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Pelabon

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[54] **GAS TURBINE RAILWAY CAR**

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[52] **U.S. Cl.** ..... **105/1 R,** 105/26 R, 105/36, 105/61.5, 105/96.2, 105/329 R, 105/342, 105/452, 105/456, 188/296

[51] **Int. Cl.** **B61c 5/00,** B61c 9/34, B61d 1/00

[58] **Field of Search** ..... 105/1 R, 26 R, 36, 61.5, 105/96.2, 329 R, 342, 452, 456, 4 R; 188/296

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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Howard Beltran

[57] **ABSTRACT**

A high-speed passenger train comprises two identical traction cars, having an engineer's cab at one end, powered by variable speed gas turbines connected to the bogie wheels by hydro-mechanical transmission systems, with one or more trailer cars between the traction cars, one of which can be provided with restaurant facilities.

10 Claims, 4 Drawing Figures

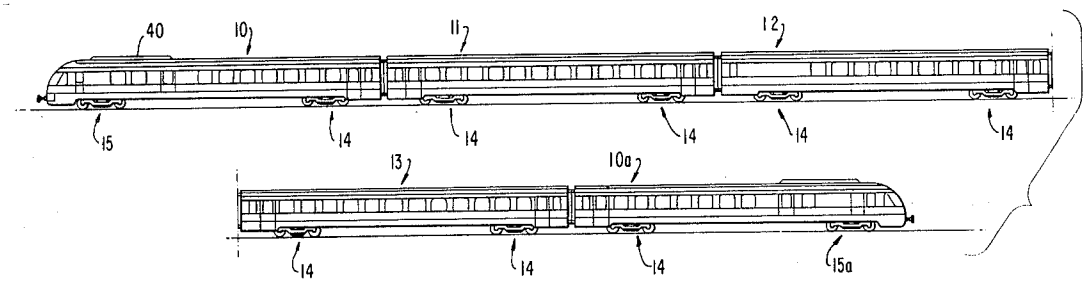


FIG. 1

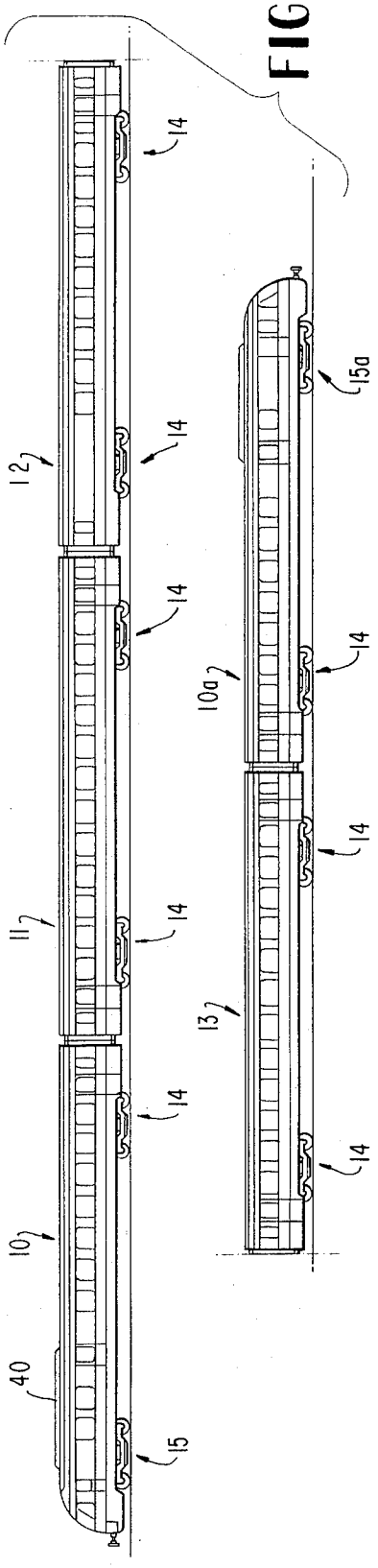
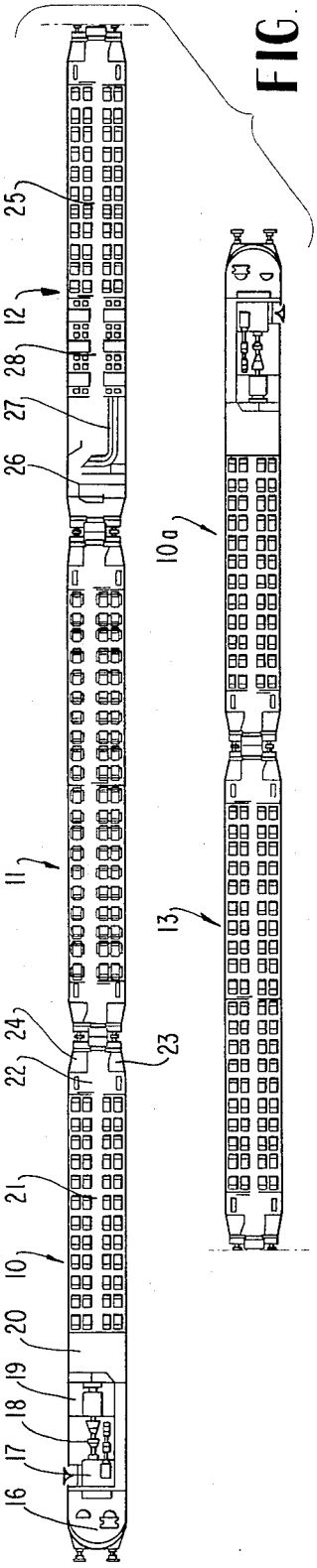
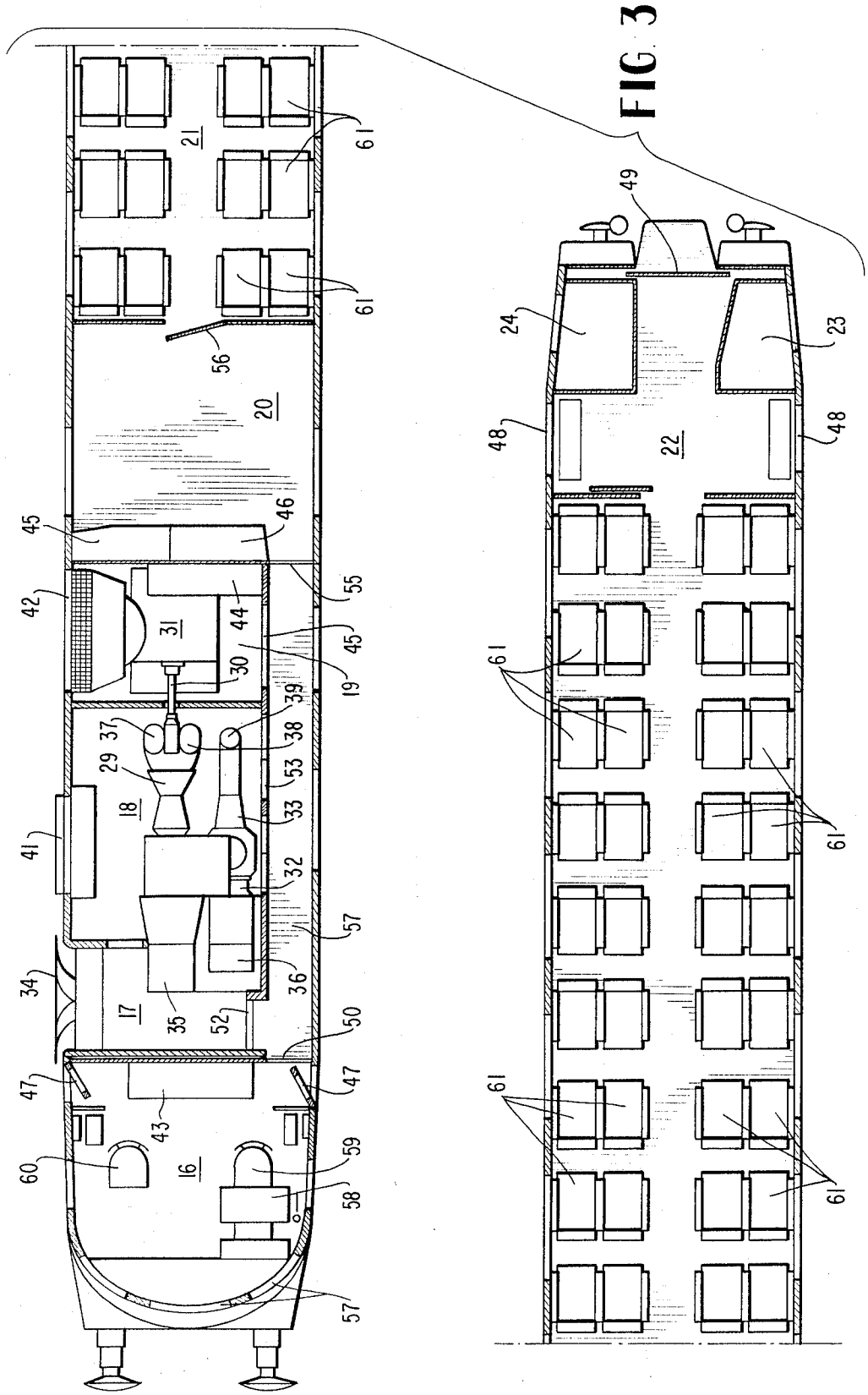

