Sept. 15, 1964 S. H. BINGHAM 3,148,632

ADJUSTABLE BEAMWAY

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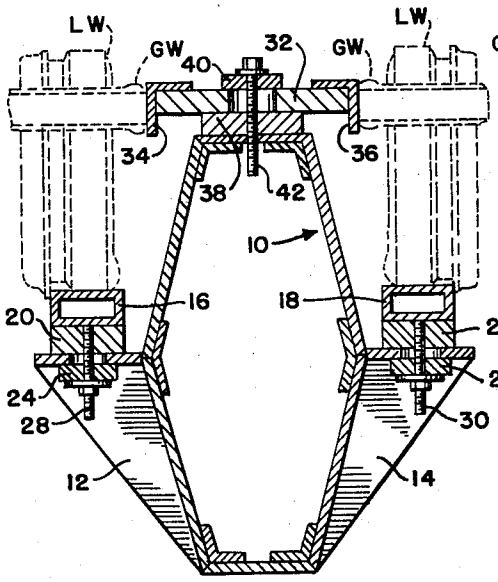


FIG. 1

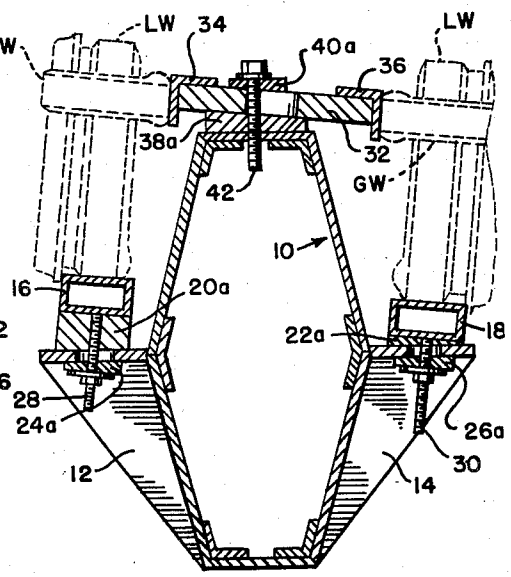


