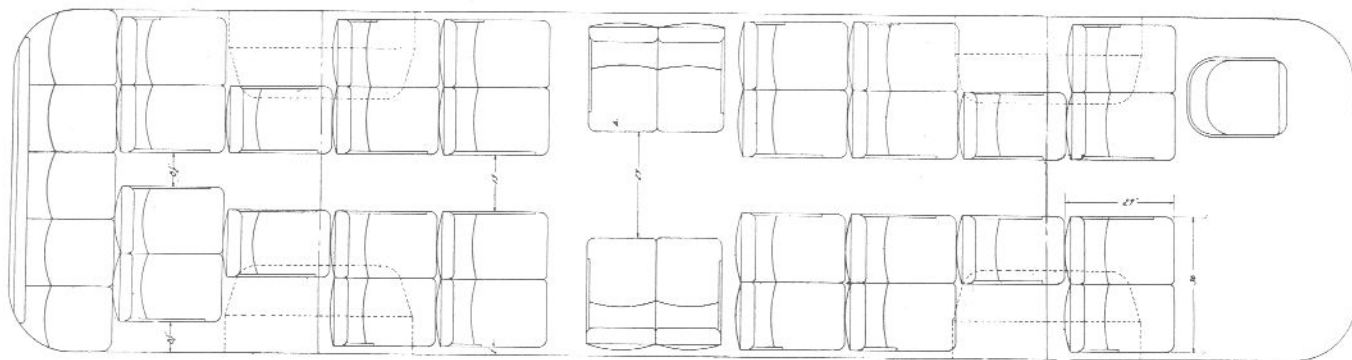
comfortable seating arrangement for 37 passengers on a long journey while at the same time there is available ample baggage room in specially designed overhead racks, fully capable of bearing large size luggage. Special plans will be submitted showing the coach fitted with a rear compartment for larger baggage, or for smoking.

Parlor car traffic already is looking for greater comfort on long journeys and Frank Fageol with his intimate knowledge of operating conditions on the highways has anticipated the patrons growing wishes along these lines.

The parlor car patron in the Twin Coach

will find for the first time real lounging comfort, that much talked about leg room and actually planned baggage space, together with a six feet, five inch headroom which allows a patron to move about if he so desires without embarrassment to himself and other passengers. The new Twin Coach will stop at once the growing resentment by the public against the cramped quarters of the so-called conventional type of parlor car.

This roominess together with the delightful buoyancy of the vehicle and its lack of vibration makes it appeal as no other highway vehicle yet developed.