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FIG. 2


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FIG 3
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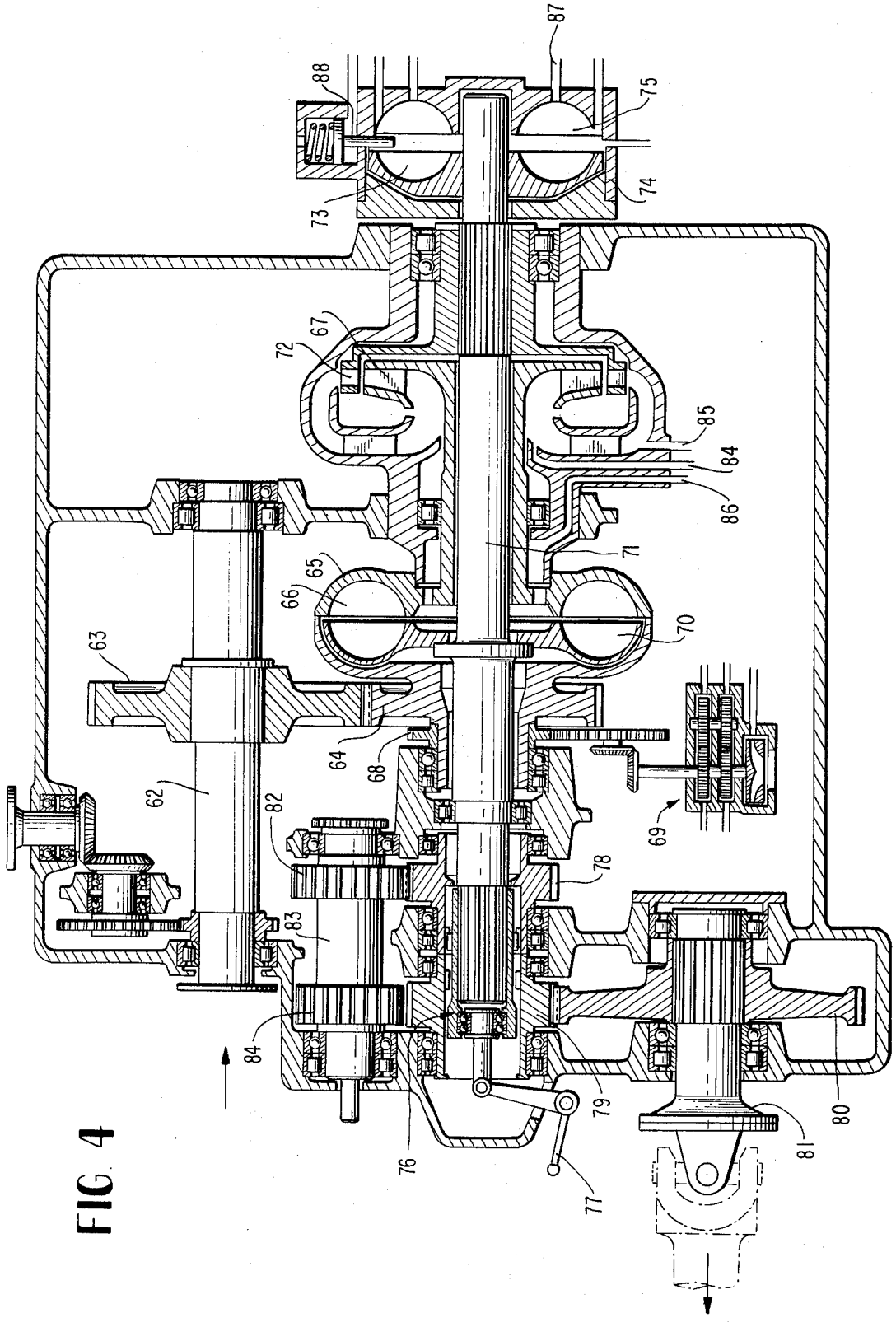

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FIG. 4

GAS TURBINE RAILWAY CAR

The invention concerns a railway vehicle propelled by a gas turbine.

