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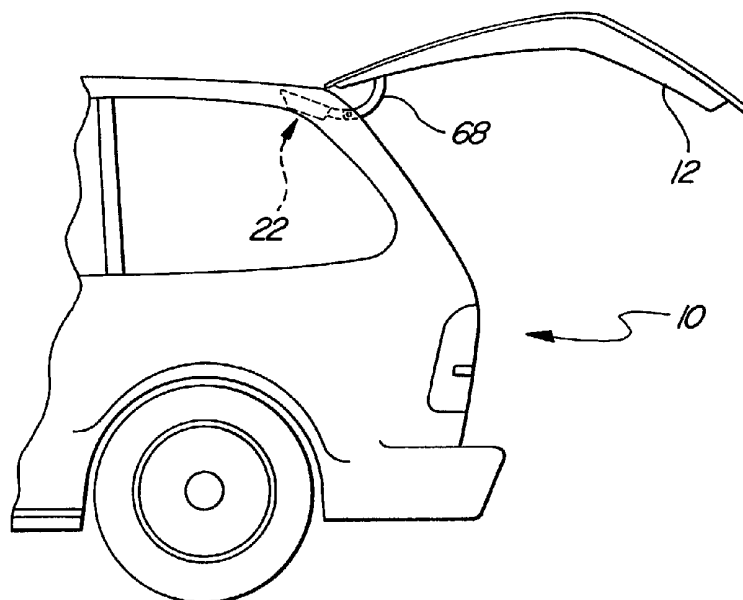
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(54) Title: LEAD SCREW DRIVE FOR A POWER LIFTGATE



(57) Abstract: A power drive assembly moves a liftgate of a motor vehicle between its open and closed positions. The motor vehicle defines an opening and the liftgate closes the opening when the liftgate is in its closed position. The power drive assembly includes a base that is fixedly secured to the motor vehicle at a position in spaced relation to the opening. A drive mechanism is fixedly secured to the guide. The drive mechanism converts electrical energy into a linear force. The power drive assembly includes a translation linkage connected to the drive mechanism for receiving the linear force and translating it into a nonlinear force to move the liftgate between the open position and the closed position. A nut, secured to the translation linkage, moves the translation linkage as it travels along a lead screw that is rotated by a motor.



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LEAD SCREW DRIVE FOR A POWER LIFTGATEBACKGROUND ART5 1. Field of the Invention

The invention relates to liftgate assemblies for motor vehicles. More specifically, the invention relates to a power drive assembly for a liftgate assembly for providing power to move the liftgate assembly between open
10 and closed positions.

2. Description of the Related Art

As motor vehicles characterized by their utility become a mainstream choice, consumers demand certain
15 luxuries primarily associated with passenger cars, either due to their inherent design and/or size. One of the features desired by consumers is the automated movement of such items as sliding doors and liftgates. While features providing automated motion are available, the designs for
20 mechanisms used to accommodate manual overrides are lacking in capability and functionality. Further, the systems consume space within the motor vehicle that makes the interior less efficient and aesthetically less appealing.

United States Patent 5,144,769 discloses an automatic door operating system. This system requires a great deal of control, both by an electronic controller and an operator of the motor vehicle. To overcome forces due
5 to manual operation, the manually operated seesaw switch used by the operator to electromechanically operate the door is in an open state, preventing current from passing through the motor.

10

SUMMARY OF THE INVENTION

A power drive assembly for a motor vehicle is disclosed. The motor vehicle defines an opening and a liftgate that is pivotal between a closed position covering the opening and an open position providing access through
15 the opening. The power drive assembly includes a base that is fixedly secured to the motor vehicle at a position in spaced relation to the opening. A drive mechanism is fixedly secured to the guide. The drive mechanism converts electrical energy into a linear force. The power drive
20 assembly includes a translation linkage connected to the drive mechanism for receiving the linear force and translating it into a nonlinear force to move the liftgate between the open position and the closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

Advantages of the invention will be readily
5 appreciated as the same becomes better understood by
reference to the following detailed description when
considered in connection with the accompanying drawings,
wherein:

Figure 1 is a side view, partially cut away, of a
10 motor vehicle incorporating one embodiment of the invention
wherein the liftgate is located in its open position;

