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[31] **53480/67**

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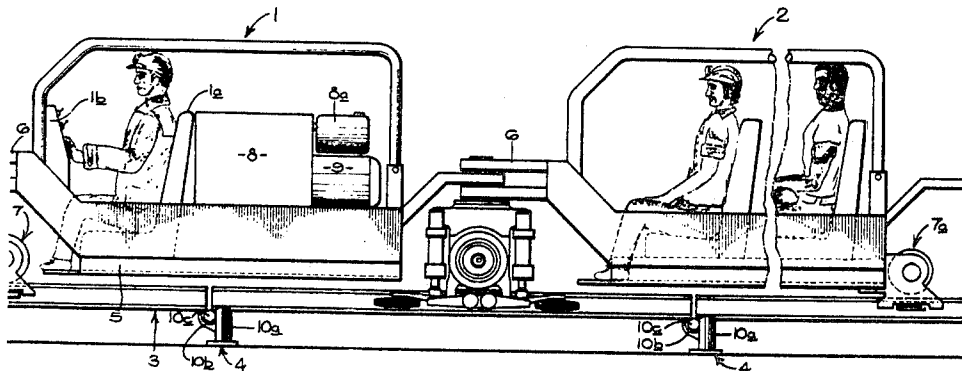
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[54] **MONORAIL TRAIN**
10 Claims, 4 Drawing Figs.

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105/144, 105/215
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118, 119, 120, 121, 242, 243, 244, 245, 246;
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ABSTRACT: This invention relates to a locomotive adapted to run on a ground mounted monorail track composed of rail elements of channel shape in cross section arranged with the mouths of the channels presented inwardly, the locomotive being supported upon bogies at opposite ends, at least one of which includes a pair of large diameter driving wheels engaging the upwardly presented faces of the horizontal flanges of the rail elements, two pairs of counterpressure wheels situated fore-and-aft of the driving wheels, and of a diameter to be contained within the channels presented by the rail elements of the track, and a beam element on which the counterpressure wheels are carried, and which is suspended by contractable hydraulic rams from a mounting member for the driving wheel, the beam element carrying guide or stabilizing wheels at opposite ends of a diameter slightly less than the horizontal distance between the inwardly presented faces of the vertical webs of the rail elements, and adapted to engage respectively with opposed faces of these webs.



