United States Patent [19]

Van Veldhuizen

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[45] **Mar. 27, 1973**

[54] **AIR TRACK AND VEHICLE THEREFOR**

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[52] **U.S. Cl.** .....**104/23 FS,** 104/161

[51] **Int. Cl.** **B61b 13/08**

[58] **Field of Search**...104/23 FS, 134, 138, 154–161; 105/63

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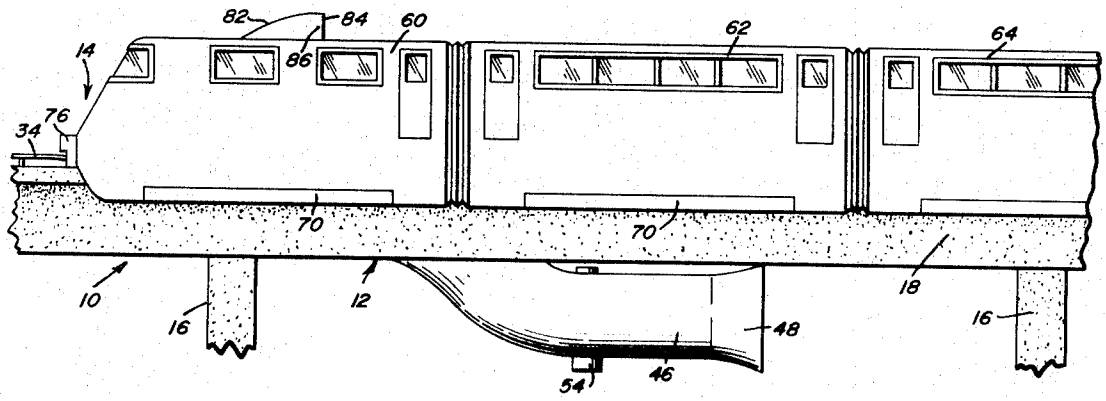
[57] **ABSTRACT**

An elongated tubular structure to comprise at least a portion of a trackway along which a vehicle may move in a guided manner. A longitudinal slot is formed throughout one longitudinal wall portion of the structure and seal means is provided for releasably sealing the slot throughout at least substantially its entire length. The seal means is constructed in a manner whereby at least portions thereof may be deflected for opening the slot throughout the length of a predetermined longitudinal extent thereof and air pump means is operatively associated with the tubular structure for supplying the interior thereof with air under pressure. A vehicle is provided for guided movement along the tubular structure and the vehicle includes portions thereof which at least partially embrace the slotted portion of the tubular structure. Also, the vehicle is provided with structure operative to open the seal means of the tubular structure in the area thereof embraced by the vehicle as the latter moves along the tubular structure and the vehicle includes means by which air escaping from the tubular structure throughout the portion thereof having its seal means displaced to an open position may be utilized to propel the vehicle along the tubular structure and/or support the vehicle from the tubular structure by the formation of an air cushion between the vehicle undersurface portions and opposing upper surface portions of the tubular structure.

