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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Driving Axle Assembly for Vehicles

We, LANCIA & C. FABRICA AUTOMOBILI-TORINO S.P.A. an Italian Joint Stock Company of 27 via Vincenzo Lancia, Turin, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to driving axle assemblies for motor vehicles, incorporating a differential gear, two half axles arranged in a rigid axle housing, wheel brakes and a reducing gear for each wheel.

An object of this invention is to provide a driving axle assembly which is suitable for use either in vehicles having a very low floor, such as passenger vehicles, or a high floor, such as trucks and lorries for the transport of goods over uneven roads, where ample clearance must be provided between the axle assemblies and the ground.

The driving axle assembly according to this invention is of the type comprising a differential gear, two half axles extending therefrom, two axle housings supporting wheel spindles, a reducing gear within each axle housing, brake means adapted to brake the wheels and an intermediate frame comprising a cage made of similar tubes having parallel axes, rigidly supporting the differential gear and having the two axle housings attached to either side of said frame, thus supporting the wheel spindles at their free ends.

According to a known construction the intermediate frame comprises a cage made of similar tubes having parallel axes the ends of said tubes being rigidly attached to the axle housings. Each axle housing is of approximately S-shape and is open at both ends. The end facing the intermediate frame has an inner flange for attachment to the tubes of the intermediate frame and its free end has an outer flange fast with a wheel spindle carrying a wheel hub containing a reducing gear.

This construction is difficult and elaborate to manufacture, both on account of the special shape of the axle housings, and due to the complexity of the mechanical motion transmitting members such as universal joints, articulated shafts, epicyclic reducing gears, etc.

This invention obviates the above drawbacks by providing a driving axle assembly for vehicles of the type referred to above, which is easy to manufacture, simple in assembly and of reduced weight.

With the above objects in view this invention provides a driving axle assembly for vehicles of the type referred to above, wherein the intermediate frame extends almost throughout the axle length, the housings secured to the ends of the intermediate frame being flat and each comprising two hollow bodies bolted together and enclosing a spur wheel reducing gear comprising a pinion arranged on an extension of its respective half axle extending from the differential and torsionally linked thereto, and a larger diameter toothed rim co-operating with the small diameter gear and connected with one of the wheel spindles which are arranged along an axis parallel with the axis of the half axle which in turn extends parallel with the tubes of the intermediate frame.

The invention shall be described in detail with reference to the accompanying drawings given by way of a non-limiting example.

FIGURE 1 is a plan view of a driving axle assembly according to this invention;

FIGURE 2 is an elevational view showing the arrangement of the driving axle assembly on a vehicle with a low floor;

FIGURE 3 is a similar view showing the driving axle arrangement in use on a vehicle with a high floor;

FIGURE 4 is a cross sectional view on line IV—IV of Figure 2;

FIGURE 5 is a similar sectional view on line V—V of Figure 3; and

FIGURE 6 is an axial sectional view through one of the driving wheel ends.

Referring to the drawings, an intermediate supporting frame 1 comprises in the embodiment shown three parallel tubes arranged at points of intersection of an isosceles triangle, as shown in Figures 4 and 5, extending almost throughout the axle length.

A differential gear housing 4 of known type is affixed to the supporting frame 1, to which are attached two brake calipers 22 carrying brake shoes 23 for the disc brakes, the operating members for which are denoted by 24 and 25. In the construction shown the operating members are pneumatically operated by air pressure generated by compressors which are normally provided on vehicles.

Two brake discs 20 are acted upon by the brake shoes and are keyed to a pair of shafts 45 extending from each side of the differential gear, respectively, connected to their respective epicyclic gearings and extending parallel with the frame tubes 2.

The ends of the tubes 2 are connected to two end housings 30, 32 serving the multiple purpose of holding the frame tubes 2 interconnected in their predetermined position, providing seatings for two reducing gears and carrying the supports for the wheels 19. The housings are each formed by two hollow members 30, 32, bolted together.