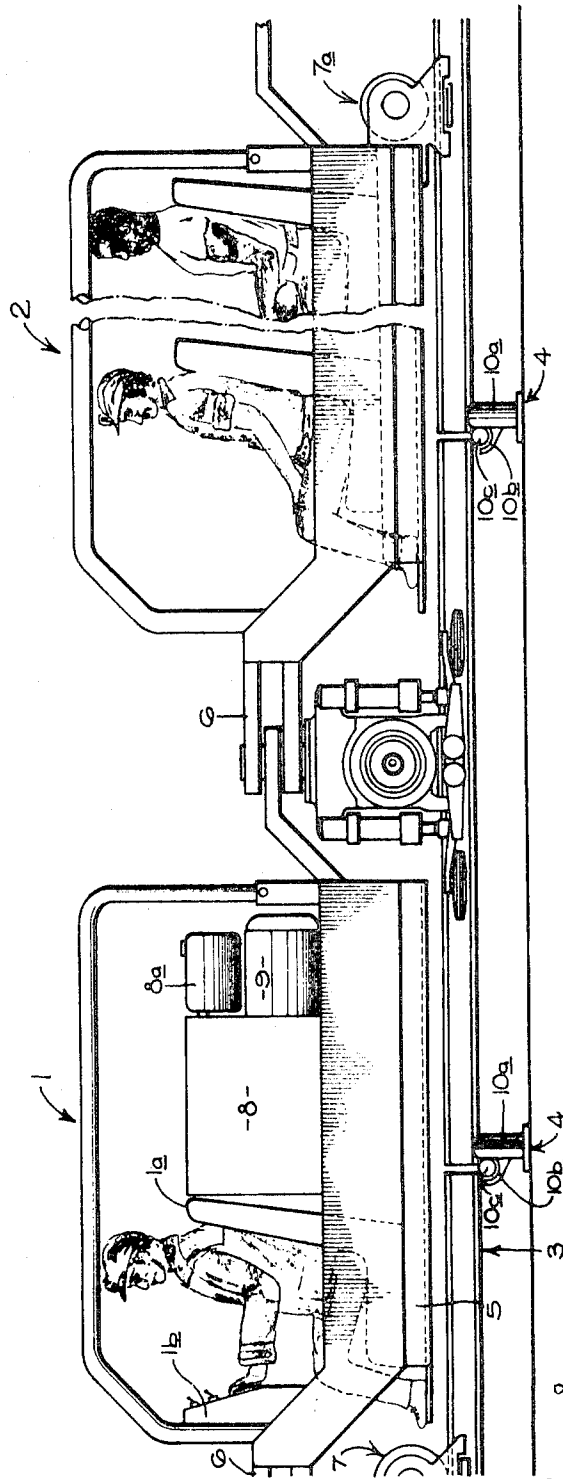
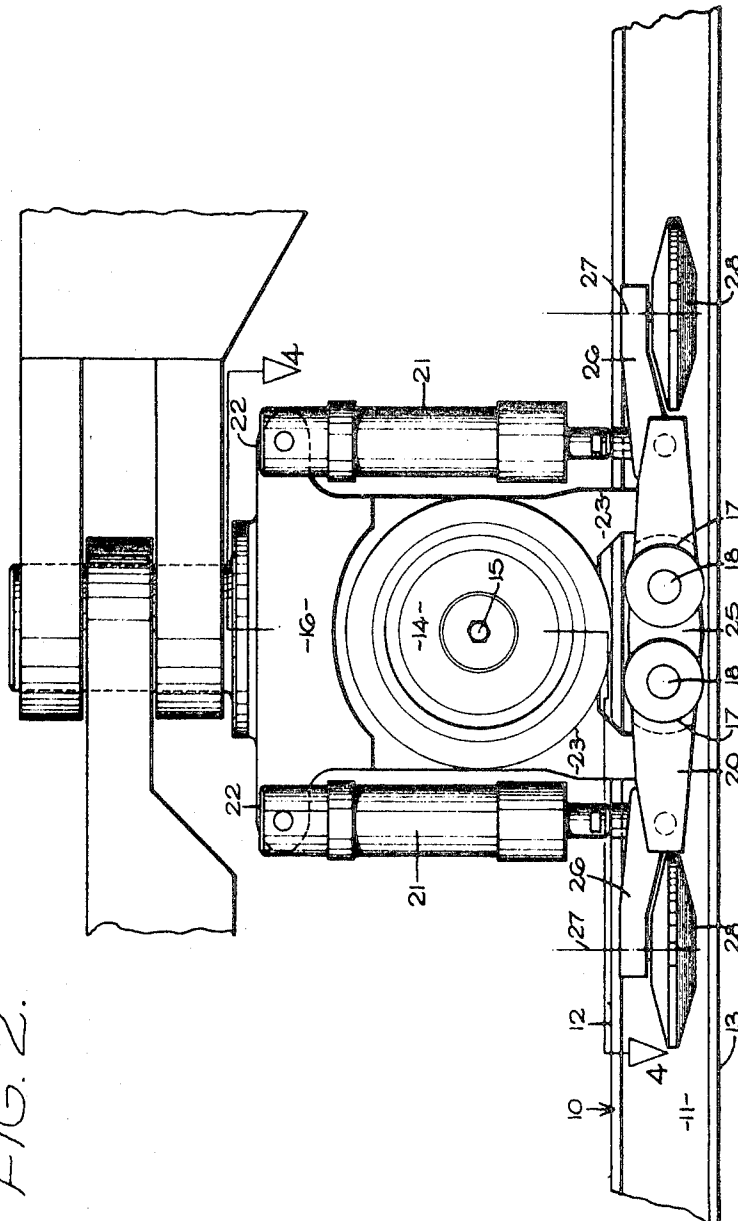


FIG. 1.

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FIG. 2.