FIG. 2

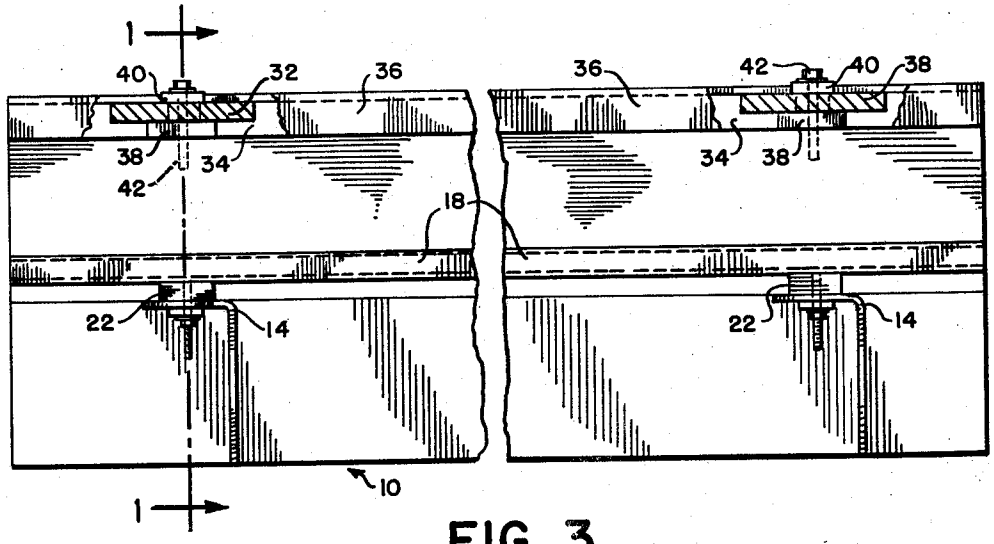


FIG. 3

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FIG. 5

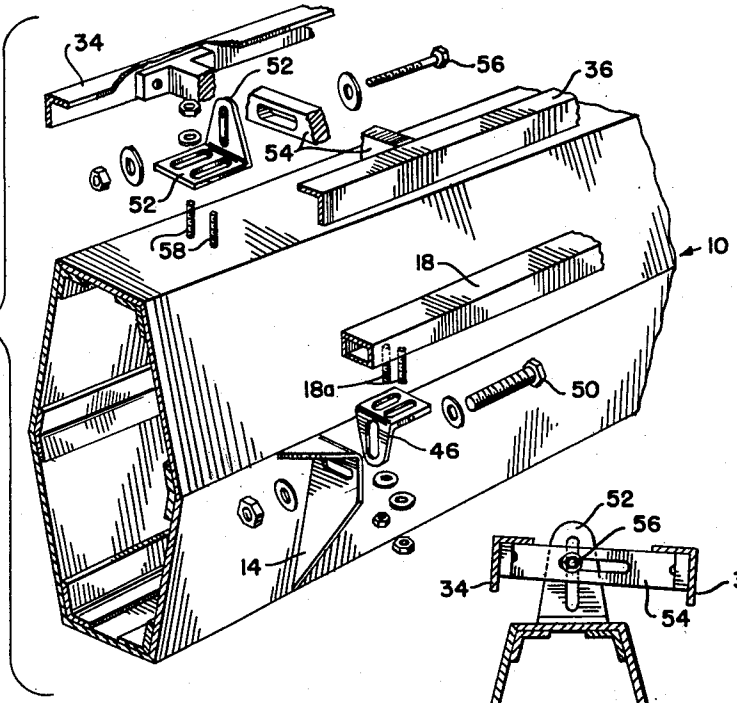
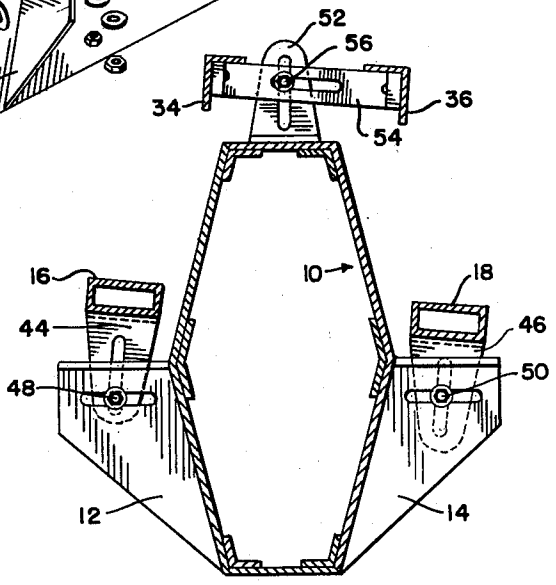


