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(54) **RETRACTABLE TOP TRUNK LID ASSEMBLY**

Related U.S. Application Data

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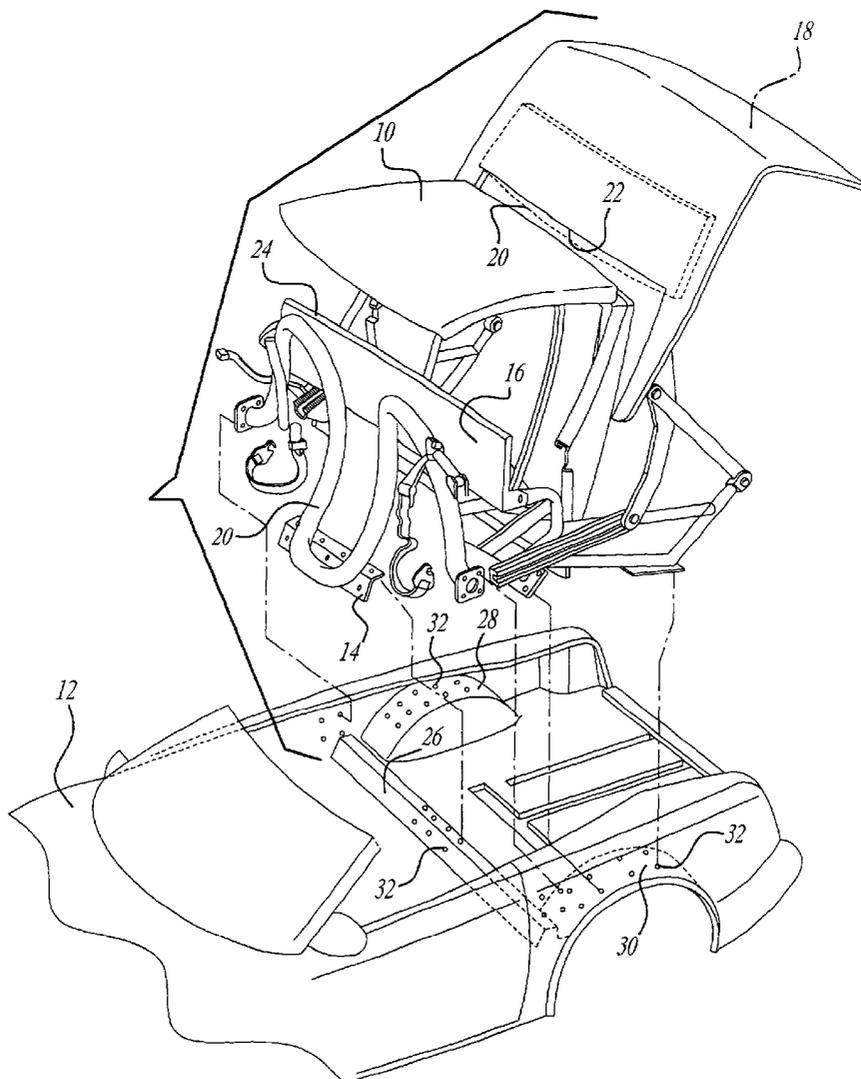
(57) **ABSTRACT**

A retractable hard top for a vehicle including a linkage and a top guide track for moving the hard top from a top up position to a stowed position. As the retractable hard top is moved between the top up and stowed positions the trunk is raised by movement along a track to which the trunk linkage is connected. The retractable hard top linkage includes a pivot bracket that is movable within the top guide track to limit the clearance necessary for folding the hard top into a stowed position.

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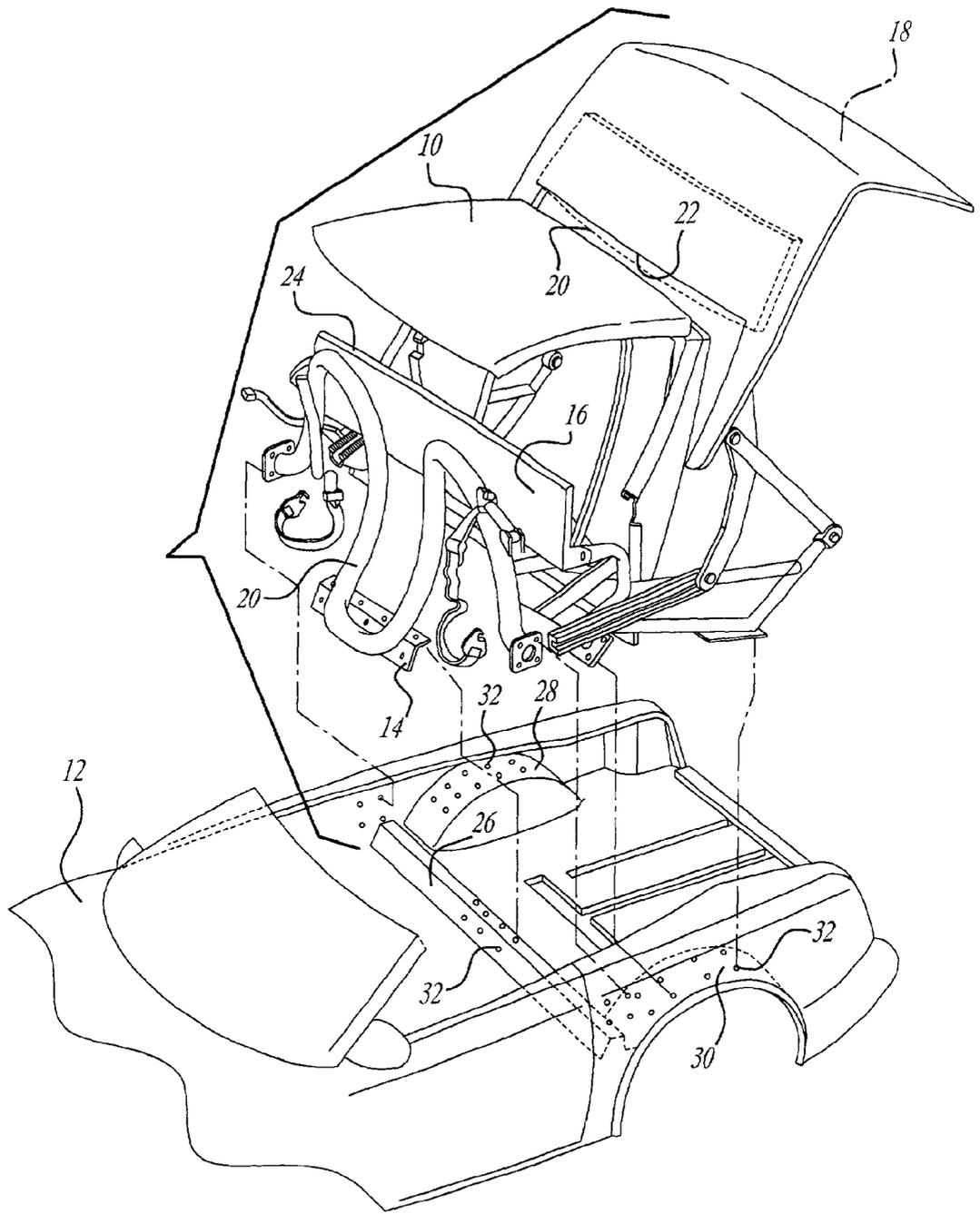