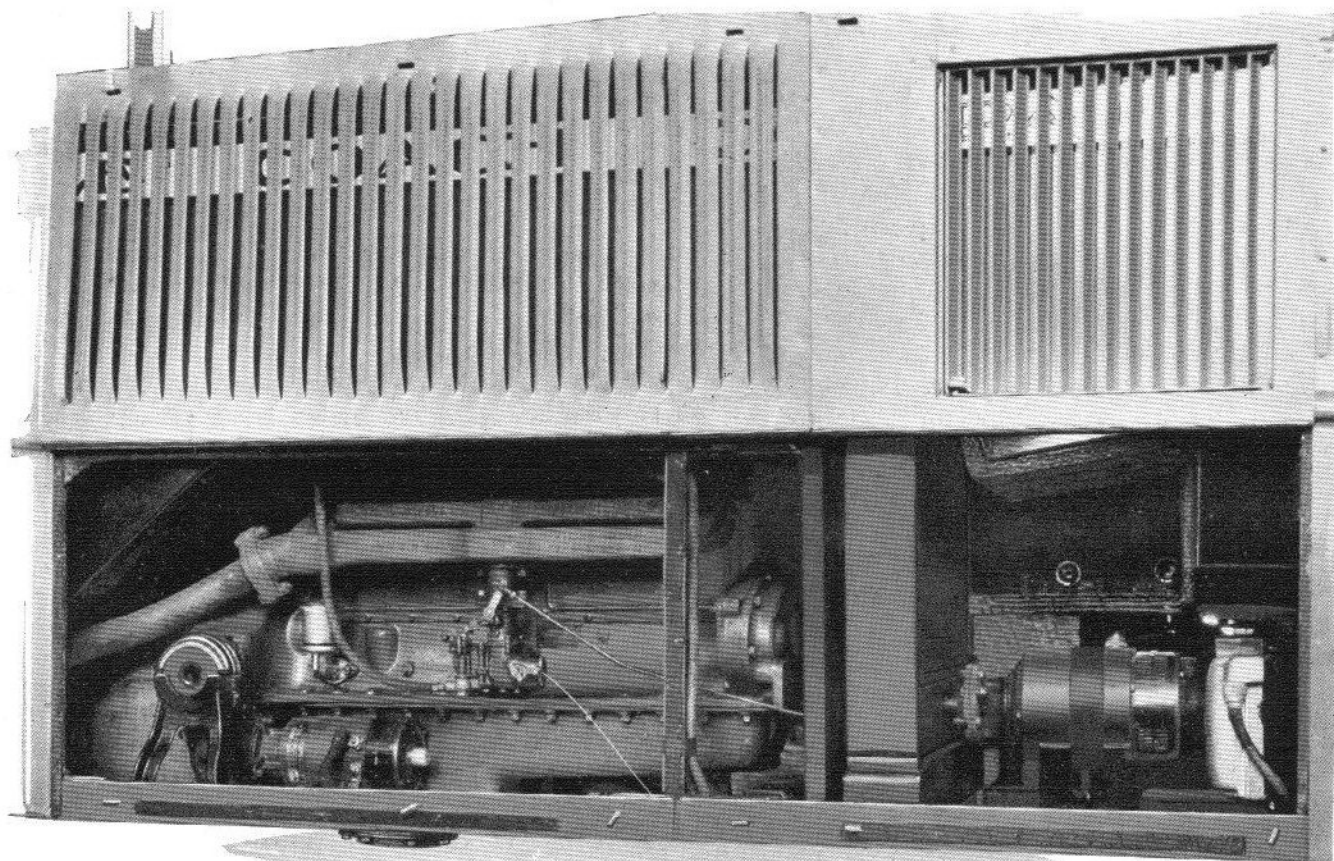
Suggested Parlor Car Arrangement



That Extra Factor of Service

Twin Engines With Single Control

A Principle Aviation Sponsors



TWO six cylinder, 55 H. P. Waukesha engines, employing the famous Ricardo combustion chamber are mounted amidship, one on each side of the coach and between the front and rear wheel. Power is transmitted from each engine to its corresponding rear wheel through a three speed transmission or, in the case of the "gas-electric" coach, through an electric generator and motor. Each engine with its radiator, fan, clutch, transmission propeller shaft and worm drive to its rear wheel, constitutes a complete unit independent of the unit on the other side. In operation, both units are handled with a single set of controls from the driver's seat so that they perform just as a single engine and

drive mechanism would perform. In emergency, either one of the units alone will drive the coach and permit the completion of the run before stopping for repairs thus preventing loss of time through any engine or drive mechanism failure.

The use of two small 55 H. P. engines instead of one large one developing 110 H. P. does not affect gasoline economy because gas consumption is directly dependent upon horsepower generated. Whether the power is developed in one engine or two makes no appreciable difference in the amount of fuel used.

Maintenance costs are less on two small engines than on a single large one because all

stresses and pressure are cut in half by dividing the work between the two and it is high pressure and strain that cause excessive wear.