FIG. 6



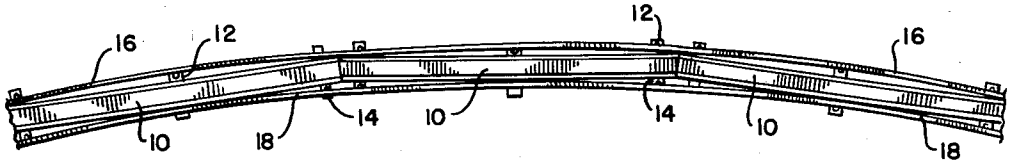


FIG. 4

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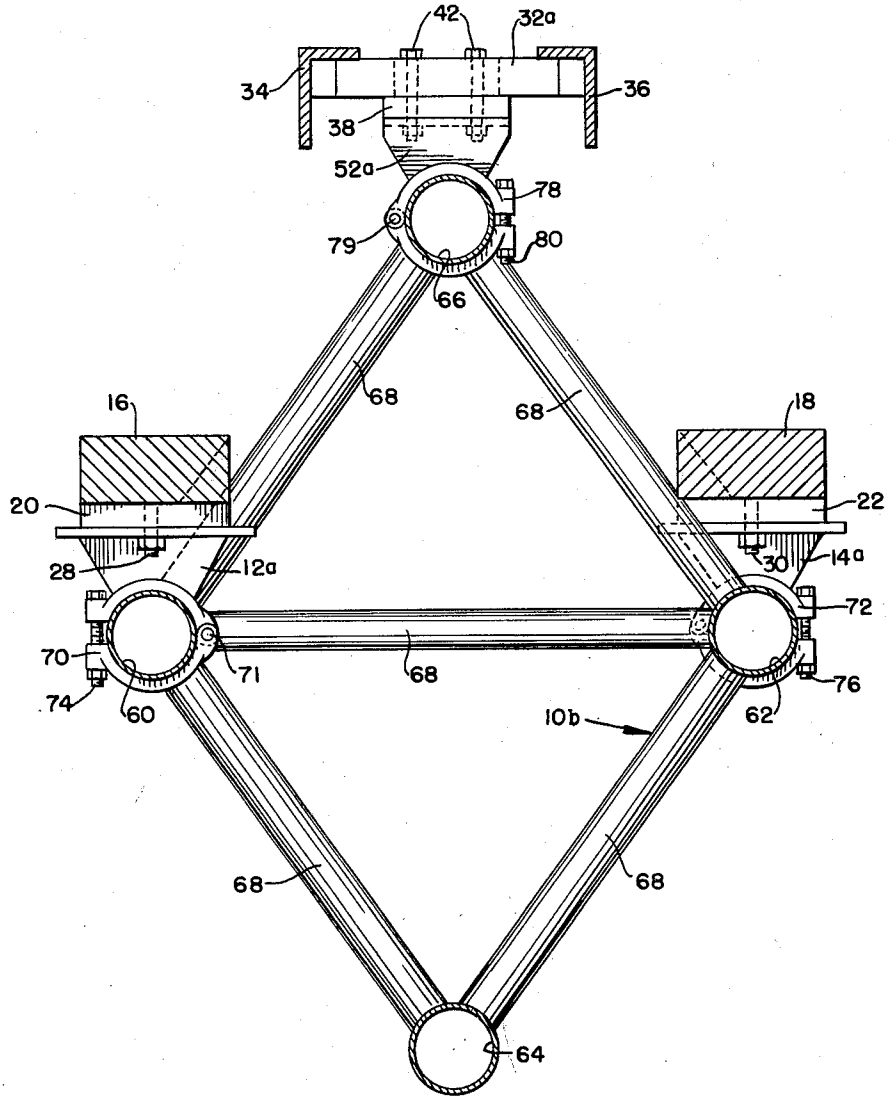
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FIG. 7



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ADJUSTABLE BEAMWAY

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6 Claims. (Cl. 104—120)

The subject matter of this invention is for improvements in beamway transportion systems, sometimes less accurately referred to as "Monorail" systems.

A basic object of the invention is to provide improvements in the means for supporting and securing the running tracks and guiding rails on the beamway to permit ready adjustment with respect to the horizontal, vertical and the angular position of the running tracks and the guiding rails with respect to each other in the rail pairs and with respect to the relative positions between track and rail pairs.

Another object of the invention is to provide simple and practical means to obtain perfect alignment of the running tracks both on the straightaway and on the curves without requiring a similarly perfect alignment of the beamway itself, thereby facilitating the installation thereof and reducing the cost of such installation.

A more specific object of the invention is to provide adjustable supports for the track pairs to provide for superelevation or banking as required at the curves without requiring twisting of the beam in the beamway.

Other specific objects of the invention are to provide simple means for compensating for column settlement, beam deflection due to loading or other causes which alter proper alignment.

Other and more detailed objects of the invention and the advantages thereof will become evident as the following detailed descriptions of the several embodiments thereof, illustrated in the attached drawings, proceeds.