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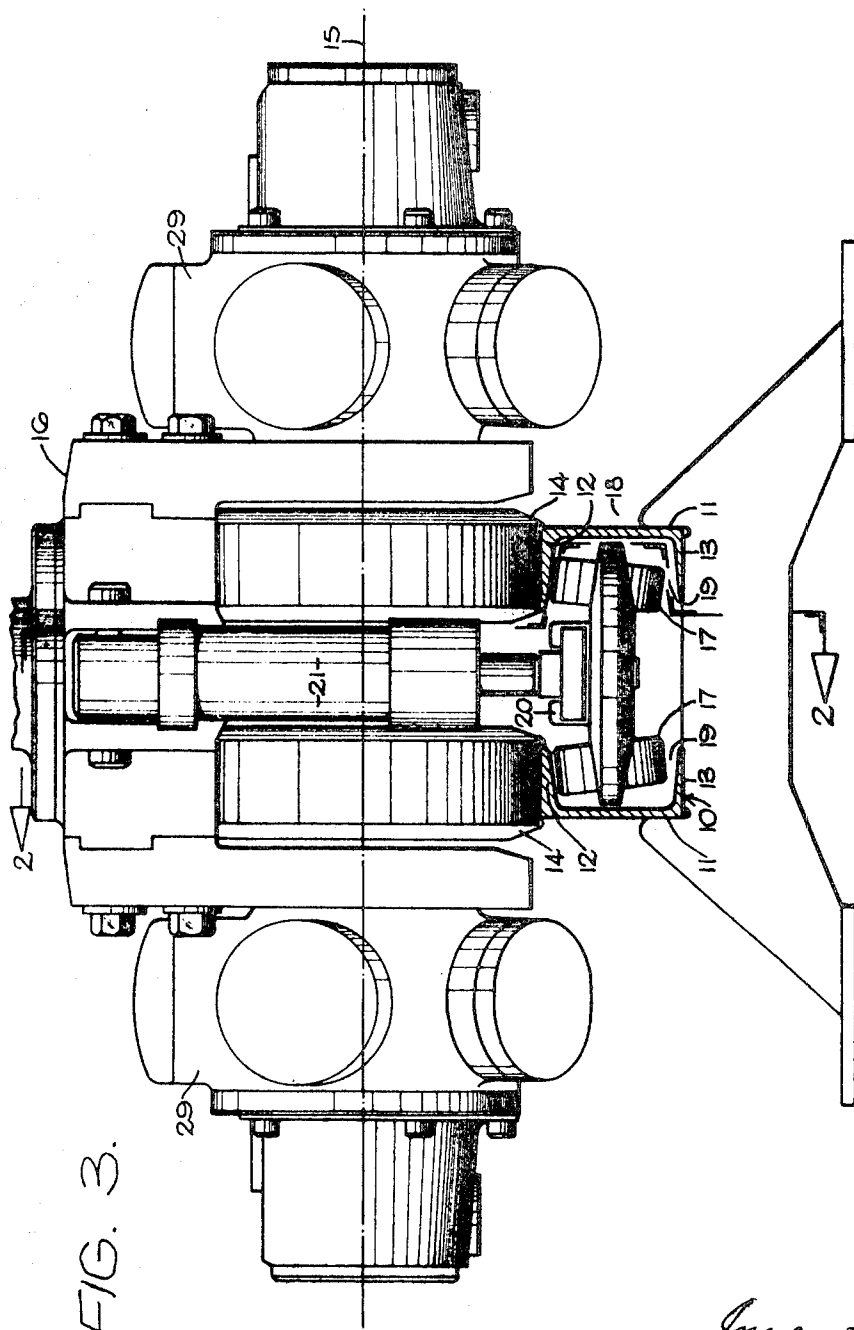


FIG. 3.