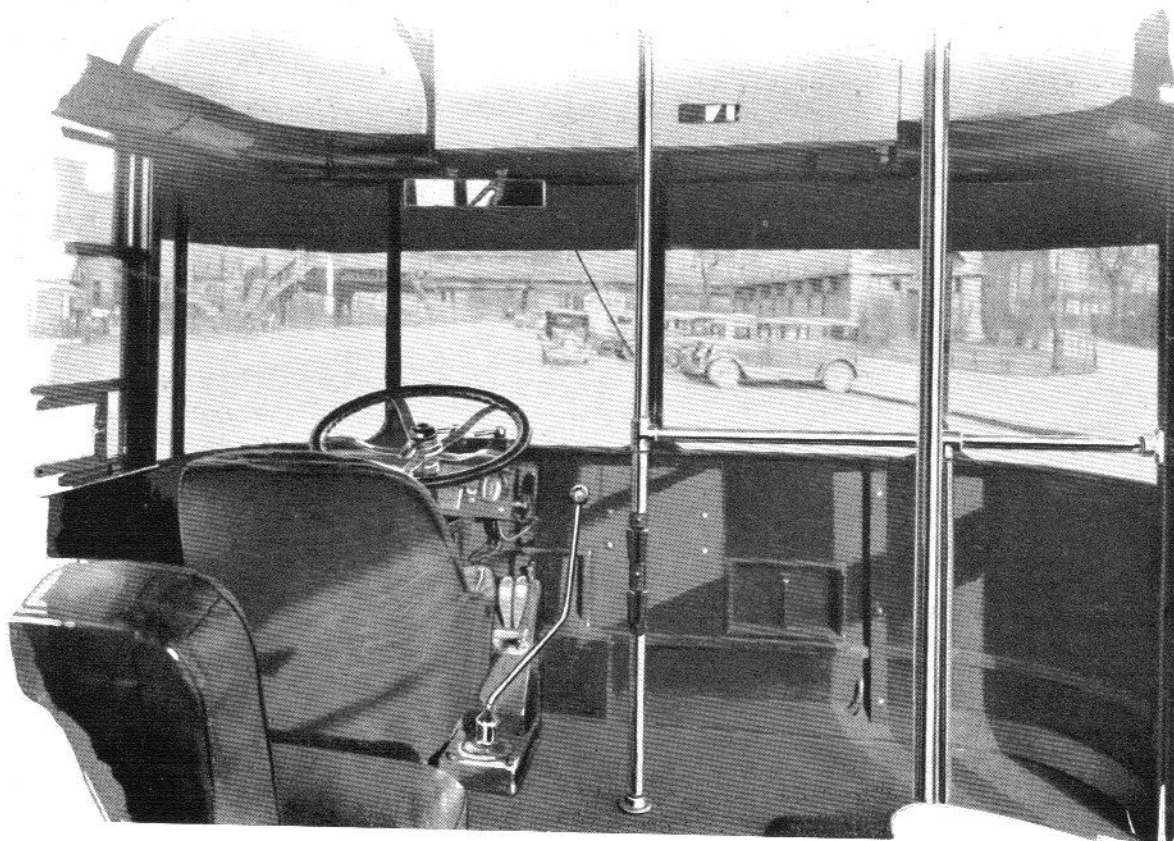
Synchronizing of speeds in the two engines is not a difficult problem. Both rear wheels are the same diameter. Since they will not slip on the road under normal conditions, they will both turn at the same speed and, as each engine is directly connected to its rear wheel, both engines will run at the same speed.

Synchronizing of power in the two engines is accomplished by operating both carburetor throttles with a single foot accelerator pedal, thus giving unified control. With both engines in even average condition, they will develop practically the same power. There will, of course, be variations from time to time but it has been found in practice that these will not affect the satisfactory operation of the coach. As a matter of fact, driving the coach

with one engine entirely cut out and the other doing all the work results only in a reduction of speed accelerating and ability.

The location of the engines, in the sides of the coach, makes them and their accessories extremely accessible for adjustment for repair. An extra large Brown-Lipe multiple disc clutch driving a Brown-Lipe three-speed transmission is mounted in unit with each engine. The two clutches are operated by a single pedal at the driver's left foot, the mechanism being so designed that the clutches will equalize themselves.

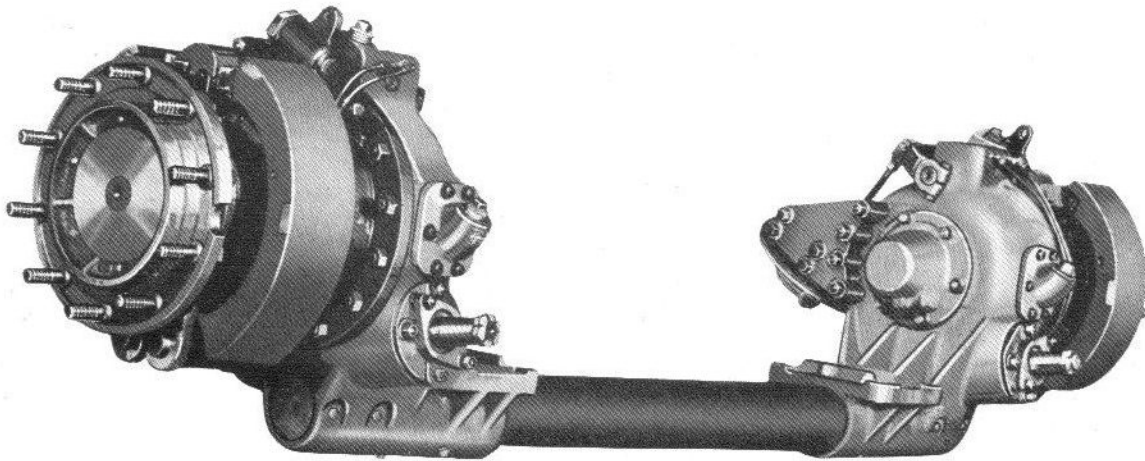
The gears, in the two transmissions, are shifted by a single lever which requires the same motions as the conventional lever in a standard pleasure car or truck. In working out all the controls on the Twin Coach, every effort has been exerted to make it easy to handle and therefore safe to ride in.