The inner member 30 is formed with a triangular portion 30*a* formed with seatings for the ends of the tubes 2 which are secured to the said portion by means of nuts or tapped collars 3. The portion 30*b* is of oval cross-sectional shape forming together with the outer member 32, which matches it in shape, a seating for the reducing gear.

The triangular portion 30*a* is provided at the top and bottom with two laterally extending brackets 31 permitting assembly of the driving axle to the suspension members in the two typical positions of assembly (Figures 2, 3, 4, 5).

In the construction shown the reducing gear comprises a large diameter toothed rim 39 and a smaller diameter pinion 40 attached to the shaft 40*a* which is journaled at its ends in roller bearings 41 and 42 located in the housing members 30, 32.

In order to support the shaft 40*a* the housing member 30 is formed with a tubular extension 30*c* in the triangular portion 30*a*.

The toothed rim 39 is secured to a shaft 36 supported in the outer member 32 and is journaled in the latter in a single bearing 38.

A cylindrical hub 33 is arranged coaxially with the shaft 36, formed with a flange and is bolted to the outer face of the member 32. A wheel or wheels 19 is or are mounted on the hub 33 through the interposition of roller bearings 34, the hub acting as the wheel support fastened to the driving axle.

The shaft 36 fastened to the toothed rim 39 of the reducing gear is longer than the hub 33 surrounding it. The protruding end of the shaft 36 has slipped thereon a splined sleeve 37 provided with a flange and torsionally secured by means of the said flange to the wheel drum 35.

The toothed rim 39 which is the driven member of the reducing gear transfers the motive force to the wheel through the shaft 36 and sleeve 37.

One end of the shaft 40*a* carrying the pinion 40, facing the inside of the driving axle, is formed with an externally splined end portion 40*b* for axial engagement by a recess in an internally splined joint 44, fastened to the half axle 45 extending from the differential gear. The same end of the shaft 40*a* is formed with a forwardly open axial recess accommodating a helical spring 43 bearing at its ends against the bottom of the said recess and the joint 44, respectively, to prevent mutual chattering of the joint 44 and shaft 40*a* during motion of the vehicle.

The arrangement is symmetrical on the other wheel or wheel pair.

A support 46 is provided on each side wall of the differential gear 4 to support the half axles 45 which extend parallel with the cage of the carrying frame 1.

Motion is transmitted through the half axles 45 from the differential gear to the gear of the reducing gears, namely to the pinion 40, then to the toothed rim 39 and, finally, to the wheels 19.

With the use of a spur wheel reducing gear the axis of the half axles 45 is offset from the axis of the wheels, whereby the driving axle can be assembled in two different positions for low floor and high floor vehicles, respectively.

With the above described arrangement the disc brakes can be conveniently located, spaced from the wheel rims, which facilitates construction and promotes heat dispersion on braking.

The advantages of the driving axle assembly according to this invention will be apparent from the above, the same advantages residing in a considerable structural simplification of the components, ease of assembly and multi-use possibility.

Moreover, the structural simplification favourably affects toughness of the unit and affords a considerable reduction in weight.

WHAT WE CLAIM IS:—

1. A driving axle assembly for motor vehicles, adapted to be connected to the vehicle by means of resilient suspension members and comprising a differential gear, two half axles extending therefrom, two axle housings supporting wheel spindles, a reducing gear within each axle housing, brake means adapted to brake the wheels and an intermediate frame comprising a cage made of similar tubes having

parallel axes, rigidly supporting the differential gear and having the two axle housings fixed to either side of said frame and supporting the wheel spindles at their free ends, wherein the intermediate frame extends almost throughout the axle length, the housings secured to the ends of the intermediate frame being flat and each comprising two hollow members bolted together and enclosing a spur wheel reducing gear comprising a small diameter gear on an extension of its respective half axle extending from the differential and torsionally linked thereto, and a larger diameter gear co-operating with the small diameter gear and connected with one of the wheel spindles which are arranged along an axis parallel with the axis of the half axle, the latter extending parallel with the tubes of the intermediate frame.

