Dec. 16, 1958 H. A. TOULMIN, JR 2,864,318

METHOD AND APPARATUS FOR RAIL TRANSPORTATION

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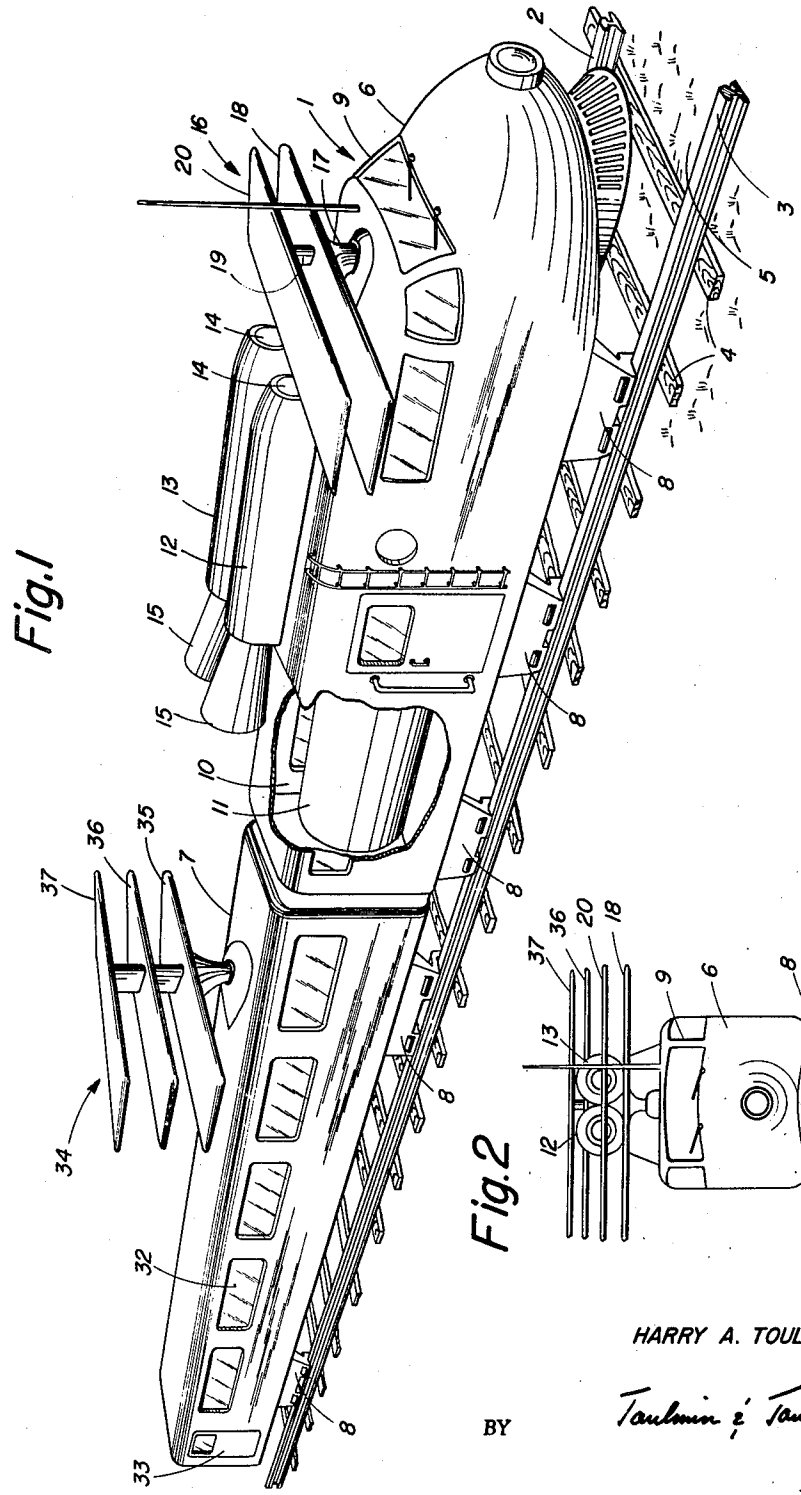


Fig.1

Fig.2

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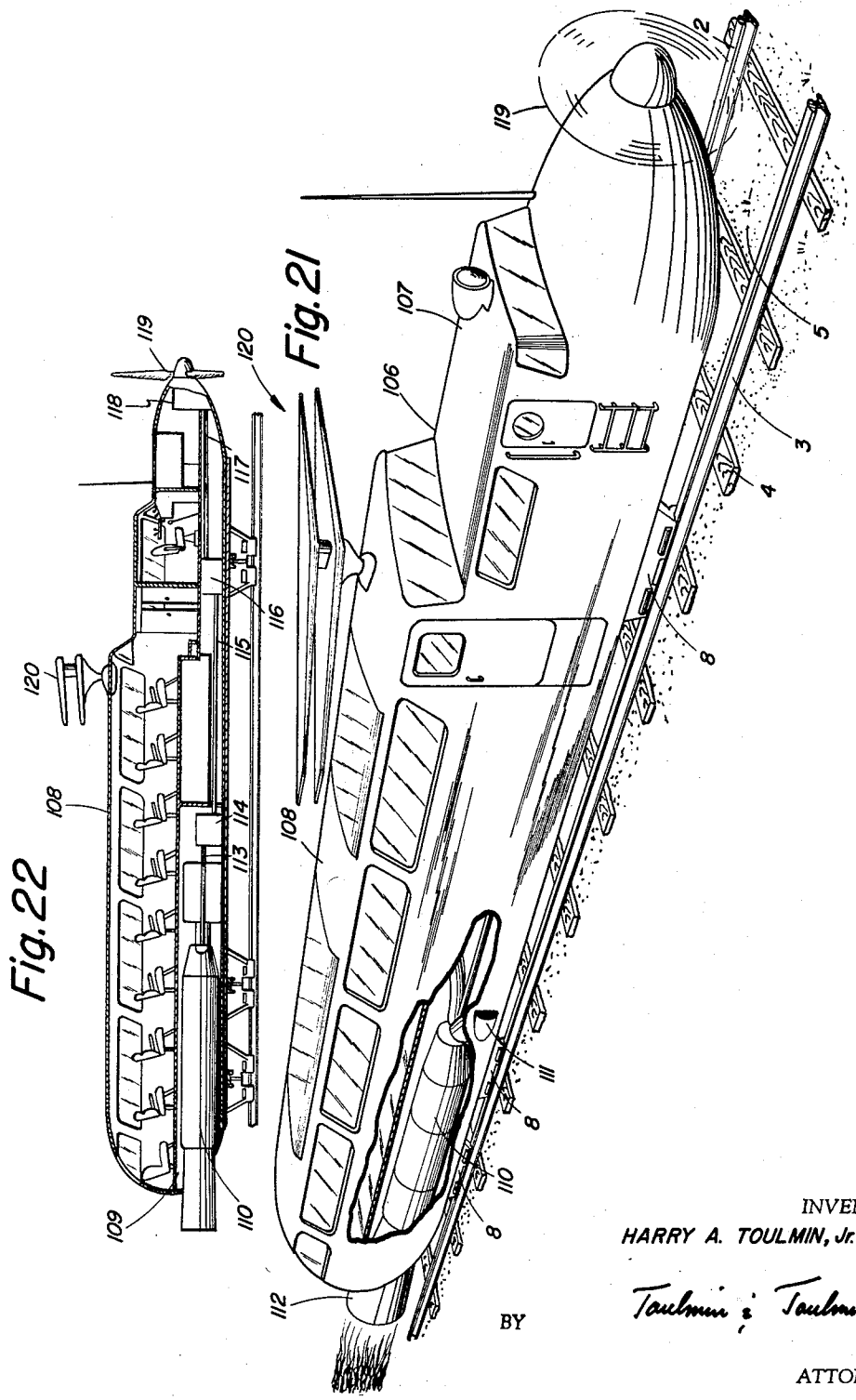
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METHOD AND APPARATUS FOR RAIL TRANSPORTATION