Fig-1

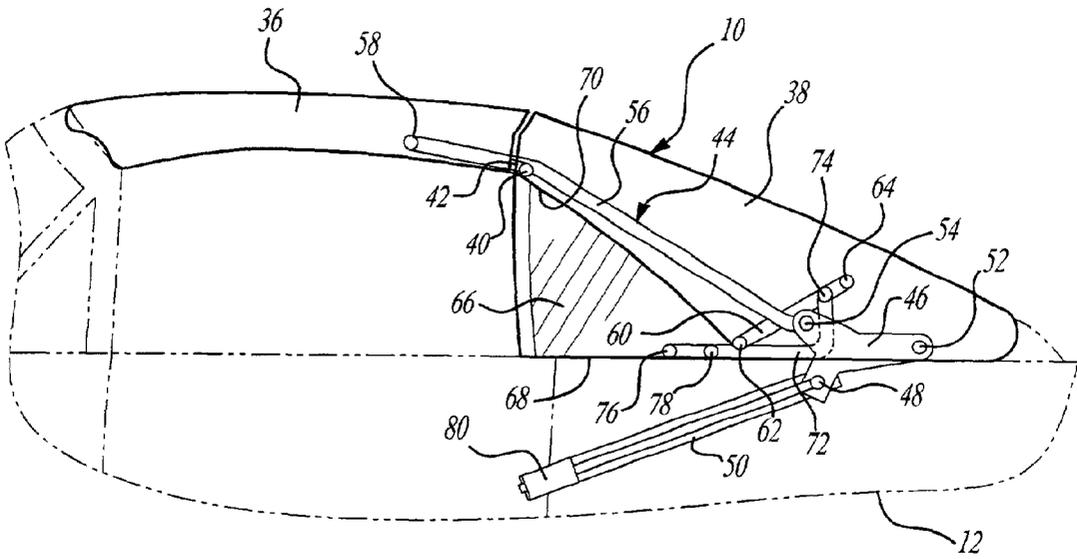


Fig-2

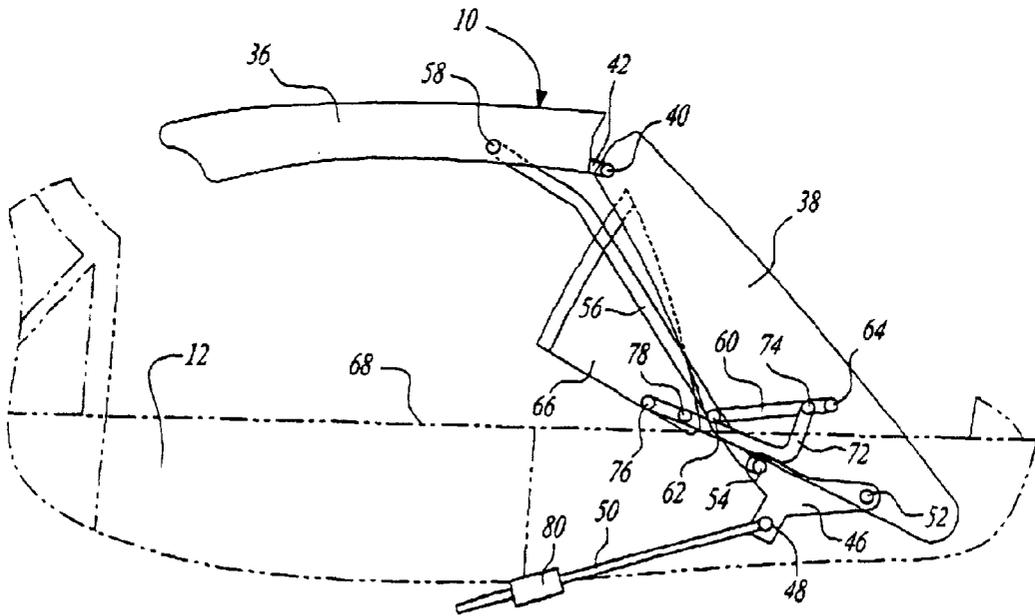


Fig-3

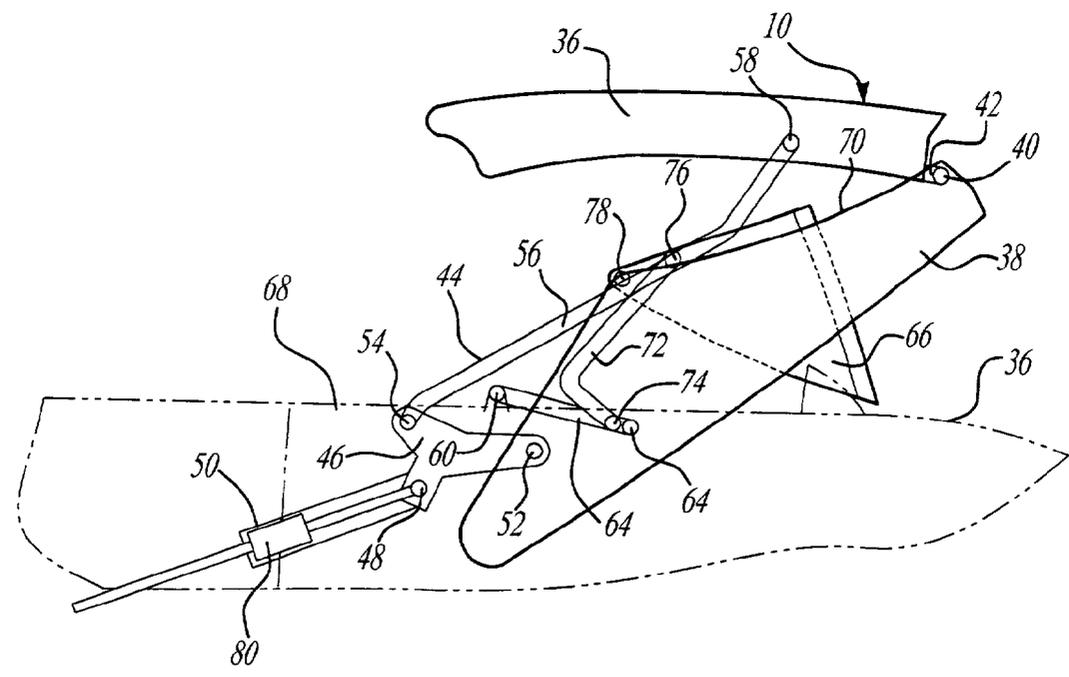
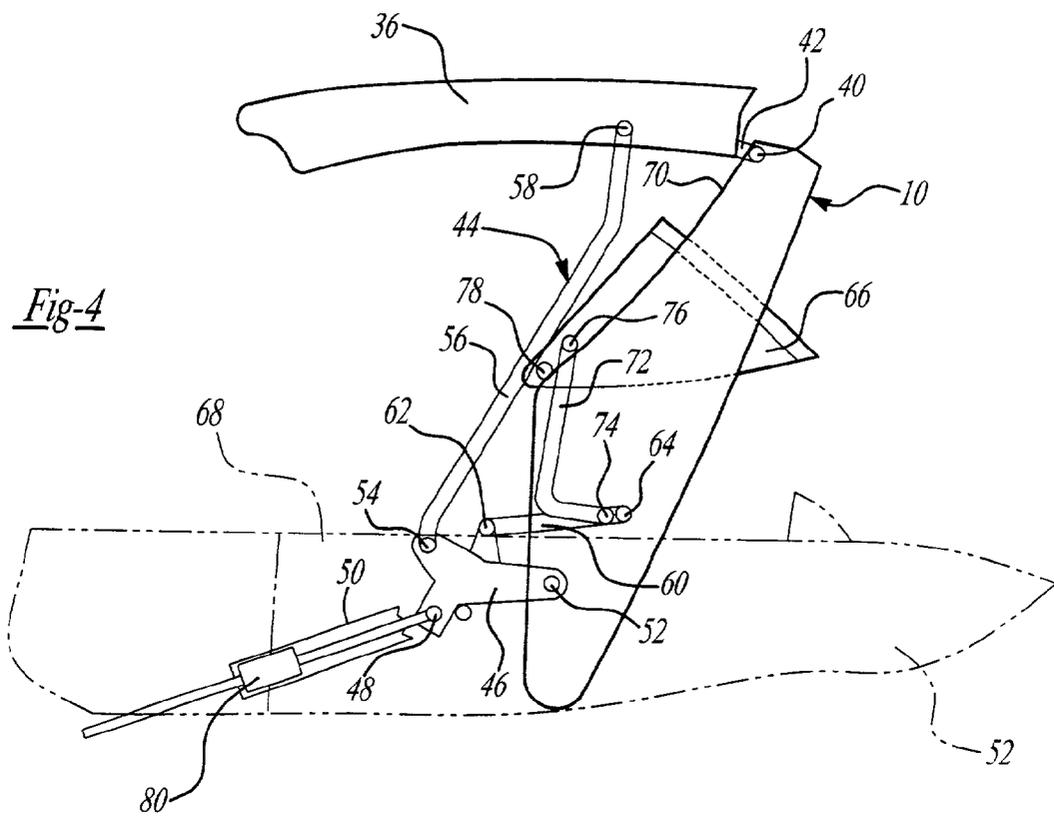