In those drawings FIGURE 1 is a vertical cross sectional view, on a straight section, of one form of beamway in accordance with this invention taken on the line 1—1 of FIGURE 3. FIGURE 2 is a similar cross-sectional view on a curved section of the beamway illustrating the various adjustments which are permitted by means of the subject matter of this invention. FIGURE 3 is a side elevational view of a section of the beamway. FIGURE 4 is a somewhat diagrammatic plan view of a section of the beamway of the form of invention of FIGURES 1–3 inclusive with the guide rail structure omitted for clarity. FIGURE 5 is a perspective view of a section of a modified beamway illustrating different supporting members for the tracks and guide rails. FIGURE 6 is a cross-sectional view of this modified structure taken at a position corresponding to the position of FIGURE 1. FIGURE 7 is a typical vertical cross-sectional view of a further modified form of the invention with a different form of beam, which section is likewise taken at a point corresponding to that at which the section of FIGURE 1 was taken.

The beamway, which will, of course, extend along the right-of-way is illustrated in the form of the invention of FIGURES 1–4 as composed of a plurality of box girders **10** of any suitable construction in detail. These girders are made in suitable lengths and as illustrated in FIGURE 4 are placed in end-to-end relationship to form the beamway and are secured together in accordance with any well-known practices in the related art, such as by welding, riveting, bonding or cementing. There are now available appropriate cementing or bonding agents of great strength, such as the epoxy resins which can be melted upon heating for breaking the connections. It is also apparent that the beamway can be made of concrete in accordance with well-known practices. It is intended, therefore, that the beamway illustrated is to be taken in an exemplary sense, as further shown by the fact that the beamway of FIGURE 7 is of a still different construction.

An important feature with regard to the beamway is illustrated in FIGURE 4, wherein the box girders **10** at a curve are each individually straight and are joined end-to-end in proper angular relationship to meet the curvature conditions at this point.

The beamway, of course, will be supported on columns or equivalent structures, in this case from underneath.

Secured to the opposite sides of the box girders **10**, at suitably longitudinally spaced points, are pairs of brackets **12** and **14**, which in this form are right-angular in shape. They are positioned so that the upper faces lie approximately in the same horizontal plane transversely and longitudinally of the beamway.

At **16** and **18** are illustrated in cross section the tracks which can be of various forms and are likewise made in sections of suitable length. At each of the supports **12** and **14** the tracks are supported on and spaced therefrom by means of spacers **20** and **22**, which may be selectively of different vertical thicknesses. Secured to the track sections from below, by way of example, are threaded studs **28** and **30** which occur in each of the support pairs **12** and **14** and which pass through elongated slots in the upper parts of the supports as shown. Nuts and washers are applied to these studs and spacers **24** and **26** are positioned between the supports **12** and **14** so that the tracks can be bolted to the beamway, in this case in the same horizontal plane.

The guide rails **34** and **36** are supported on spacers **32** which have elongated central slots, as shown, so as to support the rails in transversely spaced parallel relationship. As illustrated, threaded bolts pass therethrough and readily engage in this case the upper wall of the girder **10**. Rectangular spacers **40** and **38** are positioned on the top and bottom of the spacers **32** to vertically position the rails with respect to the tracks at various selective vertical positions. The vehicle, not shown, is of a type carrying load-bearing pneumatic-tired wheels LW, which ride on the tracks and rotate on a horizontal axis. Similarly, guide wheels GW are positioned to rotate on vertical axes in engagement with the side faces of the rails **34** and **36**. It is noted in passing that these rails may be included in electrical circuits associated with vehicle operation for whatever purpose it is desired to use them.