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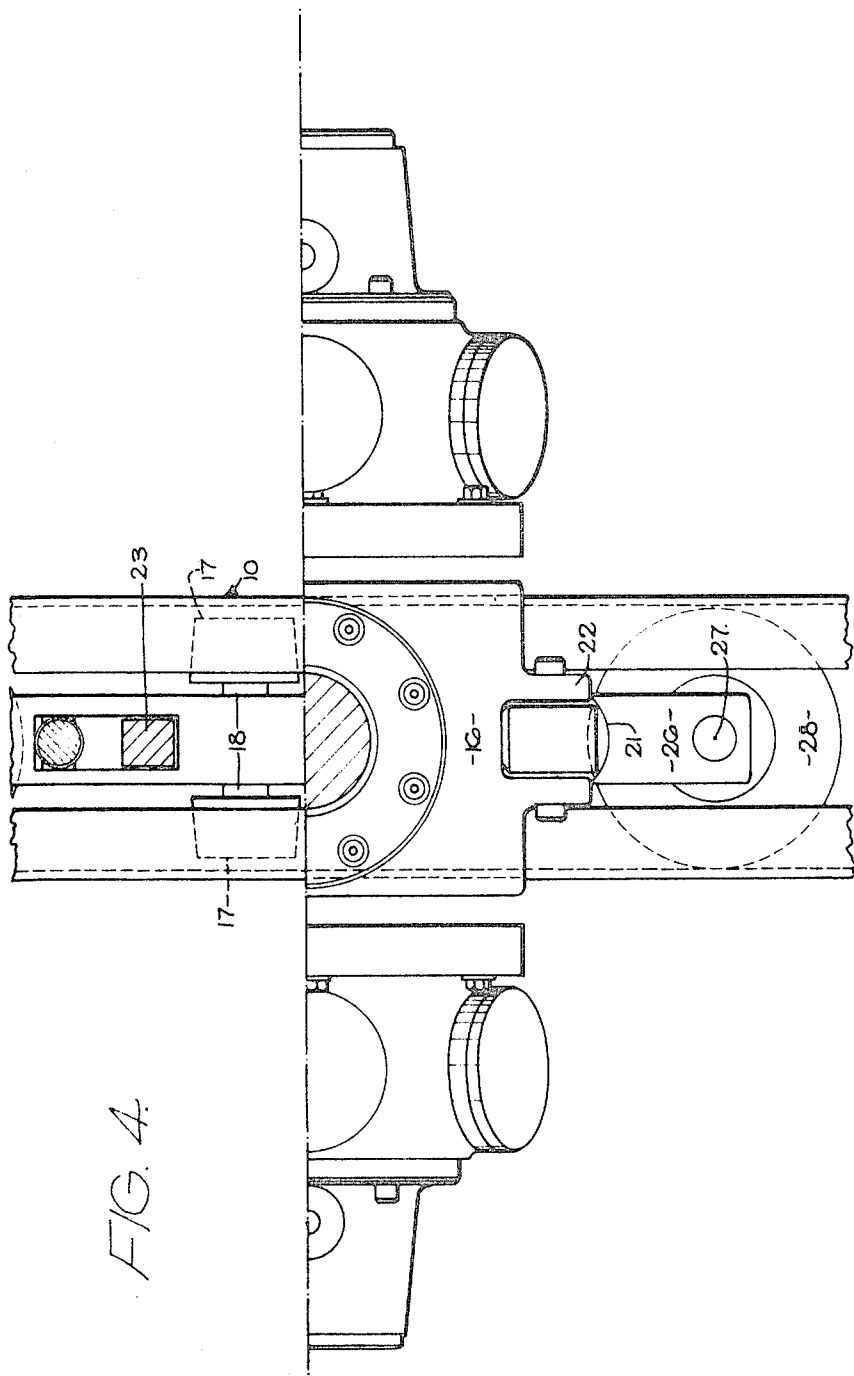


FIG. 4.

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MONORAIL TRAIN

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to conveyors of the kind comprising a ground mounted monorail trackway, and a carriage or carriages movable therealong, and positively retained against lateral angular tilting relative to the trackway by virtue of the wheels being so arranged as to define collectively a passageway extending longitudinally of the carriage of a cross-sectional shape to receive at least a portion of the cross section of the trackway, such cross-sectional shape intrinsically preventing angular tilt of the carriage relatively to the trackway about a reference axis extending longitudinally of the latter. Such conveyors are hereinafter referred to as monorail conveyors of the kind specified.

In a typical form of trackway, the latter comprises a pair of laterally spaced rail elements, the lateral spacing of which is too small to provide the requisite stability against lateral tilt of the carriage were the latter to be provided only with wheels running on the upwardly presented faces of the rail elements and freely separable from such faces. Such lateral tilt is, therefore, prevented by provision on the carriage of a wheel or wheels adapted to engage one or more of the following faces presented by the trackway, namely laterally inwardly presented faces of the rail elements, and downwardly presented faces afforded by horizontal flanges at the upper edges of the rail elements.

The invention has been developed primarily for monorail conveyors of the kind specified intended for use in underground mine workings. In this application the tunnels or roads along which the conveyor is required to operate frequently presents steep upward and downward inclinations. If the carriage of the conveyor are required to be propelled by a coupling to a self-propelled locomotive, as distinct from being propelled by connection to a haulage cable extending alongside the monorail trackway, difficulty is experienced in establishing the requisite driving grip between the wheels of the locomotive and the trackway. Such grip cannot effectively be increased by increasing the weight of the locomotive, since this would require the trackway to be formed to a heavier section, or would require the trackway to be supported from the ground by foot or spacer members situated closer to each other than is necessary in the case of cable hauled carriages, and both these factors would materially increase the cost of the installation. Further, it is desirable that a design of trackway common to both a cable hauled system and a locomotive propelled system shall be capable of being utilized.