Fig-5

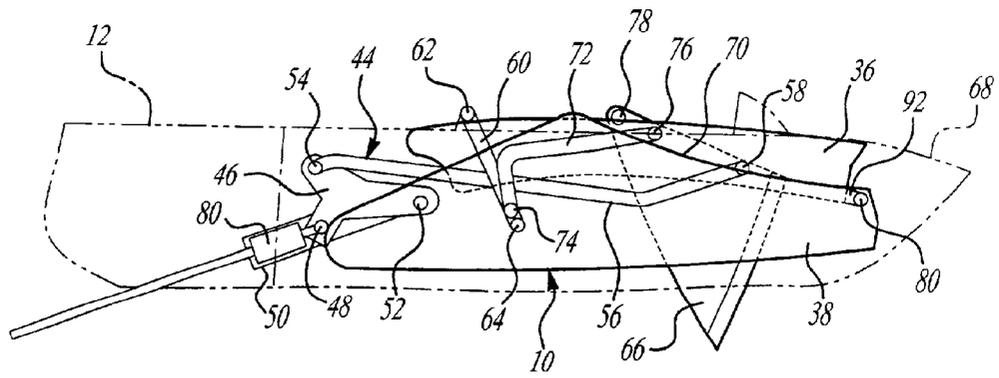


Fig-6

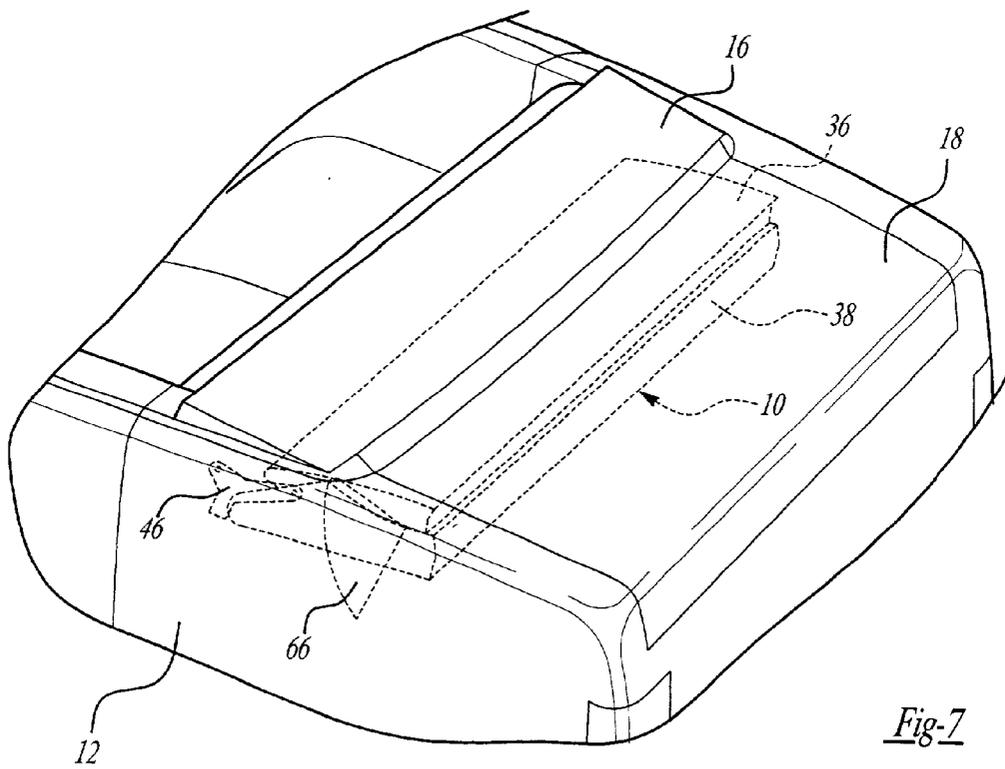


Fig-7

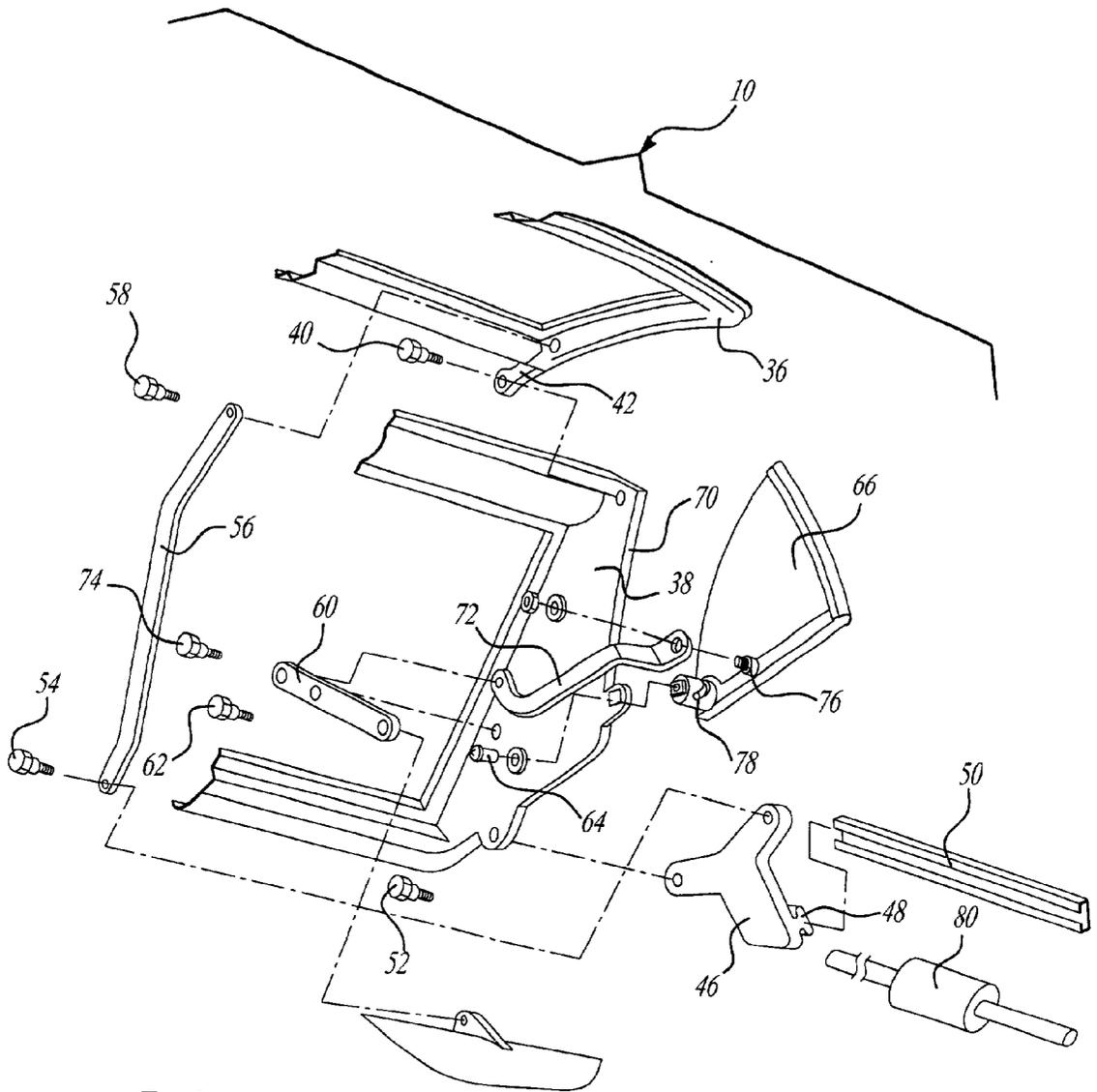


Fig-8

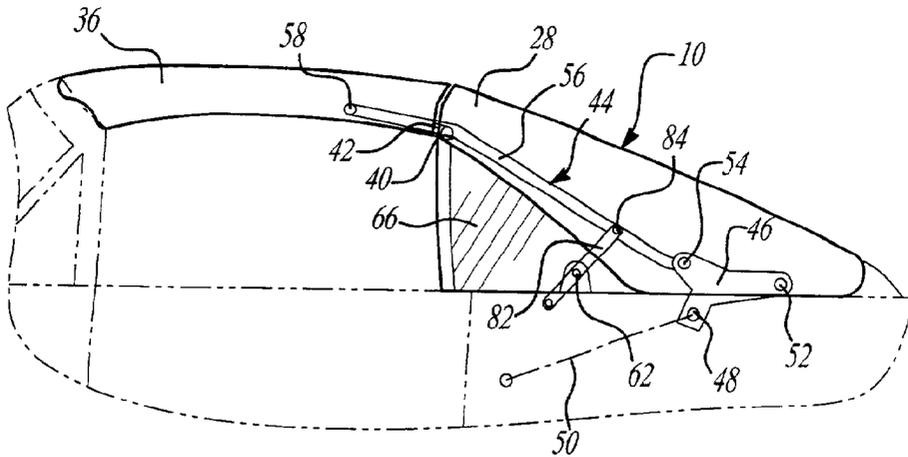


Fig-9