FIGURES 1 and 3 together further illustrate the relationship of the parts thus described, particularly for straight sections of the beamway. In order to simplify the construction and adjustment of this structure, it is noted that the tracks **16** and **18** can be adjusted transversely in either direction by loosening the nuts on the studs **28** and **30** so that the studs can move longitudinally of the slots in the top sections of the supports **12** and **14**. Thus the tracks can be adjusted horizontally with respect to each other and with respect to the longitudinal axis of the beamway in either direction transversely. The same is true of the spacers **32** for the rails by loosening the bolts **42**. Likewise the vertical position of the tracks and rails, with respect to each other and with respect to the beamway, can be adjusted by selectively interposing spacers **20** and **22** and **38** between them and the beamway. With this arrangement all compensation required as a practical matter, with respect to inequalities in the level of the beamway and the effects of deflection of the beamway under loading, can be obtained.

As illustrated in FIGURES 2 and 4, even though the beamway sections **10** are straight, the tracks can be given the required curvature and superelevation at the curves.

This is again accomplished by adjusting the threaded studs **28** and **30** in the slotted openings of their supports. In addition, however, as illustrated in FIGURE 2, the plane of the tracks **16** and **18** can be rotated to provide for banking or superelevation at the curves. This is accomplished by the selective interpositioning of wedge shaped spacers **20***a* and **22***a* between them and their supports. The washer spacers **24***a* and **26***a* are complementarily shaped so that the stresses applied to the threaded studs will be along their axes. At the same time the guide rail supports can also be tipped so as to maintain the proper parallelism with the tracks at the curves, and they can also be shifted in the proper position laterally (see FIGURE 2). Thus the spacers **38***a* and **40***a* can be wedge shaped to tip the spacers **32** which support the rails. In addition these spacers can be shifted in the proper direction so as to lie on the proper radius with respect to the rails. Thus, at the same time at the curves inequalities in the level of the beamway and banking can be arranged for without twisting the beamway. This simplifies installation and greatly reduces the cost of constructing the assemblage.

All of the advantages previously described are applicable to the modification of the invention illustrated in FIGURES 5 and 6. In this case the supports **12** and **14** are provided with horizontal slots as shown and right-angle brackets **44** and **46** can be bolted thereto by means of the bolts **48** and **50**. The brackets **44** and **46** are slotted on both legs with the result that the tracks which are supported thereon by means of threaded studs **18***a* with cooperating washers and nuts can be given all the required transverse, vertical and angular positions required as previously detailed. The rails **34** and **36** in this case are secured in any suitable manner to transverse braces **54**. They are supported from the top of the girder **10** by means of right-angle brackets **52**, which have elongated slots in both legs. Threaded studs **58** are secured to the top of the girder at spaced longitudinal points by means of which the brackets **52** can be bolted thereto in the proper position. The braces **54** are slotted and can be selectively positioned and locked to the brackets **52** by means of the bolts **56**. Thus, the rails can be given the desired horizontal, vertical and angular positions described in connection with the previous embodiment. This is clearly illustrated in FIGURE 6. These various parts when in adjusted position can be secured against undesired displacement by means of suitable adhesives as previously explained.

To further illustrate the versatility of the subject matter of this invention, a further modification is illustrated in FIGURE 7. In this case the beamway is built up of a series of fabricated trusses **10***b*, the members of which may be, for example, steel tubes **68**. The trusses also include longitudinal steel tubes **60**, **62**, **64** and **66**. These tubes can be assembled and welded together in various geometrical relationships to form a strong truss. These trusses are of suitable length and arranged and secured together in end-to-end relationship, as previously suggested, to form the beamway. Longitudinally of the trusses they will be cross braced in various well-known and obvious arrangements to provide a truss of the proper rigidity and strength.

The tracks, spacers and rails are given the same number as in the previous modifications. The supports, therefore, are, however, different. Thus, the track supports **12***a* and **14***a* are provided with clamps **70** and **72** having parts which are pivotally connected, as illustrated at **71** for example, so that they can embrace the longitudinally extending tubes **60** and **62** forming part of the truss structure. These clamps are connectible by means of threaded bolts **74** and **76** so that the supports **12***a* and **14***a* can be secured to the truss at various longitudinal positions and can be tipped to various angular positions in a vertical plane, as is obvious.

