United States Patent

[11] 3,610,160

[72] Inventor **Mihai Alimanestianu**
70 West 40th St., New York, N.Y. 10018

[21] Appl. No. **850,939**
[22] Filed **Aug. 18, 1969**
[45] Patented **Oct. 5, 1971**

[54] **TRANSPORT SYSTEM**
3 Claims, 18 Drawing Figs.

[52] **U.S. Cl.** **104/88,** 104/127, 104/76
[51] **Int. Cl.** **B61b 13/12,** B65g 17/42
[50] **Field of Search** 104/76, 77, 88, 127, 134, 168; 198/137

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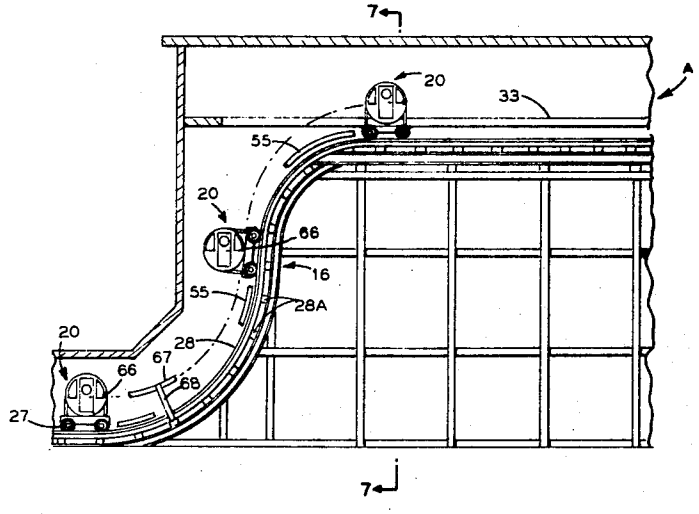
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Primary Examiner—Arthur L. La Point
Assistant Examiner—D. W. Keen
Attorney—Philip G. Hilbert

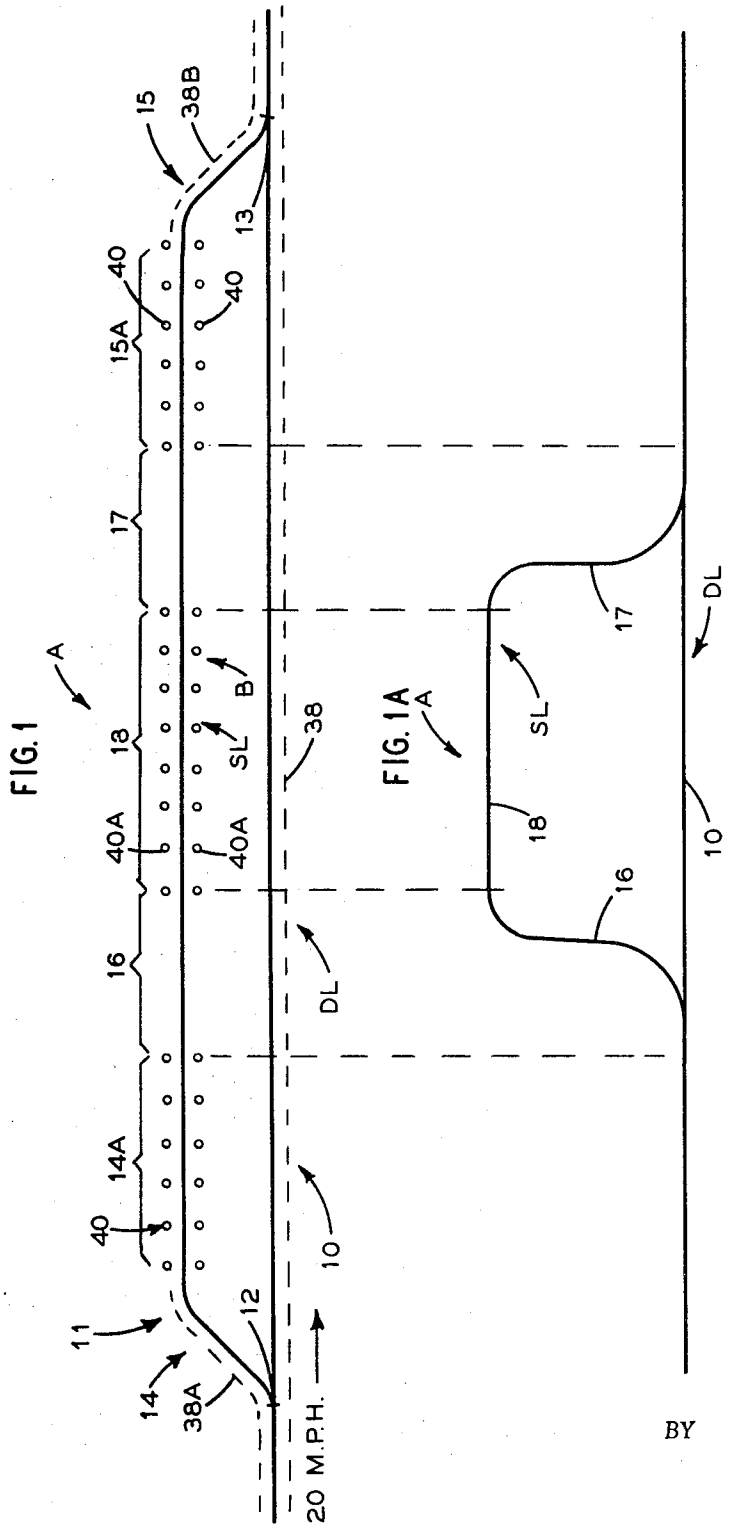
ABSTRACT: A system for transporting passengers and freight through areas of high-density traffic including loading and unloading stations at street or other convenient approach level, the transporting means moving basically on a main line level displaced from the station level, together with spur means for connecting the two levels for high-speed switching of the transportation means between the levels; and improved propulsion means for the transport system.