Driver Vision in Twin Coaches Will Reduce Accidents

An Axle Which Noiselessly Absorbs Twin Engine Power

With Members Interchangeable



An Axle Without Differential and 500 Pounds Lighter

THE rear axle is built by Timken to Twin Coach design and with Twin Coach tools and fixtures, weighs 500 pounds less than the differential type of axle. This unit consists of a center section of heavy walled steel tubing four inches in diameter carrying cast steel housings, worm drives and bearings, on each end. Spring seats are cast integral with the housings. The tubular center section is slightly tapered at the ends and the housings are pressed onto these tapered ends under hydraulic pressure and riveted.

Each rear wheel is mounted on a short shaft $3\frac{1}{4}$ " in diameter and made of Chrome Vanadium steel—the shaft having a large diameter flange forged integral with it to which the wheel and brake drum are bolted. The shafts are carried on double opposed Timken bearings so located as to be directly over the contact of the tires with the ground. The worm gears are keyed to the inner ends of the shafts which are further supported at these points on non-adjustable roller bearings.

The worm drive is what is known as the "inverted" or "underslung" type. The worm

shaft is also carried on three bearings—two opposed Timken bearings and one non-adjustable roller bearing. The brake shoes and their operating mechanism are supported on the outside of the housing.

Each housing is made in two sections bolted together in a vertical plane in such a manner that the outer half, which carries all the vital parts, can be easily removed as an assembly. This assembly includes the outer housing, the brake shoes with their hinge-pins, retaining springs and actuating cam, the drive shaft with its supporting bearings and the worm wheel. These assemblies are identically the same for both the right and left hand side of the axle and are interchangeable either as assemblies or as individual parts. This interchangeability of right and left hand units materially reduces the number of service parts to be carried in stock. All maintenance operations on the axle, including the dismounting of the housings, can be accomplished from outside of the coach. Therefore all necessary work can be done on the garage floor level and without the use of a pit.



Electrical Drive Equipment

Twin Coaches may be had with either standard mechanical drive, or with Gas-Electric Drive.

The use of Gas-Electric drive necessitates placing the engines 35 inches farther forward than mechanical drive models. This results in a slight change in seating arrangement but does not affect seating capacity.

Engine, cooling system, generator, air compressor and other motor assembly units remain the same as in mechanical drive.

A No. 1105 General Electric Generator is

used on each engine and a General Electric Motor No. 1079 is used to drive each rear wheel. This equipment gives the Twin Coach more Generator and Motor capacity than any other Gas-Electric on the market, with a resultant better acceleration and operating speeds.

Independent drive shaft brakes are provided just back of each electric motor. This gives three independent sets of brakes—just as on the standard mechanical drive models.

Electric generators and motors are very accessible through lower side panels in the body. (See page 21 for diagram.)

Specifications for The Twin Coach

GENERAL DIMENSIONS:

Front and Rear Over-hang.....	83"
Overall Height (loaded).....	103"
Overall Length, with bumpers and visors.....	31', 2"
Overall Length, without bumpers and visors.....	30'
Overall Width.....	95 $\frac{7}{16}$ "
Interior Headroom, Throughout.....	77 $\frac{1}{2}$ "

Road Clearance—

Minimum under rear axle housings.....	8"
Lowest point of body at center.....	12"
Maximum body clearance at ends.....	15"
Tread, Front and Rear.....	78"
Turning Radius (Approximately).....	30'
Wheel Base.....	194"
Weight (Approximately).....	14,500

BAGGAGE RACKS:

(Parlor Coach only) Heavy sheet aluminum overhead baggage rack supported from roof carlines run full length each side above seats. Interior lined with heavy carpet to protect baggage and adjustable straps furnished along the edges for use when necessary.