Figure 2 is a cross-sectional side view of one
embodiment of the invention in a motor vehicle with the
liftgate in the closed position; and

15 Figure 3 is a perspective view of one embodiment
of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

20 Referring to Figure 1, a motor vehicle is
generally indicated at 10. In the embodiment shown, the
motor vehicle 10 is a minivan. The motor vehicle 10
includes a liftgate 12. The liftgate 12 is shown in an

open position in Figure 1 and a closed position in Figure 2. It should be appreciated by those skilled in the art that the motor vehicle 10 and liftgate 12 could be configured differently depending on the style of the motor
5 vehicle 10 and size of the liftgate 12.

The liftgate 12 is pivotally mounted to the motor vehicle 10 with a hinge 14. The hinge 14 allows the liftgate 12 to move between its two extreme positions shown in Figures 1 and 2.

10 When the liftgate 12 is in its open position, access is provided to the motor vehicle 10 through an opening 16. A piece of trim 18 extends along the sides (one shown) and a top 20 of the opening 16. The load floor (not shown) extends between the side trim 18 to create the
15 bottom boundary for the opening 16.

The invention is a power drive assembly, generally indicated at 22, that moves the liftgate 12 between its two extreme positions. The power drive assembly 22 is fixedly secured to the motor vehicle 10 at a
20 position disposed adjacent the opening 16 thereof. The power drive assembly 22 is secured to a roof structure 23 of the motor vehicle 10 such that the power drive assembly 22 extends above and is hidden from view by the top trim

piece 20, typically referred to as the headliner. The power drive assembly 22 is secured to the roof structure 23 and an angle with respect thereto. More specifically, the power drive assembly 22 is not aligned nor is perpendicular
5 to either the roof structure 23 or the liftgate 12 when the liftgate 12 is in the closed position.

The power drive assembly 22 includes a base 24. The base 24 includes a plurality of mounting holes 26 designed to receive fasteners 28 (one shown) therein. As
10 should be appreciated by those skilled in the art, the screw fastener 28 shown in Figure 2 may be one of several types of fasteners that may be used to secure the base 24 to the roof structure 23.

The base 24 includes two side flanges 30, 32.
15 Both of the side flanges 30, 32 extend along the longitudinal sides of the base 24 generally perpendicular to a support section 34 of the base 24. The two side flanges 30, 32 and the support section 34 form a generally U-shaped cross section. The second side flange 32 includes
20 a slot 36 extending therealong. The slot 36 is linear and will be discussed in greater detail subsequently.

The power drive assembly 22 includes a drive mechanism, generally indicated at 38. The drive mechanism

38 transforms electrical energy received from a power source (not shown) into mechanical energy providing the necessary force to move the liftgate 12 between its open and closed positions.

5 The drive mechanism 38 includes a motor 40. The motor 40 receives the electrical energy and converts it to a mechanical rotational energy. That energy is transmitted out of the motor 40 via an output shaft (not shown) and into a set of gears 42. The gears 42 eventually transmit
10 the rotational energy through a shaft 44 to a clutch 46.

 The clutch 46 allows an operator of the liftgate 12 to override the power drive assembly 22 and open or close the liftgate 12 manually. Therefore, the clutch 46 allows the operator to open or close the liftgate 12 at a
15 speed other than that which is set by the power drive assembly 22. It should be appreciated by those skilled in the art that, without adding to the inventive concept shown herein, the clutch 46 may be removed in systems that do not permit manual operation.

20 A transmission 48 receives the output force from the clutch 46 and redirects it. The transmission 48 includes a plurality of gears that are rotatably mounted to

the base 24. The transmission 48 also is used to further increase torque output of the drive mechanism 38.

The output of the transmission 48 is also a rotating mechanical force. This force is used to rotate a lead screw 50. The lead screw 50 extends between the two side flanges 30, 32 and alongside the motor 40, set of gears 42, clutch 46.

A nut 52 threadingly engages the lead screw 50. The nut 52 is driven along the lead screw 50 by the rotation thereof. Therefore, the lead screw 50 defines the length of linear motion created by the power drive assembly 22. More specifically, the rotation of the motor 40 eventually translates into rotation of the lead screw 50 which, in turn, drives the nut 52 in a linear motion along the lead screw 50 and the nut 52 may only travel the length of the lead screw 50.