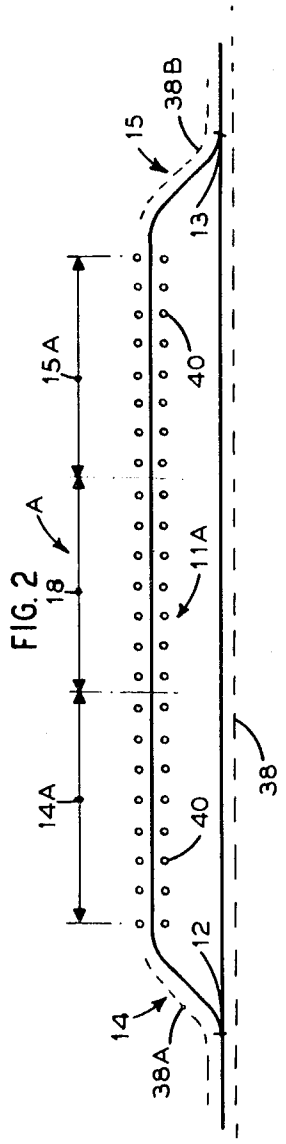


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SHEET 1 OF 7



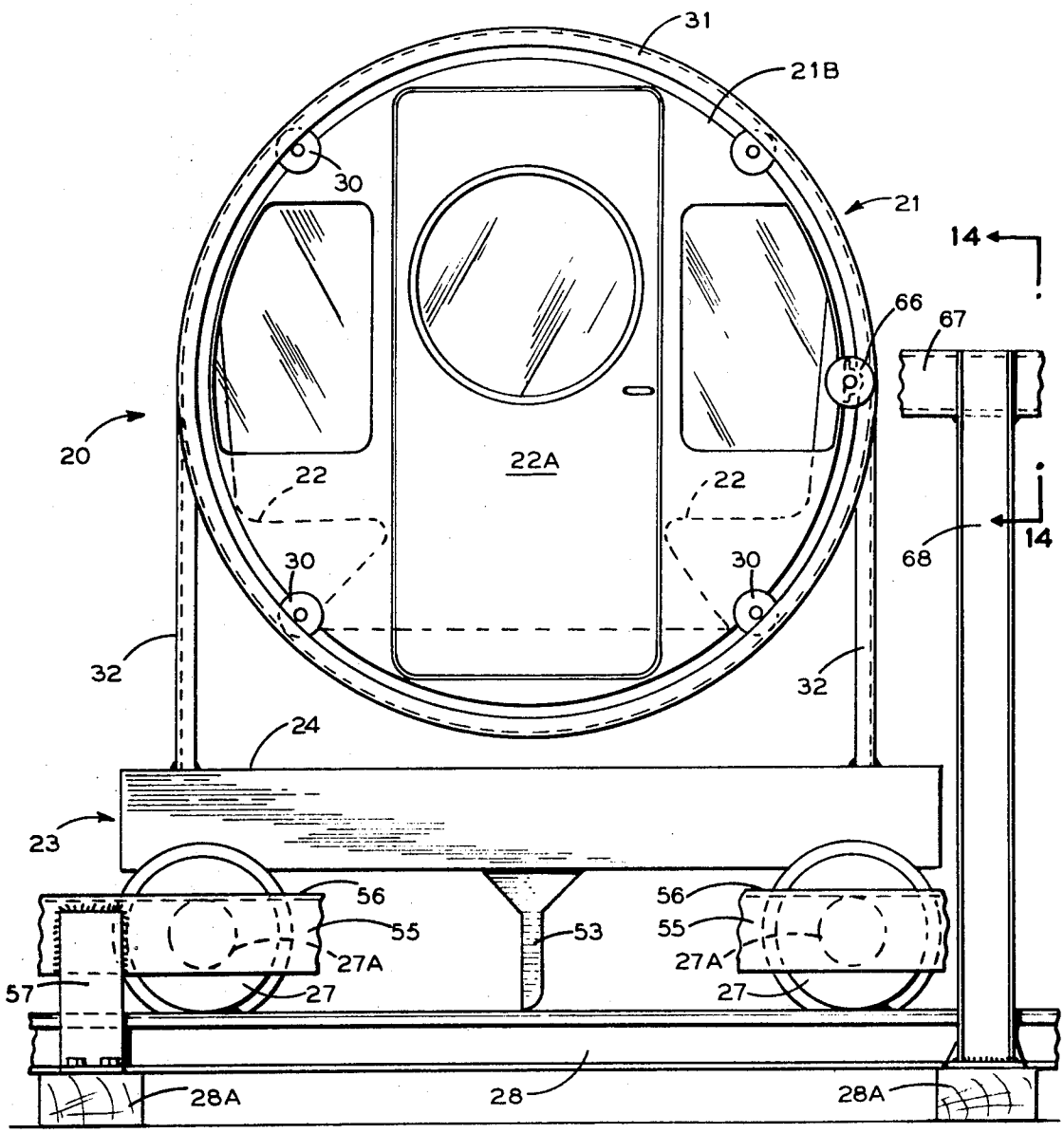


INVENTOR.
Mihai Alimanestianu

BY

ATTORNEY

FIG. 3


31
21B
30
21
14
66
67
20
22A
22
22
30
30
14
68
32
32
24
23
56
55
53
56
55
27A
27A
57
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28A
28
28A

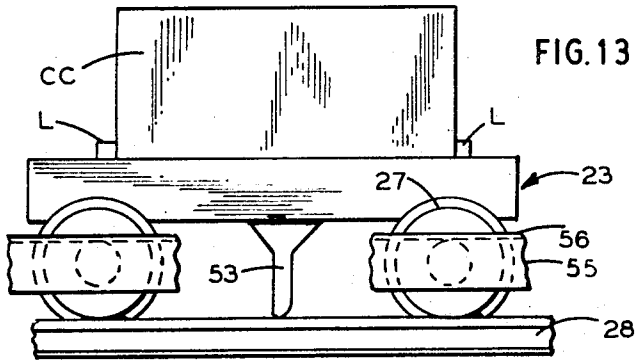
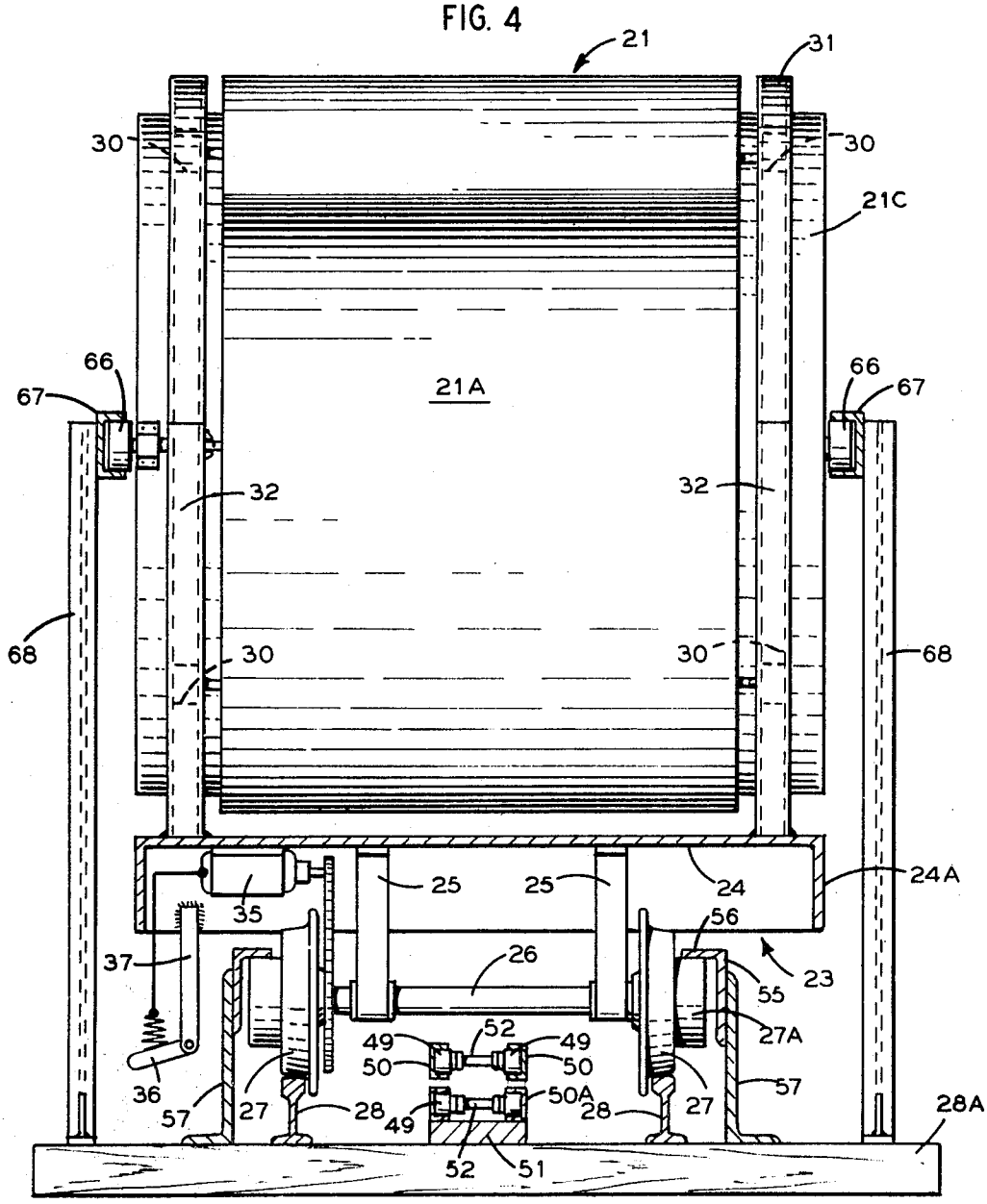