8 Claims, 9 Drawing Figures



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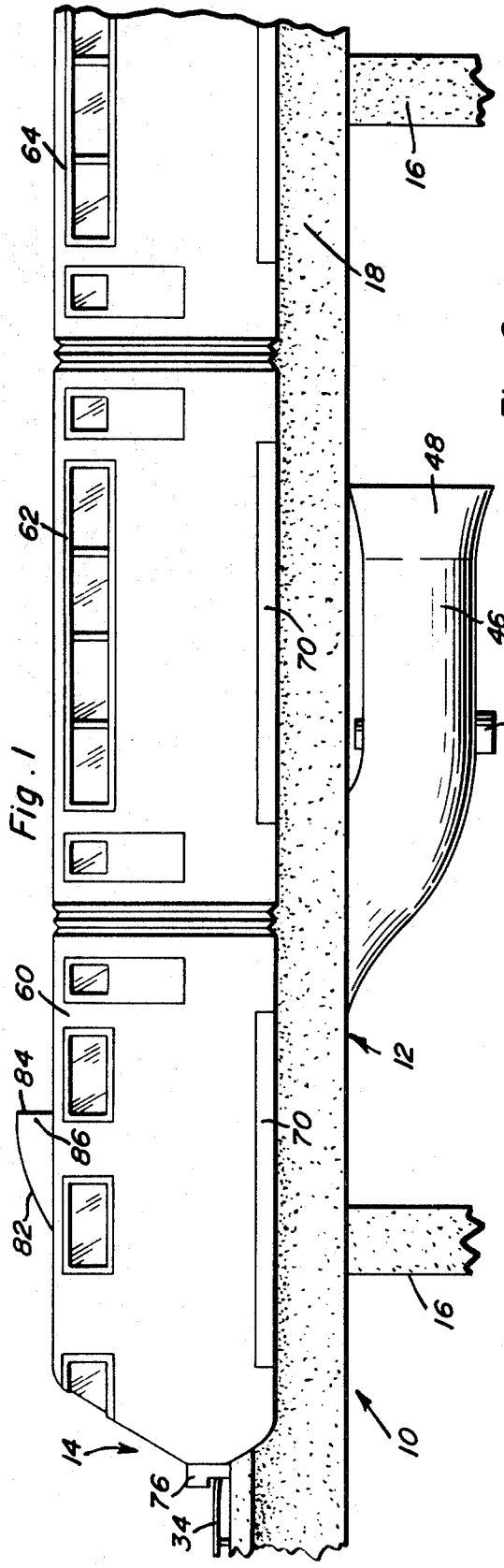

