United States Patent [19]

Denenburg

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[54] **TRANSPORTATION SYSTEM**

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[52] **U.S. Cl.** ..... **104/20;** 104/23 FS; 214/38 CB

[51] **Int. Cl.** **B61k 1/00**

[58] **Field of Search** ..... 104/88, 20, 23 FS; 214/38 CB

[56] **References Cited**

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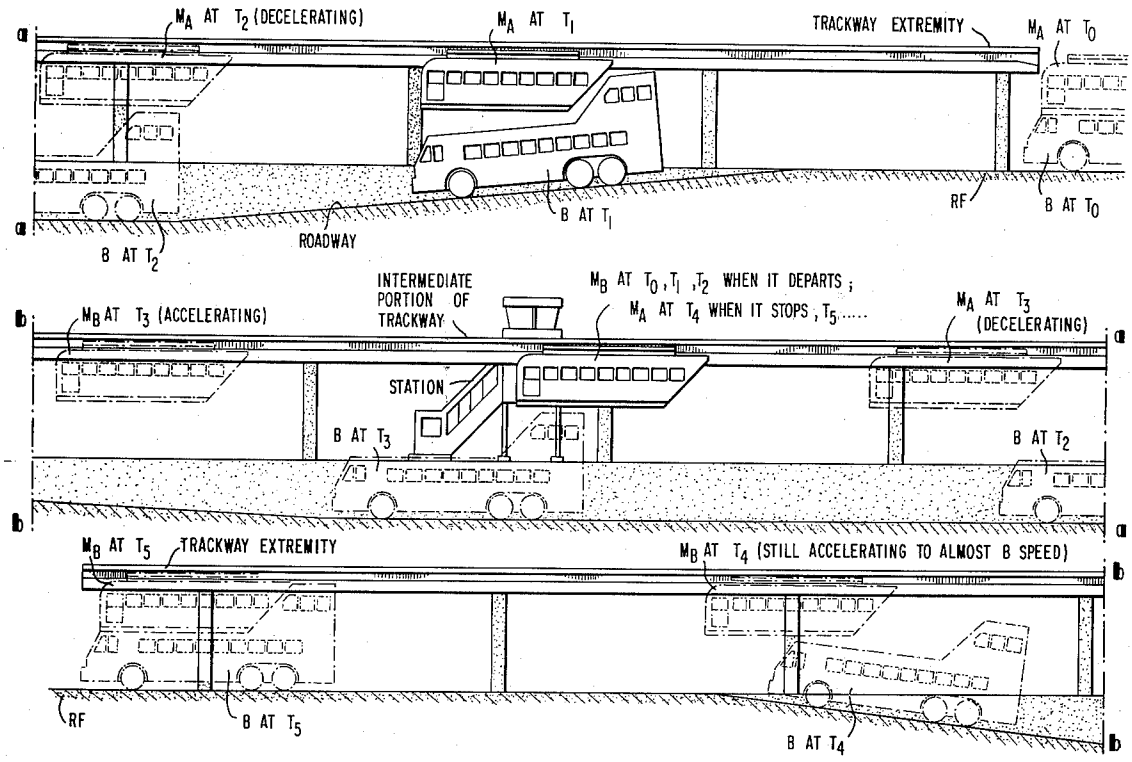
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Primary Examiner—Frank E. Werner
Assistant Examiner—George F. Abraham

[57] **ABSTRACT**

A wheel-supported vehicle carries on its top a removable modulus. When approaching a station, the modulus engages a supporting trackway, a vertical divergence between the vehicle and the modulus occurs, the modulus decelerates to a stop at the station where it unloads and loads. The vehicle continues on beneath the modulus to a pick-up point where a vertical convergence with another modulus which at that time has loaded and departed from the station occurs.