CC
L
L
27
23
56
55
53
28

FIG. 13

FIG. 4


21
31
30
30
21C
21A
66
67
66
67
32
32
68
30
30
68
24A
24
25
25
35
56
37
26
23
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27A
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50A
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57
28A
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51

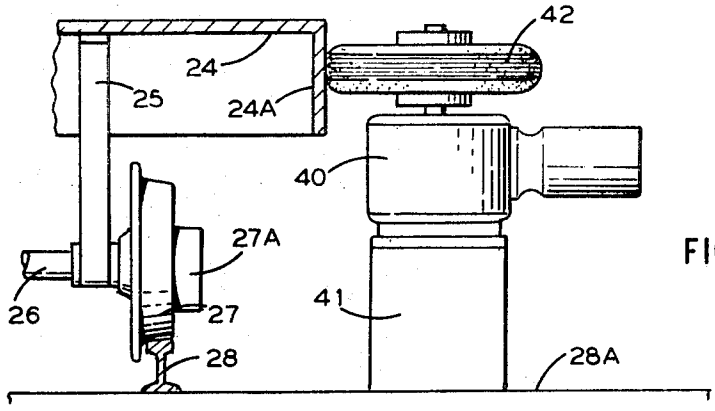

42
24
25
24A
40
27A
26
27
41
28
28A

FIG. 5

FIG. 6