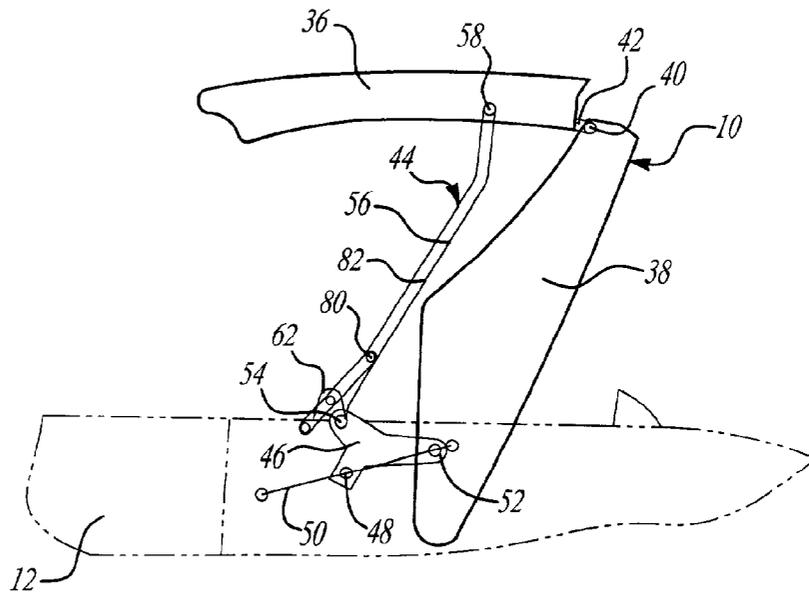


Fig-10

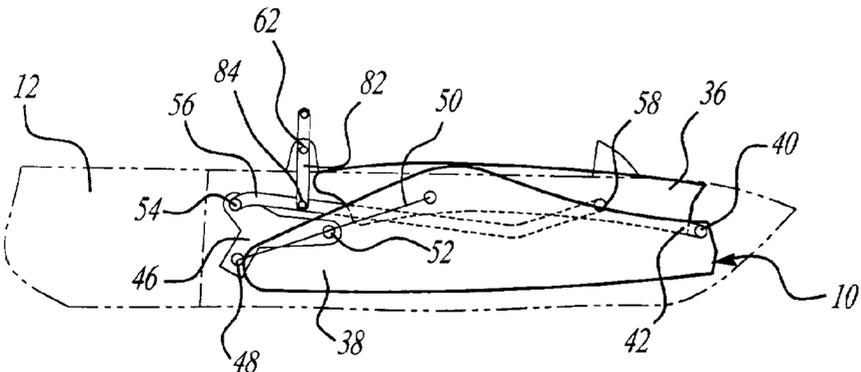


Fig-11

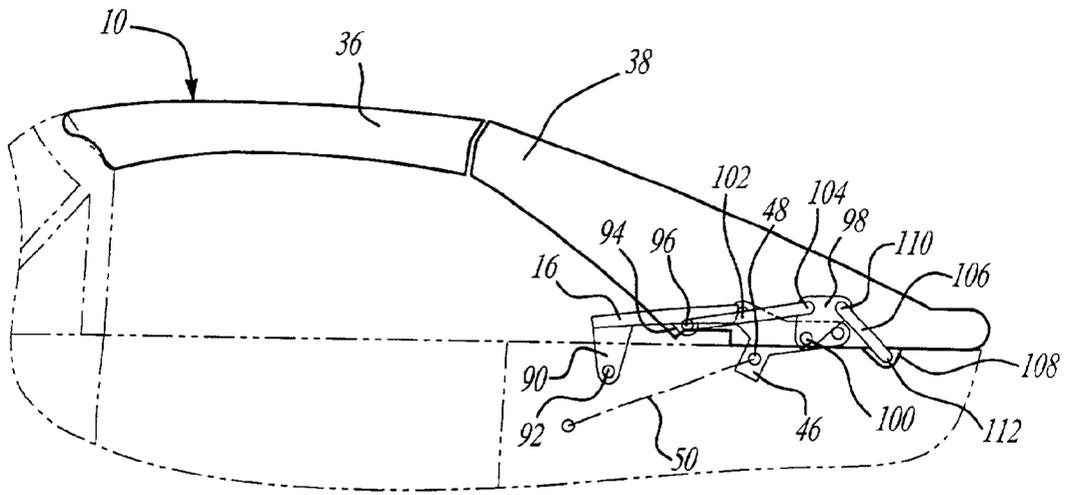


Fig-12

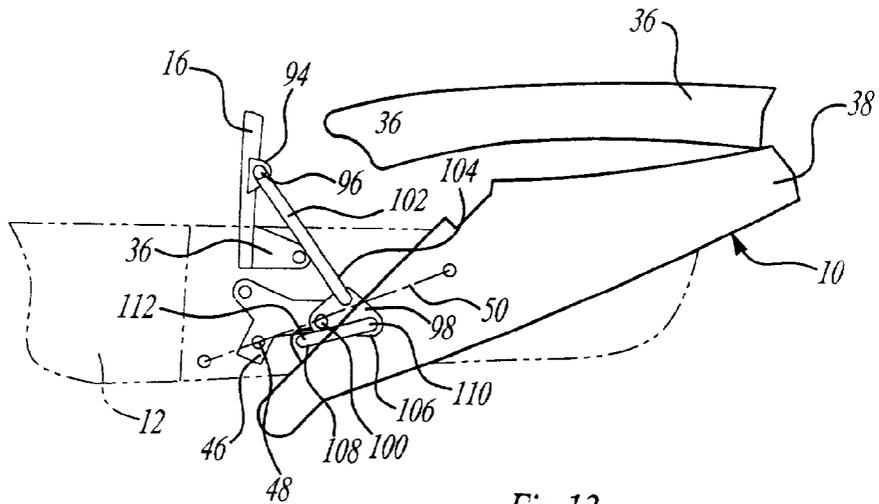


Fig-13