1 Claim, 11 Drawing Figures



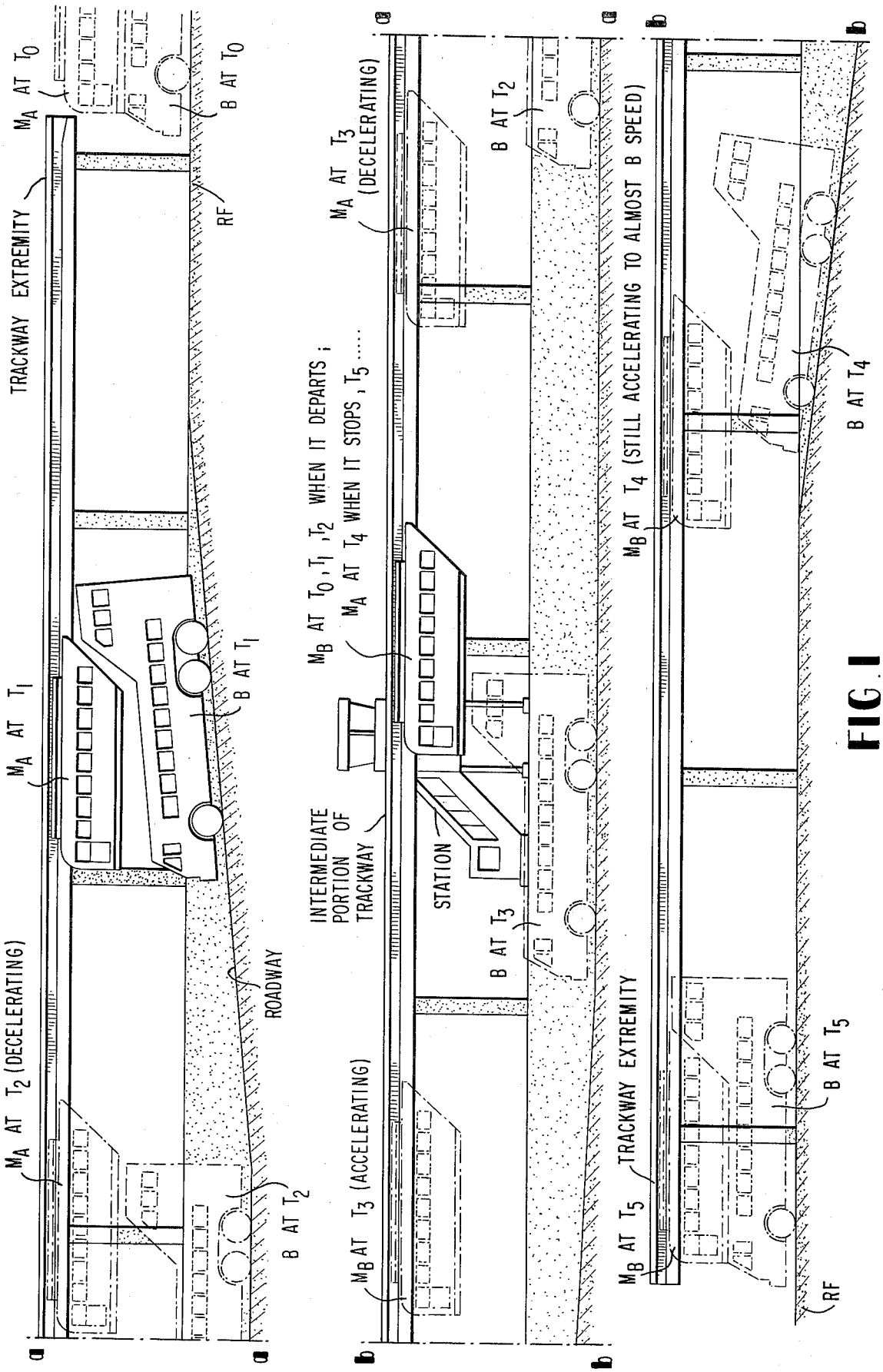

M_A AT T_0
TRACKWAY EXTREMITY
B AT T_0
RF
M_A AT T_1
B AT T_1
M_A AT T_2 (DECELERATING)
ROADWAY
B AT T_2
M_B AT T_0, T_1, T_2 WHEN IT DEPARTS ;
M_A AT T_4 WHEN IT STOPS, T_5 .....
M_A AT T_3 (DECELERATING)
B AT T_2
INTERMEDIATE PORTION OF TRACKWAY
STATION
B AT T_3
M_B AT T_3 (ACCELERATING)
M_B AT T_4 (STILL ACCELERATING TO ALMOST B SPEED)
B AT T_4
M_B AT T_5
TRACKWAY EXTREMITY
B AT T_5
RF