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Fig.5

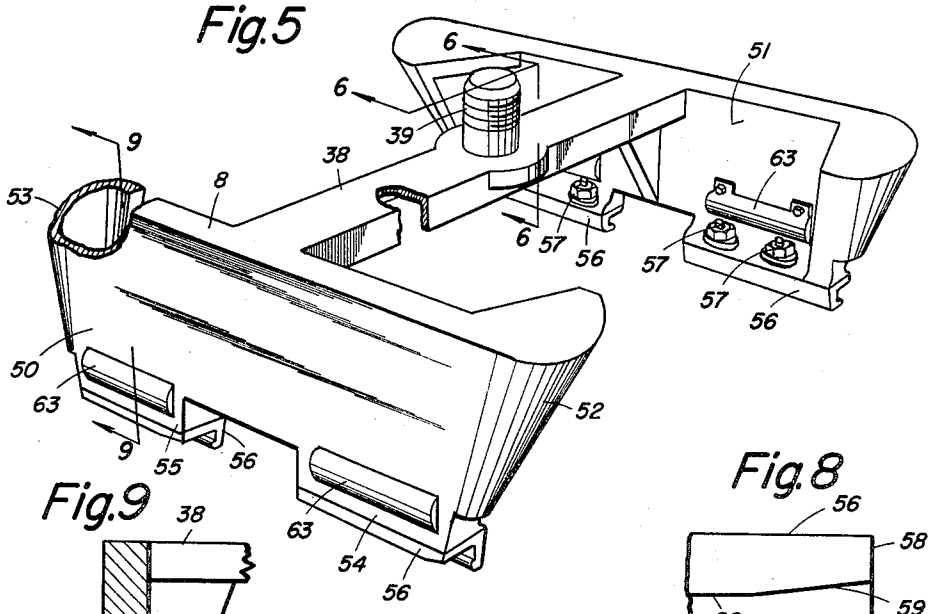


Fig.8

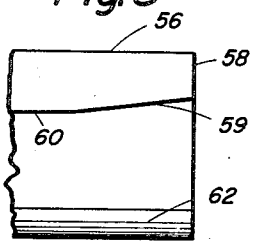


Fig.9

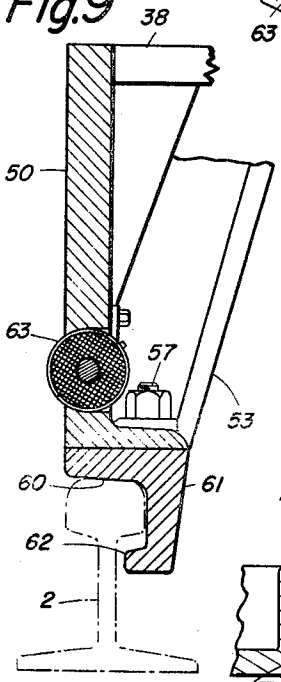


Fig.7

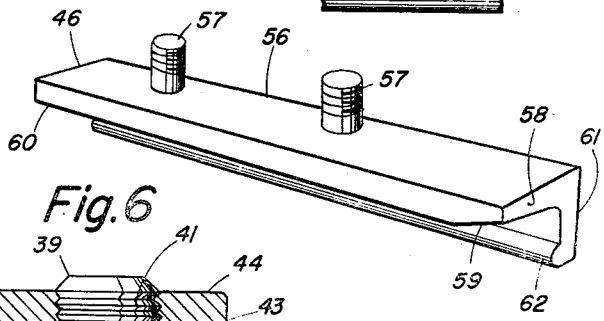
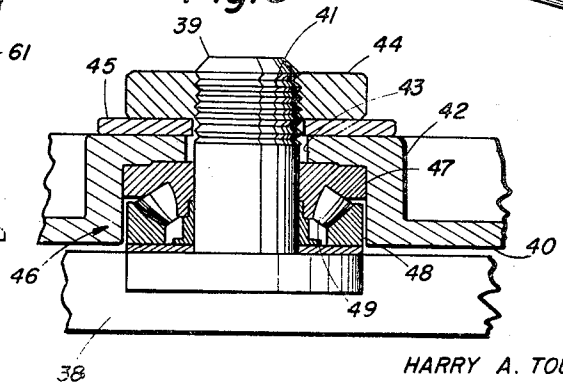


