

Sept. 3, 1946.

K. HENRICHSEN

2,407,007

ARTICULATED BUS

Filed March 27, 1944

4 Sheets-Sheet 1

Fig. 1.

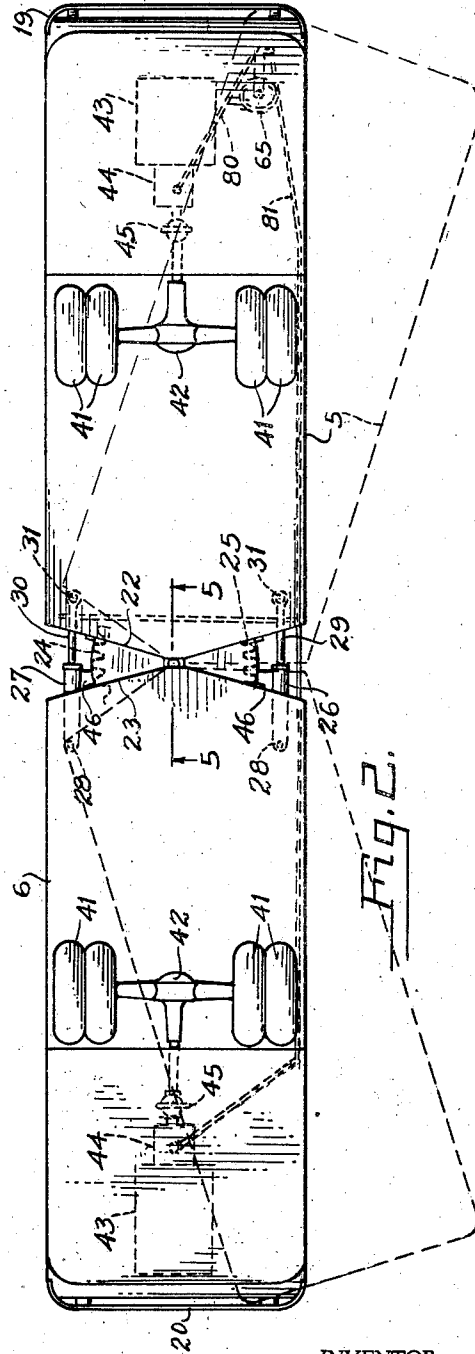
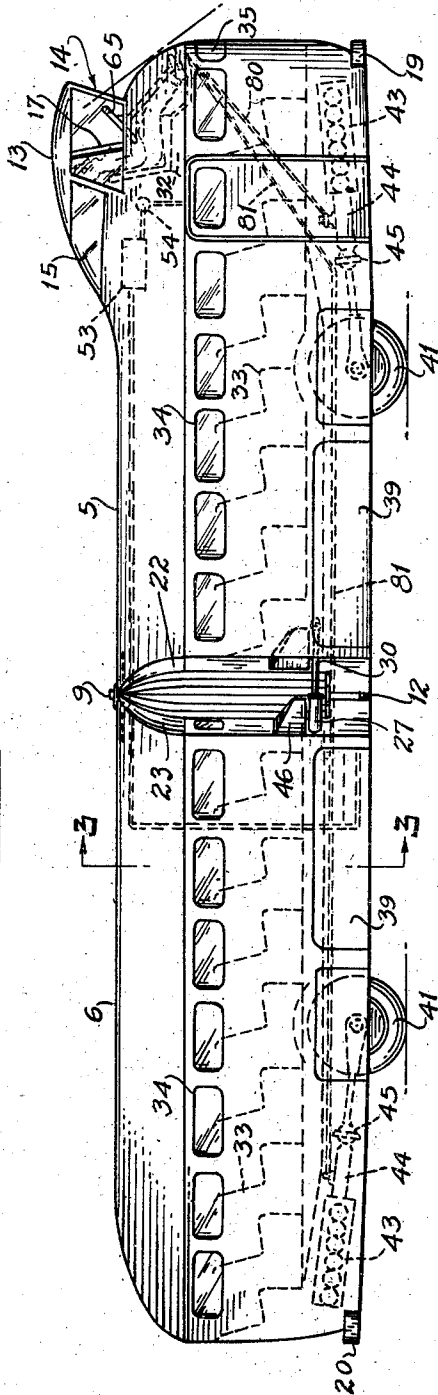


Fig. 2.