The evolution in modern techniques makes it incumbent upon us to increase the running speed of railway vehicles.

Standard methods such as electric or diesel traction do not enable the satisfactory achievement of this result, either because of the extensive investment required in the electrification of railway rights or way, or because of the weight and size of the high-powered electric or diesel engines.

One recognized method has been the installing of a jet engine on the top of a traction car, but the speed of acceleration when using jet propulsion is insufficient and, in addition, the resulting noise is extremely loud and cannot be adequately deadened.

A favorable power output is possible only if the power is transmitted directly to the driving wheels of the vehicle.

In the light of the foregoing, a solution has emerged involving the use of a gas turbine engine with mechanical or hydromechanical transmission directly connected to the wheels of a railway vehicle.

In the early stages of application of turbines to railway vehicles, the train was started by means of a piston engine, and as the train gathered speed the turbine gradually took over.

The purpose of the present invention is to achieve a significant application to railway vehicles of the special properties of gas turbines (great power output and small size). To this end, the self-propelled train covered by this invention is equipped with two identical power cars each of which has a variable-speed turbine and pulls one or more trailers devoted to passenger conveyance.

Each of the power cars has an engineer's cab up front, followed by a completely soundproof compartment reserved for the propulsion of the train, including one main turbine equipped with its accessories such as air suction filter unit, gas exhaust outlet, etc.

An auxiliary engine in the main turbine compartment drives an alternator for supplying electricity to the train as a whole, for air conditioning, etc. This auxiliary engine can be either a gas turbine or a piston engine.

The main engine is a turbine engine with a so-called "free turbine" supplying a high starting torque; it drives the two axles of the front bogie of the traction car by means of a mechanical or hydraulic transmission, or by the combination of the two systems. The gear-box mechanism also enables the driving of the second bogie of the power car.

The fully soundproofed passenger compartment is separated from the turbine compartment by a baggage storage compartment, thereby further reinforcing the soundproofing of the passenger compartment and thus enhancing passenger comfort.

In the drawings,

FIG. 1 is a side elevation of a preferred form of high-speed gas turbine powered railway train made in accordance with this invention;

FIG. 2 is a horizontal cross-section showing the interior layout of the cars comprising the train of FIG. 1;

FIG. 3 is a similar cross-section on an enlarged scale showing details of the interior layout of one of the two identical traction cars, and;

FIG. 4 is a longitudinal cross-section of the hydraulic transmission and braking mechanism through which the main gas turbine engine supplies power to a traction bogie.

In a preferred example, the train comprises two identically constructed traction cars **10** and **10***a*, which face in opposite directions, with one or more trailer cars **11**, 12 and **13** coupled between them. Each of the trailer cars is supported on a pair of trailer bogies **14** so that they may be (unlike some of the high-speed trains in use today, in which two adjacent cars are supported at their ends on a common bogie) coupled and uncoupled without difficulty, when it is necessary to remove, or replace, a car for repairs or to change the "consist" of the train. The traction cars are also supported on two bogies, one of which **14**, may be identical with those used on the trailer cars. While the forward bogie **15**, while identical to the others insofar as the suspension and braking systems is concerned, is provided with transmission mechanisms for driving the wheels of that bogie from the drive shaft of a prime mover contained in the car. While trailer, and traction, bogies suitable for use are well known, a particular form of suspension system is disclosed and claimed in my copending application Ser. No. 350,805 filed concurrently with this application a system for transmitting propulsion and braking forces between a traction bogie and a car is disclosed and claimed in my copending application Ser. No. 350,804 filed concurrently with this application; and a system for transmitting propulsion from the car by a bogie is disclosed and claimed in my copending application Ser. No. 350,804 filed concurrently with this application.

Because both of the traction cars **10** and **10**a are identically constructed, it will be necessary to describe only one of them in detail. In general, each of them comprises an engineer's compartment **16**, an air intake compartment **17**, a turbine compartment **18**, transmission mechanism compartment **19**, baggage compartment **20**, passenger compartment **21**, rear platform **22**, toilet compartment **23**, and a cabinet **24** for miscellaneous electrical equipment.