Fig.6



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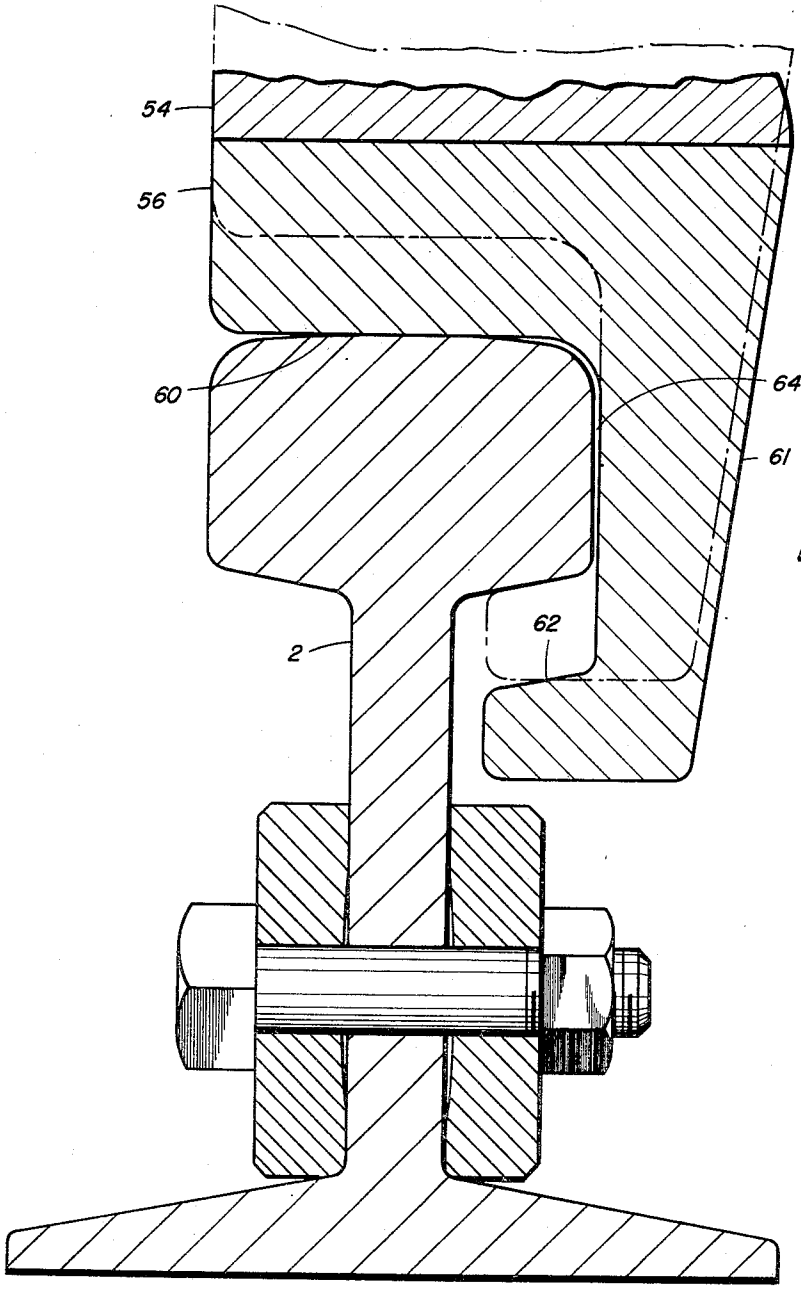


Fig. 10

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METHOD AND APPARATUS FOR RAIL TRANSPORTATION

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Fig. 12

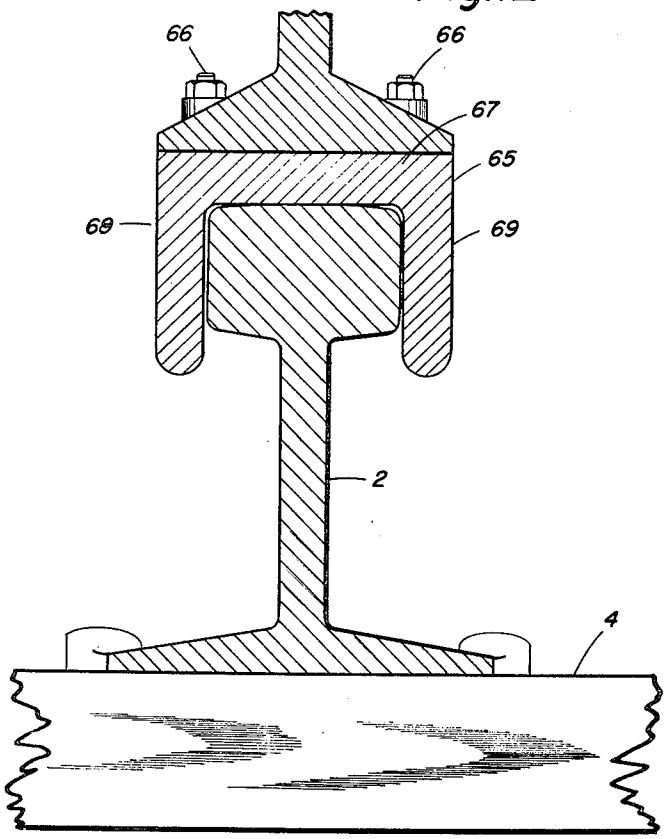
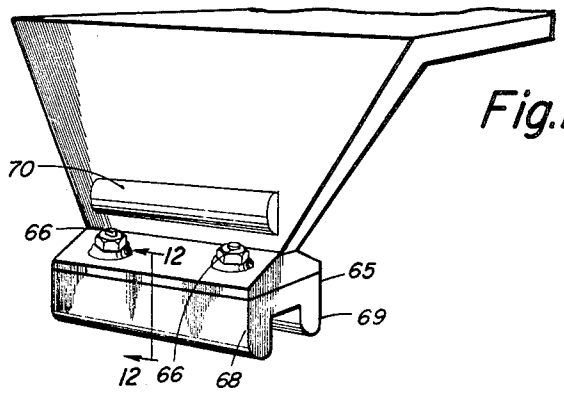