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Fig. 3.

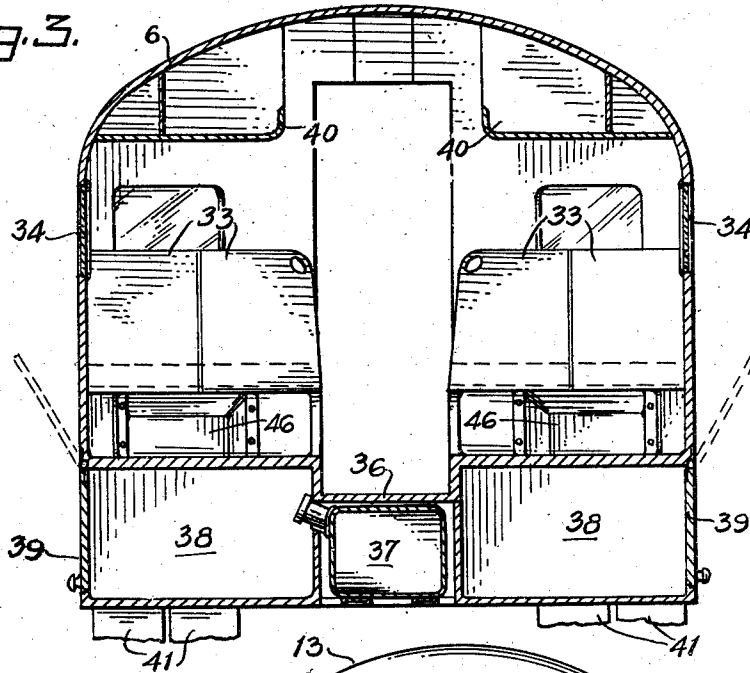
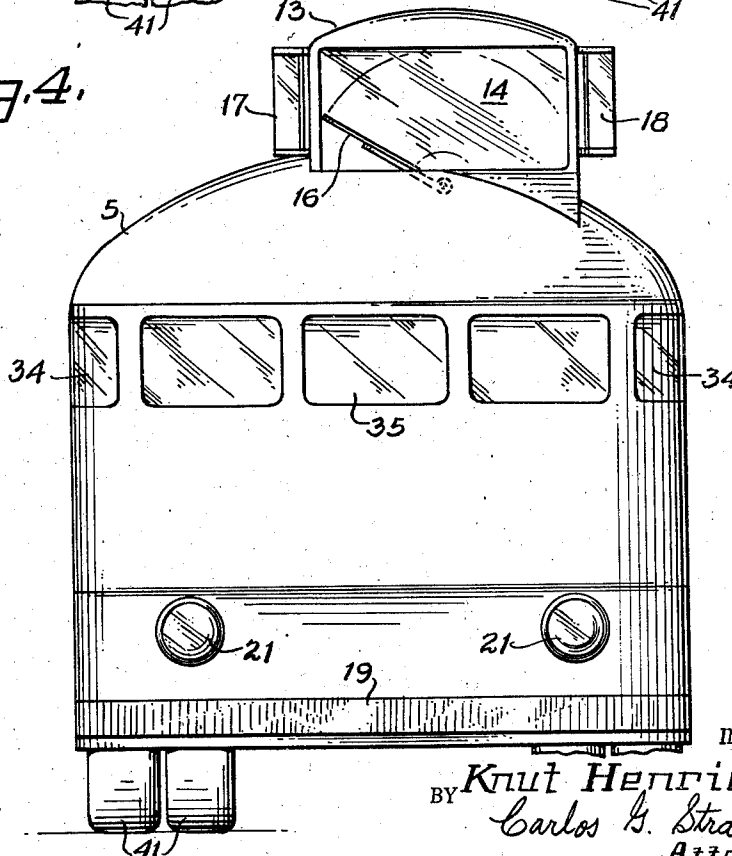


Fig. 4.



