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(54) **Animal Powered Drive Means**

(57) A road vehicle is driven by animal powered drive means comprising an endless conveyor belt (34) acting as a tread-mill and driving the vehicle drive wheels through a chain (44), a clutch (49), and a variable-ratio gearbox (46). The belt is centered on the

longitudinal centre line of the vehicle below an enclosure for the animal, driver and passenger spaces being on either side of the enclosure. The animal is supported by harness including a collar (76), trace (77), a back strap (80), girth (79) and a breeching box (84). Containers are provided to collect droppings.

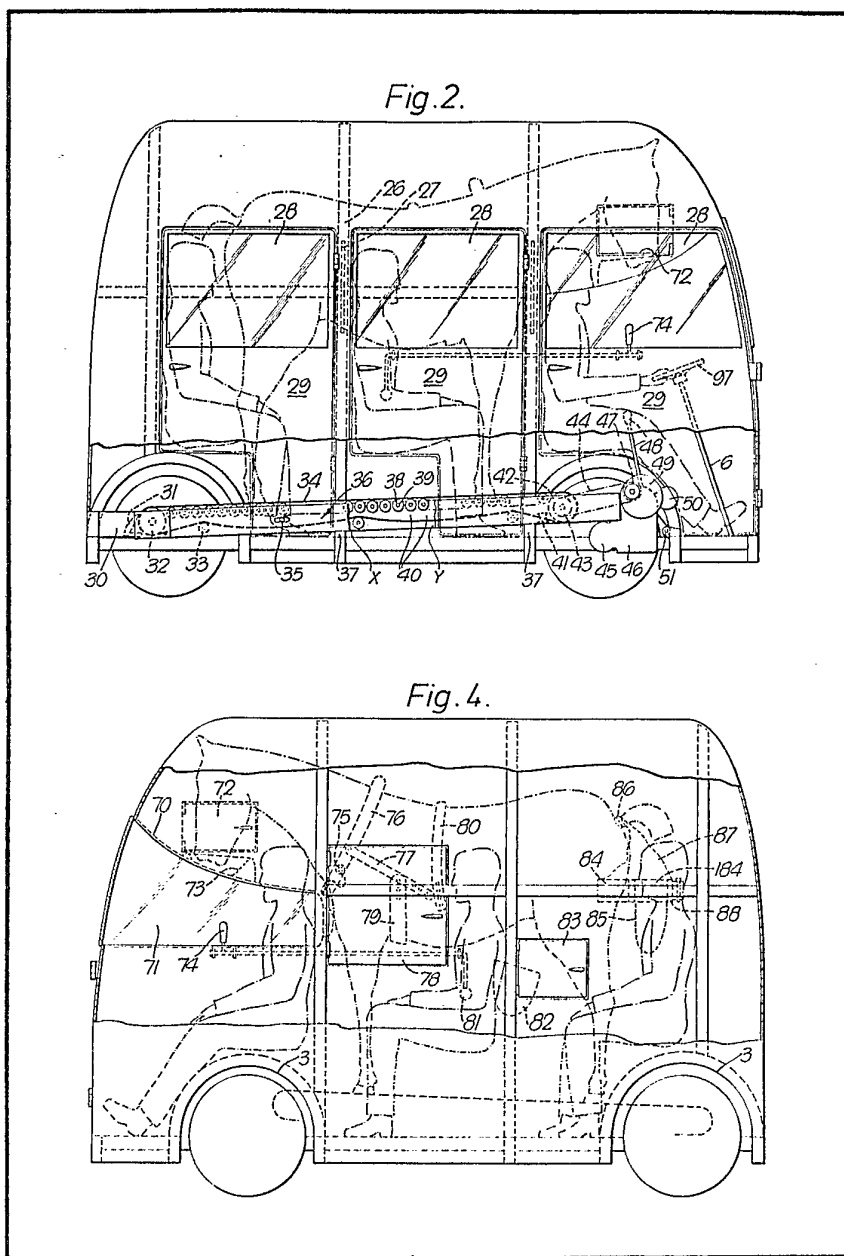
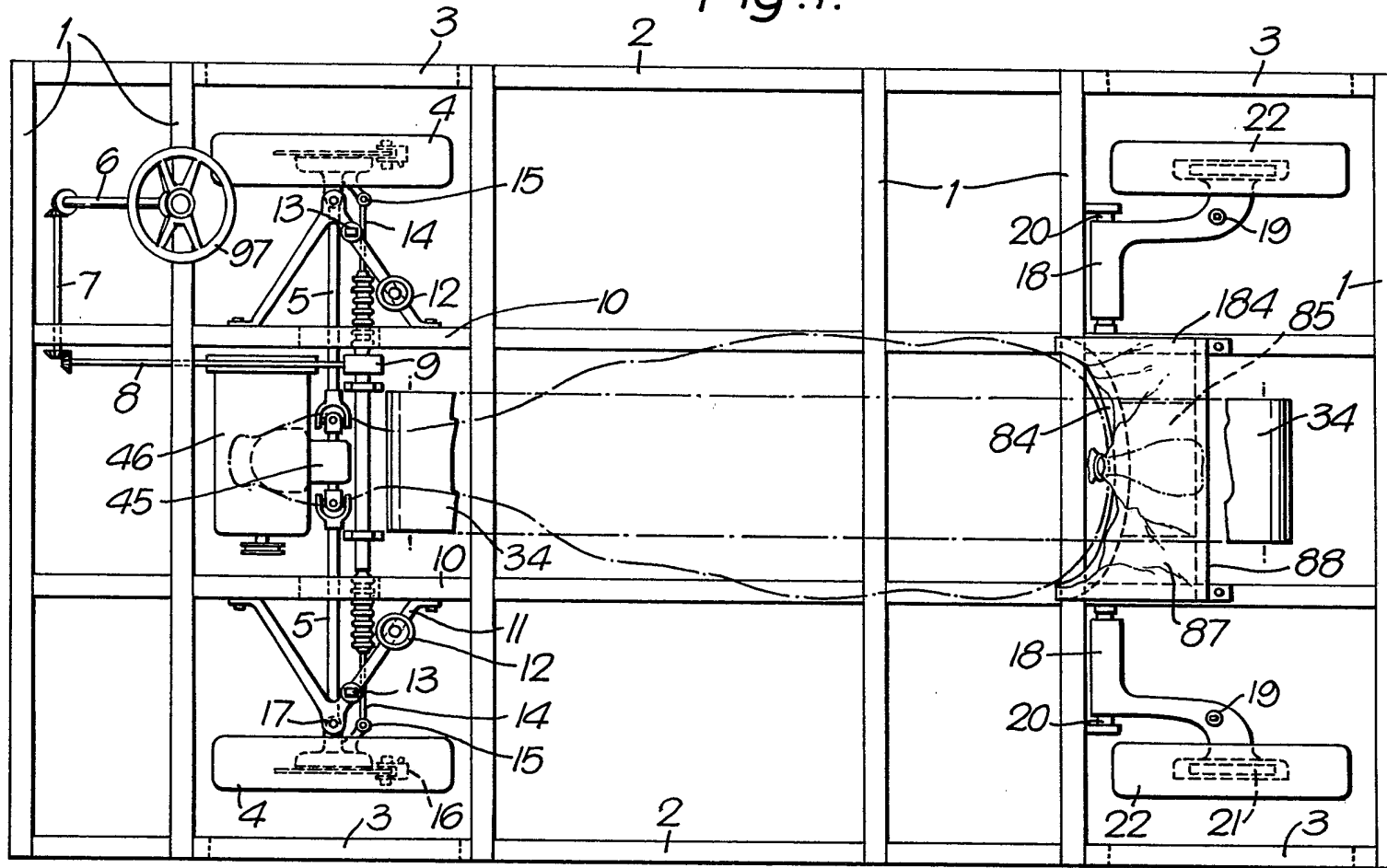