BODY:

Body Support Cross Members—Specially formed and trussed 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " channels.

Construction—All steel, trussed bridge type completely panelled with plymetal.

Floor—In four sections, made of $\frac{3}{4}$ " laminated wood; covered with $\frac{3}{16}$ " Battleship Linoleum.

Main Body Sills—6" 8 # channel, which also forms chassis side rails.

Overhang—Front and rear, 83". Both ends of body shaped alike.

Posts— $\frac{3}{8}$ " x 1 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ " T-irons, outside covering 18-gauge steel above window line.

Roof—Center section 42" wide, 24' long, made of $\frac{1}{4}$ " Plymetal (metal both sides). Sides and ends of roof formed by main side posts of metal formed to shape and covered outside with steel, lined inside with aluminum.

BRAKES:

Service Brakes—Westinghouse air brakes on all four wheels. Six cubic foot Westinghouse compressor driven direct from front end of one engine.

Emergency Brakes—Two drive shaft brakes, one on each drive shaft operated by one hand lever.

BUMPERS:

Spring steel front and rear with special removable pin and hinge to allow access to tire carriers. Attached directly to ends of main body panels and to reinforcements at sides of body.

CARD RACKS:

Standard width, above window entire length both sides.

CEILING HAND RAILS:

(Urban Coach Only) Polished alumi-

num running full length of ceiling each side above aisle. Short cross hand rail above rear seat.

CHASSIS LUBRICATION:

Myers Chassis Lubricating System used to lubricate all chassis parts, except engines and universal joints.

CLUTCHES:

Extra Large Multiple disc type—actuated by synchronized remote control.

COLLISION STRIPS:

V-shaped metal strips each side of body, 36" from ground level.

CURTAINS:

(Parlor Coach Only) "Orinoka Sunfast," fastened at top and bottom on nickel-plated rods.

DESTINATION SIGN:

Hunter illuminated, type 136 R. B. Size of glass opening 7 $\frac{3}{4}$ " x 42 $\frac{1}{2}$ ". Sign roll will be lettered according to customer's specifications.

DOORS:

Parlor Coach—Entrance ahead of front wheels, air operated; four-leaf fold out type in two sections. Elevation, entrance platform from ground 13". Elevation, entrance platform from floor level 12 $\frac{1}{2}$ ". Non-skid metal doorstep. Emergency door behind rear wheels on right hand side, sedan type with emergency latch. Sedan type emergency door with safety latch may be substituted on left hand side where state law requires, in which case right hand rear door will be omitted.

Urban Coach—Entrance ahead of front wheels, exit behind rear wheels on right hand side. Both doors air operated, four-leaf fold out type in two sections. Elevation entrance platform from ground 13". Elevation entrance platform to floor level 12 $\frac{1}{2}$ ". Non-skid metal doorstep. Sedan type emergency door with safety latch may be substituted on left hand side where state law requires, in which case right hand rear door will be omitted.

DRIP MOULDINGS:

Installed above windows, doors and on

visors, giving protection completely around body.

DRIVE:

Hotchkiss type.

DRIVE SHAFTS:

Two, 43" long, 2" diameter, with 400 series Spicer Joints at each end.

ENGINES:

Two Waukesha 6-cylinder special Twin Coach design. Detachable "L" head type employing the famous "Ricardo" patented combustion chamber.

Bore—3 $\frac{1}{2}$ ", stroke 4 $\frac{1}{2}$ ".

Displacement—260 cu. in. each engine.

Horsepower—S. A. E. 29.4; B. H. P. 55, each engine.

Carburetor—Zenith, model 105.

Cooling—Water circulation by gear driven centrifugal pumps through an extremely large capacity fin and tube type radiators.

Crankshaft—7-bearing, 2 $\frac{3}{8}$ " diameter, Chrome nickel steel, special heat-treated.

Engine Mounting—Three point suspension entirely cushioned with rubber.

Fuel System—Two vacuum tanks, one to each carburetor, from single 50-gallon tank suspended between main sills. Two filler pipes, one for filling and one for vent, extend to right side of body covered by special designed non-detachable cap.

Ignition—Delco distributor, coil and battery type automatic advance.

Starting Motors—Leece-Neville one for each engine.

Battery—12-volt, 150-ampere hour, 13-plate $\frac{1}{4}$ " plates. Sherman type connections.