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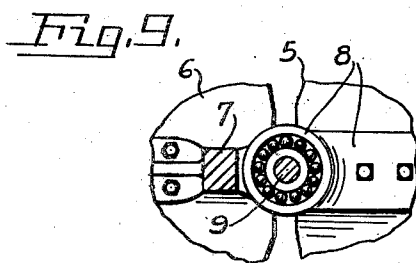
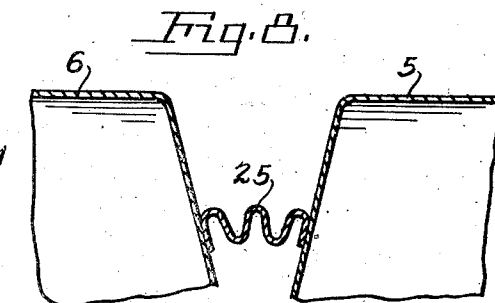
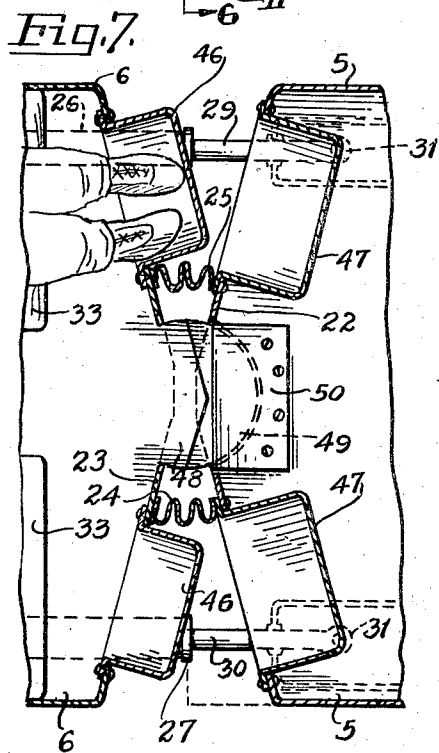
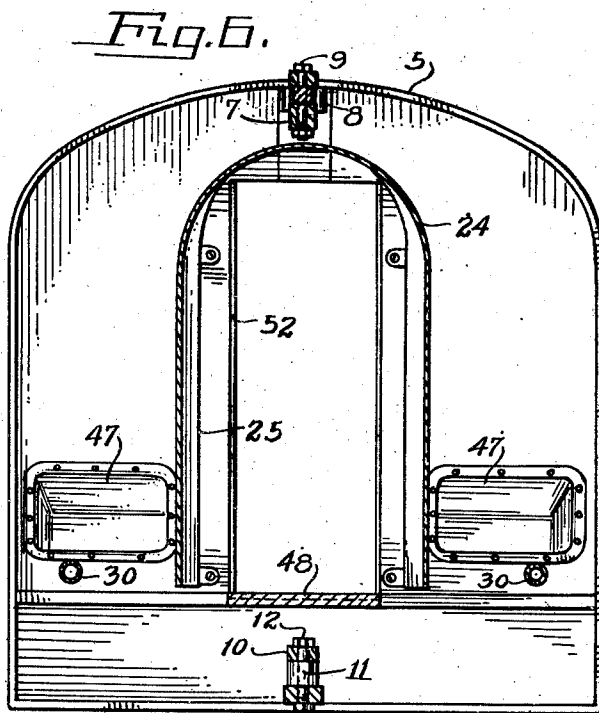
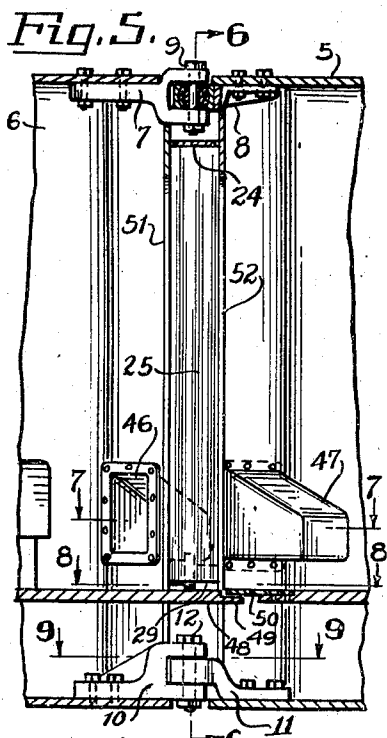
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Fig. 10.