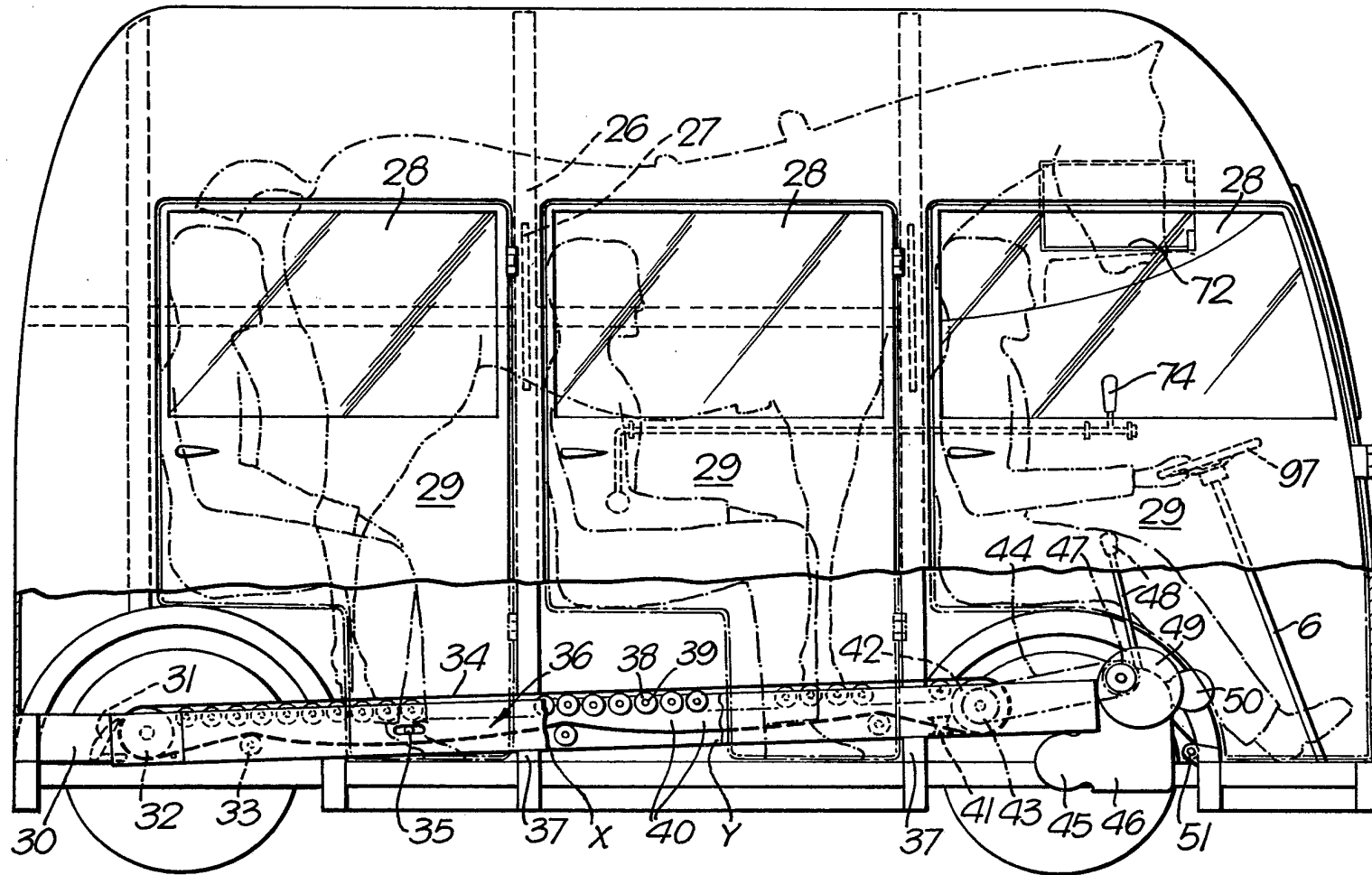
Fig. 1.