FIG. 1

FIG. 2

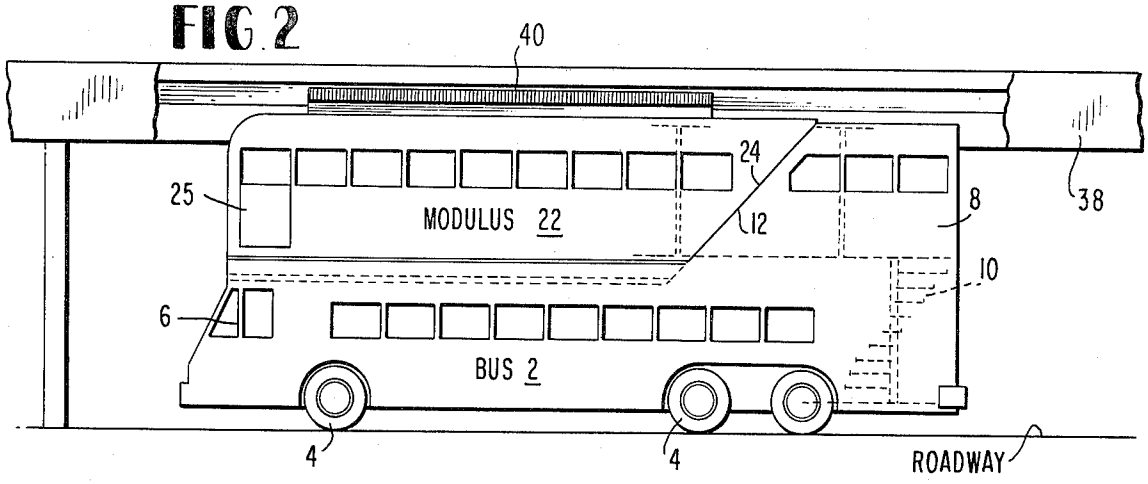


FIG. 3

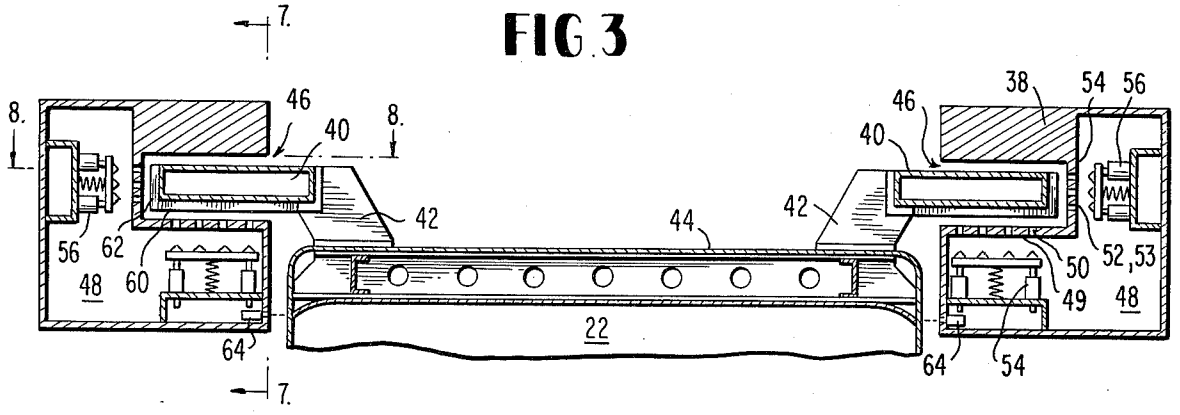


FIG. 4

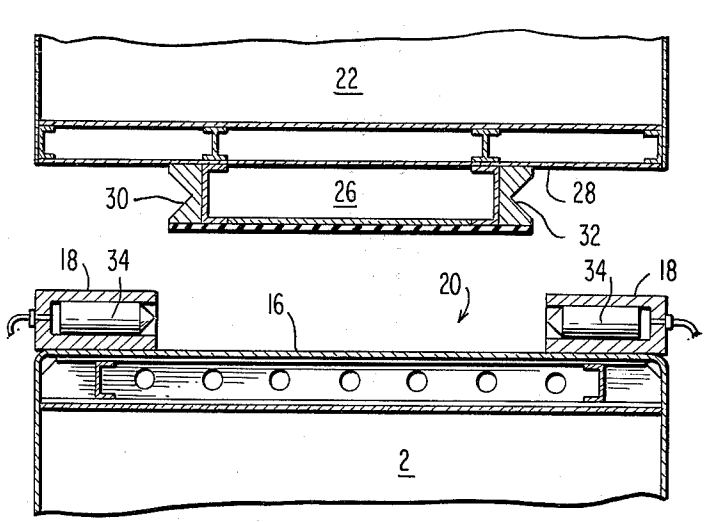