Fig. 1

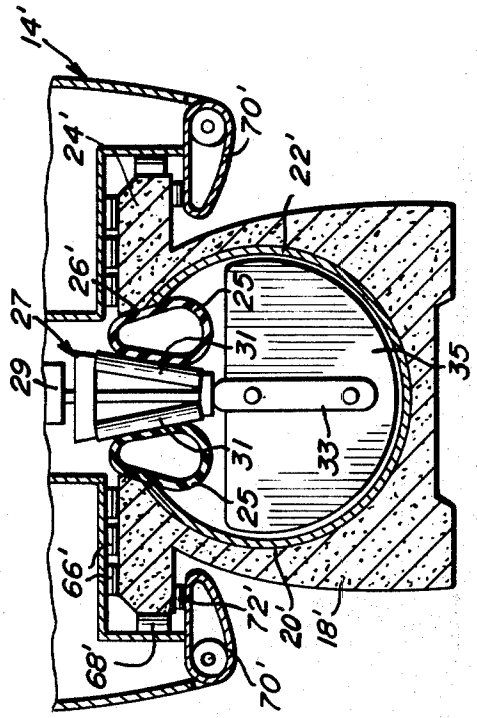

Fig. 9

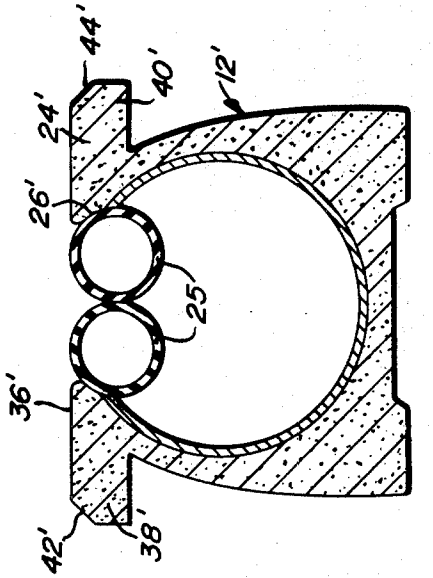

Fig. 8

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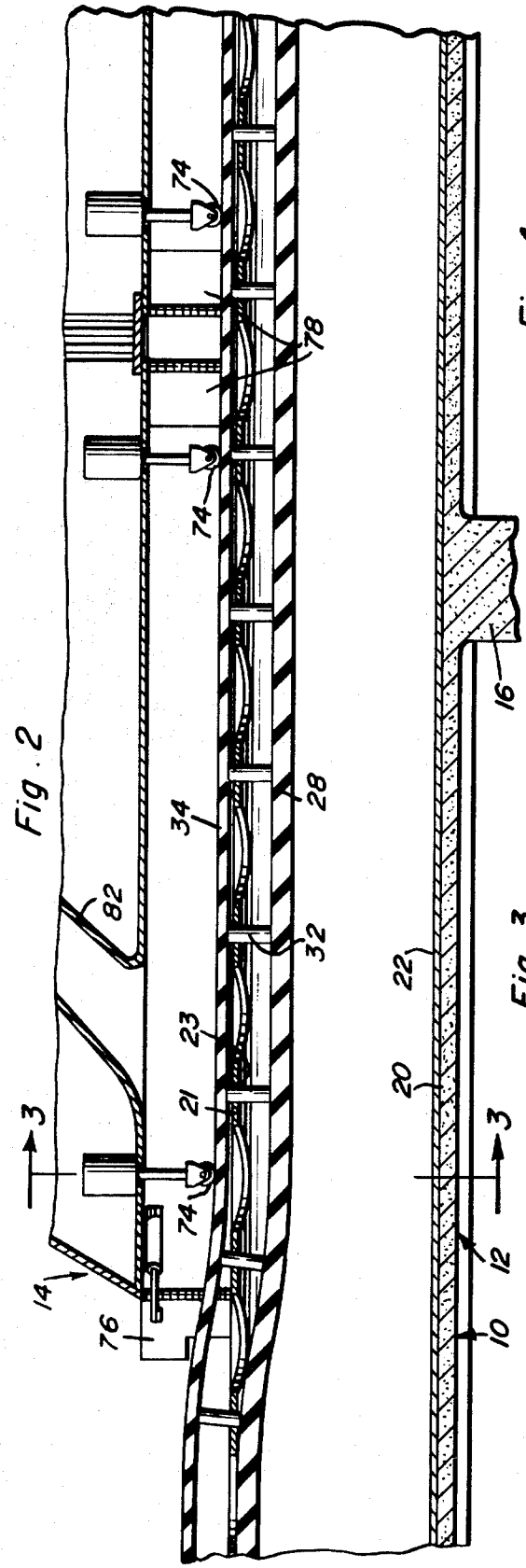