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Fig. 2.



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Fig. 3.

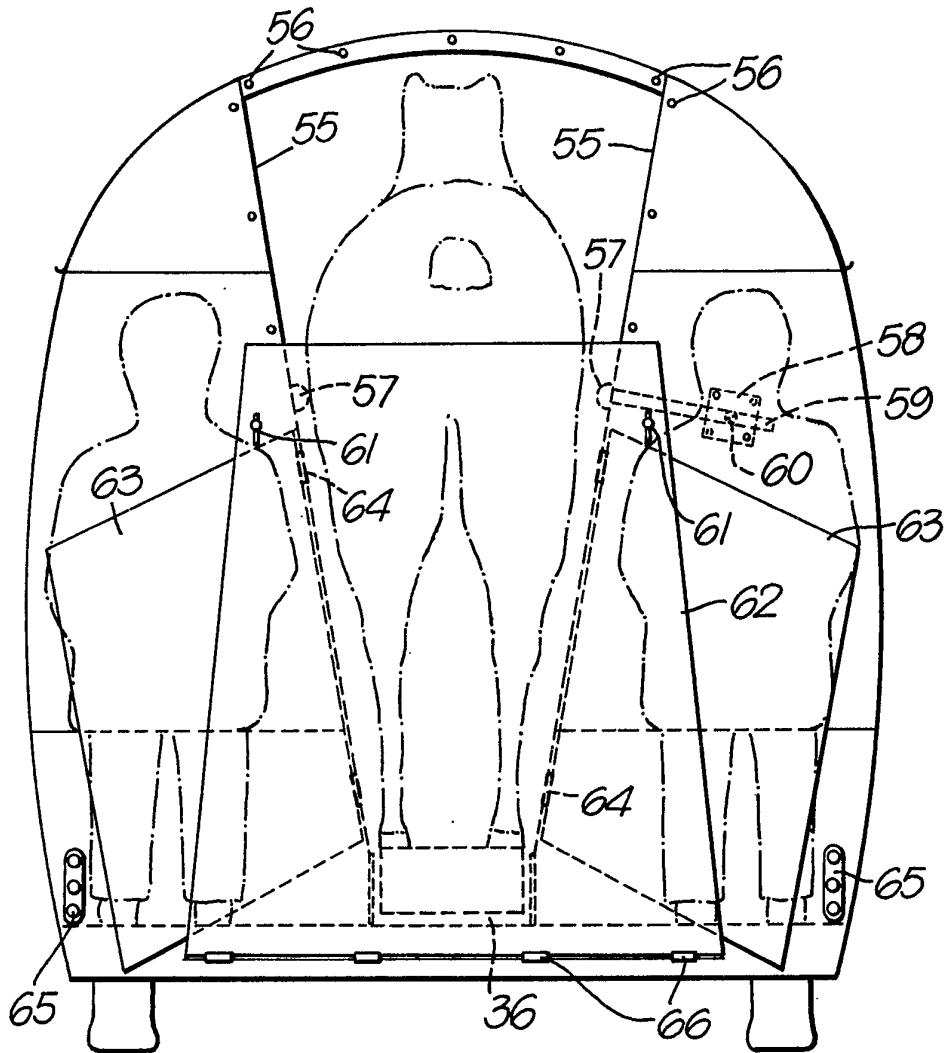


Fig. 4.