The rails **34** and **36** with their braces **32***a* are similarly supported on the brackets **52***a*. These brackets are like the brackets **12***a* and **14***a* and are provided with two-part clamps **78** having the pivotal connections **79** and the clamping bolts **80** as before. These clamps embrace the top tube **66** of the truss at desired longitudinal and angular positions. In this case, at the curves the spacers **20**, **22** and **30***a* need not be wedge-shaped because the associated brackets can be tipped to the right or left depending upon the direction of curvature of the beamway. The supports **12***a* and **14***a* have elongated slots so that the track studs **28** and **30** can be shifted laterally in either direction. The same is true of the braces **32***a* so that the rails can be transversely shifted on the brackets **52***a* when the bolts **42** are loosened. Thus, it will be seen that all of the adjustments provided by the previous modifications are available in the modification of FIGURE 7. As before, the parts can be bound in adjusted position with adhesives if necessary.

The flexibility of the subject matter of this invention has been sufficiently illustrated heretofore to indicate that the subject matter of this invention is not limited to specific geometric forms. The embodiments described are solely for illustrative purposes, it being intended that various modifications of the invention be included within the appended claims.

What is claimed is:

1. A beamway assembly of the type described, comprising a vehicle supporting and guiding beam extending along a right-of-way, a pair of guide rails, spaced bracing members interconnecting said guide rails to insure parallelism thereof, means for selectively positioning each said bracing member on said beam at a desired elevation above the upper surface of said beam and in a desired horizontal and angular position relative to the longitudinal vertical center line of said beam, a pair of track members disposed respectively on opposite sides of the longitudinal vertical center line of said beam and a plurality of spaced supports for each said track member, each support serving to position one of said track members at a desired elevation and at desired horizontal and angular positions relative to said beam center line.

2. In the combination of claim 1, at a curve in the beamway said beamway consisting of straight sections attached endwise to each other in angular relationship and said means and said supports being selectively adjusted to position said rails and track members on smooth curves.

3. In the combination of claim 1, at a curve in the beamway said beamway consisting of straight sections attached endwise to each other in angular relationship and said means and said supports being selectively adjusted to position said rails and track members on smooth curves and in parallel planes at an angle to the horizontal.

4. A beamway assembly of the type described, comprising a vehicle supporting and guiding beam extending along a right-of-way, a pair of guide rails, spaced bracing members interconnecting said guide rails to insure parallelism thereof, means mounting said bracing members on the upper surface of said beam, said means comprising generally horizontally extending slots in said bracing members to permit adjustment relative to the beam center line and means for varying the angle of said bracing members relative to the beam vertical center line and for varying the distance above said beam upper surface, a pair of track members disposed respectively on opposite sides of the vertical axis of said beam, a plurality of spaced supports for selectively positioning said track members and means for mounting the track members on said supports, each said means comprising a slot extending laterally relative to said beam longitudinal vertical center line and means for adjusting the respective track members in elevation and angular position relative to the horizontal upper surface of said beam.

5. A beamway assembly as claimed in claim 4, wherein said means for adjusting said bracing members in vertical and angular position comprises wedge-shaped shims and wherein said means for adjusting said track members in vertical and angular position likewise comprises wedge-shaped shims mounted between said supports and said track members.

6. A beamway assembly as claimed in claim 4, wherein said means for adjusting said bracing members in vertical and angular position comprises brackets having vertically extending slots and fastening means extending through said bracing member slots and said vertical slots to permit securing said bracing members in desired angular and elevational positions relative to the horizontal upper surface of said beam and wherein said means for adjusting said track members comprises brackets fixed to said beams on

opposite sides of said center line, said brackets having vertically extending slots therein and fastening means extending through said horizontal and vertical slots whereby said track members may be adjusted in elevation and angle relative to said beam upper surface whereby said rails and track members may be secured in uniformly spaced parallel planes extending at a desired angle to the horizontal.

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