2. Driving axle assembly as claimed in claim 1, wherein the inner member of each axle housing includes a hollow portion substantially of oval shaped cross section and a portion of triangular cross section providing seatings for attachment of the tubes forming the intermediate frame, the outer housing member being of an oval cross sectional shape matching in shape the hollow portion of the inner member to provide the recess housing the reducing gear, the said recess providing two seats aligned along a single axis in the two opposite walls of the said members in order to support the shaft carrying the small diameter gear, the recess being formed with a further seating in the wall of the outer member from which the wheel spindle projects, the spindle having secured to one end the toothed rim of the reducing gear.

3. Driving axle assembly as claimed in claim 1 or 2, wherein the outer member of each axle housing has secured to its outer face a tubular member projecting coaxially with the wheel spindle and supporting the wheel.

4. Driving axle assembly as claimed in claim 1, 2 or 3, wherein each wheel spindle is greater in length than the stationary tubular member coaxial therewith and carries at one end a flanged sleeve secured to the wheel drum for transmitting motion from the reducing gear to the wheel.

5. Driving axle assembly as claimed in claims 1, 2, 3 or 4, wherein the small diameter gear of the reducing gear is fastened to a shaft torsionally linked through splined couplings with one end of its respective half axle extending from the differential gear, resilient means being interposed between the ends of the said shafts facing each other to prevent axle vibration causing shattering thereof.

6. Driving axle assembly for motor vehicles, substantially as hereinbefore described with reference to and as shown in Figures 1, 2 and 4 of the accompanying drawings.

7. Driving axle assembly for motor vehicles, substantially as hereinbefore described with reference to and as shown in Figures 1, 3 and 5 of the accompanying drawings.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG.1

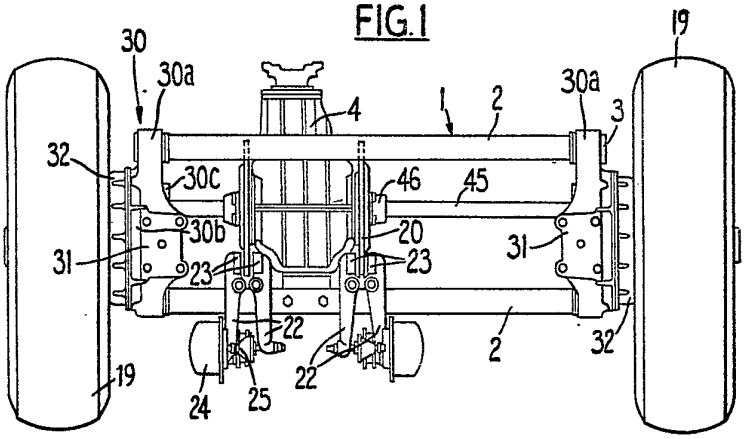
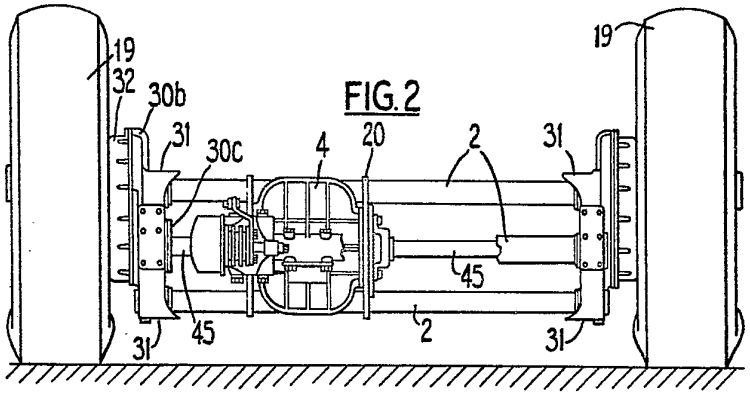