FIG. 5

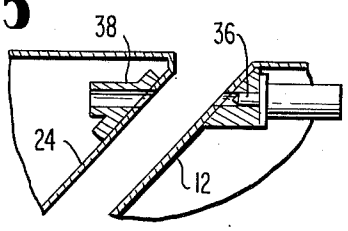


FIG. 6

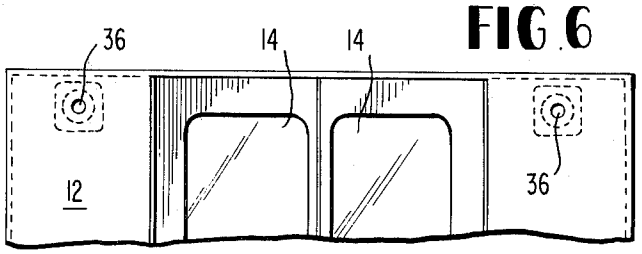
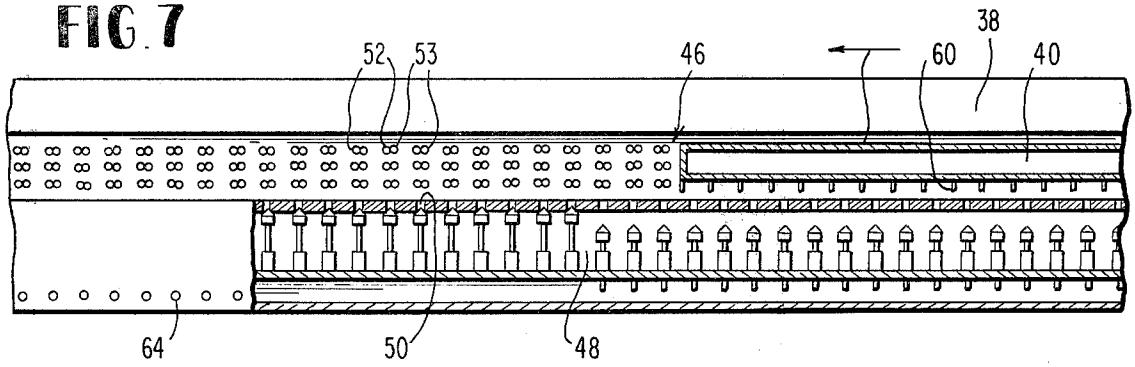