While the physical layout of the interior of the trailer cars is immaterial, in the drawings cars **11** and **13** represent two arrangements for seating passengers, while car **12** is a form of club car, containing a passenger seating area **25**, a food and beverage preparation area **26**, snack bar **27**, and dining area **28**.

Propulsive power for the traction car is supplied by a main gas turbine engine **29** whose output shaft **30** is connected to a transmission **31** which may comprise a combination of a fluid coupling and fluid torque converter, or any other form of variable speed transmission, the output of which is transmitted by a cardan shaft to a gear box mechanism on one, or both, of the axles of the front bogie **15**, or in the case of the car **10***a*, the trailing bogie **15***a* by means which are well known. While it is usual to operate the train, especially during starting, with both main turbines running, it is possible to use either the engine in the leading car or the one in the trailing car alone, and obviously if the transmission in the leading car is operated in forward gear, the transmission in the trailing car must be operated in reverse, unless the direction of the train is reversed, at which time the previously trailing traction car becomes the leading one.

Electricity for supplying the various devices on the train, such as lights, air conditioning, pumps, food preparation equipment, etc. is supplied by a three-phase alternator **32,** directly coupled to an auxiliary gas turbine **33,** also placed in the engine compartment **18** of each traction car and, only one alternator is in operation at any given time to supply the entire train, it being immaterial whether the one being used is in the leading, or trailing, car.

Fuel for starting and operating the turbines is carried in tanks (not shown) located below the floor of the car and air for the turbines enters through a two-way scoop **34** in the side of the air compartment and passes into the turbine intakes through a filter system **35** and **36.** Exhaust gases from the turbines is discharged by conduits **37, 38** and **39** through a hatch **40** in the roof of the car while an air inlet **41** in the side of the turbine compartment provides for normal air circulation of air outside of the turbines. An oil cooler **42** is also provided in the side of the transmission compartment **19,** and electrical equipment for controlling the starting, operating, and stopping of the individual turbines and the train as a whole are contained in cabinets **43, 44,** 45 and **46.**

Access to the interior of the car is possible through the two doors **47** at the rear of the engineer's compartment, the two rear doors **48** and the center vestibule door **49,** and the engineer has access to the remainder of the car through door **50,** leading to a side corridor **51** which includes doors **52, 53, 54** and **55** for entering the air filter, turbine, transmission and baggage compartments respectively; a door **56** communicates between the baggage and passenger compartments.

The forward end of the engineer's compartment **16** is protected by a thick, curved windshield **57** of tempered, or safety glass and, just behind it, is the control desk, or console **58,** which contains push button controls for starting and stopping the main and auxiliary gas turbines of either traction car, instruments for monitoring the condition of these engines, and other equipment on the train, as well as manually operable controls for regulating the speed of the train and braking it. A seat **59** is provided for the engineer, and seat **60** is provided for an additional train crew member. Passenger seats are indicated by numeral **61.**

The speed of the main gas turbine **29** is under the control of the engineer to regulate the acceleration and running of the train and, unlike previous trains, the present system does not require the assistance of an auxiliary engine, such as an internal combustion engine, for starting from a standstill. To accomplish this, the output shaft **30** is connected to the input shaft **62** of fluid transmission (FIG. 4) carrying gear **63** which meshes with gear **64** formed on the exterior of the housing **65** for the impeller **66** of a fluid clutch and the impeller **67** of a fluid torque converter. Housing **65** also includes a driving gear **68** for an oil pump **69** which supplies the hydraulic fluid used to operate the transmission. The rotor **70** of the fluid coupling is mounted on a shaft **71** and, splined to one portion of this shaft is the rotor **72** of the torque converter. Shaft **71** also carried the rotating element **73** of an hydrodynamic brake means comprising a fixed housing **74** and fixed blades **75.** The other end of shaft **71** is splined to carry an axially slidable dog clutch **76** which is movable by linkage **77** between the position shown, in engagement with floating gear **78,** to an extreme position (towards the left in FIG. 4) for engagement with another floating gear **79,** and an intermediate, or "neutral,"position in which neither gear is engaged. Floating gear **79** is continuously in meshing engagement with gear **80,** mounted on the output shaft **81.** Floating gear **78** always meshes with gear **82** on stub shaft **83** which also carries gear **84,** which also continuously meshes with the output gear **80.** In this connection, it should be realized shaft **83** does not lie in the same plane as shafts **71** and **81,** but in an angularly related plane extending through the axis of shaft **71** and, that its actual position is closer to shaft **81**; for the purpose of clarity, it has been necessary to show it in the drawing in a displaced position.