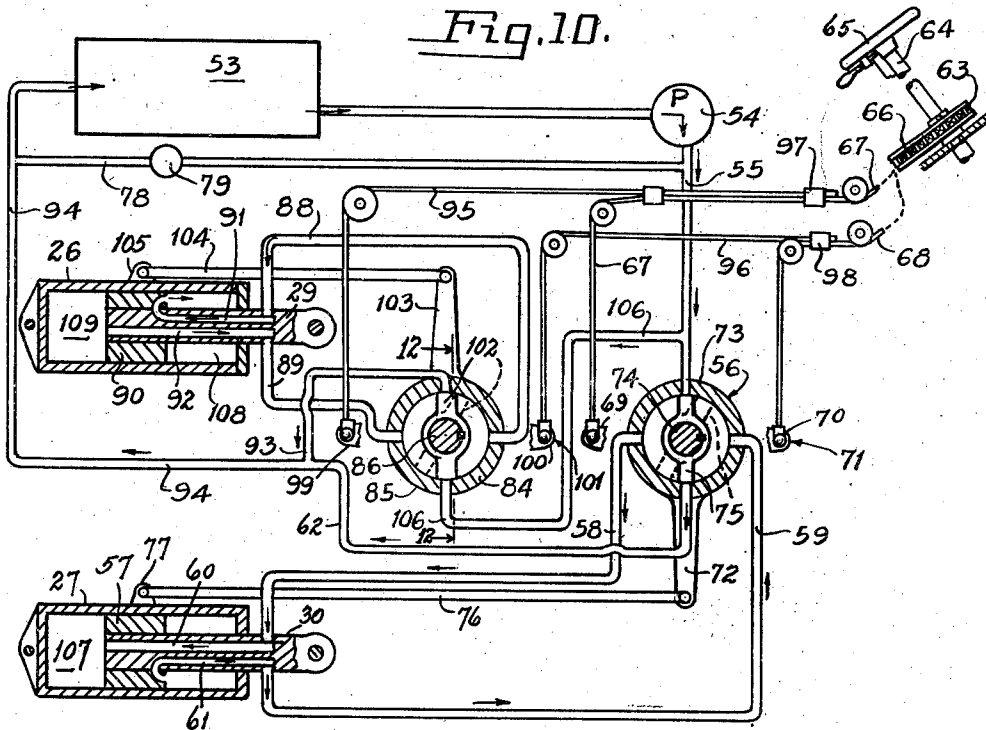


Fig. 11.

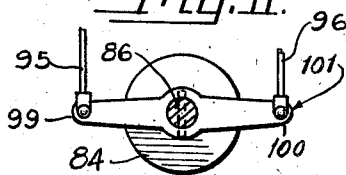


Fig. 12.