SUMMARY OF THE INVENTION

According to the invention there is provided a locomotive for a monorail conveyor of the kind specified, comprising a body on which is mounted a prime mover, and which is supported by longitudinally spaced bogies, one at least of which is a driving bogie, to enable said locomotive to travel along a ground mounted monorail trackway, incorporating at least one generally horizontal flange, and at least one generally vertical web, and which includes the improvement wherein the driving bogie or each of same comprises a bogie body structure pivotally connected to said locomotive body about an upright swiveling axis, a central group of bogie wheels mounted on said bogie body structure for engaging said flange of said trackway over upwardly and downwardly presented faces thereof, and including at least one driving wheel operatively connected with said prime mover and driven therefrom for engaging one of said flange faces, at least one counterpressure wheel for engaging the opposed one of said flange faces, preload means for urging said driving wheel or each of same on the one hand, and said counterpressure wheel or each of same on the other hand into engagement under pressure with said flange, stabilizing wheels on said bogie body structure at

opposite ends of said central group of bogie wheels for engaging opposed laterally presented faces of said trackway, and afforded by said web or webs thereof.

The invention will now be described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatic view in side elevation illustrating a monorail conveyor of the kind specified in accordance with one embodiment of the present invention;

FIG. 2 is a view in side elevation and in vertical cross section on the line 2-2 of FIG. 3 showing one embodiment of driving bogie in accordance with the invention for incorporation in a locomotive of the monorail conveyor shown in FIG. 1;

FIG. 3 is a view in end elevation of the driving bogie of FIG. 2; and

FIG. 4 is a plan view of the bogie of FIG. 2 partly in cross section on the line 4-4 of FIG. 2.

Referring firstly to FIG. 1, the monorail conveyor shown comprises two vehicles, of which 1 is the locomotive, and 2 is a load carrying vehicle. This may be a passenger vehicle, as shown, or adapted for carrying material or articles.

The trackway 3 comprises a plurality of track sections articulately connected together by coupling means at positions 4.

In the coupled train of vehicles seen in FIG. 1, successive vehicles are articulately coupled for swiveling about a vertical axis, and sufficient freedom of movement is provided to allow relative articulation between the vehicles about a transverse horizontal axis.

The locomotive comprises a body including a longitudinally extending base member 5 which is cranked upwardly at its ends, as indicated at 6, one end being bifurcated to receive the corresponding single leaf end of the next vehicle between the limbs of the bifurcated portion, and this limb and the bifurcated portion being apertured to permit of upward projection therethrough of one component of a swivel bearing on bogies 7 which collectively support the vehicles of the coupled train.

The locomotive 1 carries a prime mover 8 which may be in the form of an internal combustion engine, such as a diesel engine, having a fuel tank 8a, and driving a variable output hydraulic pump 9.

The locomotive may be equipped with a drivers seat 1a and a control console 1b.

Referring in more detail to the trackway, this comprises two laterally spaced rail elements 10, each of channel section, and having vertical webs 11, and upper and lower horizontal flanges 12 and 13.

The two rail elements 10 are connected to each other by foot elements, 10b which serve to maintain the requisite lateral spacing between the rail elements, and also space the latter a certain distance above the floor of the ground where the trackway is mounted, for example the floor of a road or tunnel in a mine working. Typically the lateral spacing between the rail elements would be such that their outwardly presented lateral faces are 7½ inches apart, the height of the upwardly presented face of the upper flanges 12 being typically about 9 inches above the level of the floor.

As mentioned, the trackway is composed of structurally separate rail sections arranged end-to-end, and adjacent to the end of each such track section coupling means are provided for connecting same together in end-to-end relation. Conveniently one coupling element may be formed on the foot element, and may be in the form of an upwardly presented cradle of parts cylindrical form, as indicated at 10b, extending transversely of the rail section, with the cradle portion offset longitudinally from the end of the track section concerned, and disposed just beneath the lower flanges 13.

The complementary coupling element of the coupling means comprises a cylindrical member welded or otherwise secured to the lower flanges 13, and extending transversely of the track section at the opposite end thereof, as indicated at 10c.