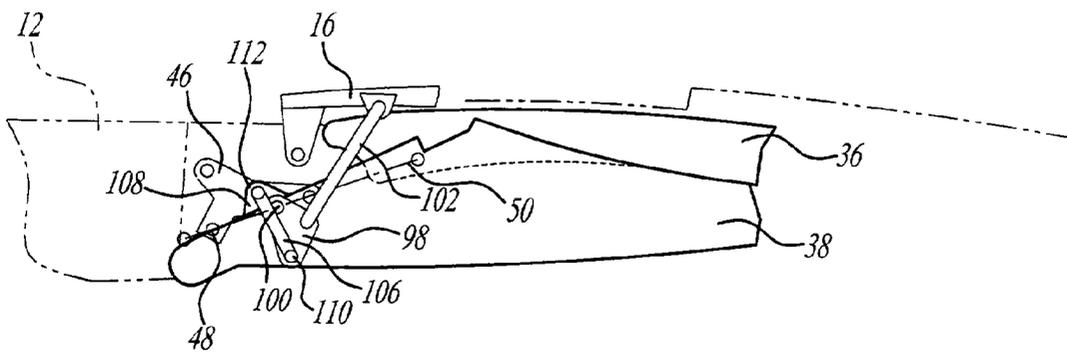


Fig-14

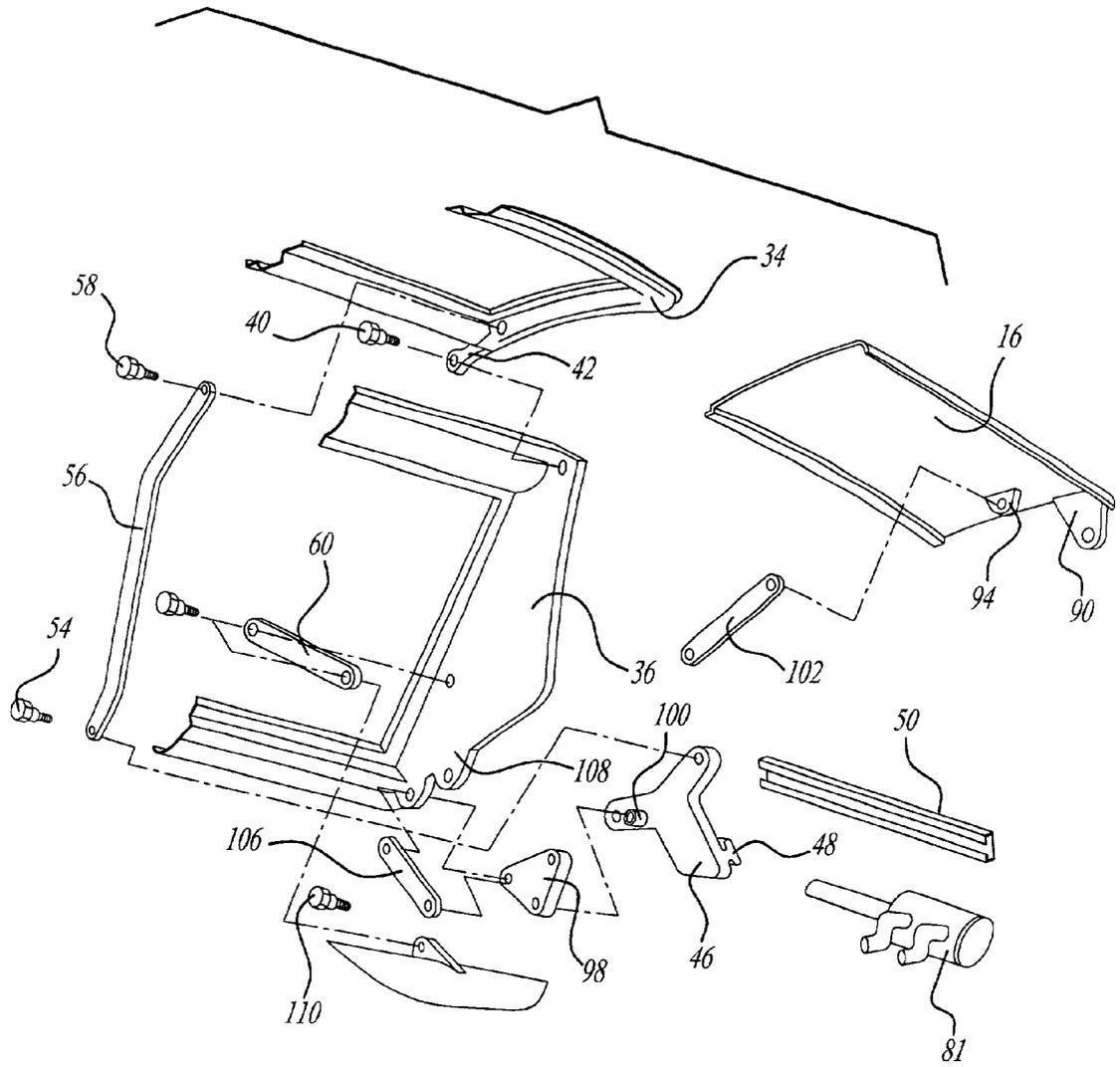


Fig-15

Fig-16

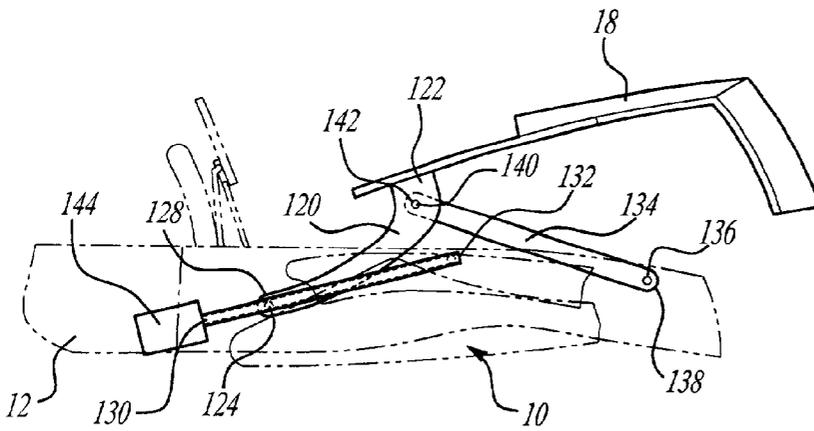
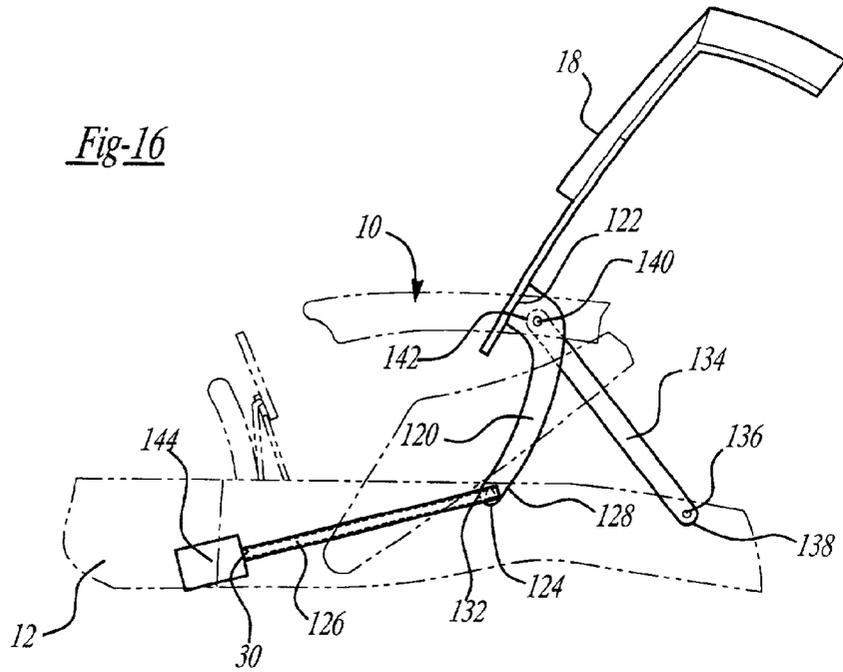
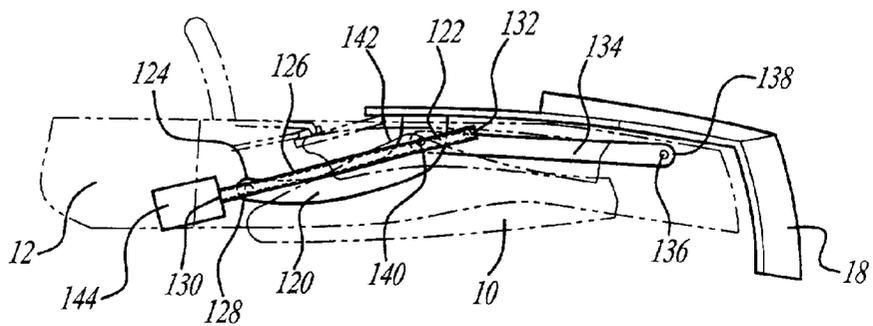