FIG. 7



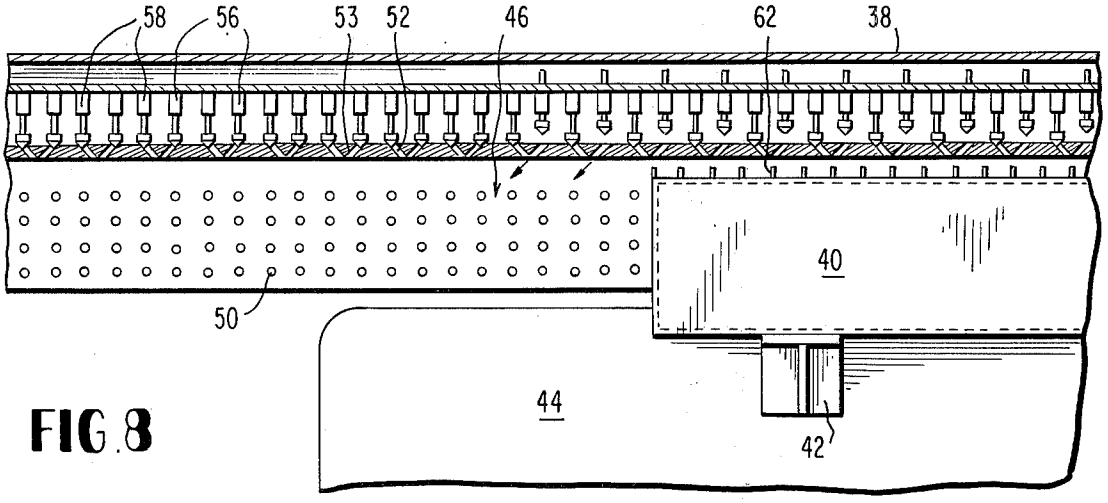


FIG. 8

FIG. 9

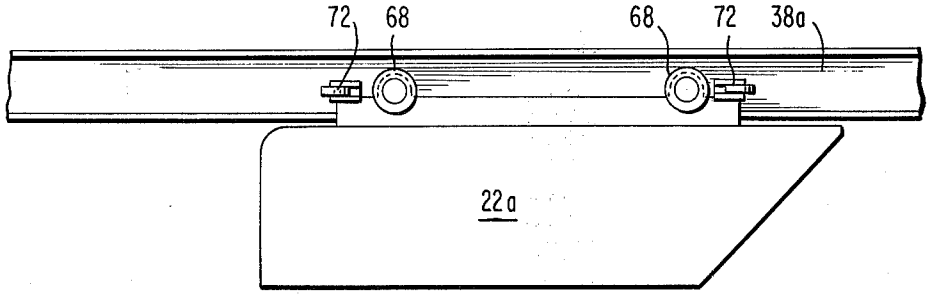
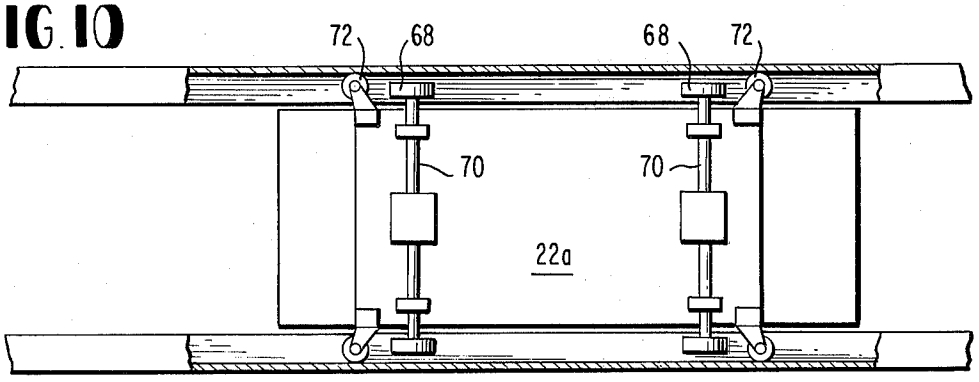