Generator—Leece-Neville 12-14 volt, 400 watt output controlled by voltage and current regulator. Driven direct from end of one engine.

FLOOR COVERING:

$\frac{3}{16}$ " Battleship Linoleum.

GAS-ELECTRIC DRIVE:

For Gas-Electric a special General Electric generator is driven from the end of each engine. From them current is conducted to two electric motors each of which drives a wheel through worm and gear same as on mechanical drive Twin Coach. Electrical equipment as recommended and furnished by the General Electric Co.

GEAR RATIOS:

Dependent on operating conditions.

HEATING:

Hot air through special vent direct from engine radiators. Distribution of heat provided through ventilation system described below.

HORN:

Bosch, Vibrator type.

INTERIOR FINISH:

Aluminum window Pilasters with Mahogany finish. Plymetal lining below windows, ceiling metal as described under "Roof." Sidewalls below window line painted rich green-grey, ceiling painted rich ivory. Mahogany wood trim at metal joints.

LIGHTING:

Directional Indicator—Operated from driver's seat.

Head Lights—Two, Guide Tilt Ray, type #937 mounted at front end 60" apart.

Interior Lighting—Ten, 5" frosted dome type.

Marker Lights—3" "Beehive" type, each corner of coach at roof line. Front lenses green, rear lenses red.

Stop Light—3" diameter, in unit with—

Tail Light—Mounted on License bracket.

PAINT SPECIFICATIONS:

According to customer's specifications

using Arco Pyroxylin finish. Reasonable amount of lettering will be done without additional charge.

REAR VISION MIRROR:

Installed above driver giving complete view of rear and of coach interior.

RUNNING GEAR:

Front Axle—Timken, extra heavy drop-forged I-beam section, tread 78".

Shock Absorbers—Specially designed rubber snubbing device, non-wearing, and bolted directly to spring. Parlor Coaches equipped with Houdaille shock absorbers on front end.

Spring Pins—1½" diameter hardened and ground operating in bronze bushings.

Springs—Front and rear, attached to main body sills, made of chrome vanadium steel, 60" long, 4" wide, 2" camber.

Rear Axle—Specially designed, Timken underslung dual worm, tread 78".

SEAT CAPACITY:

Parlor Coach—Thirty-seven passengers.

Urban Coach—Forty passengers.

SEATS:

Parlor Coach—Special Deluxe Parlor Car type seats with deep spring cushions in back, with head roll. Driver's seat bucket type, adjustable.

Urban Coach—Hale-Kilburn #208 Deluxe Street Car Seats, upholstered with first quality grain leather, unpleated. Cross seats equipped with corner grab handles. Driver's seat, bucket type, adjustable.

SPARE TIRE CARRIERS:

Located under floor at front and rear end.

STANCHIONS:

Polished aluminum, conveniently located at front and rear doors to assist passengers on entering or leaving coach.

Polished aluminum stanchion also located beside aisle at rear of each engine housing.

STEERING GEAR:

Ross, screw and lever, type #320.

TIRES:

Front 36 x 8 single; rear 38 x 7 dual. At customer's option coach will be equipped with 40 x 10.50 medium pressure single tires all around.

TRANSMISSIONS:

Brown-Lipe Model 50-3S U. P. P. Three forward speeds, and reverse. Gear Shift by special remote control.

VENTILATION:

Two large cast aluminum ventilators built in front of body. Four roof ventilators of ample capacity. Engine radiators draw part of air supply from interior of coach through special vents in engine housings, insuring constant circulation of air inside of coach.

VISORS:

Visors attached above windows at front and rear end.

WHEELS:

Cast steel, with special offset for dual rear tires.

WINDOWS:

All four corners curved safety glass. Plymetal rear corners optional. Windshield and rear windows in two sections, each section 23½" x 28". Windshield, safety glass.