The locomotive 1 may be supported at each end by driving bogies 7, or one only of these bogies may be a driving bogie,

and the other may be an idle bogie, in which case it may be a simplified form as hereinafter mentioned.

Referring now specifically to such driving bogie, the driving wheels thereof 14 are journaled for rotation about a horizontal transverse axis 15 by a bearing provided in a mounting member 16 of generally blocklike form disposed predominately above the trackway. The driving wheels together with tires, preferably formed of 'duthane' rubber, have diameters typically of 8 to 12 inches.

The mounting member is provided with an upwardly projecting post 16a forming a component of a swivel bearing and serving also to couple successive vehicles such as 1 and 2.

The driving wheels 14 contact the upwardly presented faces of the upper flanges 12 of the trackway.

The underfaces of these flanges are engaged by counterpressure wheels 17 of which there are two associated with each driving wheel 14, these being journaled for rotation about axes 18 extending horizontally and transversely of the trackway at positions offset, one on each side of a vertical plane passing through the axis 15.

The counterpressure wheels 17 are of a diameter somewhat less than the vertical internal dimension of each channel section rail element so as to provide a clearance space 19, preferably having only a small value, with respect to the bottom flange 13. Typically the counterpressure wheels have diameters of 2 to 3 inches. It is advantageous to employ counterpressure wheels having the largest diameter capable of accommodation within the vertical internal dimension of the rail element to provide more favorable compressive loading of the flanges 12 at the zones of contact with these wheels.

All four counterpressure wheels are mounted on a counterpressure wheel support in the form of a longitudinally extending beam element 20 provided with suitable bearings for the mounting of the counterpressure wheels and supported by suspension elements in the form of hydraulic piston and cylinder units 21 extending upwardly from the beam to which their lower ends are pivoted, and supported at their upper ends by pivotal connection to lugs 22 projecting longitudinally at each end of the mounting member 16.

If, as shown, the upper faces and underfaces of the flanges 12 are horizontal, the driving wheels and counterpressure wheels will be mounted in pairs in which the wheels are exactly coaxial with each other; but if these faces are not exactly horizontal, then there would be some departure from exact coaxial relation between the driving wheel pairs and/or the counterpressure wheel pairs.

The mounting member 16 also has downwardly projecting arms 23 which penetrate the beam element, the latter being apertured for this purpose, and engage guide faces 24 formed on the beam element and presented in opposite longitudinal directions.

This arrangement provides ability for the beam element to rise and fall relatively to the mounting member 16 and also undergo some angular movement about an axis 25 on the same horizontal level as the axis 18 and in vertical alignment with the axis 15 by virtue of the convexity of the guide faces 24. However, the beam element is constrained against translatable endwise movement by engagement of the arms 23 with the guide faces 24.

The driving wheels 14 are coupled to respective hydraulic motors supplied with fluid from the pump 9 disposed at the outer sides of the driving wheels and conveniently supported in any suitable manner from the mounting member 16. The pump and hydraulic motors effectively form a transmission means of variable velocity ratio dependent upon the delivery rate setting for the pump.

The driving wheels and counterpressure wheels form a central group of compact dimensions longitudinally of the trackway, and hence able to negotiate abrupt changes of inclination and lateral direction at junctions between straight rail sections. Further, the rubber tires of the driving wheels provides a longitudinal spread of downward load on the

longitudinal spacing of the axes 18, and hence the zones of contact between the rigid metal counterpressure wheels 17 and the flanges 12.

At opposite ends the beam element 20 is provided with extensions 26 having vertical bearings 27 for stabilizing wheels 28. These wheels perform a guiding function with respect to the angular position of each bogie about its vertical swivel bearing: one of the stabilizing wheels contacts the inwardly presented face of the vertical web 11 of one rail element and the other contacts the equivalent inwardly presented face of the vertical web 11 of the other rail element. The diameter of each stabilizing wheel 28 is, of course, somewhat less than the lateral separation between the inwardly presented faces of the webs 11.

The arrangement described provides a relatively short bogie capable of negotiating trackway curvatures down to about 13 ft. radius.

Further, the arrangement has flexibility in that either one or two such bogies may be provided on the locomotive. The preload exerted by the hydraulic rams 21 which urge the counterpressure wheels 17 upwardly into contact with the underface of the upper flange 12 of each rail section does not significantly increase the stress conditions existing in the lower flange 13, this being the limiting factor as regards the weight of the locomotive which can be supported by trackway.