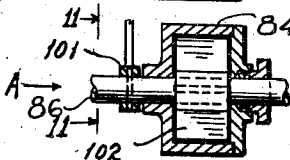
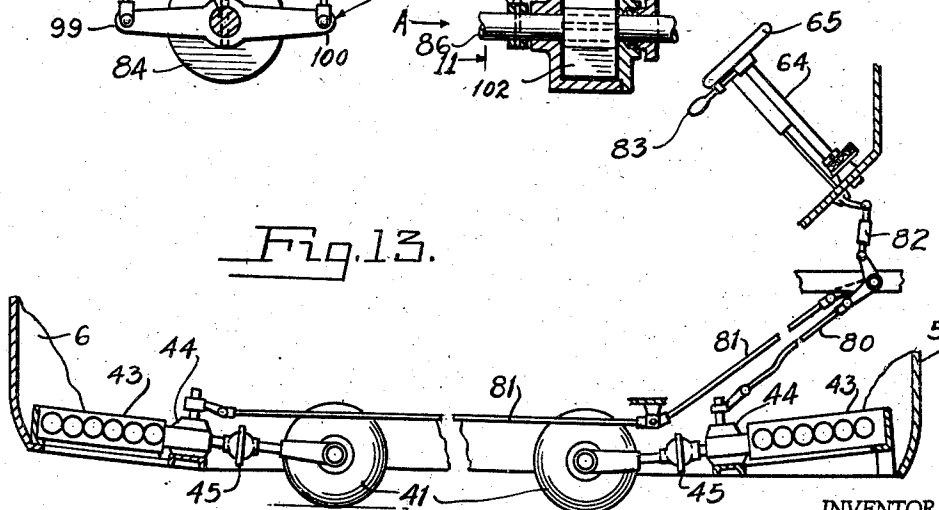


Fig. 13.



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UNITED STATES PATENT OFFICE

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ARTICULATED BUS

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Application March 27, 1944, Serial No. 528,205

3 Claims. (Cl. 180—79.2)

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My invention relates to an articulated bus, and has for its principal object to provide effective and efficient means for steering same.

Another object of the invention is to provide an arrangement of the ground wheels for conveniently steering a bus of such character.

A further object is to provide means for applying a steering force around the pivotal connection for sections of an articulated bus.

Still other objects are to provide an operator's compartment without occupying space on the level of the passengers' compartment, and to provide protected foot-room at the forward end of the rear section.

My invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes one embodiment of the present invention, which is given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is an elevational view of a bus embodying the foregoing objects.

Fig. 2 is an underneath view of said embodiment, and showing the sections in a position for making a turn.

Fig. 3 is a transverse section taken on the line 3—3 of Fig. 1.

Fig. 4 is a front elevation, partly broken away, of said embodiment.

Fig. 5 is an enlarged section taken on the line 5—5 of Fig. 2, looking in the direction of the arrows.

Fig. 6 is a section, taken on the line 6—6 of Fig. 5.

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 5.

Fig. 8 is a section taken on the line 8—8 of Fig. 5.

Fig. 9 is a horizontal section taken on the line 9—9 of Fig. 5.

Fig. 10 is a diagrammatic view of operating mechanism comprised in the invention.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 12.

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 10.

Fig. 13 is a diagrammatic view of still further operating mechanism comprised in the invention.

Referring more in detail to the drawings, the reference numbers 5 and 6 generally designate

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sections of an articulated bus. The sections have upper clevis and eye members 7 and 8 connected by a vertical, upper king bolt 9, and lower clevis and eye members 10 and 11 connected by a lower king bolt 12 that is vertically aligned with the upper king bolt 9.

The front section 5 has a cab 13 mounted at the top thereof. The cab has a front window 14 inclined forwardly and upwardly to minimize reflections from lights inside the bus and from headlights of following vehicles. The cab 13 also has a curved, streamlined, rear window 15 that extends forward a short distance at the sides of the cab. A suitable windshield wiper 16 may be arranged for use upon the front window 14. Rear view mirrors 17 and 18 may be provided at opposite sides of the cab. A front bumper 19 is mounted upon the front of the head section 5, and a rear bumper 20 is arranged at the back end of the rear section 6. Moreover, suitable headlights 21 are utilized.

The sections 5 and 6 have obtuse-angled ends 22 and 23 facing each other. Flexible bellows means 24 and 25 close the open sides between said ends 22 and 23.

An important feature of the invention is the use of steering means that operates around the axis of the king bolts 9 and 12. This means comprises a pair of hydraulic cylinders 26 and 27 that are pivotally mounted on one of the sections, as suggested at 28. Hollow piston rods 29 and 30, which reciprocate in the cylinders, are in turn pivotally connected with the opposite section, as shown at 31.