FIG.2



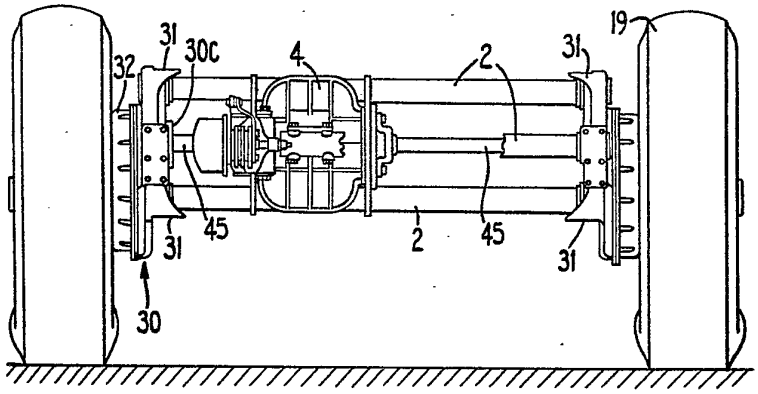


FIG.3

Fig.4

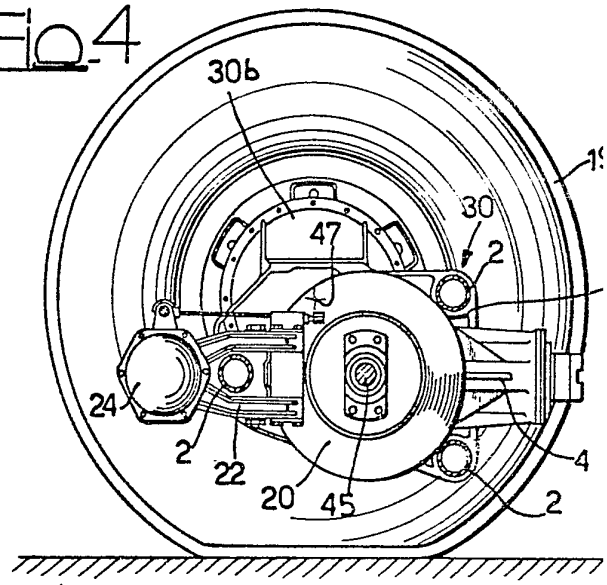
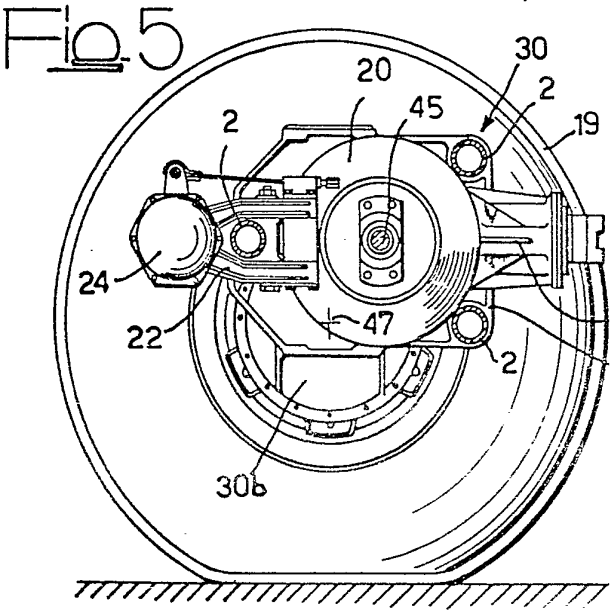
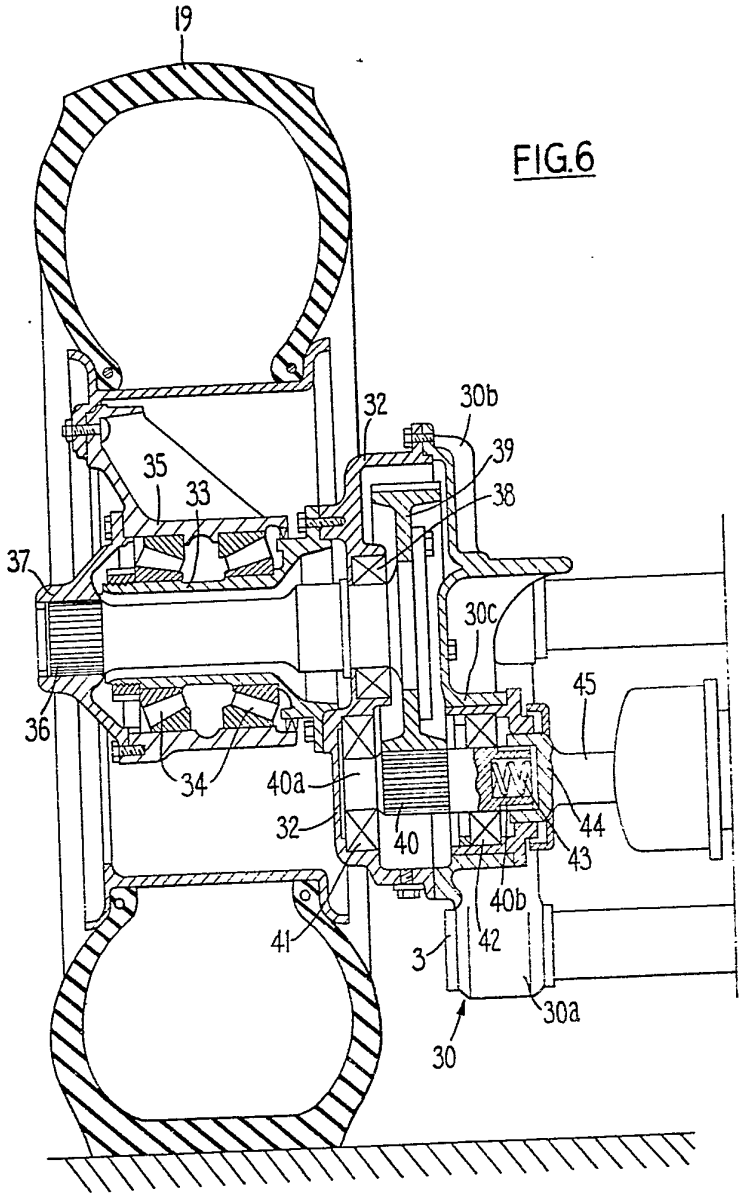