Fig. 2

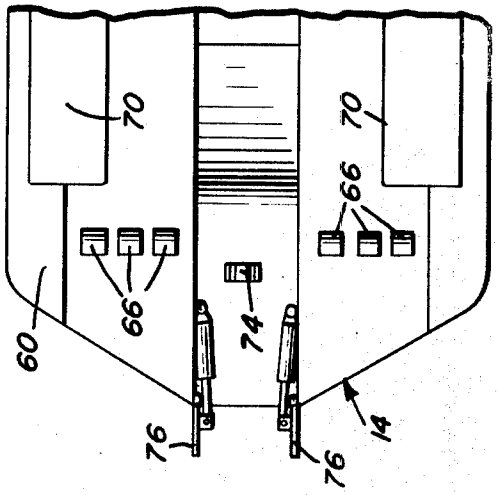

Fig. 4

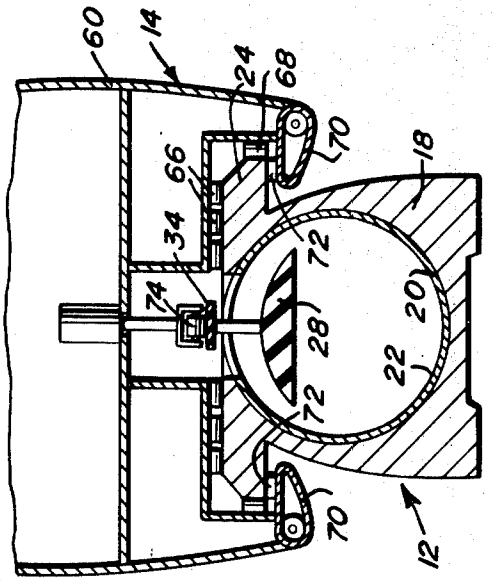

Fig. 3

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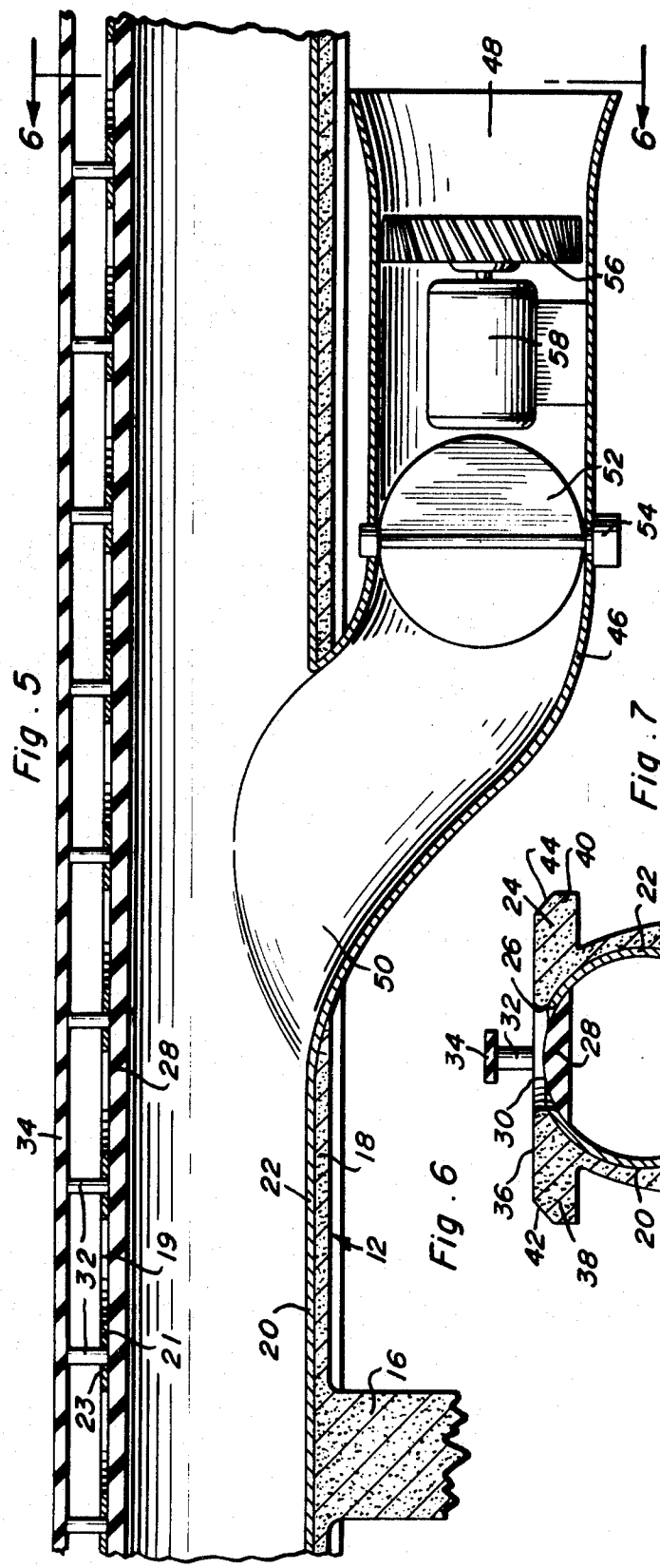