The cab 13 has a suitable driver's seat 32 and the body sections have suitable passengers' seats 33. Windows 34 are arranged along the sides and windows 35 around the front of the bus. The aisle 36 between the rows of seats extends lengthwise of both sections. Elongated gas tanks 37 may be arranged under the floors of the aisles. Luggage compartments 38 are shown under the seats 33. Doors 39 normally close the compartments 38. The doors 39 may be swung from their full line positions to their broken line positions in Fig. 3, to admit luggage to the compartments, and thereafter closed for transit. Overhead racks 40 may also be provided inside the sections, over the seats.

Two pairs of laterally aligned, ground wheels 41 are arranged under each section as best shown in Fig. 2. Each two pair are driven from respective differentials 42, which in turn are driven by motors 43 through the intermediary of transmissions 44 and universal joints 45. The motors are preferably of a flat type, sometimes called "pancake" motors, in order to house them beneath the passenger compartments.

In order to provide foot room for the front seats in the rear section, protruding enclosure

members 46 are provided, the floors of which are at approximately the floor level of the rear section. One of these enclosure members protrudes forward from each slanting face of the end 22, at opposite sides of the axis of the king bolts 9 and 12.

Arranged on the slanting faces of the end 23, in order to receive the protruding enclosure members 46, are socket members 47. Thus as the present bus turns a corner, the protruding member 46 on the inner side of the curve rests in the opposite socket member 47.

One of the sections has a lip 48 that has a shouldered part 49 which extends towards the other section. The lip 48 swings in a horizontal plane as the bus turns a corner. A plate 50 overhangs the shouldered part 49. The lip provides a platform between the sections in all relative positions of the bus sections. The sections 5 and 6 have doorways 51 and 52 respectively facing each other, for passengers to move from one section to the other.

The hydraulic steering circuit is illustrated in Fig. 10. It comprises a reservoir 53 from which liquid is drawn by a pump 54. A flexible line 55 and its branch line 106 supply liquid under pressure from the pump 54 to follow-up valves 56 and 84, whose housings 73 and 85 are mounted to swing about the axes 74 and 86 of pivoted vanes 75 and 102 in the housings 73 and 85 respectively. The housings 73 and 85 are connected with flexible inlet conduits 58 and 88 and with flexible outlet conduits 59 and 89. The inlet conduits 58 and 88 connect with inlet passages 60 and 91 in the hollow piston rods 30 and 29 respectively, while the outlet conduits 59 and 89 connect with outlet passages 61 and 92 in the piston rods 30 and 29 respectively. It is to be understood that the passages 60 and 61 connect with opposite sides of the piston 57 within the cylinder 27, and that the passages 91 and 92 connect with the opposite sides of the piston 90 within the cylinder 26. The conduits 58, 59, 88 and 89 are flexible to permit the swinging movements of the valve housings 73 and 85 and of the piston rods 29 and 30 and cylinders 26 and 27.

Return conduits 62 and 93 connect the valves 56 and 84 with a common return 94 leading back to the reservoir 53. Control means for the valves includes a sprocket 63 on the steering post 64 of the bus. A steering wheel is indicated at 65. One end of a chain 66 around the sprocket connects with a cable 67 that is fastened to an end 69 of a lever 71 that is also mounted to swing around the axis 74. The other end of the chain is connected with a cable 68 that is fastened to the other end 70 of the lever 71. Cables 95 and 96 are clamped to the cables 67 and 68 respectively, as suggested at 97 and 98, by any suitable means. The cables 95 and 96 in turn are connected with tips 99 and 100 of a lever 101 that is mounted to swing around the axis 86. Connected with the levers 71 and 101 respectively and mounted to rotate within the housings 73 and 85 are vanes 75 and 102 that are in fluid-tight engagement with the cylindrical, inner faces of the housings 73 and 85.

A depending arm 72 and an upstanding arm 103 of the housings 73 and 85 respectively connect with the cylinders 27 and 26 by means of connecting rods 76 and 104 whose ends are pivotally connected with lugs 77 and 105 on the cylinders 27 and 26. Thus the arms 72 and 103 follow movements of cylinders 26 and 27, when the latter are mounted on the same section of the

bus, and the levers 71 and 101 and their controlled vanes 75 and 102 respond to the operation of the steering wheel 65.