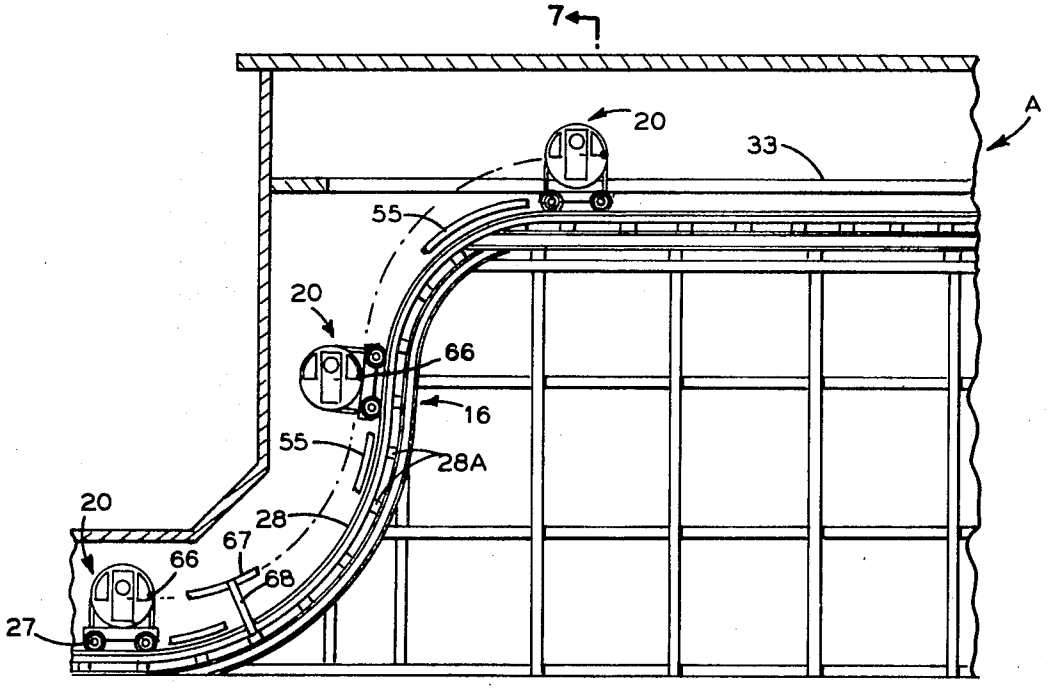


FIG. 9

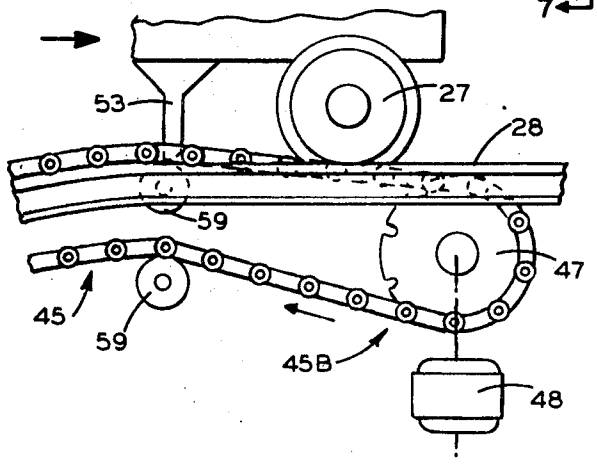


FIG. 7

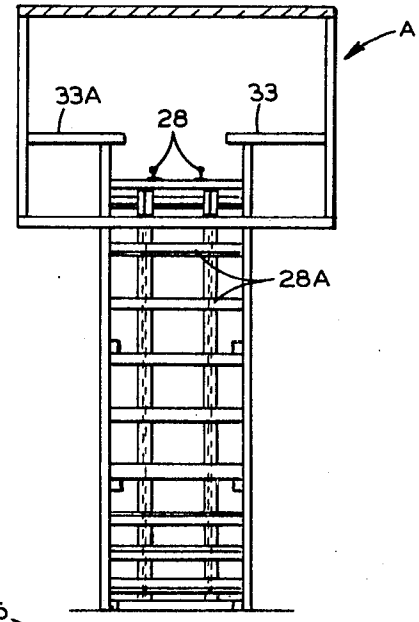


FIG. 8

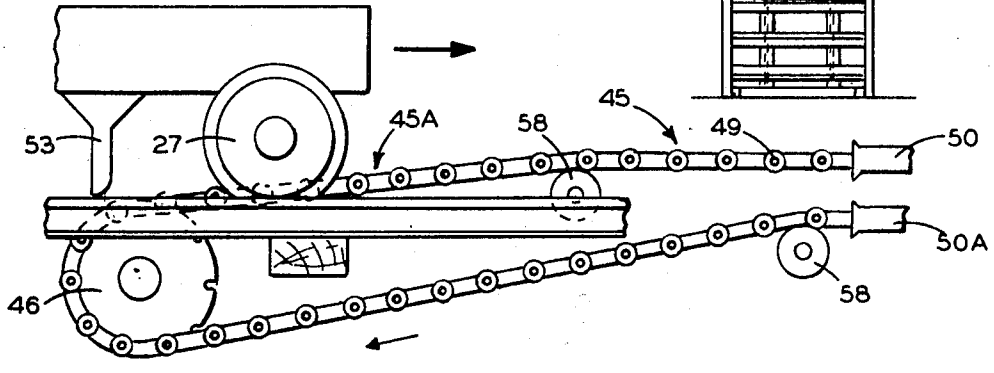


FIG. 10

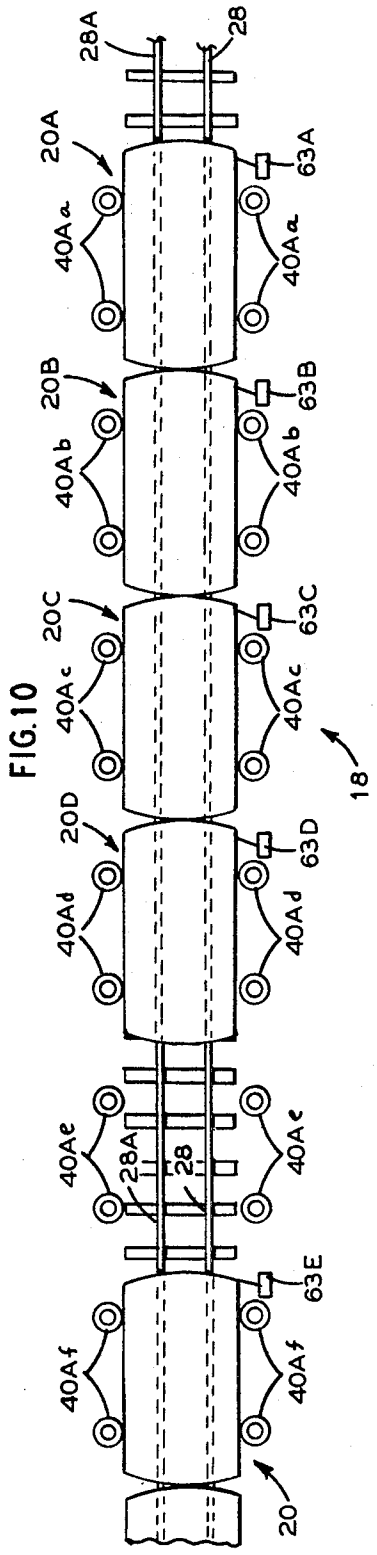

28A
28
20A
63A
40Aa
20B
63B
40Ab
20C
63C
40Ac
18
20D
63D
40Ad
40Ae
28A
28
40Ac
63E
40Af
20

FIG. 11

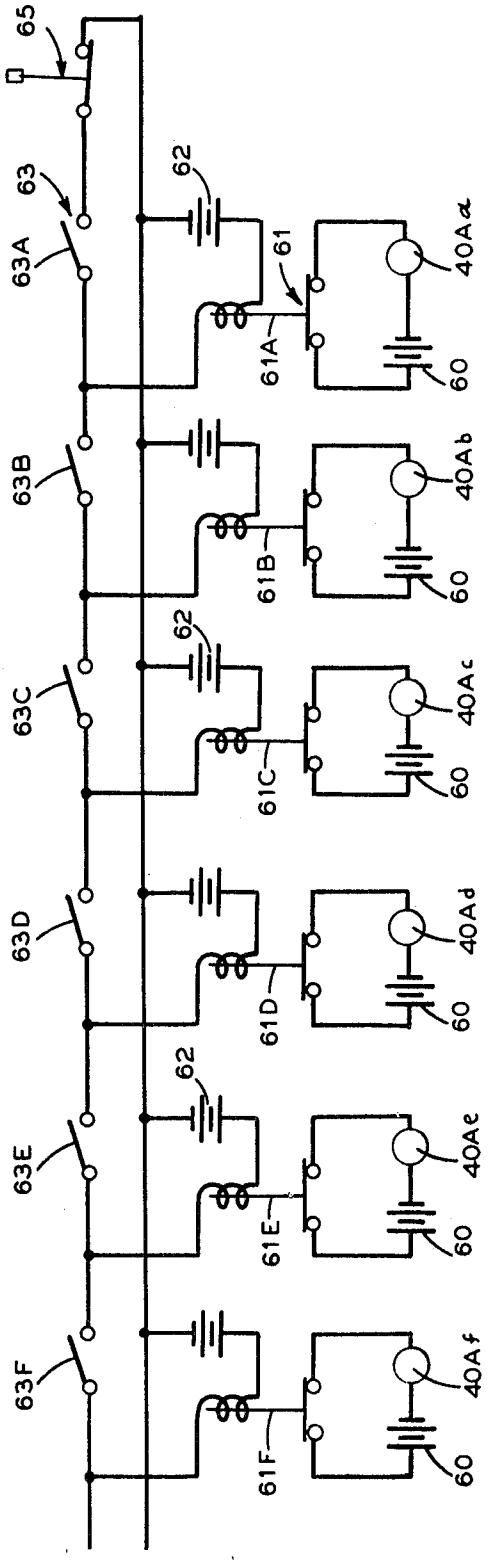

65
63
63A
62
61
61A
40Aa
60
63B
61B
40Ab
63C
62
61C
40Ac
63D
61D
40Ad
63E
62
61E
40Ae
63F
61F
40Af