Fig. 11



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Fig. 14

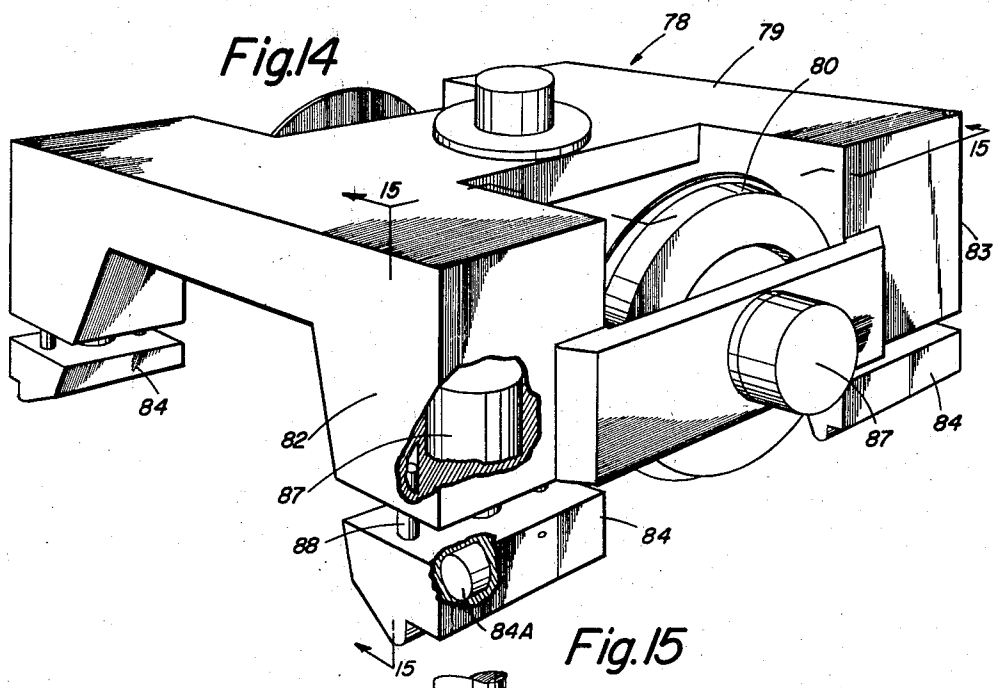


Fig. 15

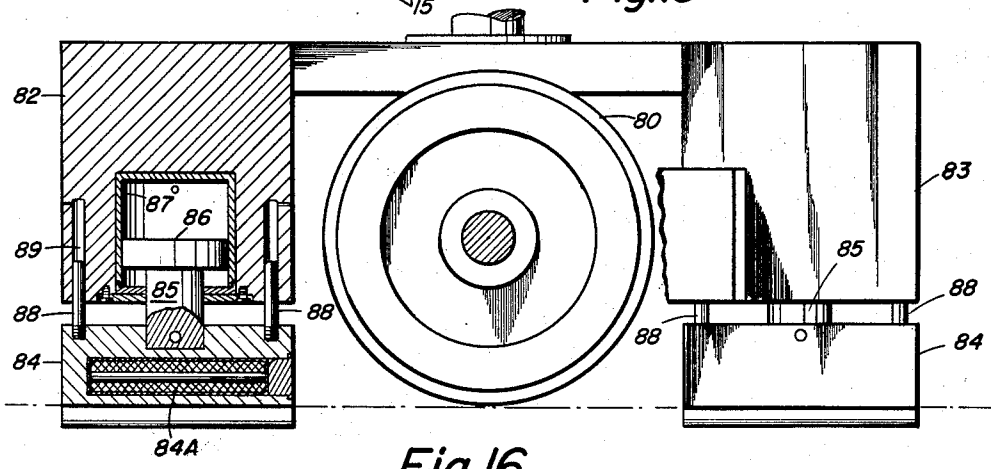
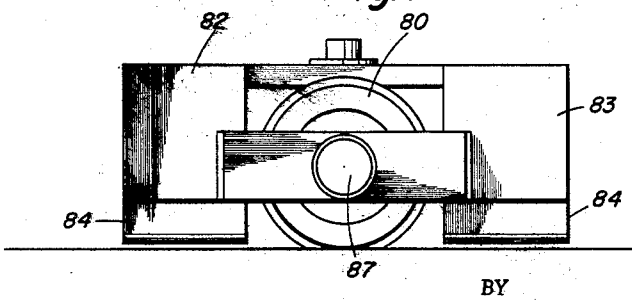