Fig. 5

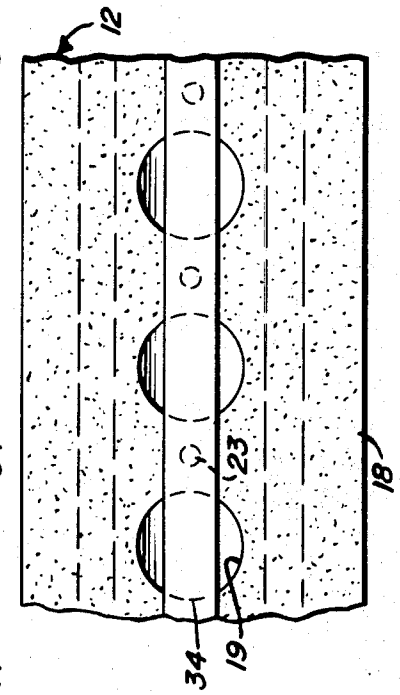

Fig. 7

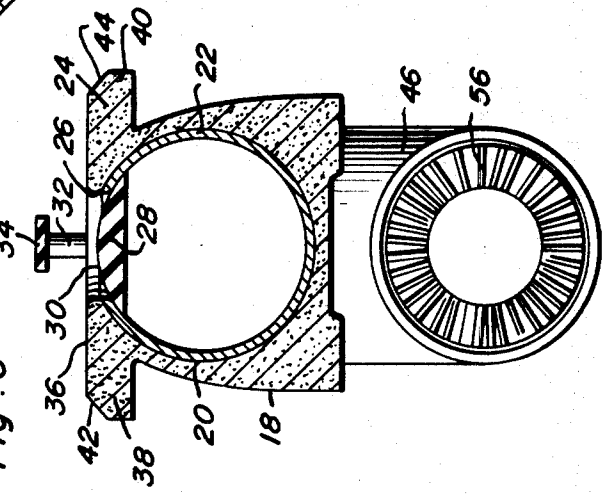

Fig. 6

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AIR TRACK AND VEHICLE THEREFOR

The instant invention has been embodied in a monorail structure and takes the form of a hollow tubular rail member from which a monorail train is supported. However, the instant invention may also be incorporated in the manufacture and operation of other types of guided vehicles.

The monorail structure of the instant invention includes a tubular rail member having an upwardly opening longitudinally extending "slot" formed therein and means is provided for pumping air into the rail member under pressure. The slot formed in the rail member is closed against the escape of compressed air therethrough by seal means extending at least substantially throughout the length of the slot and at least partially deflectable to an open position. The vehicle provided for movement along the rail structure embraces the upper portion of the latter for guiding movement therealong and includes cam means rollingly engaged with the deflectable portions of the seal structure and operable, upon movement of the vehicle along the rail, to deflect the portions of the seal means closing the slot portion of the rail with which the vehicle is registered. The compressed air escaping through that portion of the slot with which the vehicle is registered may be used not only to form an air cushion for supporting the vehicle in slightly spaced relation relative to the rail but also as a propulsion force to move the vehicle along the rail.

In one embodiment of the invention disclosed, air is pumped longitudinally through the tubular rail and the vehicle includes support arm means projecting downwardly through the opened portion of the slot and provided with a partition member snugly slidably received within the air passage extending through the rail. The partition is stationarily supported from the arm structure which is in turn rotatably supported from the vehicle for oscillation between a first position with the partition disposed transverse to the passage and a second position with the partition disposed in a plane extending longitudinally of the passage. In a second form of the invention disclosed, the "slot" is defined by a plurality of longitudinally spaced openings formed through the upper wall portion of the tubular rail and the vehicle itself is provided with one or more rearwardly opening outlets for the discharge of excess amounts of air released from the track in addition to that amount of air required to form a supporting air cushion for the vehicle. This rearward discharge of compressed air may be controlled for controlling the forward speed of the vehicle.

The main object of this invention is to provide a monorail system which may utilize relatively light monorail vehicles requiring, at most, only light weight accessory power sources and which utilize either compressed air from or the movement of air through the supporting rail structure for propulsion and support of the vehicle from the rail structure by means of an air cushion, the supply of air within the track structure itself being economically supplied thereto at points spaced considerably therealong by either continuously operating air pump means or air pump means serving individual sections of the track structure and operated only during periods of operation of monorail trains on those track sections.

Another object of this invention is to provide a monorail system which may be operated and maintained with a minimum of labor and at a minimum of cost.

Another very important object of this invention is to provide a monorail system that will be capable of moving upwardly along inclined track sections with considerably less power due to the reduced weight of its vehicles unburdened by the weight of self-contained motive power sources.

A further object of this invention, in accordance with the immediately preceding object, is to provide an air cushion type monorail system designed to provide the required vehicle supporting air cushion with a minimum of power.