A by-pass 78 connects the outlet conduit 55 with pipe 94 leading back into the reservoir. A pressure regulated unloader valve 79 of conventional construction permits flow of fluid through the by-pass 78 when the pump 54 builds up the pressure to a predetermined degree in the line 55, thus short-circuiting the valves, the cylinders and their connecting elements. The unloader valve 79 provides constant pressure by allowing the hydraulic fluid to circulate freely when none of the units requires power.

In Fig. 13, gear shift rods 80 and 81 operate the front and rear transmissions respectively. Suitable linkage 82 operates the rods 80 and 81 from a gear shift lever 83 on the steering post 64. Detailed illustration of the construction and a detailed description of the operation of such linkage is believed unnecessary for those skilled in the art, and, moreover, the details thereof do not per se constitute the present invention.

In the operation of my present construction, it is to be understood that the ground wheels 41 are driven by the engines 43 in the respective sections of the bus. There is unitary control of both transmissions 44 by means of the single gear shift lever 83. It is also believed clear without further illustration, that the carburetors for the two engines may be controlled by a single, operator-controlled accelerator.

The steering wheel 65 is not directly connected with the front wheels of the present construction, as in the case of conventional bus construction. The steering wheel 65 controls the cables, which in turn operate the vanes 75 and 102 of the valves. In Fig. 10, the full line positions of the vanes 75 and 102 maintain the bus sections in their same relative positions, such as when the bus is proceeding straight ahead; in other words, the vane edge, as shown in said figure, abut the inlet and outlet ports, within the valves, of the conduits 55, 62, 106 and 93 that connect with the fluid supply and with the return to the reservoir. All flow through the valves is thereby stopped and the bus sections are locked in their relative positions.

When it is desired to turn the bus, the steering wheel is turned, say, clockwise in Fig. 10. This movement will draw cables 67 and 95 toward the steering post 64, thus lifting the lever ends 69 and 99 upwardly and move the vanes 75 and 102. A corresponding reverse operation of the cables 68 and 96 causes the lever ends 70 and 100 to swing downward and move the vanes to full line position in said figure. This movement of the levers 71 and 101 in a clockwise direction, in Fig. 10, is transmitted to the vanes 75 and 102, which are also moved in a clockwise direction, such as to a position indicated in broken lines in that figure.

In the broken line position of vane 75, pressure fluid from the pump 54 passes through the valve housing 56 from the conduit 55 to conduit 58. This supplies pressure to the chamber 107 in the cylinder 27. Pressure from the other side of the piston 57 flows out through the passage 61, through conduit 59, through the valve housing 73 to outlet pipe 62 and back to the reservoir 53 for liquid or other fluid. This causes the piston rod 30 and cylinder 27 to be pushed outwardly with respect to each other, thus thrusting the bus sections at an acute angle to each other (such as shown in broken lines in Fig. 2).

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At the same time and to aid in this angular movement, the pressure is being introduced into the valve housing 85 through the conduit 106. The fluid passing through the housing is transmitted by the conduit 88 to the passage 91 in the piston rod 29. Since the fluid is thereby introduced into the chamber 108 in the cylinder 26, the piston rod 29 and cylinder 26 are moved together, the piston moving to the left in Fig. 10. To allow this movement, the pressure in the chamber 109 is exhausted through passage 92, conduit 89, valve housing 85, outlet conduits 93 and 94 back to the reservoir.

Thus there are push and pull movements upon the bus sections, by means of the piston and cylinder means, in order to turn a corner with the bus. Of course, the operation is just the reverse in order to turn the bus the opposite direction.