The nut 52 cannot rotate with the lead screw 50 because it is secured in its orientation by a guide roller 54. The guide roller 54 rotates about a pin 56 that is fixedly secured to the nut 52. The guide roller 54 rolls through the slot 36 in the second side flange 32. The guide roller 54, in combination with the pin 56, prevents the nut 52 from rotating with the lead screw 50 as it

rotates. Thus, the nut 52 travels along the lead screw 50 when the lead screw 50 is being rotated by the drive mechanism 38.

The power drive assembly 22 also includes a translation linkage 58. The translation linkage 58 is secured to the nut 52 such that when the nut 52 travels along the lead screw 50, the translation linkage 58 moves along therewith. The translation linkage 58 includes a linear portion 60 and an arcuate portion 62. The translation linkage 58 extends between a drive end 64 and a bracket end 66. The linear portion 60 is disposed adjacent the drive end 64 whereas the arcuate portion 62 is disposed adjacent the bracket end 66. In the embodiment shown in the Figures, the linear portion 60 is greater in length than the arcuate portion 62.

Pivotally secured to the bracket end 66 of the translation linkage 58 is a bracket 68. The bracket 68 extends through an arc that terminates with a pivotal connection with the liftgate 12. More specifically, the bracket 68 extends between the translation linkage 58 and the liftgate 12. The arcuate path of the bracket 68 allows an opening 70 in the top trim piece 20 to be smaller. More specifically, the arcuate shape of the bracket 68 defines a

constant cross-sectional area as the bracket 68 travels through the opening 70.

In opening the liftgate 12, the motor 40 and clutch 46 are energized forcing the lead screw 50 to rotate
5 in a first direction. The nut 52 travels along the lead screw 50 away from the transmission 48 toward the bracket 68. In doing so, the translation linkage 58 moves in a linear fashion forcing the bracket 68 to move in a nonlinear manner. With the top trim piece 20 acting as a
10 guide (with reinforcement, not shown), the bracket 68 moves along its arcuate path forcing the liftgate 12 toward its open position. While no connection is shown, a hinge may pivotally secure the bracket 68 to the liftgate 12. Once the liftgate 12 has completed its opening travel, the
15 clutch 46 is de-energized, de-coupling the motor 40 from the lead screw 50. Gas struts (not shown) support the liftgate 12 in the open position.

Rotation of the motor 40 in the opposite direction moves the nut 52 along the lead screw 50 toward
20 the transmission 48 forcing the liftgate 12 to return to its closed position for eventual latching.

The invention has been described in an illustrative manner. It is to be understood that the

terminology, which has been used, is intended to be in the nature of words of description rather than of limitation.

Many modifications and variations of the invention are possible in light of the above teachings.

5 Therefore, within the scope of the appended claims, the invention may be practiced other than as specifically described.

I claim:

1. A power drive assembly for a motor vehicle defining an opening, the motor vehicle including a liftgate pivotable between a closed position covering the opening
5 and an open position providing access through the opening, said power drive assembly comprising:

a base fixedly secured to the motor vehicle at a position in spaced relation to the opening;

a drive mechanism fixedly secured to said guide,
10 said drive mechanism converting electrical energy into a linear force; and

a translation linkage connected to said drive mechanism receiving said linear force and translating said linear force into a nonlinear force to move the liftgate
15 between the open position and the closed position.

2. A power drive assembly as set forth in claim 1 wherein said linkage includes a linear portion and an arcuate portion.

20

3. A power drive assembly as set forth in claim 2 wherein said linkage includes a drive end and a bracket end such that said linear portion is disposed adjacent said

drive end and said arcuate portion is disposed adjacent said bracket end.

4. A power drive assembly as set forth in claim
5 3 including a bracket pivotally connected to said bracket
end of said translation linkage.

5. A power drive assembly as set forth in claim
4 wherein said bracket extends through a curved path such
10 that a cross section of said bracket remains constant as
said bracket is moved by said translation linkage through
the opening.