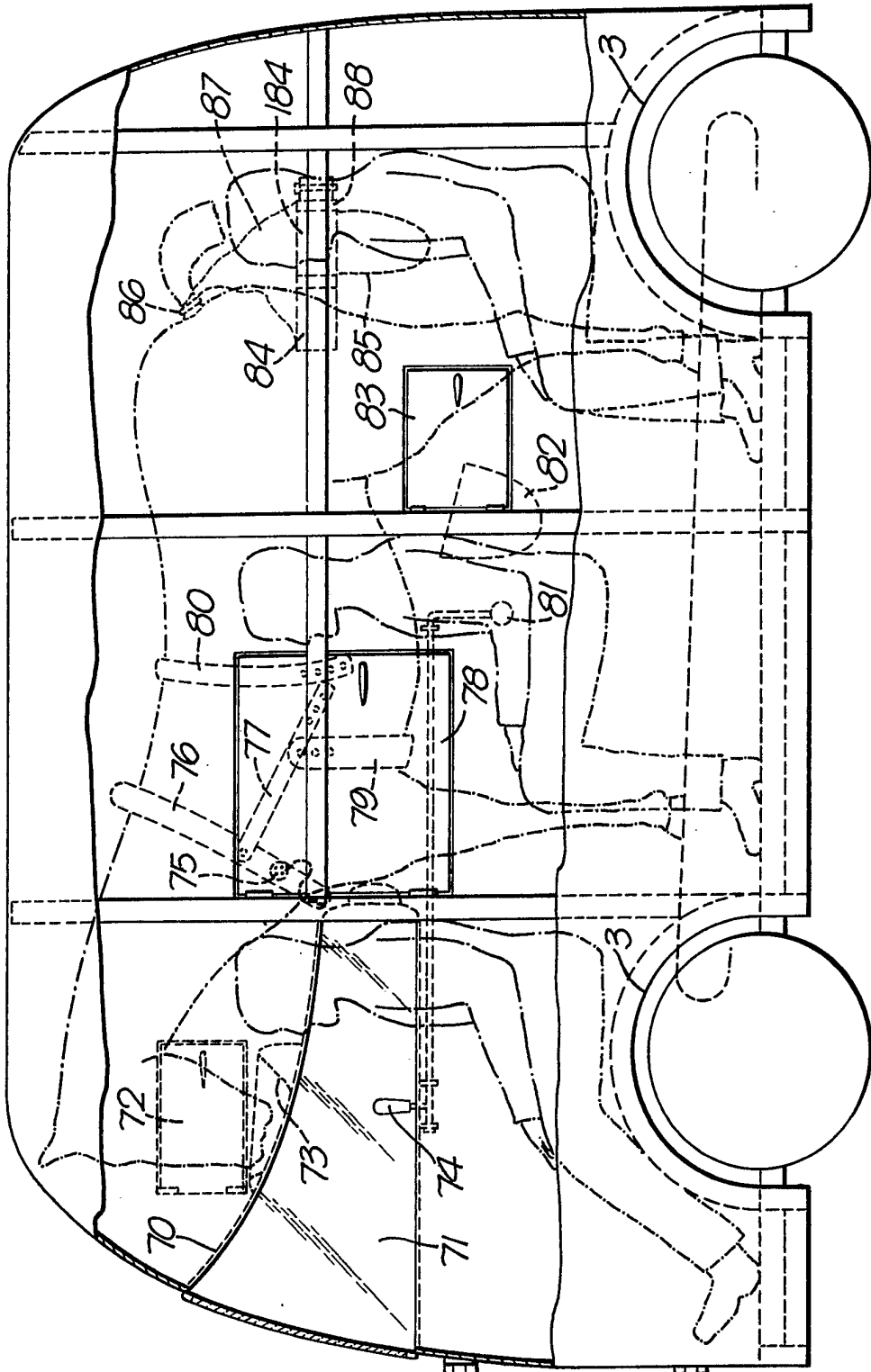
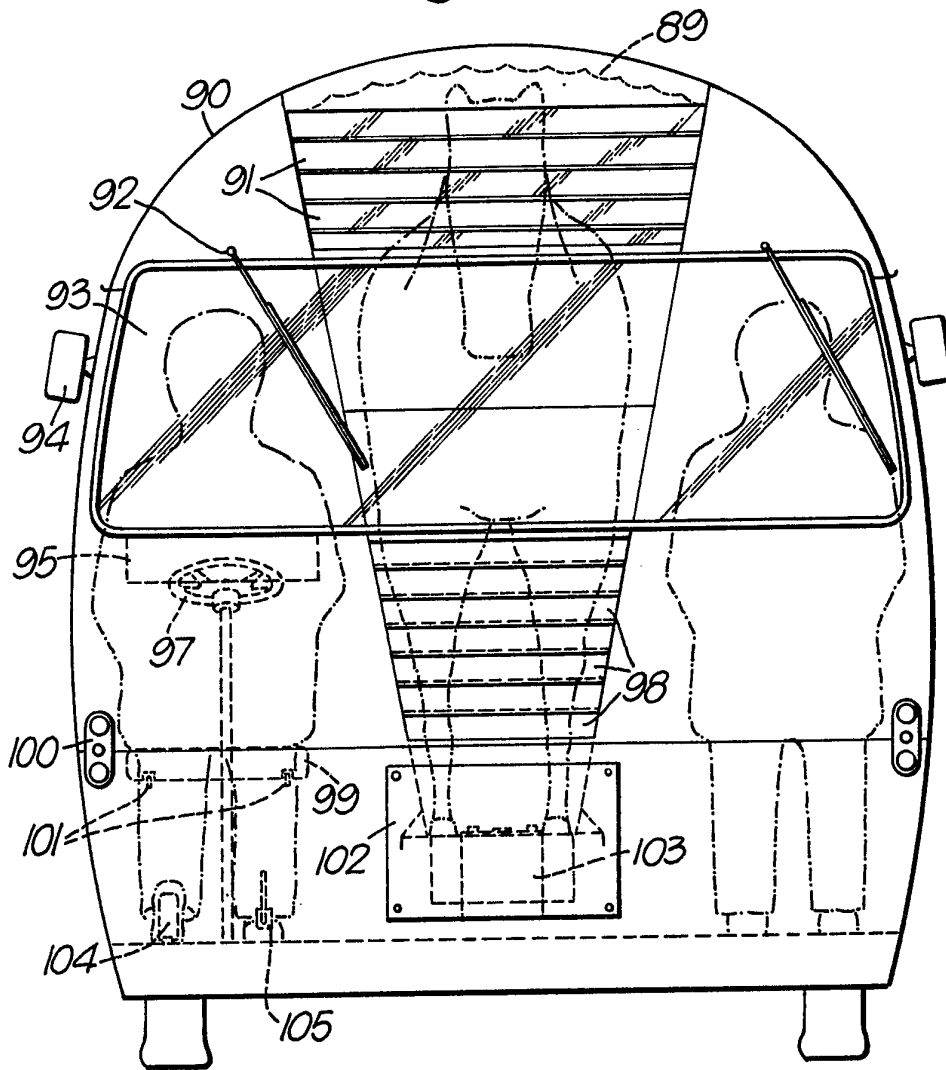