Fig.5



1030287 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3

FIG.6



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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
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Fig.4

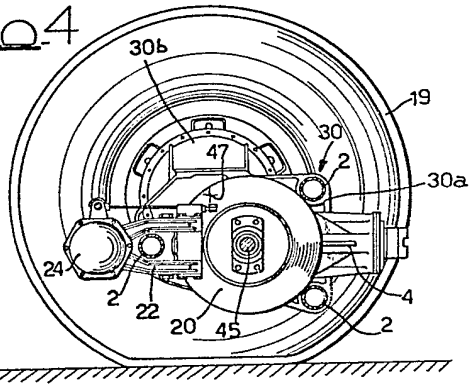

Fig.5

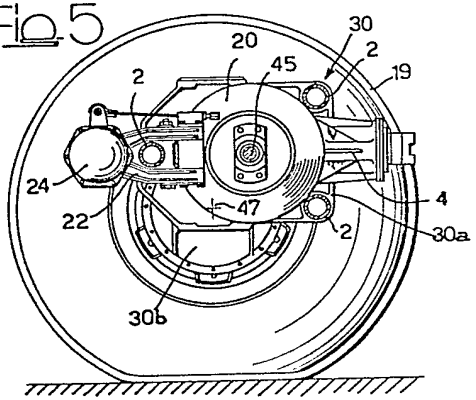

FIG.6