6. A power drive assembly as set forth in claim
15 5 wherein said drive mechanism includes a motor for
transforming electrical power into mechanical power to move
said translation linkage.

7. A power drive assembly as set forth in claim
20 6 wherein said drive mechanism includes a lead screw that
receives the mechanical power and is rotated thereby.

8. A power drive assembly as set forth in claim
7 wherein said drive mechanism further includes a clutch.

9. A power drive assembly as set forth in claim
5 8 wherein said translation linkage extends along said base
adjacent said motor and said clutch.

10. A power drive assembly for a motor vehicle
defining an opening, the motor vehicle including a liftgate
10 pivotable between a closed position covering the opening
and an open position providing access through the opening,
said power drive assembly comprising:

a base fixedly secured to the motor vehicle at a
position in spaced relation to the opening, said base
15 including a side flange defining a slot cut therethrough;

a drive mechanism fixedly secured to said guide,
said drive mechanism converting electrical energy into a
linear force; and

a translation linkage connected to said drive
20 mechanism receiving said linear force and translating said
linear force into a nonlinear force to move the liftgate
between the open position and the closed position.

11. A power drive assembly as set forth in claim
10 wherein said drive mechanism includes a motor for
transforming electrical power into mechanical power to move
said translation linkage.

5

12. A power drive assembly as set forth in claim
11 wherein said drive mechanism further includes a lead
screw for receiving said mechanical power to be rotated
thereby.

10

13. A power drive assembly as set forth in claim
12 wherein said drive mechanism includes a nut threadingly
engaged with said lead screw for travel along said lead
screw when said lead screw rotates.

15

14. A power drive assembly as set forth in claim
13 wherein said nut includes a guide roller for travel
through said slot as said nut travels along said lead
screw.

20

15. A power drive assembly as set forth in claim
14 wherein said linkage includes a linear portion and an
arcuate portion.

16. A power drive assembly as set forth in claim
15 wherein said linkage includes a drive end and a bracket
end such that said linear portion is disposed adjacent said
5 drive end and said arcuate portion is disposed adjacent
said bracket end.

17. A power drive assembly as set forth in claim
16 including a bracket pivotally connected to said bracket
10 end of said translation linkage.

18. A power drive assembly as set forth in claim
17 wherein said bracket extends through a curved path such
that a cross section of said bracket remains constant as
15 said bracket is moved by said translation linkage through
the opening.

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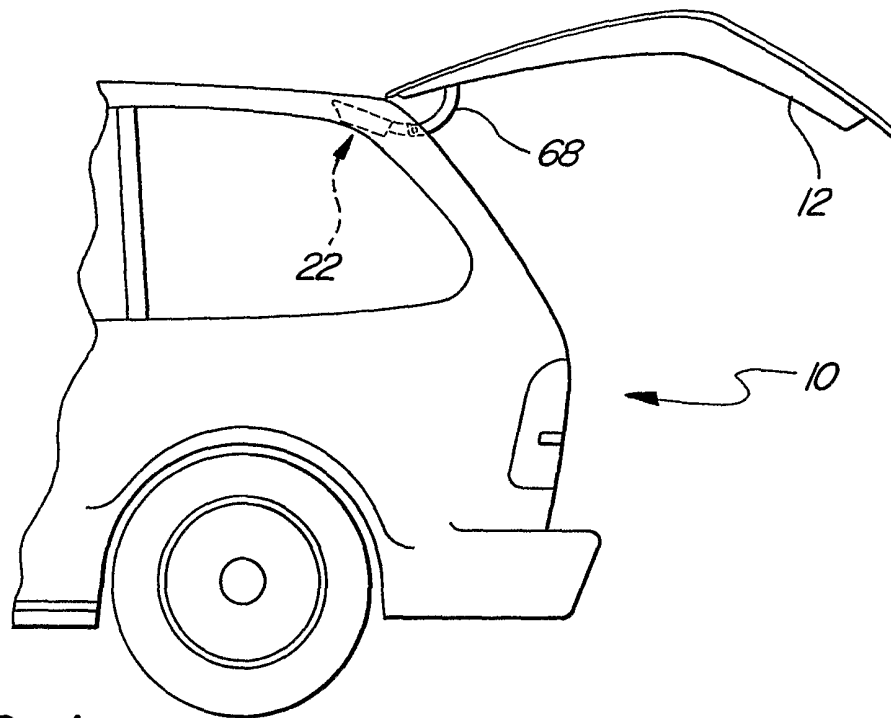