Fig.5.



## SPECIFICATION

**Animal Powered Drive Means**

This invention relates to animal powered drive means, primarily but not exclusively for vehicles and the vehicles so driven.

In accordance with invention, an animal powered drive means comprises an endless movable belt, means above a substantially horizontal run of the belt to support an animal so that its feet are in contact with the belt, and the output shaft rotatably driven by movement of the belt caused by a walking or running movement of the animals feet.

In a preferred form of the invention, the drive means is incorporated in a vehicle, the output shaft being connected to one or more road wheels or propellers for producing movement of the vehicle over land or water. For such a purpose the preferred animal is a horse.

There are several advantages in taking the horse off the road surface in vehicle propulsion. The most obvious is speed variation. The drive connection between the endless belt and the road wheels can include a gearbox with a number of different ratios available. By selecting the lowest gear the vehicle moves forward slower than the walking speed of the horse; this helps it to pull a load up hill. By selecting the highest gear the vehicle moves faster than the walking speed of the horse and so shortens the journey time.

Other advantages include a clean, stone-free surface for the horse to walk on, thereby reducing the risk of hoof-damage and stumbling, and the horse is enclosed in a controllable environment so it need not get too hot, too cold, or wet.

Furthermore, the horse has no control of the direction and speed of the vehicle, so that even if it is nervous in traffic it cannot bolt or shy. The space in which it stands ensures it cannot move its position to any material extent, so that it is possible to fix containers in the right position to prevent its droppings reaching the road.

A preferred embodiment of the invention providing a horse driven passenger carrying road vehicle will now be described with reference to the accompanying diagrammatic drawings wherein:—

Fig. 1 shows a plan view of the vehicle,  
Fig. 2 shows the right hand side view,  
Fig. 3 shows the rear of the vehicle,  
Fig. 4 shows the left hand side view, and,  
Fig. 5 shows the front view.

The vehicle includes a rigid chassis (Fig. 1) having six main cross members 1 strong enough to carry the weight of a horse in the middle while supported only at their outer ends. Longitudinals 2 hold the cross members the correct distance apart. Wheel arches 3 facilitate changing wheels. Two special longitudinals 10 include holes through which front wheels drive shafts pass, and an anchorage for the front suspension arms. The front wheel drive shafts 5 have universal joints at both ends and contain telescopic joints to vary their length.

The front wheels 4 are connected to lower and upper suspension arms 11 by ball and socket joints 17. Springs as at 12 support the weight of the vehicle through an anchorage under the front seat, and shock absorbers as at 13 prevent bounce.

The front hub assemblies are fitted with steering swivels 15, these are connected by track rods 14 to the steering gear rack 9. The steering rods 7 and 8 are connected by bevel gears to the steering column 6.

The front brakes 16 are disc brakes applied hydraulically by pressing a foot brake pedal.

The rear wheels 22 are independently sprung on trailing arms such as 18. Torsion bar springs as at 20 support the weight of the vehicle and shock absorbers 19 prevent bounce. The rear brakes 21 are drum brakes, applied either hydraulically by a foot-brake pedal or through cable and linkage by a hand-brake lever, which is beside the drivers seat.