The hydraulic fluid necessary to pressurize the hydraulic rams 21 may be derived from the hydraulic pump 9 driven by the prime mover. Alternatively, a manually operated pump, for example in the form of a piston and cylinder assembly operable through a screw mechanism, may be sufficient to provide the requisite pressure of hydraulic fluid to establish the required preload.

If only one driving bogie is required to be provided on the locomotive, the other bogie may be of simplified form, such as that seen at 7a at the extreme right-hand end of the vehicle 2.

Further, although as depicted in the drawings, the body of the locomotive is of rigid form longitudinally, it would be possible for the locomotive to have an articulated body supported at its midposition by a bogie which may be the driving bogie or one of same. In this case, one body section of the locomotive may carry the prime mover, and the parts 8, 8a and 9 already mentioned, and the other section of the locomotive body may incorporate the driving station and be equipped with a seat, such as 1a, and control console, such as 1b.

It will be understood that it would be within the scope of the invention for the two driving wheels which are mounted for rotation about a common axis to be replaced by a single driving wheel of a width to span both rail elements. Similarly, single counterpressure wheels mounted each on its own axle may be employed instead of coaxial pairs.

Further, instead of using two pairs of counterpressure wheels, or two counterpressure wheels rotatable about axes spaced apart longitudinally and situated fore-and-aft of the driving wheel, a single counterpressure wheel, or a single pair of coaxially mounted wheels may be employed in certain circumstances, for example there the depth of the rail section permits of the accommodation of a counterpressure wheel of greater diameter than those previously referred to. The axis of such counterpressure wheel or wheels would be substantially in the same vertical plane as that of the driving wheel or wheels.

Moreover, it would also be within the scope of the invention to employ two pairs of driving wheels, or two driving wheels of a width to span both rail sections, mounted for rotation about respective axes which are spaced apart longitudinally from each other. In this arrangement, there would be either a single counterpressure wheel, or a single pair of coaxially mounted counterpressure wheels in association with each of the driving wheels, or pairs thereof, as above-described, or each driving wheel, or each pair of driving wheels, may have associated with it two pairs of longitudinally spaced counterpressure wheels situated fore and aft of the axis of rotation of the driving wheel or wheels.

of counterpressure wheels may be common to the two driving wheels or pairs thereof, namely that situated at an intermediate longitudinal position relative to these driving wheels.

I claim:

1. A locomotive for use in a monorail conveyor of the kind specified, comprising a body on which is mounted a prime mover, and which is supported by longitudinally spaced bogies, one at least of which is a driving bogie, to enable said locomotive to travel along a ground mounted monorail trackway, incorporating at least one generally horizontal flange, and at least one generally vertical web, the improvement wherein the driving bogie comprises:
 - a. a bogie body structure pivotally connected to said locomotive body about an upright swiveling axis, and including:
 - i. a mounting member and
 - ii. a counterpressure wheel support
 - b. a central group of bogie wheels mounted on said bogie body structure for engaging said flange of said trackway over upwardly and downwardly presented faces thereof, and including:
 - i. at least one driving wheel operatively connected with said prime mover and driven therefrom and mounted on the mounting member for engaging one of said flange faces; and
 - ii. at least one counterpressure wheel mounted on said counterpressure wheel support for engaging the opposed one of said flange faces;
 - c. means interconnecting the mounting member and the counterpressure wheel support and including:
 - i. preload means for acting upon the mounting member and the counterpressure wheel support for urging said driving wheel and said counterpressure wheel into engagement under pressure with said flange;
 - ii. pivot means for accommodating angular movement of the counterpressure wheel support relative to the preload means about a horizontal axis;
 - iii. guide means for constraining the counterpressure wheel support against movement longitudinally of the bogie relative to the mounting member, and for accommodating relative movement of the mounting member and counterpressure wheel support upwardly and downwardly;
 - d. stabilizing wheels on said bogie body structure at opposite ends of said central group of bogie wheels for engaging opposed laterally presented faces of said trackway, and afforded by said web thereof.
2. A locomotive according to claim 1 wherein:
 - a. said driving wheel is mounted for rotation on said mounting member about a single axis situated above said flange;
 - b. said counterpressure wheels are mounted for rotation on said counterpressure wheel support about respective axes disposed beneath said flange and offset longitudinally from said driving wheel axis to lie forwardly and rearwardly respectively of the latter;
 - c. said stabilizing wheels are mounted on said bogie body structure at a position beneath said flange to engage with respective opposed faces of said web which extend downwardly from said flange.
3. A locomotive according to claim 2 wherein:
 - a. said mounting member is disposed above said flange;
 - b. said counterpressure wheel support is in the form of a beam element extending longitudinally of said trackway below the level of said flange, and having bearing means for rotatably mounted said longitudinally spaced counterpressure wheels for rotation about their axes respectively;
 - c. said preload means comprises suspension elements extending upwardly from said beam element adjacent to opposite ends thereof, one before and one behind said driving wheel axis and connected adjacent to their upper ends to said mounting member;
 - d. at least one of said suspension elements comprises components movable between an extended position and a