Fig. 16



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Fig. 17

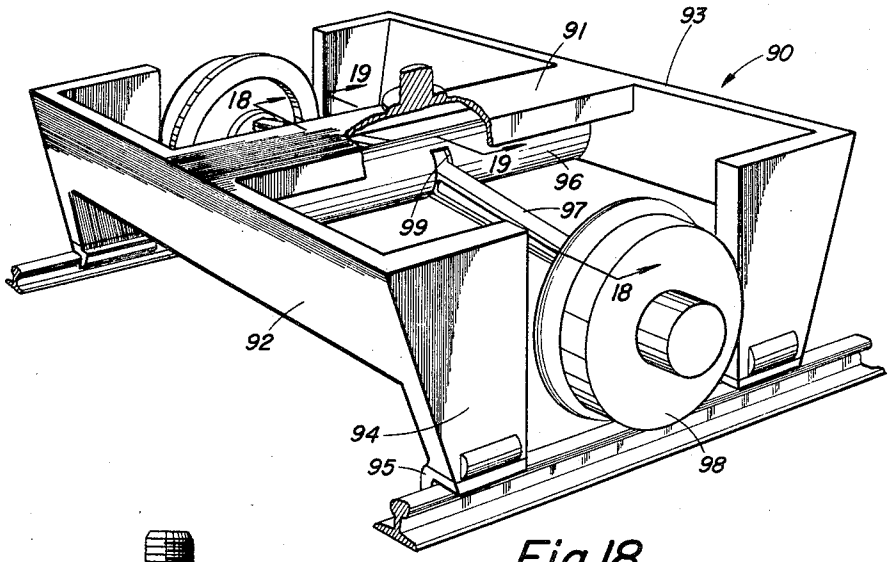


Fig. 18

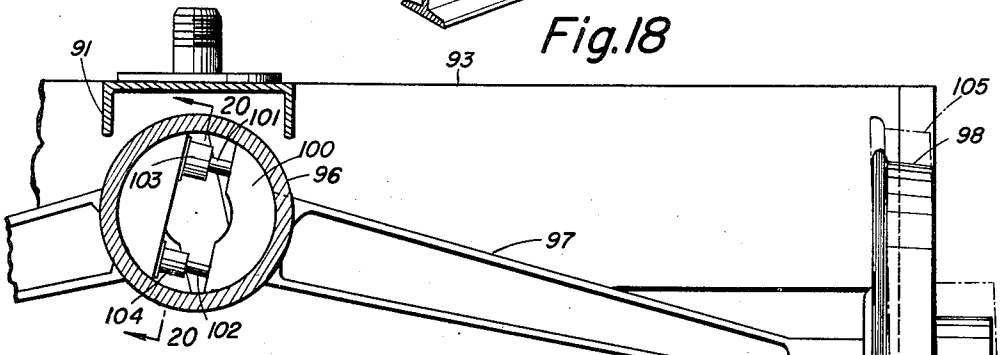


Fig. 19

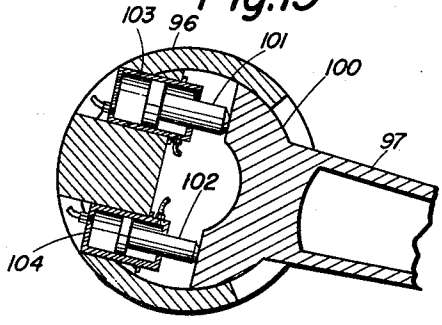
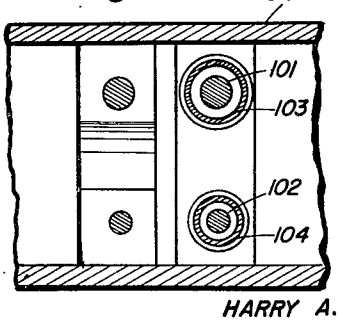


Fig. 20



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Fig.3

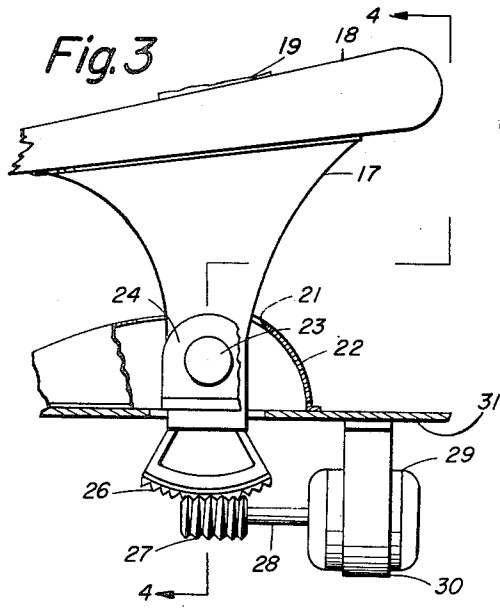


Fig.4

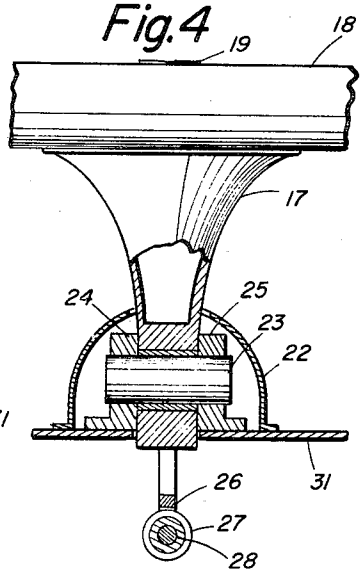
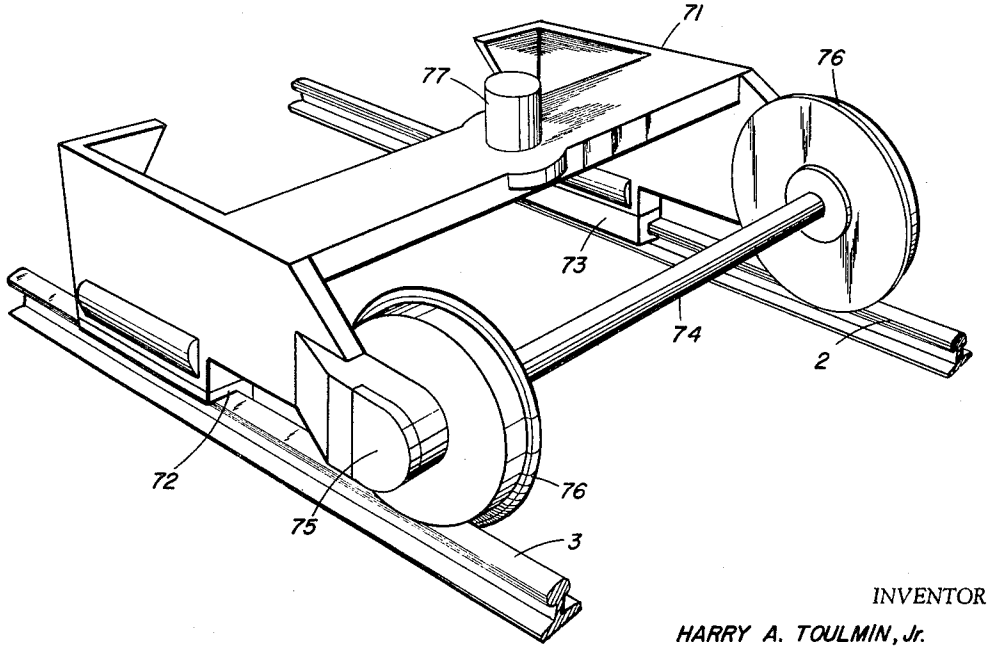


Fig.13



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United States Patent Office 2,864,318 Patented Dec. 16, 1958

2,864,318

METHOD AND APPARATUS FOR RAIL TRANSPORTATION

Harry A. Toulmin, Jr., Dayton, Ohio, assignor to The Commonwealth Engineering Company of Ohio, Dayton, Ohio, a corporation of Ohio

Application December 7, 1955, Serial No. 551,683

3 Claims. (Cl. 104—23)

This invention relates to rail transportation, more particularly to increasing speed and capacity to make railways competitive with airlines and to eliminate limitations on rail travel due to the following facts:

(*a*) The limitations on speed due to the weight of the vehicle;

(*b*) The use of conventional automotive power of steam, electricity or diesel engines.

It is the object of this invention to utilize the existing rail system without disturbance of it.

It is a further object to provide a car construction of great simplicity and lightweight which has no wheels.

It is another object to eliminate the axles and conventional running gear.

It is an additional object to provide high speeds that are impossible with the use of wheels and conventional running gear or with conventional railway cars and still maintain a very safe and convenient construction for the cars carrying passengers and freight.

It is a still further object of this invention to provide high speed rail transportation by the employment of jet and turbo-prop power sources which achieve speeds many times those of railway practices as now known.