A conveyor housing 36 (Fig. 2) is placed above the chassis and secured to it through spacer blocks 37 which are higher at the front to give a slight gradient. The conveyor housing must be strong enough to carry the weight of the horse in the middle while supported only at the ends. The horse walks on an endless flexible conveyor belt 34 which is two and a half hooves wide and two strides long. The belt is supported on a number of conveyor rollers 38 throughout its length. The conveyor rollers are two thirds of a hoof in diameter and close together, they spin freely in bearings 39 which are mounted in side-plates 40 which lie inside the conveyor housing. These side-plates are adjustable in slots 35 to make the belt run true; and both side-plates and rollers can be removed for changing the endless belt. Small return rollers 33 keep the belt off the floor of the conveying housing.

A rear belt drum 32 is adjustable to tighten and track the belt. It is removable for changing the belt. A toe-guard 31 moves with the rear drum and acts as a safety guard. A back hoof gap 30 can take both back feet if the breeching box (to be described later) breaks free and lets the horse move back. If that happened the horse's front weight would be carried by a strong girth.

The returning belt is guided onto a front belt drum 42 by belt guides 41. The front belt drum 42 needs only limited adjustment to track the belt centrally. It is removable for changing the belt. From one side of the front belt drum a spindle extends to hold a sprocket wheel 43. A drive chain 44 connects the sprocket wheel 43 with a second sprocket wheel 47 which rotates a plate clutch 49. The clutch rotates the input shaft of a gearbox 46 which is attached to the chassis by brackets 51. On the back of the gearbox is a differential 45 which rotates the front wheel drive shafts. The gearbox contains a number of drive ratios and a reverse; any gear can be selected by movement of a gear lever 48. On the front of the gearbox is an alternator 50 for re-charging the vehicle battery.

Above the conveyor is the horse space (Fig. 3).

This space is bounded by sloping sides 55, which are kick-proof. They descend just below the level of the conveyor belt to make contact with the conveyor housing. At the front end they are just far enough apart to allow the belt to run freely between them.

The distance between their lower edges increases continuously from front to rear for their whole length so the belt clearance both sides gets wider at the rear. This taper ensures that if a hoof is in contact with the sideboard when it touches the belt it will immediately run clear. The sides 55 also slope outwards upwardly so they are well clear of the horse's body at its widest part. Soft-covered rails 57 may be adjusted inwards to lightly touch the horse by sliding a bar 59 out of a clamp 58 which is attached to a partition 26. A set screw 60 is tightened to prevent further movement. Across the back of the horse space is a tail board 62 which is hinged at 66 to the back of the chassis. It is held up by catches 61. For loading or unloading the horse the tail board is lowered to form a ramp.

Loading is made easier by side gates 63, these are hinged down the back edge of the sloping sides at 64 and can be turned back to form a guide way up the ramp. Once the horse is in the horse space, a side gate can be closed behind the horse so it cannot kick anyone standing on the ramp while fitting the breeching box.

On the outer corners of the back of the vehicle are tail lights 65. Above the tailboard a section of the roof is removed to give the horse head room while walking in. This rear gap is surrounded by the fasteners 56 and in cold weather a flexible curtain may be fitted to partly or completely cover the hole.

The front of the horse space is sealed off by a front board 70 (Fig. 4). The front board starts at the top of the windscreen and drops back towards the base of the horse's neck, it then descends vertically a short distance (leaving plenty of room for the front legs to step) and then continues forward horizontally to reach the front of the vehicle below the windscreen.

The complicated shape of the front board is necessary so that a section 71 of the sloping sides can be removed to improve the drivers field of vision, and yet still leave the horse space sealed off from the driver and passengers.

The short vertical section of the front board is padded so the horse can safely lean against it before the trace straps are fastened. Beneath the horse's head is a feed box 73 which can be refilled from the small door 72 above the driver's head. This door is thin enough to allow verbal instructions from the driver to the horse.

The sloping sides have two more access apertures (in line with the horse's shoulders), these are normally sealed by doors 78. These doors are opened to provide access to the harness attachment points. The collar 76 is attached to the soft covered rails by the adjustable trace straps 77. The horse is prevented from jumping upwards by a back band 80 and prevented from

falling by a strong girth 79. The girth and its anchorage to 57 must be strong enough to carry two-thirds of the weight of the horse, although it is hardly ever needed.

70 After the harness straps have been fastened a plug 75 is inserted in a socket in the collar. An electrical thermometer under the collar is thereby connected to the vehicle instrument panel; and through the same plug a connection is made from the instrument panel to an electrical instrument inserted in the collar (where the trace is attached) in order to measure the forward push.