It will be noted that a follow-up type of valve is used for the valves 56 and 84. That is, relative movements of the bus sections are transmitted back to the valve housings by means of the connecting rods 76 and 104. For instance, as the piston rod 30 is being pushed outwardly from the cylinder 27, the housing 73 follows around clockwise, in Fig. 10, to shut off the flow of fluid through the valve housing. Simultaneously, the housing 85 is moving clockwise, in Fig. 10, because the cylinder 26 and piston rod 29 are moving together in telescoping relation. Thus the housing 85 moves to shut off the flow of fluid therethrough. Because of these arrangements, continuous rotation of the steering wheel is necessary to continue turning movements. When rotation of the steering wheel is stopped, the arrangement of the bus sections are "frozen" with respect to each other. To straighten out the bus, continuous rotation of the steering wheel is necessary in a reverse direction, until the bus sections reach their desired relationship. That is to say, steering the present fluid-controlled mechanism simulates a mechanical control on an ordinary motor vehicle.

It is to be understood that by "non-rotatable axes" in the hereto appended claims is meant that the axes of the road wheels do not rotate substantially about vertical axes. Of course, it is believed clear without further illustration that conventional springs may be interposed between the body sections and the axles for the road wheels without rendering the axes of the road wheels what is here meant by "rotatable." In other words, in the hereunto appended claims, the axes of the road wheels are not considered rotatable even though springs support the body sections upon the axles of the ground wheels.

While I have illustrated and described what I now regard as the preferred embodiment of my invention, the construction is, of course, subject to modifications without departing from the spirit and scope of my invention. I, therefore, do not wish to restrict myself to the particular form of construction illustrated and described, but desire to avail myself of all modifications that may fall within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an articulated vehicle wherein at least two sections are interconnected together by a single pivotal connection located substantially at the longitudinal centerline of the sections, and wherein each section is supported on a pair of wheels, steering means for vehicle including an

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actuating device interconnecting each of the respective sections and effective to change the angularity of the sections relative to each other in accordance with the selected direction of travel for the vehicle, including cylinder and piston elements interconnecting said sections, the cylinder being operatively connected to one of said sections and the piston to the other said section, a fluid pressure supply source, a valve mechanism including valve members, shafts on which said valves are mounted, housings enclosing said valve members and rotatably mounted on shafts for movement relative to said valve members, arms on said housings, rods connecting said arms and cylinder elements, flexible fluid supply and exhaust lines connecting said fluid pressure supply source with said piston elements, a hand wheel, and means controllable by movement of said hand wheel to operate said valve members independently of said housings to supply fluid pressure to said pistons and move one section of the vehicle relatively to the other, said housings being moveable by said cylinders independently of said valve members to shut off the supply of fluid pressure to said pistons.

2. In an articulated vehicle wherein at least two sections are interconnected together by a single pivotal connection located substantially at the longitudinal centerline of the sections, and wherein each section is supported on a pair of wheels, steering means for the vehicle including actuating devices interconnecting each of the respective sections and effective to change the angularity of the sections relative to each other in accordance with the selected direction of travel, including cylinder and piston elements interconnecting said sections, the cylinder being pivotally connected to one of said sections and the piston to the other of said sections, a fluid pressure supply source, and a valve mechanism including a moveable valve member and a moveable housing, manually operated means for moving the valve member to control the supply of fluid pressure to the respective pistons, and means for moving the valve housing in response to movement of the sections relative to each other so as to cut off the supply of fluid pressure to the pistons whereby continuous movement of the valve member is required for a continuous supply of fluid to the respective pistons.

3. In an articulated vehicle wherein at least two sections are interconnected together by a single pivotal connection located substantially at the longitudinal centerline of the sections, and wherein each section is supported on a pair of wheels, steering means for the vehicle including actuating devices interconnecting each of the respective sections and effective to change the angularity of the sections relative to each other in accordance with the selected direction of travel, including cylinder and piston elements interconnecting such sections, the cylinder being operatively connected to one of said sections and the piston being operatively connected to the other of said sections, a fluid pressure supply source, and a valve mechanism including a moveable valve member and a housing, manual means for operating said valve member to supply fluid pressure to the pistons, and means acting in response to the relative movement of the sections for moving the valve housing to offset the movement of said valve member by the manually operated means.

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