FIG. 10



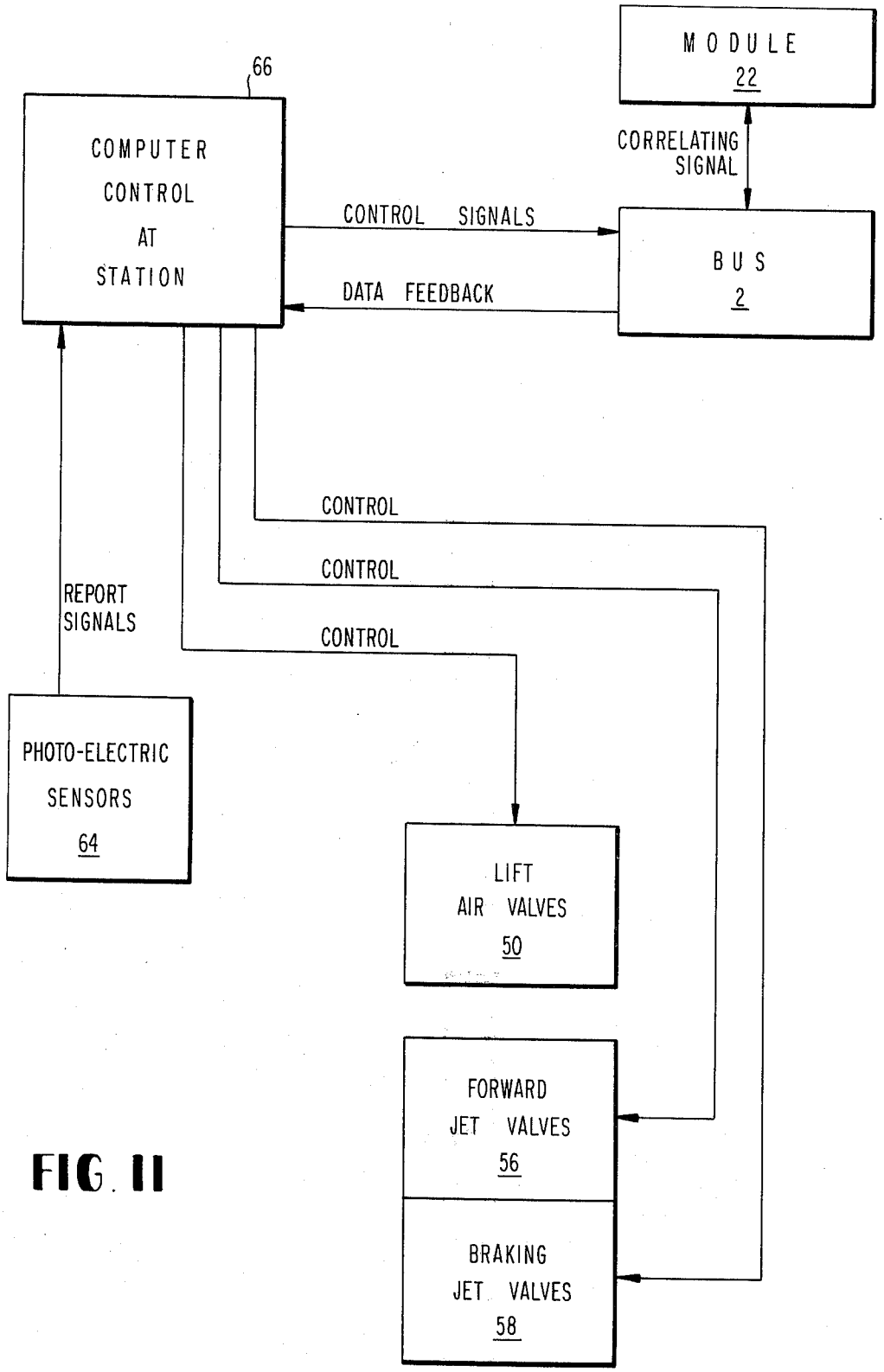

66
COMPUTER CONTROL AT STATION
MODULE 22
CORRELATING SIGNAL
CONTROL SIGNALS
DATA FEEDBACK
BUS 2
CONTROL
CONTROL
CONTROL
REPORT SIGNALS
PHOTO-ELECTRIC SENSORS 64
LIFT AIR VALVES 50
FORWARD JET VALVES 56
BRAKING JET VALVES 58

FIG. 11

TRANSPORTATION SYSTEM

FIELD OF INVENTION

Railways, Airplane.

PRIOR ART

Post application Ser. No. 210,051; Easton et al., U.S. Pat. No. 3,611,945.

OBJECTS

The primary object of this invention is to provide a transportation system utilizing vehicles capable of continuous movement, wherein loss of time by loading can be avoided by those who do not desire to be loaded or unloaded. More specifically, it is intended to provide a system particularly adapted to urban needs, wherein busses (either rubber-tired or rail-supported) can be around suburban areas, collecting and discharging passengers in conventional fashion, then run into the heart of a city along high-speed routes, and then run with continuous movement past a series of stations. Instead of stopping at any station, the bus releases a module into which all passengers who desire to disembark at that station have gathered. The modulus stops at the station, and the bus continues on beyond the station where it picks up another module which has been separated from a previous bus, loaded and departed from the station.

The utilization of a vehicle with a separable modules is not broadly novel (see Easton et al., supra). What is believed to be novel here is the provision of a system wherein a number of bus-like vehicles can move about areas such as suburbs in conventional fashion, so that passengers can be picked up or discharged, and then these vehicles can be caused to converge on stations within the city, and all of them can be accommodated by a comparatively few stations without delay at any station to any of the passengers who desire to continue on to another station.

These and other objects will be apparent from the following specifications and drawings, in which:

FIG. 1 is a three-part view showing two busses and two moduli undergoing a typical operational sequence at a station;

FIG. 2 is a side elevation of a bus, with a modulus attached, at a point where the modulus is engaged with an auxiliary air-cushion trackway at a station;

FIG. 3 is a fragmentary cross-sectional view of the top of a modulus in an air-cushion trackway;

FIG. 4 is a fragmentary cross-sectional view of a part of the bottom of a modulus vertically separated from a bus;

FIG. 5 is a fragmentary cross-sectional view showing one of the latches to deter vertical movement between a module and a bus;

FIG. 6 is a fragmentary elevational view showing the position of latches shown in FIG. 5, and showing the location of doorways between a bus and a module;

FIG. 7 is a diagrammatic cross-sectional view along the line 7—7 of FIG. 3;

FIG. 8 is a diagrammatic cross-sectional view along the line 8—8 of FIG. 3;

FIG. 9 is a diagrammatic side elevational view of a modified form of module support;

FIG. 10 is a plan view of the modification shown in FIG. 9; and,

FIG. 11 is a block diagram of the control and report-back signal system.