It is still another object of this invention to carry out these high speeds with existing rails by reason of the novel construction of the rail engaging mechanism attached to the bodies of the vehicles which are the subject matter of this invention.

It is still an additional object of this invention to attain these speeds with the minimum of friction between the rails and the supporting mechanism by utilizing one or means for maintaining the bodies and power plants of the rail equipment of this invention substantially out of frictional engagement with the rails utilizing the rails simply for guiding purposes and for restraining the power plant and vehicle bodies from leaving the rails.

It is yet another object of this invention to provide an effective braking mechanism adaptable to this new art of transportation and to also provide various means of maintaining the power plant and vehicle in such a position with respect to the rails that the power plant and vehicle bodies will move on the air with the diminution of friction between the bodies and the rails.

It is yet a further object of this invention to provide mechanisms which are self-braking due to the frictional engagement of the guiding and supporting means of the vehicle bodies with the rails and due to the use of magnetic braking in association with the power plant and the vehicle bodies.

It is yet an additional object of this invention to achieve speeds as high as desired with a power plant such as a turbo-prop, a jet or other equipment means where the speeds will range in hundreds of miles an hour, making it possible to compete with aircraft between cities and at the same time to provide a safer and smoother ride than either provided now by the railroads or by aircraft, while maintaining at all times braking mechanism which keeps the

power plant and vehicles under satisfactory and safe control at all times.

This invention, therefore, accomplishes the objective of utilizing the rail system already established without change of stations, road beds, rails, signal ssytems, etc. and to be able to utilize such systems along with the present conventional rail transportation means, whether it be diesel, steam or electric.

Other objects and advantages of this invention will become apparent upon reference to the accompanying description when taken in conjunction with the following drawings wherein:

Figure 1 is an overall perspective view of the rail vehicle disclosed as this invention;

Figure 2 is a front elevational view of the rail vehicle in Figure 1;

Figure 3 is a side elevational view of the lifting surfaces employed in the subject rail vehicle and showing the manner in which the angle of incidence of the lifting surfaces is adjusted;

Figure 4 is a sectional view taken along the lines **4—4** of Figure 3;

Figure 5 is an overall perspective view of the truck employed in this rail vehicle;

Figure 6 is a sectional view taken along the lines **6—6** of Figure 5;

Figure 7 is an overall perspective view of one of the runners mounted on the truck illustrated in Figure 5;

Figure 8 is a partial elevational view of the runner illustrated in Figure 7 showing the beveled front edge thereof;

Figure 9 is a sectional view along the lines **9—9** of Figure 5, showing in detail the braking coil and the structure for mounting the runner to the truck;

Figure 10 is a sectional view similar to that illustrated in Figure 5 but in enlarged scale and showing in detail the manner in which the runner engages the rail;

Figure 11 is a perspective view of a portion of a truck equipped with a modified runner;

Figure 12 is a sectional view along the lines **12—12** of Figure 11 and in enlarged scale to show the manner in which the modified runner engages the rail;

Figure 13 is a modification of the truck employed in the rail vehicle of this invention wherein the truck comprises both runners and wheels;

Figure 14 is an overall perspective view of another modification of the truck employed in this invention wherein both runners and wheels are employed with the runners adapted to be vertically adjustable;

Figure 15 is a sectional view taken along the lines **15—15** of Figure 14;

Figure 16 is a side elevational view of the truck illustrated in Figures 14 and 15 showing the runners in elevated position and the truck supported solely upon the wheels;

Figure 17 is an overall perspective view of still another modification of the truck employed in this invention wherein both wheels and runners are used with the wheels being adjustable vertically;

Figure 18 is a sectional view taken along the lines **18—18** of Figure 17 and showing the structure for adjusting the elevation of the wheels of the modified truck of Figure 17;

Figure 19 is a sectional view taken along the lines **19—19** of Figure 17 and showing the details of the hydraulic mechanism which elevates the wheels;

Figure 20 is a sectional view taken along the lines **20—20** of Figure 18 and illustrating the positioning of the hydraulic cylinders with respect to the inner ends of the wheel axles;

Figure 21 is an overall perspective view of a modification of the rail vehicle as illustrated in Figure 1; and

Figure 22 is a vertical sectional view taken along the

longitudinal axis of the modified rail vehicle illustrated in Figure 1.

Returning now to the drawings, more particularly to Figure 1 wherein like reference symbols indicate the same parts throughout the various views, **1** generally indicates a rail vehicle constructed in accordance with the teaching of this invention. The rail vehicle **1** is supported on conventional rails **2** and **3** which are attached to cross ties **4** and mounted on a track bed **5**. The rails and rail bed construction are conventional as illustrated in Figure 10, but the rails preferably are of the welded type whereby joints between individual rails are eliminated.

The rail vehicle **1** comprises a locomotive **6** and a cargo car **7**, adapted for passenger use, which are supported upon individual trucks **8**. The trucks **8** will be later described in detail.

The locomotive **6** has a control cab **9** which is mounted forwardly of an engine room **10**. The engine room **10** contains a fuel tank **11** and other auxiliary equipment necessary for the operation of turbo jets **12** and **13** which are mounted on the roof of the locomotive **6**.

The propulsion means, as represented by the turbo jets **12** and **13**, may also comprise ram jets or rockets. Since rockets carry their own fuel, the use of rockets as propulsion means for the rail vehicle is more suitable when the vehicle is intended for high speed operation over short distances.

Each of the turbo jets **12** and **13** is conventional in structure and has an intake opening **14** and an exhaust **15**.

Mounted upon the roof of the control cab **9** and forwardly of the turbo jets **12** and **13** is a lifting structure indicated generally at **16**. The lifting structure **16** comprises a supporting base **17** upon which is mounted a lower lifting surface **18** and a vertical support **19** mounted on the lifting surface **18** which supports an upper lifting surface **20**. Each of the lifting surfaces **18** and **20** has air foil sections which give the maximum amount of lift at the high speeds at which the rail vehicle is to be operated.

The lifting structure **16** is more clearly illustrated in Figures 3 and 4 where it can be seen that the supporting base **17** projects downwardly through an opening **21** in a housing **22**. The lower end of the supporting base **17** is journalled upon a shaft **23** which is mounted between a pair of shaft supports **24** and **25**. There is a sector gear **26** on the lower end of the supporting base **17** which engages a worm gear **27** mounted upon a shaft **28** which is driven by a reversible electric motor **29**. The electric motor **29** is mounted in a bracket **30** which is supported from the ceiling of the control cab, as indicated at **31**.