FIG. 12

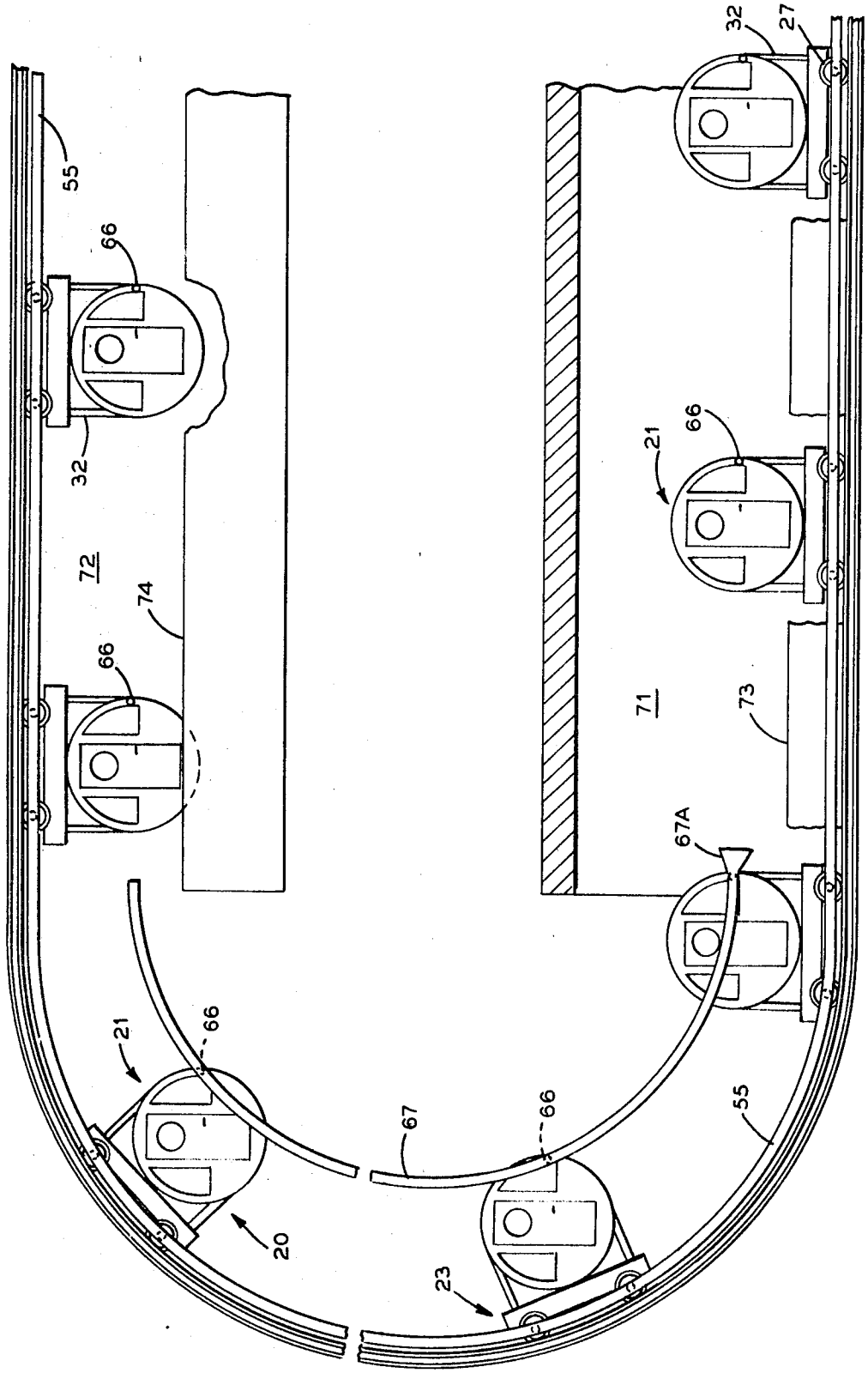


FIG. 14

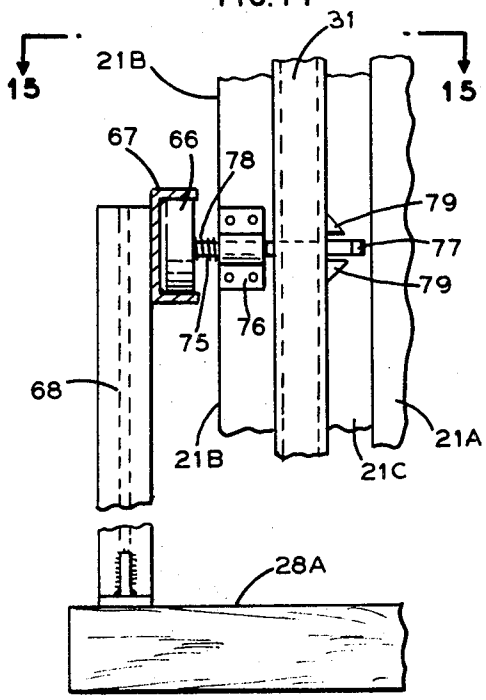


FIG. 16

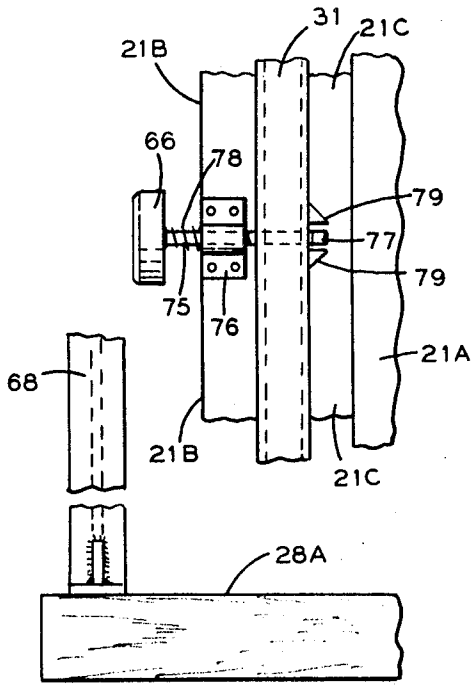


FIG. 15

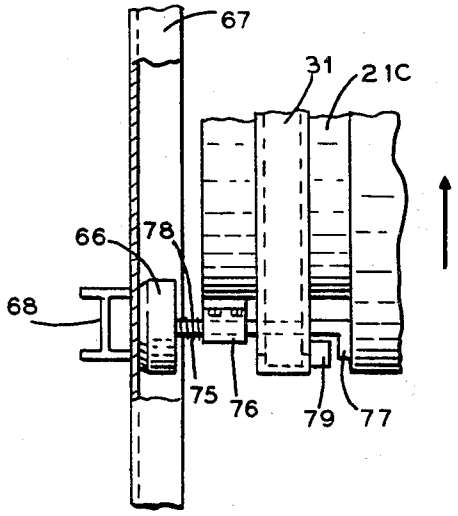
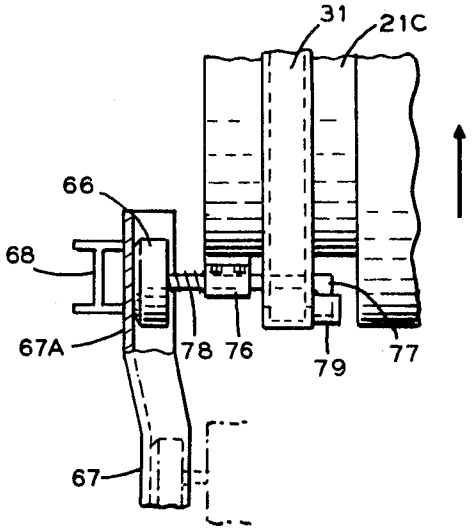


FIG. 17



TRANSPORT SYSTEM

BACKGROUND OF THE INVENTION

The problem of moving passengers and freight between selected points in high traffic density areas becomes more and more acute as known forms of transport are unable to cope with ever increasing numbers of passengers and volumes of freight. The problems become even more pressing as efforts are made to encourage the transfer of traffic from automotive transportation to public transportation, in order to reduce traffic congestion, air pollution, and the like.