Referring first to FIG. 1, the operational sequence of the system will first be outlined. Typically, there is a roadway having between two flat portions RF a depressed portion D, and a vehicle, in the preferred form a bus B, which carries on its top a detachable modulus. In this diagram, it will be assumed that there are two moduli, namely, modulus MA which is carried on the bus as it approaches a station, and modulus MB, which has been left at the station by a previous bus (not shown). For purposes of exposition, six consecutive units of time, T0 through T5 will be assumed. It will be further understood that this is an elevated trackway along which the moduli may glide, and the roadway is vertically separated from the trackway in the region of the station sufficiently for a bus to pass clearly beneath a module when the latter is at the station.

As seen at the upper right-hand part of FIG. 1, module MA is atop bus B at T) immediately prior to engagement with the trackway. Bus B and module MA proceed along to the left, as seen in FIG. 1 until the time T1. At the upper central part of FIG. 1 it will be seen that, at T1, bus B has started down the incline towards the depressed part of the roadway, which is reached at T2. At T2, bus B proceeds beneath module A, which by then has started to decelerate.

During the intervals T0 and T1, there has been waiting at the station another modulus MB. At T2, modulus MB departs from the station and, by T3, this other modulus has started to accelerate towards the same speed as bus B. By T4, modulus MB is still accelerating, almost to the speed of the bus and modulus MA has stopped at the station. At T4, bus B has started up the incline away from the depressed part of the roadway, and is coming up beneath modulus MB. Approaching the T5 position, bus B has come up and engaged beneath modulus MB and at T5 modulus MB, engaged on bus B, is about to reach the end of the trackway. At that time, modulus MA is waiting at the station for another bus.

Although the bus may be of the track-supported type, the illustrated form is designed for highway use. In FIG. 2 there is shown a bus 2 having conventional rubber tires 4, a driver's station 6, and an elevated upper deck 8 at the rear. Access from the lower portion of the bus to the upper deck may be gained by stairs 10 in the rear of the bus, and at the front of the upper deck 8 is an upwardly and rearwardly inclined plate 12 through which there are doors 14 (FIG. 6). Running fore-and-aft of the top 16 of bus 2, on opposite sides thereof are a pair of bars 18 which, together with the bus roof, define an upwardly open recess 20.

Normally resting on bars 18 is a modulus 22 which has an upwardly and rearwardly inclined rear wall 24 which mates against the wall 12 at the front of the upper deck of the bus, and an elongate box-like tongue 26 which runs fore-and-aft along the modulus bottom 28 and engages into recess 20. Rear wall 24 of the modulus has doors (not shown) which register with the doors 14 on the bus, and side doors 25 are provided at the front of the modulus. Dovetail-shape grooves 30, 32 along the sides of tongue 26 are engaged by hydraulically-operated plungers 34 to lock he modulus onto the top of the bus, and other suitable locking devices, such as plungers 36 engaging in recesses 38 may be utilized to lock the modulus onto the bus.

In the form shown in FIGS. 1–8, modulus 22 is supported on trackway 38 by an air-cushion system.

Extending along each side of a modulus are elongate stub wings 40 which, as shown in FIG. 3, extend outwardly from hangers 42 on each side of the modulus top 44. Running lengthwise within each side of trackway 38 are channels 46 within which wings 40 loosely engage. Along the lower and outer sides of channels 46 are L-shape headers 48 connected to sources of air under pressure (not shown). Through the base walls 49 of the headers are a series of ports 50 and through the stem walls 51 of the headers are forwardly and rearwardly directed ports 52 and 53. Ports 50 are controlled by sets of solenoid valves, and ports 52 and 53 are likewise controlled by sets of solenoid valves 56 and 58. Along the bottoms and outer sides of wings 40 are fins 60, 62. It will thus be apparent that if solenoid valves 54 in the header base walls are open, the module will be supported on an air cushion therebeneath. The sets of ports 52 or 53 in the header stem walls keep the module centered between the opposite channels. If ports 52 are opened, the module is propelled forwardly, and if ports 53 are opened, the module is either braked or propelled rearwardly. The position of the module along the trackway 38 is sensed by a series of photoelectric cells 64 which are spaced along the trackway. In accordance with standard air-cushion vehicle practices, only those ports 50 beneath and closely adjacent to the wings are opened, and only these ports 52 or 53 which lie laterally of or are adjacent to the wings are opened at any given time.