Fig-17

Fig-18



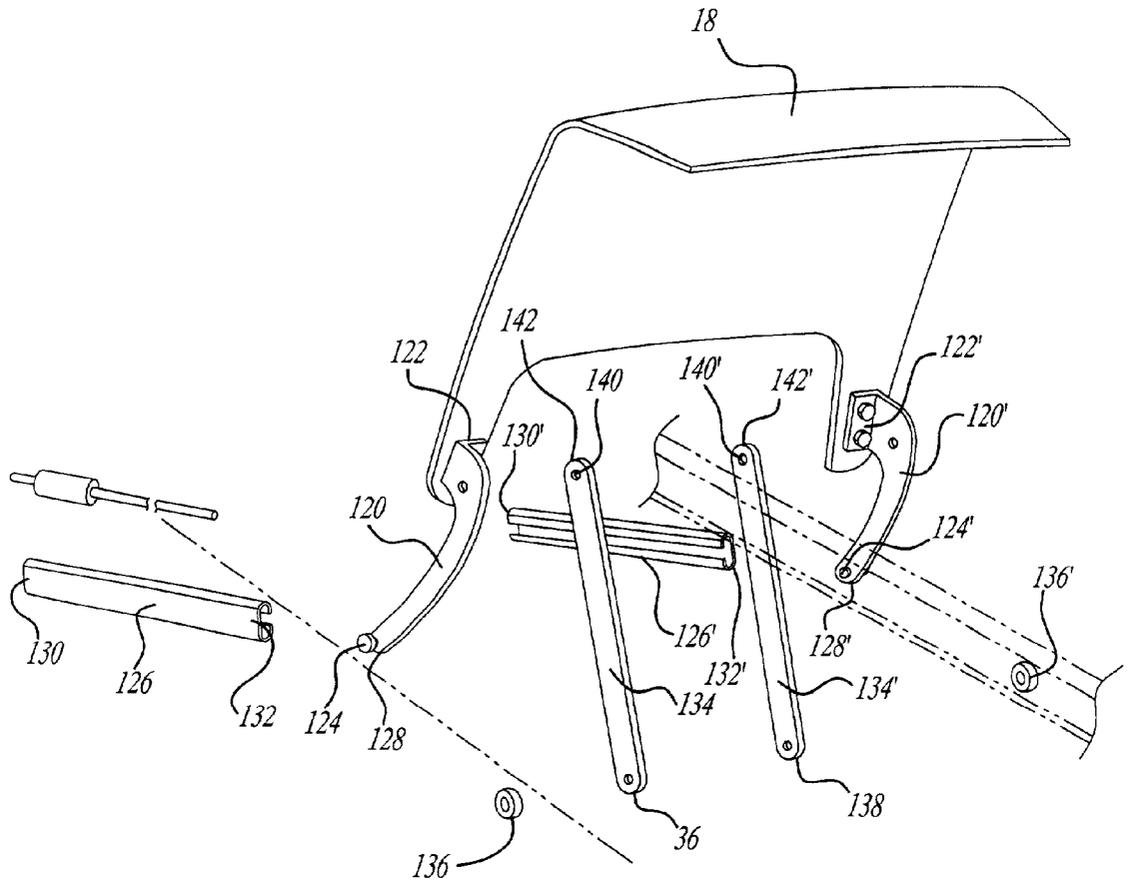


Fig-19

Fig-20

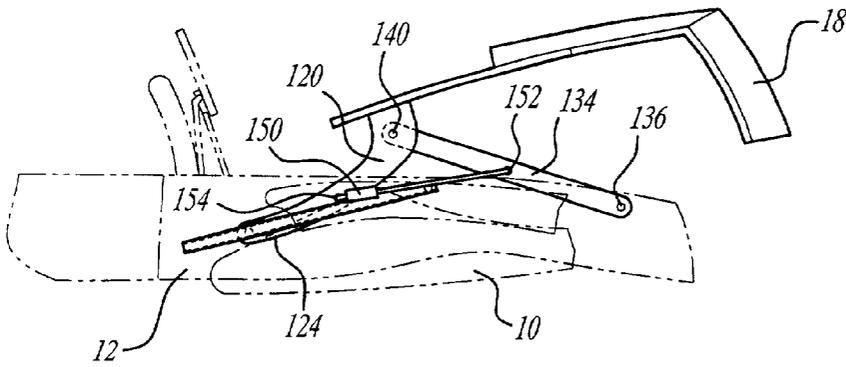
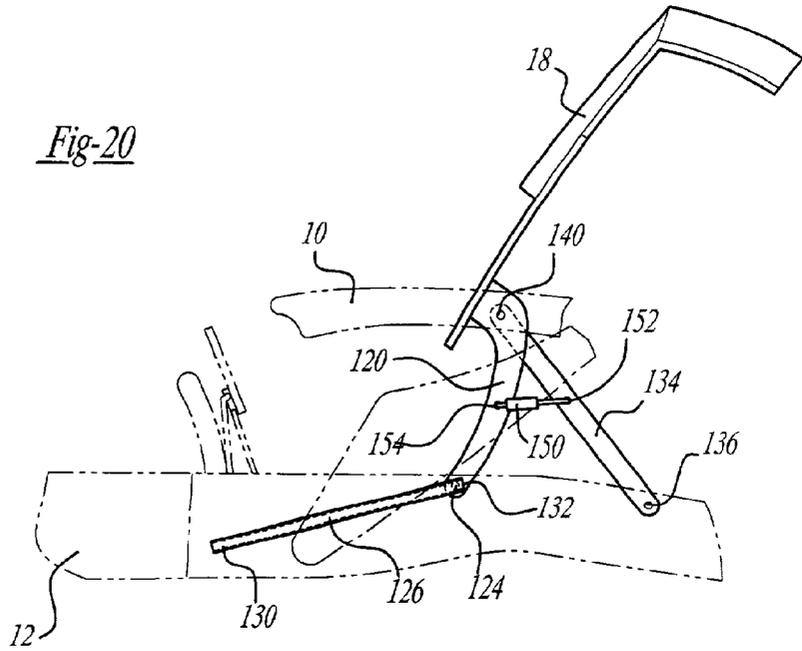
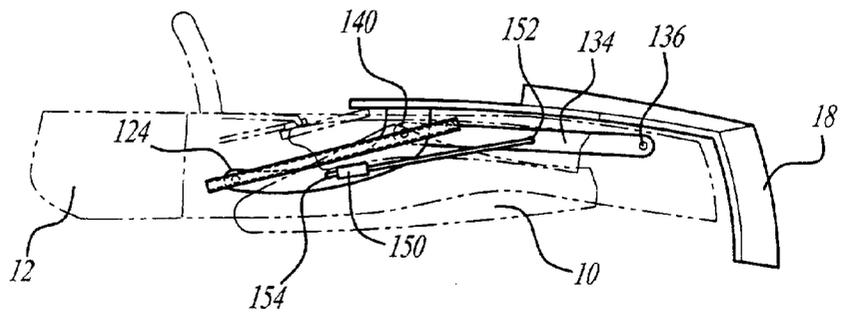


Fig-21

Fig-22



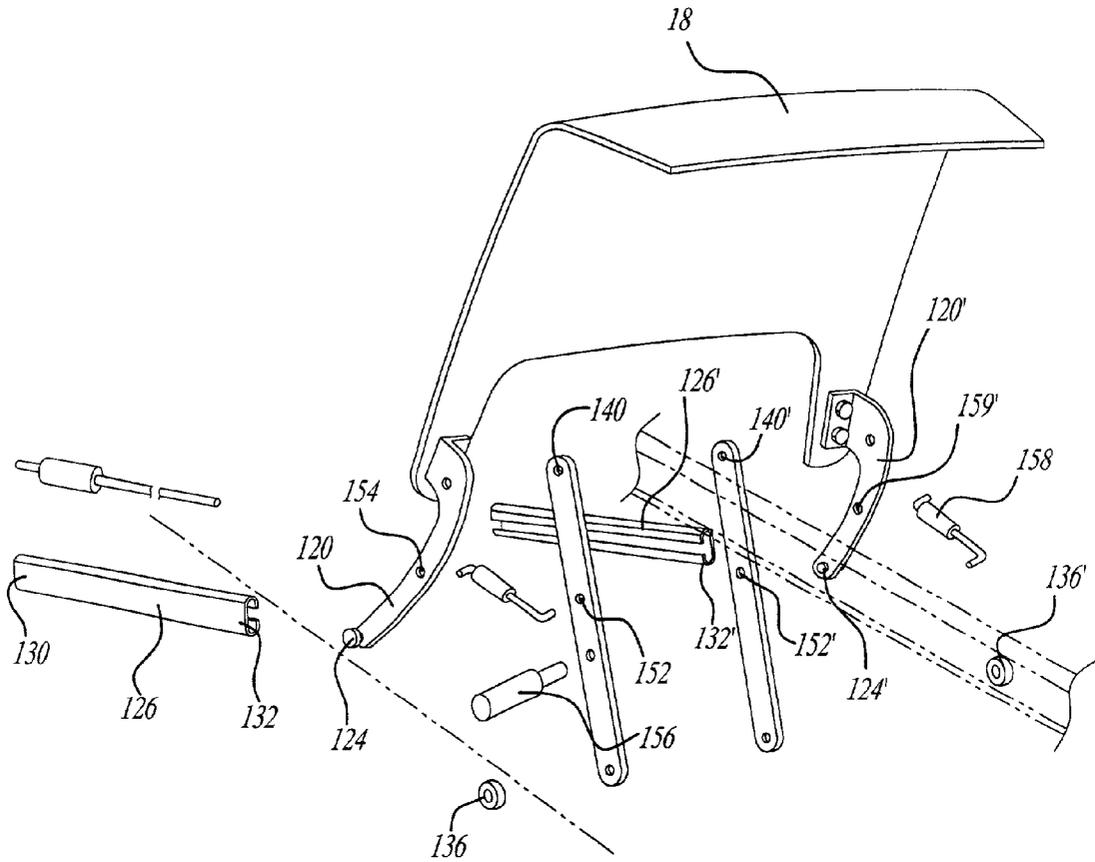


Fig-23

Fig-24

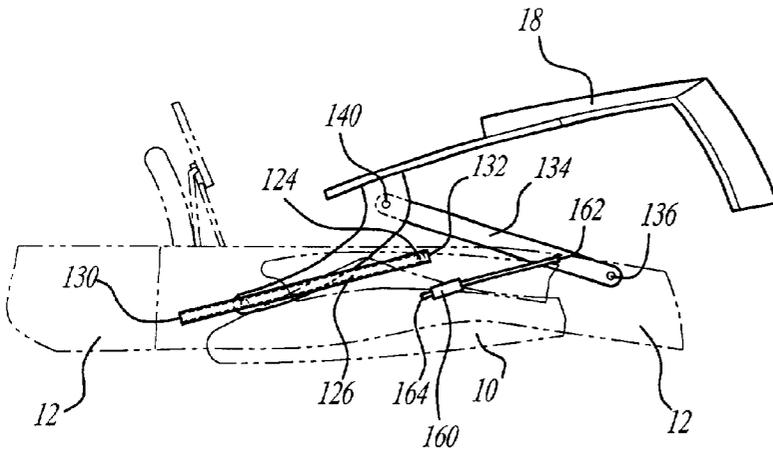
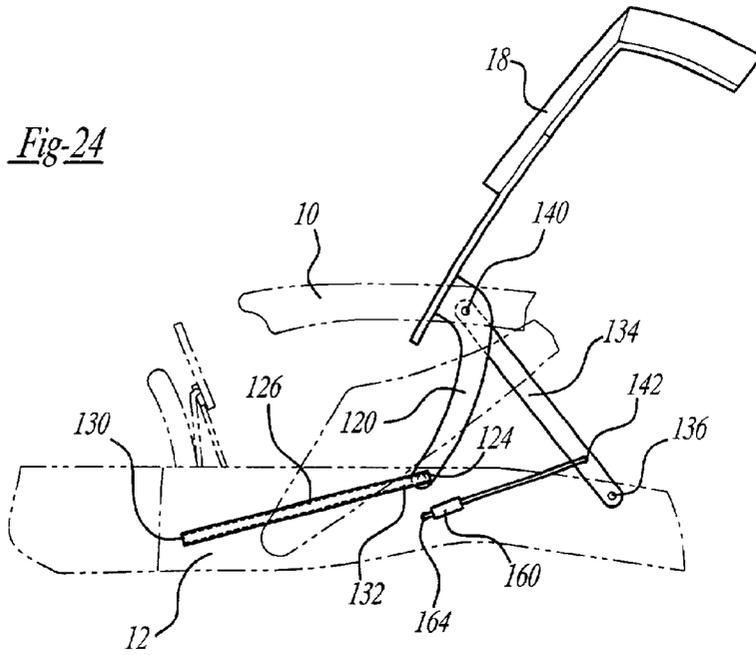
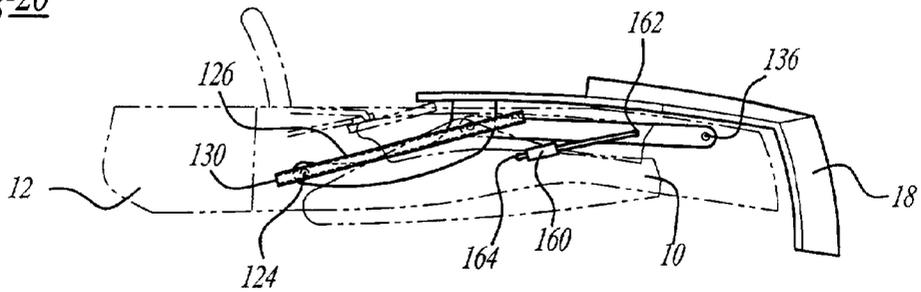