However, with public transportation systems as presently known, in the form of high-speed systems such as subways; the actual capacity thereof is far removed from theoretical values and the operations are somewhat inefficient in terms of actual traffic movements. Further, passenger access to subway systems is extremely inconvenient because of the depressed transport level in relation to the surface approach level, requiring long staircases or expensive escalator or elevator systems.

Also, in subway systems as known, with ever increasing length of coupled trains to increase passenger capacity; there is a decrease in operational efficiency, together with increased expense for lengthening loading and unloading stations to accommodate the lengthened trains. Further, the use in such systems of variable speed motors for propulsion, represents very high capital investment for the same as well as continuing high maintenance costs.

The extended length of loading and unloading stations is known transport systems, impairs the efficiency of loading and unloading operations and makes passenger or freight movements inconvenient in respect to the approach and leaving the transport means.

Accordingly, an object of this invention is to provide improved transportation systems, particularly adapted for high density passenger or freight traffic, which is highly flexible in operation, is of greater convenience for passengers, utilizes propulsion means which is economical in cost and maintenance, and is capable of substantially increased capacities of passenger and freight movements.

Another object of this invention is to provide in a transport system, a main line traffic level in displaced relation to loading and unloading levels which may be at street or other suitable approach levels, with spur lines connecting the main line level with station levels, the spur lines having essentially vertical paths with abrupt transition to the horizontal portions thereof at the station levels.

Another object of this invention is to provide in a transport system of the character described, transport units having relatively small individual passenger or freight capacity, which lends themselves to highly flexible operation and efficient movements over acutely angular portions of the spur line path.

A further object of this invention is to provide in a transport system of the character described, improved passenger transport units which comprise a pallet-type undercarriage and a passenger-carrying capsule of limited passenger capacity, mounted on the undercarriage for movement about a horizontal axis to allow the capsule to maintain a normal upright position at all times, while the undercarriage takes varied positions in accordance with the angularity of various portions of the spur line path.

Still a further object of this invention is to provide in a transport system of the character described, improved propulsion means including constant speed electric motors throughout the system; yet allowing for efficient acceleration and deceleration at switching points between the main line and the respective spur lines at loading and unloading stations.

Yet another object of this invention is to provide in a transport system of the character described, main line and spur line paths which are colevel, for the movement of passengers or freight thereover, constant speed electric motors being used to effect efficient movements of the transport means over such paths.

Still another object of this invention is to provide in a system of the character described, improved locking and guiding means for capsules movably mounted on pallets.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic showing of a station area of a transportation system embodying the invention, in plan;

FIG. 1A is an elevational view thereof;

FIG. 2 is a diagrammatic showing in plan, similar to that of FIG. 1 and showing an alternative form of the invention;

FIG. 3 is a side elevational view showing a passenger carrying capsule forming an element of the system;

FIG. 4 is an end elevational view thereof;

FIG. 5 is a partial elevational view thereof, showing drive means therefor;

FIG. 6 is a side elevational view showing the approach side of a station portion of the system;

FIG. 7 is a vertical sectional view taken on the line 7—7 of FIG. 6; FIG. 8 is a partial elevational view showing drive means for the capsule at the approach side of the station;

FIG. 9 is a view similar to that of FIG. 8, showing the drive means at the terminal far end thereof;

FIG. 10 is a plan view showing the capsules in the station area;

FIG. 11 is a circuit diagram showing the control means for the capsules in the station area;

FIG. 12 is a view in elevation showing a modification of the transport system; and

FIG. 13 is an elevational view showing a cargo carrying pallet as an element of the transportation system.

FIG. 14 is an elevational view showing locking and guide means for the capsule; FIG. 15 is a sectional view taken on the line 15—15 of FIG. 14; FIG. 16 is a view similar to that of FIG. 14, showing the locking means in operative position; and FIG. 17 is a plan view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The instant invention is embodied in a transport system for high traffic density areas which includes a main line extending between distant points and spur lines at intermediate points. The individual spur lines are connected at the opposite ends thereof to the main line at longitudinally spaced points therein. Such spur lines pass through loading and unloading station areas which may be at a level different from that of the main line or may be colevel therewith.

When the spur lines include a portion at a level different from the main line level, the main line connecting portions of the spur line have a substantially vertical path on both the approach and departure ends thereof.

Thus, as shown in FIG. 1, 10 designates a main line path of a transport system embodying the invention. A single station on the line, to which passenger or cargo transport means may be switched from main line 10, is generally indicated at A. Such station A includes an intermediate portion B which is at a street level SL while the main line path 10 is at a depressed level DL.

A spur line path generally indicated at 11 is connected to main line path 10, at longitudinally spaced points 12, 13 for switching from and to the main line path 10. Spur line path 11 includes offset portions 14, 15 which are colevel with path 10, portions 14A, 15A extending from portions 14, 15 respectively and also colevel with path 10, portions 16, 17 extending from portions 14A, 15A respectively, said portions 16, 17 extending substantially in a vertical plane, FIG. 1A, and interconnecting an intermediate portion 18 located at the street level SL of station area A.

Passenger-carrying means used in the instant transport system, is generally indicated at 20, FIGS. 3, 4. The same comprises a capsule of limited passenger capacity, indicated at 21; and being of the order of 2–6 persons. The capsule 21 is shown as being of cylindrical shape, although the same may have other shapes. Capsule 21 comprises a cylindrical wall 21A,

circular sidewalls 21B and cylindrical end portions 21C of reduced diameter. Capsule 21 is provided interiorly thereof with facing seat portions 22; doors 22A in sidewalls 21B allowing for passenger unloading on one side while loading on the other side.

Each capsule is mounted on a pallet 23 which includes a base portion 24 having depending from the underside thereof bearing members 25 on which axles 26 are mounted, Wheels 27 are mounted on axles 26 for engagement with rails 28 which extend in main line path 10 and portions of spur line path 11. Pallets 23 are propelled by motors 35 which are of constant speed type, and located on the underside of base portion, being connected to axles 26 by suitable sprocket chains.

Capsule 21 are mounted on pallets 23, for rotation relative thereto about a horizontal axis. To this end, rollers 30 are journaled in end portions of wall 21A and received in circular track frames 31 of channel cross section. Frames 31 are in upright opposed relation and fixed to base portion 24 of pallet 23 by vertical frame members 32.

Current is supplied to motor 35 by way of a spring-pressed shoe 36 mounted on a depending bracket 37; the shoe being engageable with third rail means 38 which extends along the rails 28 of the main line path 10. Third means 38A, 38B are also provided along spur line path portions 14, 15 respectively.

It is understood that a particular transport unit 20 or group of such units, destined to a particular station A, is switched from the main line path 10 to spur line path 11, at switching point 12. The switched unit 20 then traverses spur line path portions 14, 14A which are colevel with main line path 10; is then raised to level SL over a substantially vertical spur line path portion 16 for further movement over spur line path portion 18 in station A at portion B thereof.

Here the unit 20 is brought to a stop, as hereinafter described, to allow passengers to leave capsule 21 on one side thereof while others enter the capsule on the other side thereof, via doors 22A; the capsule 21 now being located between platforms 33, 33A.