FIG. 11 diagrammatically illustrates a control system. At each station is a computer 66 into which all pertinent data is fed, and from which all appropriate control signals are dispatched. As soon as the wings 40 of a modulus enter the channels of a trackway 38 their presents are sensed by photocells 64 and reported to computer 66. "Lift" signals are applied to the solenoid valves 54 which control the ports in the header base wall to provide an air cushion beneath the module's wings, and speed control signals are dispatched to the bus 2. During its entire time of passage beneath the trackway, the speed of the bus is controlled by the computer; and, if needed, the speed of each bus as it approaches a trackway can be controlled. Obviously, radio links can be utilized.

As the bus approaches the incline where vertical separation occurs, control signals from computer 66 actuate the plungers 18 and 36 so as to unlock the module from the bus. After vertical separation from the module, the bus proceeds along the depressed roadway until it reaches the upward inclination, by means of which it rises up under a preceeding module as previously explained.

As the module which has just been separated from the bus approaches the station, valves 58 are opened under the control of signals from computer 66, the module is braked to a stop. Unless the module is otherwise held against movement at the station, all the valves which control the air ports in the headers are closed so that the module wings rest on the base walls of the headers.

After the passengers have unloaded and loaded at the station, and when the next bus comes along, computer 66 opens valves 54 beneath the wings and opens valves 56 so that the air jets through ports 52 to start the module forward. By the time the module is ready for coupling onto the bus which rises beneath it, both the module and bus are traveling at the same speed. After engagement of the bus beneath the module, plungers 18 and 26 are actuated so as to lock the bus and module together.

In the foregoing, an air cushion suspension for the module has been described. In FIGS. 9 and 10 an alternate type of suspension of a module 22*a* on another type of trackway 38*a* is illustrated. In this embodiment, trackway 38*a* has channels 46*a* in which run supporting wheels 68 on the ends of axles 70 mounted atop the modulus. Bumper wheels 72 which engage the sides of channels 38*a* keep the modulus centered. Conventional braking and driving arrangements would be provided to stop the modulus at the station, and to start it off again for coupling onto a bus top. Otherwise, the operation of the system is essentially the same as the air-cushion embodiment.

Either form of the invention may be scaled down and adapted for use as a scale model in order to work out the timing and passenger flow of a system utilizing the invention, and this form shown in FIGS. 9 and 10, when miniaturized, is particularly adapted for use as a toy or hobby in the building of modern transportation systems in model form. In either embodiment, vertical separation between the modulus and the bus may be obtained by inclining the trackway upwardly towards the station so that the bus runs along a level roadway; or both the trackway and roadway may incline away from and towards one another.

I claim:

1. In a transportion system

a vehicle adapted to run along a roadway, a modulus removably supported on the top of the vehicle,

a station on said roadway,

an elevated trackway above the roadway extending therealong continuously for a distance on both approach and departure sides of the station,

said trackway on the approach and departure sides of the station having extreme portions thereof which are vertically separate from the roadway by a certain distance and having an intermediate portion at and adjacent the station which is vertically separated from the roadway by a distance substantially greater than said certain distance, means on said trackway for supporting said module for movement therealong, the vertical separation of the trackway above the roadway at the intermediate portion thereof being sufficient to permit the vehicle to pass freely beneath the modulus when the latter is supported on the trackway,

said trackway having elongate support means extending along opposite sides thereof and disposed laterally outward from a module supported thereon, laterally projecting means on opposite sides of said module overlying said support means,

said laterally projecting means on the module comprising elongate surface means, and means extending lengthwise along the elongate support means on the trackway providing air-cushion support for said elongate surface means,

air-jet means disposed along said trackway for selectively propelling or braking the module, a central control device at said station, and means extending along said trackway for sensing the position of a module thereon and for reporting the same to the central control device, said central control device including means for operating said air jet means for either propelling said module along the trackway or for stopping the module at the station.

* * * * *