When the train is stopped, there will be no oil in the fluid coupling and torque converter and the clutch **76** will be in the neutral position so that rotation of input shaft **62,** due to idling of the turbine, will have no effect on output shaft **81.** To start the train the clutch **76** will be moved to engage either gear **78** or **79** depending on the direction of movement desired. The engineer will move the control to increase speed which sets in operation automatic controls (not shown) which causes the pump **69** to introduce fluid into the torque converter through passage **84,** while closing passage **85.** Rotation of impeller **67** gradually increases the speed of rotor **72** until a condition is reached (depending on torque and train speed) at which the speed of rotation of the rotor will approach that of the impeller at which time the automatic controls will begin to direct fluid from pump **69** into the chamber of the fluid coupling through passage **86.** At the same time, passage **84** will be closed and passage **85** opened, to cause drainage of the torque converter. During normal running the coupling is used to transmit power to shaft **71,** while the torque converter remains empty of fluid.

For decelerating the train, fluid from pump **69** will be introduced into the hydrodynamic braking means through passage **87** to cause a drag to be placed on the rotating blades **73,** while the extent of this decelerating drag can be controlled by actuator **88** which varies the annular space separating the two sets of blades.

I claim:

1. A high-speed, self-propelled railway train comprising a plurality of cars, means for supplying propulsive power for the train, each of said cars including a pair of bogies for independently supporting each car in rolling engagement with a track system, at least one of the endmost cars of said train being a traction car, said propulsive power means comprising prime mover means contained in said traction car, and on engineer's compartment contained in said traction car for controlling operation of said propulsion power means and the starting, running, and stopping of the train, said prime mover means comprising, a single gas turbine engine of the variable output speed free running turbine type, variable speed ratio hydraulic transmission means connected to the output of said turbine, and fixed ratio transfer gear means for transmitting power from the output of said hydraulic transmission to at least one pair of wheels of a bogie supporting, said traction car whereby said train can be propelled at varying speeds from a standing stop by said free running turbine.

2. The invention defined in claim **1,** wherein said hydraulic transmission means includes fluid clutch means and fluid torque converter means, the inputs thereof being connected to the output of said turbine, the out-

puts of the clutch and torque converter being connected to said fixed ratio transfer gear means, and means for selectively introducing fluid into and withdrawing fluid from said clutch and converter means alternatively.

3. The invention defined in claim 1, wherein both of the endmost cars of said train are traction cars of substantially identical construction, said engineer's compartment in each car being disposed at one end of the car, the traction cars being oppositely disposed with respect to each other to position the respective engineer's compartments at the respective ends of the train, said means for transmitting power from the turbine of each car to the respective pair of bogie wheels of each traction car including selectively engageable reversing gear means, whereby said train may be operated selectively in either direction at varying speeds from a standing start under control of an engineer in the engineer's compartments of either traction car on power supplied by the gas turbine engine of either traction car, and on power supplied simultaneously by the gas turbine engines of both traction cars.

4. The invention according to claim 1, wherein said power transmission means also includes hydraulic braking means for decelerating the train.

5. The invention according to claim 1, wherein one of the cars of said train includes an area provided with facilities for the serving of refreshments.

6. The invention according to claim 1, wherein said train also includes at least one turbo generator means for supplying electricity for operation of the train.

7. The invention according to claim 6, wherein said turbo generator is contained within said traction car.

8. The invention according to claim 6, wherein said prime mover means and said turbo generator are contained within a common enclosed soundproof compartment in said traction car.

9. The invention according to claim 8, wherein said turbo generator includes an electrical alternator.

10. The invention according to claim 9, wherein said traction car is subdivided into a pluraltiy of compartmented areas comprising:

an engineer's compartment at one end of the car;

a turbine compartment disposed adjacent said engineer's compartment provided with an air inlet and filter for the turbines, exhaust gas system for the turbines and separate ventilating system for the compartment;

a compartment for said power transmission system;

a service corridor running alongside the turbine and transmission compartments and communicating with said engineer's, turbine and transmission compartments;

a compartment for baggage;

a compartment for passengers adjacent said baggage compartment;

a toilet compartment;

a platform compartment at the other end of the car communicating with said passenger and toilet compartments and being provided with access doors for communication with the exterior sides of the car and with an adjacent car.

* * * * *