Behind the girth is a signal mop 81 this normally lies close to the sloping side but may be moved to touch the horse by a handle 74 beside the driver. By moving the handle skillfully the driver can impart signals to the horse.

Underneath the horse is a container 82 which is attached by its upper corners to the sloping sides so that it hangs centrally and yet clear of the horse's legs at all times. It can be installed or removed from an access door 83.

Behind the horse is the breeching box 184. This must be fitted as soon as the horse enters, and before attaching the harness. A strong frame slides in from the back to fit over the soft rails as it is pushed forward to touch the horse. The sides of the frame can be secured to the soft-covered rails by dropping a peg in one of a number of holes to fit the horse. This connection is strong enough to withstand the strength of the horse when pushing back.

The front member of the breeching box frame 84 is concave to fit the shape of the horse, it is padded to eliminate chafing. The back member of the frame 88 is straight. Between the back and curved front is a gap wide enough to hold a container 85. A triangular flexible cover 87 has one side secured to the back of the frame and normally lies over the container to prevent the horse's tail falling in. The apex of the triangle is held high under the tail by an elastic strap 86 around the tail.

On each side of the horse space are passenger enclosures (Fig. 2). Partitions 26 separate the passengers, support the backs of the seats, strengthen the sloping side, support the roof and provide the door posts. Inner windows 27 allow passengers to look forward and may be opened by sliding half-panes horizontally sideways to enable conversation to take place. The seats are secured to the floor.

Doors 29 are hinged down their front edge. Windows 28 can be opened by sliding the transparent pane down into the door.

The vehicle roof 90 (Fig. 5) covers the horse and driver and passengers. Centrally above the windscreen a transparent louvred ventilator 91 may be opened and closed from the driver's seat. Above the horse's head the roof is padded 89 to protect its poll.

Across the front of the vehicle is the driver's and front passenger's cabin. Doors 29 allow easy access and hold side mirrors 94. The windscreen



93 reaches right across the front and is cleared by wipers 92.

Centrally below the windscreen is the louvred ventilator 98. The slats can be opened or closed from the driver's seat to partially control the horse's temperature. Below the ventilator is a removable hatch-cover 102 which provides access to the battery 103.

Situated on the outer corners of the front of the vehicle are the front light and direction indicator lights 100.

The driver's seat 99 is adjustable along the track 101. In front of the driver is the steering wheel 97, the clutch pedal 105, the foot-brake 104 and the instrument panel 95.

The instruments show horse-temperature, collar-push, the time distance covered, and speed.

#### Claims

1. An animal powered drive means comprising an endless movable belt, means above a substantially horizontal run of the belt to secure an animal so that its feet are in contact with the belt, and an output shaft rotatably driven by movement of the belt caused by a walking or running movement of the animal's feet thereon.

2. An animal powered drive means according to claim 1, wherein the output shaft is connected to the input shaft of a variable speed gearbox through a clutch.

3. An animal powered drive means according to claim 1 or 2 wherein the horizontal run of the belt is supported along its length by a plurality of freely rotatable rollers.

4. An animal powered drive means according to any of claims 1—3, wherein the belt is entrained around a drum which is adjustable for tensioning and tracking the belt.

5. An animal powered drive means according

to any of the preceding claims, wherein the space above the horizontal belt run is surrounded by a pair of side walls, a front board, and a tail board, the tail board being lowerable to form a ramp to allow the animal to be led into and out of the space.

6. An animal powered drive means according to any of the preceding claims, wherein the means to secure the animal comprises a collar attached to fixed side rails by adjustable trace straps, a back band, and a girth.

7. An animal powered drive means according to any of the preceding claims, wherein a breeching is provided to support the hindquarters of the animal.

8. A road vehicle wherein the motive power is an animal powered drive means according to any of the preceding claims.

9. A road vehicle according to claim 9 wherein the movable belt extends longitudinally of the vehicle and substantially mid-way between its sides.

10. A road vehicle according to claim 9 wherein a space for a driver is provided at the front of the vehicle and adjacent the animal space above the belt of the drive means, and means are provided to enable the driver to control and communicate with the animal and to vary the speed of the vehicle or stop it independently of the movement of the animal.

11. A road vehicle according to claim 9 or 10, wherein means are provided above the level of the horizontal run of the belt to catch and retain excreta from the animal.

12. A road vehicle provided with animal powered drive means constructed and arranged substantially as described and shown in the accompanying drawings.