- contracted position to drawn said beam element upwardly in the latter of said positions, and establish the requisite contact pressure between said bogie wheels of said central group, and said upwardly and downwardly presented faces of said flange.
4. A locomotive according to claim 2 wherein:
 - a. said driving wheel has a diameter larger than the diameter of said counterpressure wheels;
 - b. said counterpressure wheels have diameters less than the vertical dimension of said web of said trackway.
5. A locomotive according to claim 2 wherein:
 - a. said driving wheel or each of same is provided with a tire of resilient material providing a zone of contact with the upwardly presented face of said flange extending longitudinally thereof;
 - b. said axes of rotation of said counterpressure wheels are spaced apart from each other by a distance only slightly greater than the length of said zone of contact;
 - c. said counterpressure wheels are formed of relatively rigid material, and have zones of contact with the downwardly presented face of said flange lying at opposite ends of, but close to, the ends of said first zone of contact of said driving wheel or wheels with said flange.
6. A locomotive according to claim 1 wherein:
 - a. said counterpressure wheel support comprises a beam element disposed beneath said flange and extending longitudinally of said trackway;
 - b. said guide means comprises respective cooperative guide elements on the mounting member and on the beam element engaging with each other to provide for upward and downward movement of said beam element relatively to said mounting member, and constraint to longitudinal movement of said beam element relatively to said mounting member.
7. A locomotive according to claim 6 wherein:
 - a. said guide elements on said mounting member comprise downwardly projecting arms at opposite ends of said mounting member extending vertically to a position beneath said flange of said trackway;
 - b. said guide elements on said beam element comprise guide faces thereon presented in opposite longitudinal directions for engagement with respective ones of said arms.
8. A locomotive according to claim 1 for use with a trackway including laterally spaced rail elements each having a vertical web, and a laterally inwardly extending horizontal or approximately horizontal flange at the upper end of said web, wherein:
 - a. each driving bogie of said locomotive incorporates two laterally spaced coaxial driving wheels for engagement with the upwardly presented faces of respective flanges of said rail elements
 - b. said prime mover is operatively connected with said driving wheels by transmission means on said bogie body structure disposed laterally outwardly of said driving wheels respectively;
 - c. said counterpressure wheels include pairs thereof disposed respectively forwardly and rearwardly of said driving wheels;
 - d. the mounting member is disposed above said rail elements, and includes bearing means for rotatably mounting said driving wheels;
 - e. said counterpressure wheel support includes a beam element extending longitudinally of said trackway between said laterally spaced rail elements thereof, and beneath the flanges of said rail elements, and includes bearing means for rotatably mounting said counterpressure wheels;
 - f. said preload means comprises suspension elements extending upwardly between said rail elements and connecting said beam element with said mounting member adjacent to opposite ends of the latter, at least one of said suspension elements being contractable;

g. said stabilizing wheels are mounted in bearing means provided adjacent to opposite ends of said beam element for engagement with respective inwardly presented faces of said webs of said rail elements.

9. A locomotive according to claim 1 wherein each of said bogies comprises a bogie body structure, including means for effecting pivotal connection between said locomotive and a carriage to be drawn thereby about an upright axis, and for providing swiveling movement of said bogie relative to said

body of said locomotive about said upright axis.

10. A locomotive according to claim 10 wherein said bogie body structure includes an upwardly projecting post for extension through bearing means provided both on said body of said locomotive and on a carriage to be drawn thereby, said bogie this providing support to both said locomotive and to said carriage at the end of said locomotive and said carriage at which said bogie is situated.

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