A final object of this invention to be specifically enumerated herein is to provide a monorail system in accordance with the preceding objects which will conform to conventional forms a manufacture, be of simple construction and easy to maintain so as to provide a device that will be economically feasible, long lasting and relatively maintenance free.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. **1** is a side elevational view of a first embodiment of the monorail system with portions of the monorail track and monorail vehicle being broken away;

FIG. **2** is an enlarged fragmentary longitudinal vertical sectional view taken substantially upon a plane passing through the central portion of the forward end of the monorail vehicle illustrated in FIG. **1**;

FIG. **3** is a fragmentary transverse vertical sectional view taken substantially upon the plane indicated by the section line **3—3** of FIG. **2**;

FIG. **4** is a fragmentary bottom plan view of the lead car of the monorail vehicle illustrated in FIG. **1** and on somewhat of an enlarged scale;

FIG. **5** is a fragmentary enlarged longitudinal vertical sectional view taken substantially upon a plane passing through the longitudinal center line of the track structure and illustrating the manner in which the hollow tubular portion of the track structure is supplied with air under pressure;

FIG. **6** is a fragmentary transverse vertical sectional view taken substantially upon the plane indicated by the section line **6—6** of FIG. **5**;

FIG. **7** is a fragmentary top plan view of the track structure illustrated in FIGS. **5** and **6**;

FIG. **8** is a fragmentary transverse vertical sectional view of a modified form of track structure; and

FIG. **9** is a fragmentary transverse vertical sectional view of the modified form of track structure with the lower portion of an associated monorail vehicle disposed thereon and the opposite side portions of the seal structure of the monorail track portion laterally deflected to open that portion of the discharge slot of the rail structure with which the vehicle is registered.

Referring now more specifically to the drawings, the numeral **10** generally designates the monorail system of

the instant invention including a track structure referred to in general by the reference numeral **12** and a monorail vehicle referred to in general by the reference numeral **14**.

The track structure **12** includes a plurality of upright standards **16** form whose upper ends a generally horizontal tubular track component **18** is supported. The track component **18** is provided with a longitudinal bore or passage **20** suitably lined as at **22** and the track component **18** includes an upper cross head portion **24** upwardly through the center of which the upper extremity of the passage or bore **20** opens to form longitudinal slot means **26** defined by a plurality of longitudinally spaced openings **19** formed through the top wall **21** of the track component **18**.

An elongated flexible and resilient sealing strip **28** is provided within the bore or passage **20** and includes a transversely arcuate upper surface **30** from the center portion of which longitudinally spaced upwardly directed supports **32** extend. The supports **32** may be formed integrally with the sealing strip **28** and the upper ends of the supports **32** are connected by means of a horizontal flexible and slightly resilient depression rail **34** which projects upwardly above the cross head portion **24**. Further, the supports **32** are guidingly reciprocal through upstanding bores **23** formed in the top wall **21** between adjacent openings **19**.

The upper surface **36** of the cross head portion **24** is planar and substantially horizontally disposed and the opposite side portions of the cross head portion **24** define first and second flange portions **38** and **40** for a purpose to be hereinafter more fully set forth. Also, the cross head portion **24** has its opposite side upper corner portions beveled as at **42** and **44**.

At points spaced longitudinally along the track structure **12**, a plurality of air inlet neck structures **46** are provided and each air inlet neck structure **46** includes a flared inlet end **48** which opens to the ambient atmosphere beneath the track component **18** and an outlet end **50** which curves upwardly and opens smoothly into the bore or passage **20**. Each air inlet neck **46** includes an oscillatable control valve member **52** actuated by a suitable motor **54** for controlling the flow of air through the air inlet structure **46** and an air turbine **56** is disposed in each air inlet neck structure **46** and driven by means of a suitable motor **58**.

The monorail vehicle **14** includes a plurality of end aligned and connected cars **60**, **62** and **64** and each car is provided with an undersurface configuration for embracingly receiving the cross head portion **24** therein in the manner illustrated in FIG. **3** of the drawings as well as supporting and guide rollers **66** and **68** rollingly engageable with confronting surfaces of the cross head portion **24**. In addition, each of the side portions of each car includes a skirt portion **70** which is swingable beneath the corresponding cross head flange and provided with longitudinally spaced guide rollers **72** for insuring that the cars **60**, **62** and **64** do not become excessively elevated relative to the cross head portion **24**. If it is desired, the skirt portions **70** may be powered by any suitable means (not shown) for movement between the active positions thereof illustrated in FIG. **3** of the drawings and inactive positions swung downwardly and outwardly away from positions beneath the opposite side flanges of the cross head portion **24**. Also, the rollers **66** may be vertically retractable, if desired.