The unit 20 then leaves station A, being passed to the depressed level D L over spur path portion 17, followed by movements over path portions 15A, 15 to switching point 13 where the unit 20 then rejoins main line path 10. Suitable switching means is provided at points 12, 13, as for example, switching means disclosed in copending application Ser. No. 754,379, filed Aug. 21, 1968.

Assuming that units 20 travel on the main line path 10 at a given constant speed, say 20 m.p.h. as provided by motors 35 and third rail current supply 38; when unit 20 is switched at point 12, current supply for motors 35 is now supplied by third rail current supply 38A, over path portion 14. When path portion 14A is reached, propulsion of unit 20 is taken over by a series of pairs of oppositely disposed motors 40. As shown in FIG. 5, motors 40 are provided with friction tire means 42 fixed to vertical output shaft 43; the motors 40 being located on bases 41 located on opposite sides of rails 28 in said zone 14A, to bring friction tire means 42 into driving engagement with depending apron portions 24A of pallet base portion 24.

Motors 40 are of the constant speed type; however, each succeeding pair of motors operates at a speed value some what less then that of the preceding pair of motors Thus, in effect, motors 40 acts as decelerating means for units, and thus capable of reducing the speed of the same from 20 m.p.h. to a relatively low value, such as 2 m.p.h. It will be apparent that third rail means 38A terminates at a point where motors 40 take over, thus deenergizing motors 35 when motors 40 propel unit 20.

The unit 20 has now reached the spur line path portion 16 where unit 20 must be propelled upwardly from level DL to level SL. To this end, there is provided an endless sprocket chain 45 entrained about end sprocket wheels 46, 47 located at opposite ends of zone 16. Sprocket wheel 47 is driven by a motor 48 at a constant speed of 2 m.p.h. substantially equal to the speed of the last pair of motors 40 in zone 14A.

The sprocket chain 45 is of conventional type with end rollers 49 received in guide channels 50, 50A for the upper and lower runs thereof respectively. The guide channels 50, 50A are suitably mounted on a base 51 disposed on rail ties 28A. Chain 45 includes links 52 which provide openings for receiving a prong member 53 depending from pallet base 23, to thereby engage unit 20 with said chain 45 to propel the same upwardly over path 16.

To facilitate the engagement of prong 53 with chain 45 at the lower end of zone 16, the chain portion 45A adjacent sprocket wheel 46, is angled downwardly by suitable location of sprocket wheel 46 and idlers 58, to provide converging paths for the lower end of prong 53 and the upper run of chain portion 45A. Similarly, at the upper end of zone 16, prong 53 disengages from the chain portion 45B, by reason of the divergence of the paths thereof, due to the location of sprocket wheel 47 and idlers 59, see FIGS. 8, 9.

Means for retaining pallets 23 in engagement with rails 28 in zone 16 are provided in the form of idler wheels 27A extending outwardly of the larger diameter rail-engaging wheels 27. Retainer means 55 extending along the length of zone 16 and to one side of rails 28, comprise an elongated member of inverted L-shaped cross section, having its short horizontal leg 56 overlying the idler wheels 57A, and being positioned properly by individual angle supports 57 fixed to ties 28A.

Thus, the unit 20 has now reached elevated path portion 18 at station portion B, where the propulsion of the same is now taken over by pairs of opposed constant speed motors 40A. Motors 40A operate at a constant speed to match that of chain 45, i.e. about 2 m.p.h. so that unit 20 moves slowly over the short distance of zone 18. Motors 40A operate in the same manner as shown in FIG. 5, the friction tires 42 thereof engaging apron portions 24A of pallet base portion 24.

Motors 40A are arranged to be deenergized as the single or multiple units 20 traverse the zone 18, to thereby bring the same to a halt at appropriate points along said zone 18.

Accordingly, a control system for motors 40A is provided as indicated in FIGS. 10, 11, to render the same operative to bring the units 20 into station area B and to allow such units to leave station area B; and further, to render the same inoperative to halt the units for unloading and loading in said station area B.

To this end, each group of motors 40A arranged to propel a single unit 20, is connected in circuit with current supply 60 through a normally closed solenoid switch 61. Each switch 61 is energized by a current source 62 in circuit with a normally open microswitch 63. Switches 63 are spaced along the extent of station area B, as at 63A–63D to be closed as individual units 20 pass the same.

Thus, as unit 20A moves into path portion 18, it will successively close switches 63D, 63C and 63B without affecting the operation of successive groups of motors 40A*d*–40A*b*, since switches 63D–63A are series connected. However when leading switch 63A is closed, as unit 20 reaches the extreme right hand position in path 18, solenoid switch 61A is energized, to open the circuit to motor group 40A*a*, causing unit 20 to come to a halt, said motors 40A*a* having the the conventional brake means operated when the motors are deenergized. The succeeding units 20B–20D, operate switches 63B–63D and solenoid switches 61B–61D in a similar manner, to bring such units to a halt in zone 18.

To reenergize motors 40A*a* to allow unit 20A to leave path portion 18, a pushbutton switch in series with switch 63A is operated to open the circuit to solenoid switch 61A whereby the same is closed to thus reenergize motors 40A*a*. Operation of switch 65 restores solenoid switch 61B, etc. to their normally closed positions.

Units 20A, 20B, etc. leave station A to return to main line path 10 by way of path portions 17, 15A and 15. Thus, the units 20 are reengaged by a sprocket chain 45 at the upper end thereof, said chain 45 moving at a speed of 2 m.p.h. as previously described, to bring said units down from level SL to level DL over path portion 17. The propulsion of said units is then

taken over by paired motors 40 in path portion 15A to accelerate the moving units from 2 m.p.h. to 20 m.p.h. successive sets of motors operating at constant speeds of progressively increasing values.

The propulsion of units 20 is then continued by third rail portion 38B which again energize motors 35 on the pallets 23, as previously described. The units 20 then pass at switch point 13, suitably operated, to main line path 10 where third rail 38 supplies current to propulsion motors 35.

While capsules 21 rotate in circular frames 31, the center gravity of said capsules is below the rotational axis thereof, so that the capsules tend to maintain a position such that seats 22 thereof are level, while units 20 travel on horizontal path portions. However, when such units travel on path portions 16, 17, means is provided for guiding the rotational displacement of capsule 21 relative to pallet 23, so that the horizontal position of seats 22 is maintained.

To this end, cam roller means 66 is journaled on the sidewalls 21B of the capsule. Cam track means 67 of channel cross section is located along the extent of path portions 16, 17, being supported by members 68 upstanding from ties 28A. Track means 67 is suitably curved to provide proper radial distances measured from ties 28A, FIG. 6, so that with cam roller means 66 moving in said track means 67, the units 20 will be positively maintained in proper position so that seats 22 will be still level while units 20 move over path portions 16, 17.

Further, units 20 are restrained against even limited rotational sway while moving over horizontal portion of the main path 10 and spur path 11, and more particularly when such units 20 are brought to a stop in station A or leave therefrom. To this end, capsules 21 are releasably locked to pallets 23 by way of a pin 75 extending from cam roller 66 and journaled on capsule wall portion 21C in a bearing member 76.