Suitable controls are provided in the control cab **9** to enable the engineer to operate the motor **29** to adjust the angle of incidence of the lifting surfaces **18** and **20**. This angle will be increased to give the maximum amount of lift to the lifting surfaces at low speeds. The angle will be steadily decreased as the vehicle approaches top speed.

Returning to Figure 1, the cargo car **7** which is attached rearwardly of the locomotive **6** is adapted for passenger transportation and comprises a plurality of side windows **32**, a door **33** and seats in the interior thereof for the accommodation of the passengers. A lifting structure **34** which is similar to the lifting structure **16** is also adjustably mounted upon the roof of the cargo car **7**. The lifting structure **34** comprises a plurality of lifting surfaces **35**, **36** and **37**.

Proceeding next to Figure 5, there is illustrated therein the truck **8**, a plurality of which are employed to support both the locomotive and the cargo car of the rail vehicle. The truck **8** comprises a cross piece **38** in the center of which is mounted a vertically upstanding pin **39** to provide a swivel connection with the under surface of the rail vehicle.

In Figure 6 there is illustrated the structure by which the pin **39** is connected to the under side of the rail vehicle indicated at **40**. The pin **39** has threads **41** on the upper end thereof. The entire pin assembly is accommodated in a recess **42** which is in the under side of the rail vehicle. The pin **39** is inserted upwardly into the recess **42** through an aperture **43** into the rail vehicle. A nut **44** is threaded upon the pin **39** to secure the pin to the rail vehicle. A washer **45** is interposed between the nut **44** and the upper surface of the under side of the rail vehicle.

A bearing indicated generally at **46** is housed within the recess **42**. The bearing **46** comprises an upper bearing plate **47** and a lower bearing plate **48**. A plurality of frusto-conical roller bearings **49** are seated within a plurality of cooperating recesses in the bearing plates **47** and **48**.

Depending downwardly from each end of the cross piece **38** are side frame members **50** and **51**. The front and rear edges of the frame members **50** and **51** are streamlined as indicated at **52** and **53** to decrease wind resistance.

Each of the side frame members **50** and **51** are similar and the description of side frame **50** will suffice to disclose the structure of the entire truck **8**.

The side frame member **50** has front and rear support members **54** and **55**. A runner **56**, shown in Figure 7, is mounted on the lower surface of each of the support members **54** and **55**. The runner **56** is constructed from high grade steel and is detachably mounted on the side frame member **50** by bolts **57**. The front edge, indicated at **58**, of each of the runners **56** is beveled at **59** and illustrated in enlarged scale in Figure 8.

The runner **56** comprises a contact surface **60** which rests upon the upper surface of the rail **2**, as illustrated in Figure 9. There is a depending flange or web **61** on the inner edge of the contact surface **60**. The depending flange **61** extends below the head of the rail **2** and has an outwardly extending lip **62** on the lower edge thereof to form a clamp. The space between the runner contact surface **60** and the upper surface of the lip **62** is somewhat greater than the vertical thickness of the head of the rail **2**. This difference will permit the rail vehicle to move vertically a short distance above the surface of the rail and yet be restrained from departing from engagement with the rail by the lip **62** engaging the under surface of the rail head.

In order to facilitate the braking of the rail vehicle, a magnetic coil **63** is mounted in the side frame members **50** and **51** above each of the runners **56**, as shown in Figures 5 and 9. The magnetic coil **63** is controlled from the control cab **9** and when energized produces a strong magnetic force which draws the runners **56** toward the rails **2** with a substantial force. This magnetic attraction plus the weight of the vehicle upon the rails combine to decelerate the rail vehicle within a reasonably short distance, shorter than if the magnetic braking were not employed.

Reference to Figure 10 will clarify the manner in which runner **56** clamps the vehicle to the rail and limits the vertical movement of the vehicle relative to the rail. In the extreme upper position of the vehicle, it can be seen that the upper surface of the lip **62** engages the under side of the rail head. Lateral movement of the rail vehicle is limited by the outer face of the depending flange or web **61** engaging the inner face of the rail head. The distance between the outer surfaces of the runner web **61** is somewhat less than the gauge of the rails. This will result in a small clearance under normal running conditions between the web of the runner and the rail head as indicated at **64**.

In Figure 11 there is illustrated a modification of the rail engaging structure wherein a runner **65** is detachably mounted by bolts **66** to the lower surface of the supporting bases of the truck. The runner **65** is essentially in

the shape of a channel iron and has a web **67** which rests upon the top surface of the rail **2**. At each end of the web **67** are depending flanges **68** and **69** between which is accommodated the rail head. It will be noted that in this modification of the runner no provision is made for limiting the vertical movement of the rail vehicle with respect to the rail. As discussed previously, a magnetic coil **70** is provided to assist in the braking of the vehicle.

Figure 12 which is a sectional view of Figure 11 shows in greater detail the relationship of the runner and the rail when the vehicle is in a stationary position.

Proceeding next to Figure 13, there is illustrated therein a modification of the truck disclosed above. In this modification the truck comprises both runners and wheels. The truck indicated at **71** in Figure 13 comprises runners **72** and **73** which are similar to those previously described. In addition, an axle **74** is journalled from journal box **75** mounted forwardly of the runners. Conventional railroad wheels **76** are mounted on the ends of the axle **74**. A pin **77** is similarly provided to swivelly attach the truck **71** to the under surface of the rail vehicle.

In this modification, the runners and the wheels jointly support the rail vehicle both when it is stationary and when it is travelling along the rails.

Proceeding to Figure 14, there is illustrated at **78** another modification of a truck for use with the rail vehicle of this invention. In this modification wheels are employed to support the truck when the vehicle is stationary or at low speeds. Upon attaining a predetermined speed runners are lowered to engage the rails and to lift the wheels from rolling engagement with the rails.

The modified truck **78** comprises a frame **79** on each side of which are journalled wheels **80** in journal boxes **81**. The journal boxes **81** are supported between runner mounts **82** and **83**. A runner **84** is mounted on the lower surface of each of the runner mounts **82** and **83**. Each runner **84** has mounted therein a magnetic braking coil **84A** and is attached to the end of a rod-like shaft **85** which is secured to a piston **86** enclosed within a cylinder **87**. The piston **86** is hydraulically actuated by the supply and discharge of hydraulic fluid under pressure into the cylinder **87**. Guides **88** are slidably mounted within the bores **89**. A hydraulic circuit is also connected to each of the bores **89** to assist in dropping the runners **84** into engagement with the rails.