Each of the cars also includes a vertically retractable cam roller **74** rollingly engaged with the depression rail **34** and it may be seen from FIG. **2** of the drawings that as the monorail vehicle **14** moves along the track structure **12**, the rollers **74** will downwardly depress those portions of the seal strip **28** with which the cars **60**, **62** and **64** are registered.

The front end of the forward car **60** and the rear end of the rearmost car of the monorail vehicle **14** are provided with motor controlled closure flaps **76** which may be variably closed to control the escape of air from the front and rear ends of the vehicle **14** and adjacent ends of adjacent cars of the monorail vehicle **14** are provided with similar motor controlled flaps **78** to variably control the movement of air escaping from the track structure **12** from one car to the next.

In actual practice, the depression rail **34**, when fully depressed, may be displaced downwardly to the upper surface **34** of the cross head portion **24** whereupon the flaps **76** and **78** may be rendered more effective with their lower marginal edge portions closely overlying the upper surface **34** of the cross head portion **24** and the rail **34**. Also, at least the lead car **60** is provided with a rearwardly and upwardly inclined air discharge chute **82** which opens rearwardly above the top of the car **60** as at **84**. The rearwardly opening discharge end of the chute **82** may be provided with an oscillatable control valve structure or member similar to the control valve member **52**.

In operation, air under pressure is pumped in the bore or passage **20** through the various air inlet neck sections **46** spaced along the track structure **12**. Those portions of the seal strip **28** with which the monorail vehicle **14** are registered are deflected downwardly by the rollers **74** and thus air escapes from the slot **26** upwardly into the downwardly opening underside of the cars of the vehicle **14**. This air forms a supporting air cushion between the upwardly facing surfaces of the cross head portion **24** and the opposing downwardly facing surface portions of the monorail vehicle **14**. In addition, the excess air discharged from the passage or bore **20** that is not utilized in forming a supporting air cushion beneath the vehicle is discharged upwardly through the chute **84** for propelling the vehicle **14** forwardly along the track structure **12**.

If it is desired, the track structure **12** may be broken up into individual longitudinal track sections each provided with its own air inlet neck section **46** and separated from adjacent tracks sections by means of transverse diaphragms closing the bore or passage **20** of one section from the bore or passage of an adjacent section. Of course, if this structure is to be utilized, suitable modifications of the seal strip **28** and depression rail **34** will also be required to enable smooth transition of the vehicle **14** from one track section to an adjacent track section. If individual isolated track sections are utilized, the motors **58** driving the air turbines **56** of adjacent track sections may be sequentially actuated by any suitable automatic control (not shown) as the monorail vehicle **14** moves along the track structure **12**.

With attention now invited more specifically to FIGS. **8** and **9** of the drawings, there will be seen modified forms of track structure and monorail vehicle generally designated by the reference numerals **12'** and **14'**, respectively. Many of the components of the track

structure 12' and monorail vehicle 14' are similar to corresponding components of the structure 12 and the vehicle 14 and therefore designated by corresponding prime numerals.

However, the manner of sealing the slot 26' of the track structure 12' resides in the provision of a pair of opposite side resilient tubes 25 secured to those portions of the cross head portion 24' defining the opposite sides of the slot 26'. The adjacent edges of the tubes 25 contact each other and form a fluid tight seal across the slot 26'. However, the vehicle 12' includes a depending support arm structure referred to in general by the reference numeral 27 rotatably supported from each of the cars of the monorail vehicle 14' by means of bearing assemblies 29 and each support arm structure 27 includes a pair of downwardly divergent rollers 31 laterally outwardly deflecting and parting the adjacent sides of the tubes 25 so as to open the slot 26' in the areas thereof with which the monorail vehicle 14' is registered. In addition, each of the support arm structures 27 includes a downward extension 33 from which there is supported a partition 35 and the partition 35 is oscillatable with the support arm structure 27 from a transverse position such as that illustrated in FIG. 9 of the drawings forming a sliding partition in the bore or passage 20' toward a position generally paralleling the bore or passage 20' and thus not obstructing the flow of air therethrough.