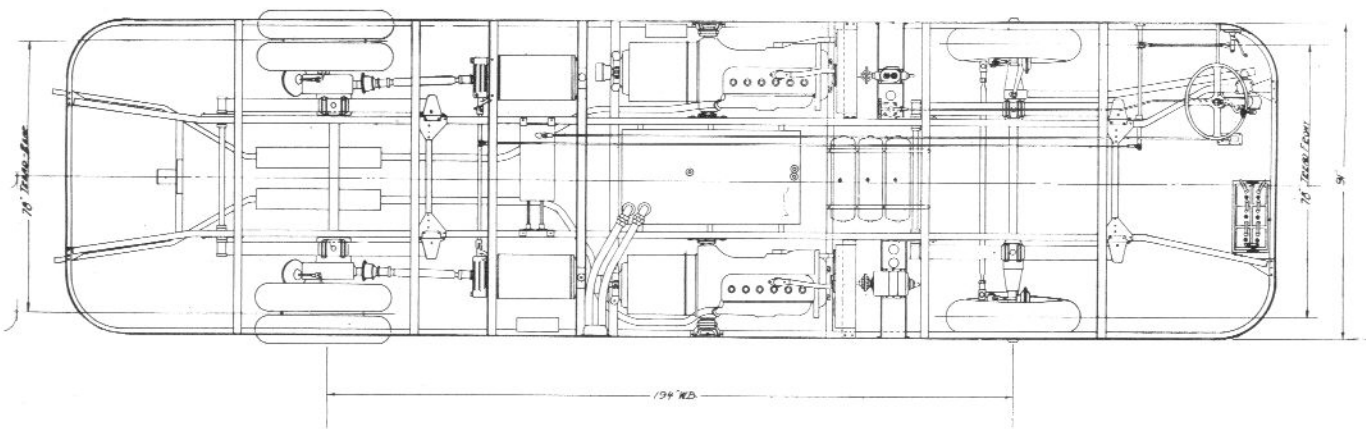
Sash—Heavy duty brass sash of special non-rattling construction.

Side window spaced 36½" centers, lift 15".

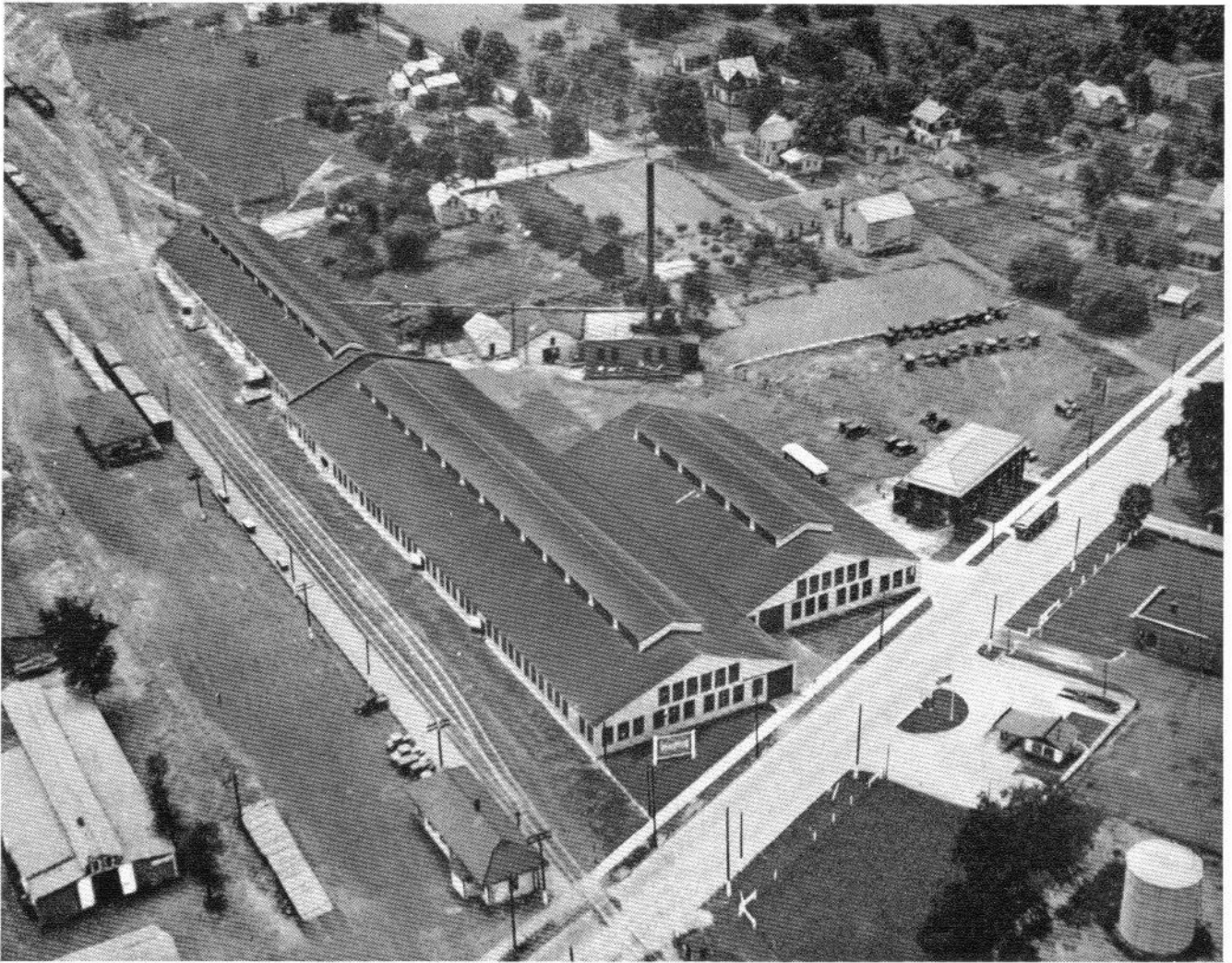
Sliding glass opening at left of driver for signal.