When the runners **84** are in lowermost position, the wheels **80** are lifted out of contact with the rail, as shown in Figure 15.

Figure 16 shows the position of the runners **84** when they are retracted and the entire weight of the vehicle is supported by the wheels **80**.

Figures 17 to 20 illustrate still another modification of the truck employed with the rail vehicle of this invention wherein it is possible to raise the wheels from engagement from the rails. In Figure 17 there is illustrated an overall perspective view of a truck **90** which has a longitudinally extending frame member **91** on the ends of which are mounted transverse frames **92** and **93**. Runner supports **94** depend from each of the ends, of the transverse frames **92** and **93**. Runners **95**, such as previously described, are detachably mounted on the lower ends of each of the runner supports **94**.

A horizontally extending tubular frame member **96** is mounted between the transverse frames **92** and **93** beneath the longitudinal frame member **91**. Extending outwardly in opposite directions from the tubular frame member **96** are axles **97**. Railroad wheels **98** are journalled on the end of each of the axles **97**.

Each of the axles **97** projects through opposed openings **99** in the tubular member **96**. On the inner end of the axle **97** within the tubular member is a base **100** having a curved surface which corresponds to the curvature of the inner surface of the tubular member **96** and is adapted to slidably engage the same. An upper hydraulically actuated piston **101** and a lower hydraulically actuated piston **102** both bear upon the upper and lower ends, respectively, of the base **100**. A suitable hydraulic circuit is connected to each of the hydraulic cylinders **103** and **104** which house the pistons **101** and **102**, respectively.

This circuit is similarly operated from the control cab **9** of the rail vehicle. The admission of hydraulic fluid under pressure into the hydraulic cylinder **104** will result in pushing the hydraulic piston **102** outwardly to bear against the lower end of the base **100** to raise the wheel **98**, as illustrated by the phantom lines **105** in Figure 18.

Reference to Figures 18 to 20 will reveal that the upper cylinder is of greater diameter than the lower cylinder **104**. This is necessary because a greater force is necessary to act upon the upper portion of the base **100** to maintain the wheels **98** in their normal position as illustrated in Figure 18 when the total weight of the rail vehicle is supported by the wheels.

In Figures 21 and 22 there is illustrated a modification of the rail vehicle disclosed in this invention. This modification comprises a single unit rail vehicle which is adapted to carry passengers and is somewhat similar to the motor cars currently employed on railroads. This modification discloses a rail vehicle indicated at **106** which comprises a control cab **107** in the forward portion therein and a passenger compartment **108** rearwardy of the control cab and occupying a substantial portion of the length of the vehicle. The passenger compartment **108** is raised above the control cab **107** to provide an engine compartment **109** below the passenger compartment. In the engine compartment there is contained a turbo jet **110** having intakes **111**, which are on the outer surface of the vehicle **106**, and an exhaust **112**. A drive shaft **113** driven by the compressor of the turbo jet extends forwardly of the turbo jet into a transmission **114**. A second drive shaft **115** extends from the transmission **114** to a second transmission **116** positioned below the control cab **107**. Power is transmitted from the transmission **116** by a shaft **117** to a gear reduction unit **118** from which power is obtained to drive a propeller **119** mounted on the nose of the vehicle **106**. The propellor **119** is principally used at low speeds of the vehicle **106** before the turbo jet **110** has attained its most efficient output. A lifting unit **120** is adjustably mounted on the roof of the vehicle **106**. The lifting unit **120** comprises a number of lifting surfaces and is similar to the lifting units previously described.

Thus it can be seen that the present invention teaches a new concept of rail transportation. In the form of rail transportation disclosed herein, the principal source of power is obtained from rockets or turbo jets and the conventional running gear in use on railroads is eliminated. The result is a high speed rail vehicle which is operable upon conventional rail systems. The speeds at which this rail vehicle may travel are such to enable the rails to compete with faster forms of transportation.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modification within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In a land vehicle for traveling upon spaced rails mounted on the ground, a vehicle, a plurality of trucks on the undersurface of said vehicle to support the same, runners on said trucks to engage said rails and to slidably support the vehicle thereon, depending flanges on said runners engageable with the undersurface of the rail head, the distance between the runner and its flange being greater than the height of the rail head so as to limit the vertical movement of the vehicle with respect to the rails but to maintain the vehicle in engagement with the rails when elevated thereabove, jet propulsion

units on the top surface of said vehicle to propel said vehicle upon the rails, and airfoils on said vehicle for aerodynamic reaction with the relatively moving air to elevate the vehicle above the rails when the vehicle attains a predetermined speed.

2. In a land vehicle for traveling upon spaced rails mounted on the ground, a vehicle, a plurality of trucks on the undersurface of said vehicle to support the same, runners on said trucks to engage said rails and to slidably support the vehicle thereon, depending flanges on said runners engageable with the undersurface of the rail head, the distance between the runner and its flange being greater than the height of the rail head so as to limit the vertical movement of the vehicle with respect to the rails but to maintain the vehicle in engagement with the rails when elevated thereabove, jet propulsion units on the top surface of said vehicle to propel said vehicle upon the rails, and airfoils on the top surface of said vehicle forwardly and rearwardly of said jet propulsion units for aerodynamic reaction with the relatively moving air to elevate the vehicle above the rails when the vehicle attains a predetermined speed.

3. In a land vehicle for traveling upon spaced rails mounted on the ground, a vehicle, a plurality of trucks on the undersurface of said vehicle to support the same, each of said trucks being pivotally mounted on said vehicle and comprising both flanged wheels and runners to engage the rails and to slidably support the vehicle thereon, both runners and wheels supporting the vehicle when it is stationary, depending flanges on said runners engageable with the undersurface of the rail head, the distance between the runner and its flange being greater than the height of the rail head so as to limit the vertical movement of the vehicle with respect to the rails but to maintain the vehicle in engagement with the rails when

elevated thereabove, jet propulsion units on the top surface of said vehicle to propel said vehicle upon the rails, and airfoils on said vehicle for aerodynamic reaction with the relatively moving air to elevate the vehicle above the rails when the vehicle attains a predetermined speed.

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