The track structure 12' is somewhat different from the track structure 12 in that the bore or passage 20' has air pumped longitudinally therethrough whereupon the partitions 25 may be utilized in the manner of pistons to propel the monorail vehicle 14' along the track structure 12' when the partitions 25 are disposed transverse to the bore or passage 20' in the manner illustrated in FIG. 9 of the drawings. Of course, if it is desired to slow the forward progress of the monorail vehicle 14', the support arm structures 27 may be at least slightly oscillated to allow greater passage of air past the partitions 25. However, by the rollers 31 opening the slot 26' in the areas thereof with which the monorail vehicle 14' is registered, air is discharged from the passage or bore 20' for forming an air cushion between the track structure 12' and the monorail vehicle 14'. Finally, inasmuch as the arm structure 27 projects downwardly into the slot 26', the latter is continuous rather than being defined by a plurality of openings spaced along the track structure 12'.

The forgoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be restored to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A vehicle track structure including means defining an elongated tubular member and adapted to have a vehicle move therealong in a guided manner, said tubular member including one wall portion having a longitudinal slot formed therein, means for supplying air under pressure to the interior of said tubular member, said tubular member including elongated flexible seal means extending along and closing said slot, said seal means including at least portions thereof capable of being inwardly displaced for at least partially opening said slot, a vehicle mounted on said track structure for guided movement therealong, at least a portion of said vehicle being registered with said slot and adapted to receive air discharged therefrom, said vehicle portion including seal deflection means operatively engaged with at least said portions of said seal means for inwardly deflecting the portions of the latter with which said vehicle portion is registered as said vehicle moves along said track structure, comprising a seal strip including a portion of greater width than said slot and disposed within said tubular member in sealing contact with the inner surface portions thereof on opposite sides of said slot, said portion of said vehicle including cam means engaged with said seal strip and inwardly deflecting the latter to displace said seal strip portion inwardly and out of sealed engagement with said inner surface portions of said tubular member.

2. The combination of claim 1 wherein said cam means includes roller means rollingly engaged with said seal strip.

3. The combination of claim 2 wherein said seal strip includes an elongated depression rail disposed outwardly of said slot with which said roller means is rollingly engaged.

4. The combination of claim 1 wherein longitudinally spaced portions of said tubular member include means independent of said slot for admitting air under pressure into the interior of said tubular member.

5. The combination of claim 1 wherein said vehicle portion comprises an underportion of said vehicle, said slot opening upwardly through and upper portion of said elongated tubular member, said upper and underpoints defining upper and lower air cushion confining surfaces.

6. The combination of claim 1 wherein said vehicle includes an air exhaust passage therein including a rearwardly opening outlet end and an inlet end opening into said portion of said vehicle for receiving at least a portion of the air discharged from said tubular member through said slot.

7. The combination of claim 1 wherein comprises a monorail structure and said vehicle defines a downwardly opening and open ended longitudinally extending channel in which the upper portion of said monorail structure is snugly received.

8. A vehicle track structure including means defining an elongated tubular member and adapted to have a vehicle move therealong in a guided manner, said tubular member including one wall portion having a longitudinal slot formed therein, means for supplying air under pressure to the interior of said tubular member, said tubular member including elongated flexible seal means extending along and closing said slot, said seal means including at least portions thereof capable of being inwardly displaced for at least partially opening said slot, said track structure being generally T-shaped in cross section so as to include a transverse crosshead projecting outwardly of the opposite sides thereof, said crosshead defining an outer longitudinal surface extending between the opposite side marginal portions of said crosshead, said slot opening outwardly through the central portion of said surface, a vehicle mounted on said track structure for guided movement therealong,

at least a portion of said vehicle being registered with said slot and adapted to receive air discharged therefrom, said seal means comprising a seal strip including a portion of greater width than said slot and disposed within said tubular member in sealing contact with the inner surface portions thereof on opposite sides of said slot, said vehicle portion including seal deflection means operatively engaged with at least said portions of said seal means for inwardly deflecting the portions of the latter with which said vehicle portion is registered as said vehicle moves along said track structure, said vehicle including means defining a central downwardly opening recess in which said crosshead is snugly received for guided movement of said vehicle along said crosshead, said slot opening into said recess and the compressed air escaping from said slot past said seal means functioning to form a vehicle supporting air cushion between said crosshead and the surfaces of said vehicle opposing said crosshead.

* * * * *