WIRING:

Concealed in removable panel, waterproof and readily accessible.



Chassis Plan For Gas Electric Drive



The Home of The Twin Coach at Kent, Ohio

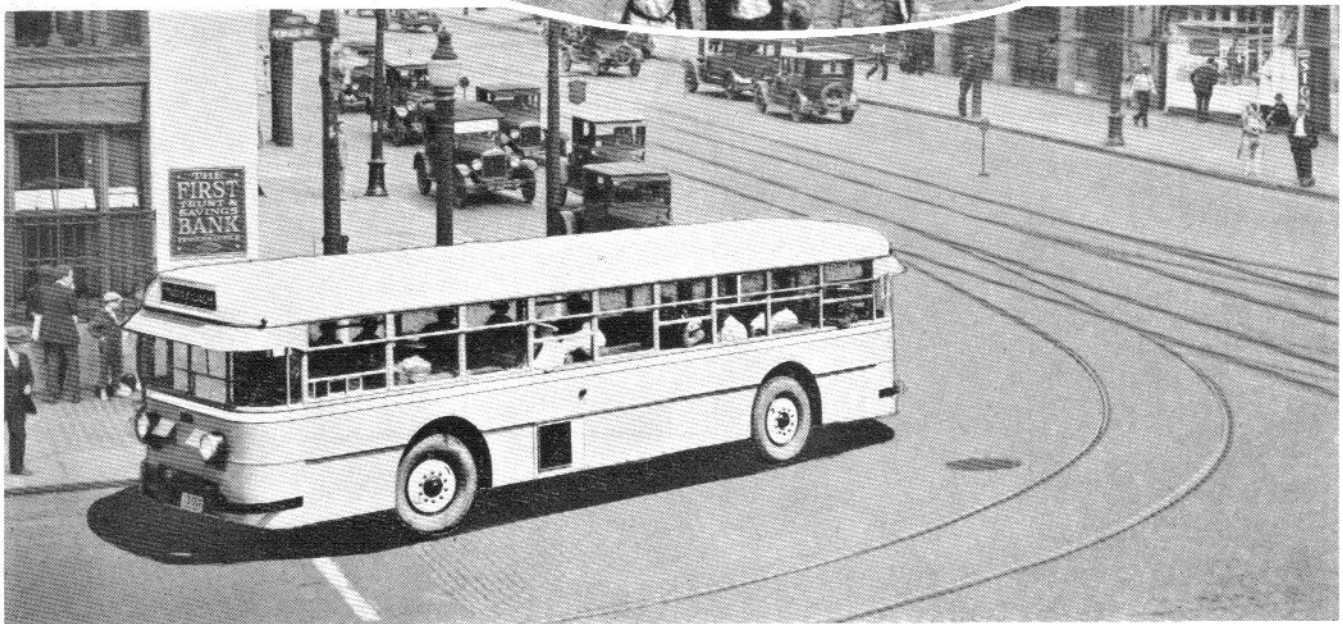
The first factory in the history of the industry devoted to the *standardized* manufacture of motor coaches along the lines of the most highly developed automotive practice.



The front wheels are 7 feet back from the front end - giving a wheel base of 194 inches against 230 inches in old type coaches.



The turning radius is 30 feet—designed from a study of average road clearance.



Maneuverability Speeds Schedules—Cuts Labor Costs