Fig-25

Fig-26



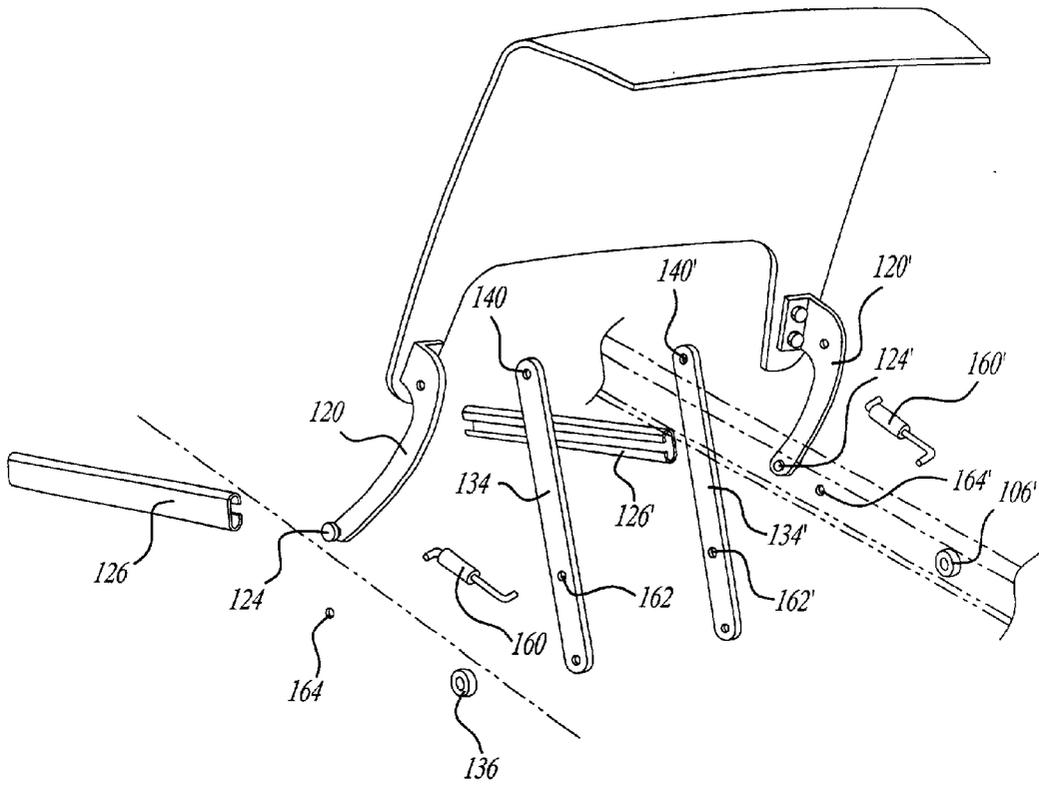


Fig-27

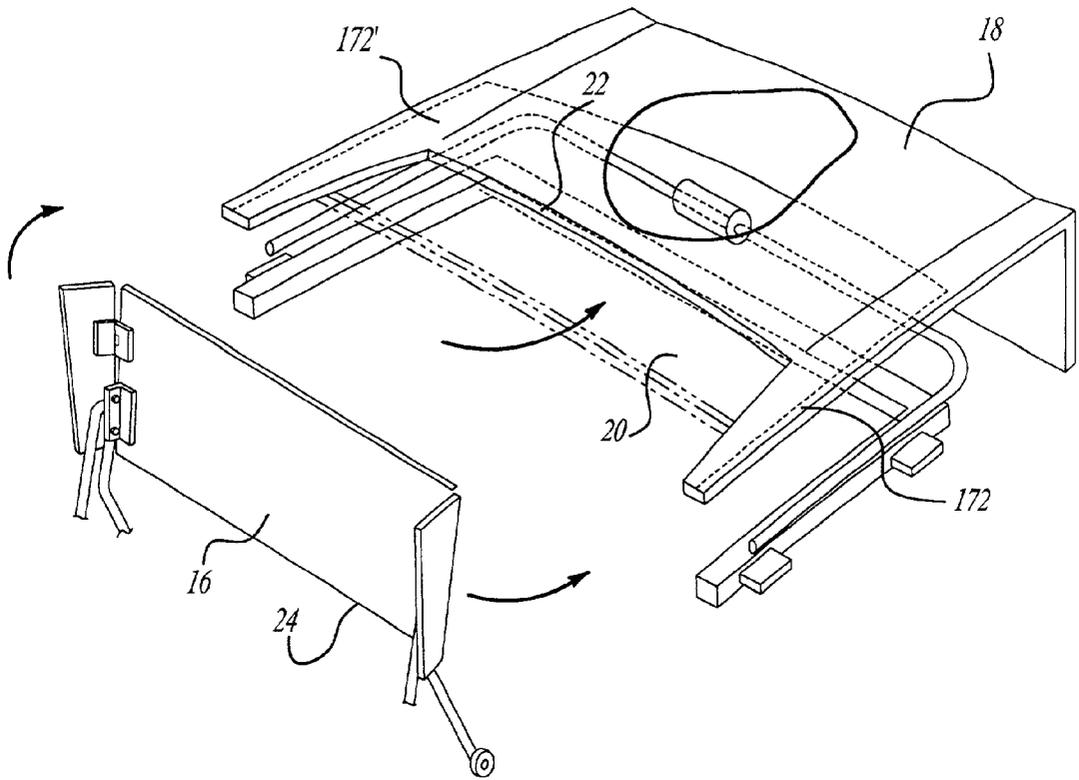


Fig-28

RETRACTABLE TOP TRUNK LID ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 09/334,763 filed Jun. 16, 1999.

TECHNICAL FIELD

[0002] This invention relates to retractable hard top vehicle roofs and related vehicle components that facilitate roof retraction and extension.

BACKGROUND ART

[0003] Motor vehicles generally are provided with a rigid roof structure completely enclosing the top of the passenger compartment. In some instances a sunroof may be provided at an additional cost to provide some overhead ventilation, however, the size of the vehicle sunroofs is normally very limited. Vehicle roofs with sunroofs do not in any way approach the ventilation, openness and panoramic view that is available with a convertible roof.

[0004] Conventional convertibles have a soft top that is folded into a series of folds that are stretched over three or four convertible top bows when the top is in its extended, or up, position. Convertible soft tops are prone to problems including excessive noise and potential water leakage. Soft tops are also generally less durable than a hard top and may require replacement periodically during the life of the vehicle. Some of the difficulties with the soft top convertibles result from the fact that they are not particularly well suited to winter weather. Cold temperatures, ice and snow that are encountered in winter discourage consumers from selecting convertible style vehicles even though the consumers may want a convertible for summer driving. In winter, water leakage through the convertible roof can make driving unpleasant and cause water damage to the interior of the vehicle. A soft top can make a vehicle difficult to heat due to heat transfer through the convertible top unless it is lined and insulated. If a convertible top is lined and insulated, reduction in noise levels and better heat retention may be achieved but the top becomes more bulky and requires more space within the vehicle for stowage.