Pin 75 extends through the annular space between capsule 21 and the fixed frame 31, said pin terminating in an upturned stop portion 77; the pin 75 being biased axially by spring means 78 to locate stop portion 77 between a pair of abutments 79 secured to frame 31, FIG. 16, 17, to thus lock capsule 21 to pallet 23.

However, as a unit 20 approaches path portion 16, cam roller 66 enters offset portion 67A of cam track 67 with progressive inward movement of roller 66 and pin 75, FIGS. 14, 15, to thereby move stop portion 77 out of engagement with abutments 79, to release the capsule 21 from pallet 23. Thus, the guidance of capsule 21 in respect to pallet 23 is now taken over by cam roller 66 as it moves in cam track 67, as previously described. At the terminal ends of path portions 16, 17, as cam roller 66 leaves the ends of cam track means 67, spring 78 biases the pin 75 to bring stop portion 77 into engagement with abutments 79, to relock capsule 21 to pallet 23.

The transport system may also take the form of a continuous loop 70, located in a vertical plane, FIG. 12, with horizontal portions 71, 72 being located at different levels. Thus, transport units 20 including capsules 21 mounded on pallets 23, similar to that previously described, may run on rails 28 and operated to stop at selected stations 73, 74, etc. along the horizontal runs of said rails.

The system 70 includes constant speed propulsion means as previously described for operating the units 20 at a given constant speed between stations, together with deceleration on approaching a station and acceleration upon leaving a station, all as described above. Further, the capsules 21 are retained in nonhorizontal portions of the system by means of cam roller means 66 on the capsules and cam track means 67 with an entry portion 67A thereon, in the manner previously set forth. Further the pallets 23 are retained in engagement with rails 28 in the nonhorizontal path portions by retainer mean 55 which engages idler wheels 27A, as set forth above.

Cargo, as well as passengers may be carried over the systems of the instant invention. As shown in FIG. 13, pallets 23 may carry cargo containers CC which are releasably secured to base portion 24 thereof, by latch means L of known construction.

Further, as shown in FIG. 2, the main line path 10 and spur line path 11A connected to path 10 at switch points 12, 13 may be colevel, using constant speed propulsion means throughout. Here the third rail 38 supplies current to pallet motors 35 by way of shoe 36, to operate said pallets 23 at constant speed over path 10. Spur line portions 14, 15 are provided with third rail portions 38A, 38B for operating the pallet motors 35 as previously described.

Pairs of motors 40 in spur line portion 14A progressively decelerate the transport units 20 to a minimal speed for entering station A, as set forth above, while motors 40A move units 20 through the station, bringing them to a halt, and then starting them up again, by control means previously set forth. The units 20 are then accelerated in path portion 15A by pairs of motors 40 operating at constant speeds but at stepped up values. The third rail 38B then propels the units 20 at main line speed for rejoining main line path 10 at switch point 13, the third rail then supplying current to pallet motors 35. On main line path 10, third rail 38 takes over the supply of current to motors 35.

It is understood that means other then sprocket chains 45 may be used to propel the transport units 20 over the nonhorizontal portions of the system at suitable speeds.

Since the capsules 21 are of limited capacity and their pallets 23 are of corresponding appropriate dimensions, their movements are highly flexible over main and spur line paths, particularly in terms of loading and unloading; which allows for high-speed schedules and maximum passenger and cargo throughput.

Further, such capsules 21 have little difficulty in negotiating curves in the various spur line portions, particularly at the lower and upper ends of path portions 16, 17. Also, such capsules require stations A of materially reduced length which facilitates passenger movements in the station and materially reduces construction costs of the same.

I claim:

1. A transport system comprising a main line path, a spur line path communicating at the opposite ends thereof with said main line path at longitudinally spaced switch points therein, a loading and unloading station, said spur line path passing through said station, carrier means movable over said main line path for diversion to said spur line path at one of said switch points and return to said main line path at the other of said switch points, means for propelling said carrier means over said main line path at main line speed, means for propelling said carrier means at said main line speed over a pair of portions of said spur line path extending from said switch points respectively, means for propelling said carrier means over a second pair of spur line path portions extending from said first-mentioned pair of spur line path portions respectively and arranged to provide progressively decreasing speeds from said main line speed to a given minimal spur line speed and progressively increasing speeds from said minimal spur line speed to said main line speed respectively, and means for propelling said carrier over an intermediate spur line path portion in said station at said minimal spur line speed, said spur line path being at a level different from the level of said main line path, said spur line path further comprising a pair of substantially vertical portions connecting the opposite ends of said intermediate spur line portions respectively, means for propelling said carrier means over said vertical spur line path portions, means for retaining said carrier means in its movements over said vertical spur line path portions against displacement therefrom, said spur line path including rail means and said carrier means including wheels movable over said rail means, rotatable idler means on said wheels, said retaining means comprising fixed means engageable with said idler means for retaining said wheels in engagement with said rail means.

2. A transport system comprising a main line path, a spur line path communicating at opposite ends thereof with said

main line path at longitudinally spaced switch points therein, a loading and unloading station, said spur line path passing through said station, carrier means movable over said main line path for diversion to said spur line path at one of said switch points and return to said main line path at the other of said switch points, means for propelling said carrier means over said main line path at a main line speed, means for propelling said carrier means at said main line speed over a pair of portions of said spur line path extending from said switch points respectively, means for propelling said carrier means over a second pair of spur line path portions extending from said first mentioned pair of spur line path portions respectively and arranged to provide progressively decreasing speeds from said main line speed to a given minimal spur line speed and progressively increasing speeds from said minimal spur line speed to said main line speed respectively, means for propelling said carrier means over an intermediate spur line path portion in said station at said minimal spur line speed, means for controlling said last mentioned propelling means for stopping and starting said carrier means in said station, said last-mentioned propelling means comprising a plurality of longitudinally spaced electric motors located along the length of said station for operative engagement with successive, adjacent carrier means, said controlling means comprising a plurality of longitudinally spaced, series-connected normally open switches located along the length of said station for operation by said carrier means, and normally closed switch means in circuit with each of said motors responsive to the closing of said normally open switches to open the circuits to said motors.

3. A transport system comprising a main line path, a spur line path communicating at the opposite ends thereof with said main line path at longitudinally spaced switch points therein, a loading and unloading station, said spur line path passing through said station, carrier means movable over said main line path for diversion to said spur line path at one of said switch points and return to said main line path at the other of said switch points, means for propelling said carrier means over said main line path at a main line speed, means for propelling said carrier means at said main line speed over a pair of portions of said spur line path extending from said switch points respectively, means for propelling said carrier means over a second pair of spur line path portions extending from said first-mentioned pair of spur line path portions respectively and arranged to provide progressively decreasing speeds from said main **186** speed to a given minimal spur line speed and progressively increasing speeds from said minimal spur line speed to said main line speed respectively, and means for propelling said carrier means over an intermediate spur line path portion in said station at said minimal spur line speed, said first-mentioned propelling means comprising electric motor means on said carrier means, said third-mentioned propelling means comprising a plurality of longitudinally spaced constant speed motor means arranged along said second pair of spur line path portions for frictionally engaging and advancing said carrier means, successive motor means of said plurality of motor means having speeds of progressively changing values.