FIG-1

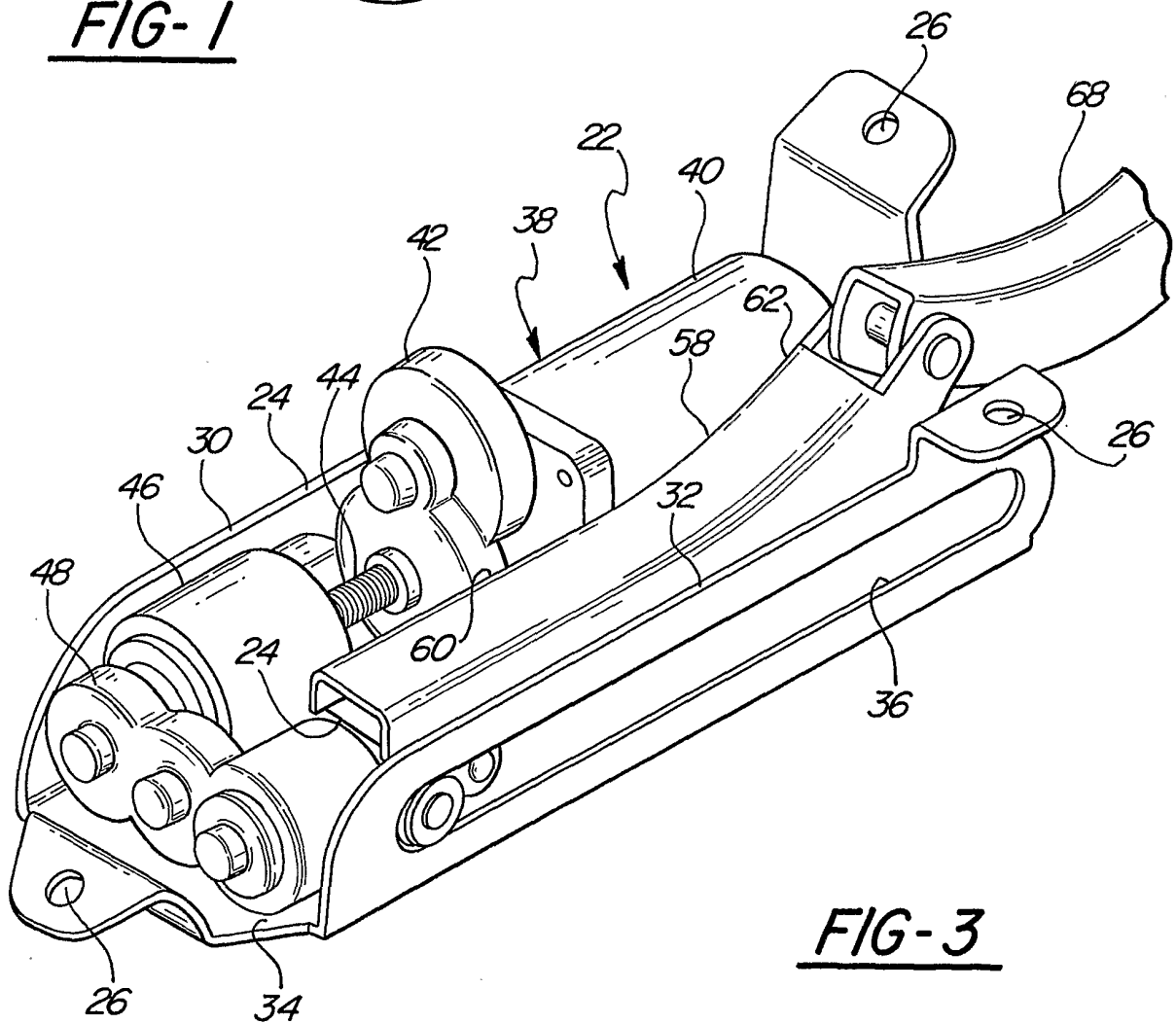


FIG-3