[0005] Retractable hard tops offer the advantages of a hard top roof and a convertible in that they provide a durable vehicle roof that is not prone to excessive noise levels or leakage and provides excellent durability. However, retractable hard tops generally require complex linkages and drive mechanisms. For example, U.S. Pat. No. 5,823,606, discloses a system in which the trunk is provided with a dual hinge mechanism to allow it to be opened in the conventional manner on a forward hinge and to be tipped about its rear edge on an auxiliary rear hinge. In addition, a relatively large storage compartment must be provided to permit the retractable hard top to be folded and then moved into its storage compartment. Depending upon the size of the roof and trunk area of the vehicle, it may be difficult or impossible to configure a retractable hard top according to prior art designs that would still leave sufficient space in the trunk for useful storage. In addition to providing space for storing the retractable hard top, if an automatic hard top is provided, there must be adequate clearance between the trunk lid, wheel housings, floor of the vehicle and belt line of the

vehicle so that the hard top may be automatically retracted without interference from other vehicle elements.

[0006] Assembly of convertible tops and retractable hard tops has generally been accomplished by taking separate components including the top and its associated linkage and the tonneau and its associated linkage and assembling them to a partially constructed vehicle on an assembly line. Alternatively, convertibles have been manufactured by removing the roof structure of a conventional coupe, reinforcing the frame and then installing the convertible top and tonneau. In either method the trunk lid is assembled as part of the vehicle entirely separately from the top. Likewise, if a roll bar is provided it is entirely separate from the top and from the trunk lid prior to assembly to the vehicle. These assembly methods are inefficient and add operations to the final vehicle assembly process. Also, testing and adjustment of various systems relating to the operation of the trunk lid, tonneau and top are required post assembly to the vehicle including integration of electrical connections, hydraulic systems and mechanical linkages.

[0007] These and other problems and design objectives are addressed by the present invention as summarized below.

DISCLOSURE OF INVENTION

[0008] The advances embodied in the present invention may be applicable to retractable hard tops and soft convertible tops. The present invention includes improvements in the top alone and in combination with a power tonneau cover, trunk lid, and rollbar. The invention also offers advantages relating to modular assembly techniques involving the retractable top, trunk, tonneau and rollbar.

[0009] According to another aspect of the invention, the retractable vehicle top system may be incorporated in a vehicle having a trunk lid that has a linkage that raises the trunk lid as it pivots to provide additional clearance for the retractable vehicle top system as it moves between the top up position and the stowed position. The retractable roof and trunk lid combination includes a roof formed in at least two sections that are pivotally connected to each other by a roof linkage to the vehicle body. The roof linkage includes right and left roof pivot brackets that are connected to right and left sides of the vehicle body by right and left roof pivot members received in right and left roof guide tracks. A trunk lid is connected to both sides of the vehicle body by a trunk lid linkage. The trunk lid linkage includes right and left movable trunk lid pivot members that are received in right and left trunk lid tracks. The movable trunk lid pivot members are connected to the trunk lid and the vehicle body. The roof has a top up position wherein the roof covers the passenger compartment in a stowed position wherein the passenger compartment is uncovered. Two sections of the roof are adjoined in the top up position and are folded together in the stowed position. The roof pivot brackets are moved along the roof guide tracks as the roof is moved between the top up position and the stowed position. The trunk lid has a closed position in which the trunk lid covers the trunk and an open position in which access is provided to the trunk. In the open positions movable trunk lid pivot members are shifted upwardly by moving the trunk lid pivot members in the trunk lid tracks from the position that the pivot members are in when in the closed position to thereby provide clearance for the roof as the roof is moved between the top up position and the stowed position.

[0010] A motor may be connected to the vehicle and trunk lid linkage or connected between two relatively movable parts of the trunk lid linkage. A separate motor may be provided for the retractable top and the trunk lid or both may be powered by a single motor.

[0011] The trunk lid assembly includes several novel features. The trunk lid assembly includes a trunk lid having a closed position and a raised position. Right and left arcuate support arms are affixed to right and left sides of the trunk lid on their back ends and have a roller on their front ends. Right and left tracks each have a forward end and a rearward end. The tracks are mounted on right and left sides of the vehicle. The tracks receive the rollers on the front ends of the support arms. Right and left trunk lid control arms are pivotally secured to right and left sides of the vehicle. Rollers are disposed in the forward ends of the tracks and the control arms are pivoted forward when the trunk lid is in the forward position. The rollers are disposed in the rearward ends of the tracks and the control arms are pivoted upwardly from their forward position when the trunk lid is in the raised position so that the whole trunk lid is raised upwardly as the trunk lid support arms are pivoted to move the trunk lid to the raised position. The trunk lid assembly may be operable by either a motor or by hydraulic cylinders. The motor or hydraulic cylinders may be connected to right and left sides of the vehicle and right and left trunk lid support arms. The hydraulic cylinders may also be connected to right and left trunk lid control arms and right and left trunk lid support arms to move the trunk lid between its closed and raised positions. Alternatively, the trunk lid assembly may include right and left hydraulic cylinders that are connected to right and left sides of the vehicle and the right and left trunk lid control arms to move the trunk between its raised and closed positions.

[0012] According to another aspect of the invention, an outer tonneau cover may be secured to the trunk lid for sliding movement on the trunk lid toward and away from the inner tonneau cover that is attached to the retractable top and frame to open and close an opening defined by a front edge of the trunk lid and the rear edge of the inner tonneau cover.

[0013] According to another aspect of the invention, a retractable vehicle top, trunk lid and tonneau cover assembly may be provided in combination for a vehicle including many of the structural elements previously described with respect to each element separately. Likewise, a retractable vehicle top, rear quarter window, tonneau cover assembly may be provided as a system incorporating the structural elements previously described with respect to each of the components.

[0014] According to another aspect of the invention, a modular convertible top for a vehicle is disclosed in which a frame that is adapted to be secured to the vehicle is used to mount a retractable top and tonneau cover prior to assembly to the vehicle. The frame, retractable top and the inner tonneau cover are all installed in the vehicle simultaneously as a unit.

[0015] Another aspect of the modular convertible top concept, is to provide a trunk lid that is secured to the frame that is also installed in the vehicle simultaneously and as a unit with the frame, retractable top and inner tonneau cover.

[0016] The modular convertible top concept may also comprise including a roll bar that is secured to the frame and installed with the other components simultaneously as a unit.

[0017] The invention also comprehends a method of assembling a convertible top and related components to a vehicle wherein the retractable top and related components are assembled to a frame prior to assembly to the vehicle and wherein the assembly is secured as a unit to the vehicle.

[0018] These and other aspects of the present invention will be better understood in view of the attached drawings and detailed description of several embodiments of the invention that follows.

BRIEF DESCRIPTION OF DRAWINGS

[0019] FIG. 1 is an exploded perspective view showing the modular concept of the present invention wherein a retractable top, power tonneau, trunk lid and roll bar are assembled to each other and a frame including mounting brackets and installed as a unit simultaneously in a vehicle.

[0020] FIG. 2 is a fragmentary side elevation view of a vehicle with a retractable top made in accordance with the present invention in its top up position.

[0021] FIG. 3 is a fragmentary side elevation view of a vehicle having a retractable top made in accordance with the present invention at the beginning of the retraction cycle.

[0022] FIG. 4 is a fragmentary side elevation view of a vehicle having a retractable top made in accordance with the present invention with the retractable top at an intermediate point in the retraction cycle.

[0023] FIG. 5 is a fragmentary side elevation view of a vehicle having a retractable top made in accordance with the present invention with the retractable top at a nearly fully retracted position.

[0024] FIG. 6 is a partial side elevation view of a vehicle having a retractable top made in accordance with the present invention with the retractable top at a fully retracted position.

[0025] FIG. 7 is a fragmentary perspective view of a rear portion of a vehicle showing a retractable top made in accordance with the present invention with the retractable top in phantom lines as stowed in the vehicle.

[0026] FIG. 8 is a fragmentary exploded view of the retractable top and rear quarter window made in accordance with the present invention with a portion of their associated linkages.

[0027] FIG. 9 is a partial side elevation view of a vehicle showing an alternative linkage mechanism according to the present invention with the retractable top in its top up position.

[0028] FIG. 10 is a fragmentary side elevation view of a vehicle and the embodiment of the retractable top made in accordance with the embodiment of FIG. 9 and shown in its partially retracted position.

[0029] FIG. 11 is a fragmentary side elevation view of a vehicle and a retractable top made in accordance with the embodiment of FIG. 9 illustrating the top in its fully retracted position.

[0030] FIG. 12 is a fragmentary side elevation view of the vehicle having a retractable top and a power inner tonneau cover made in accordance with the present invention with the retractable top in its top up position.

[0031] FIG. 13 is a fragmentary side elevation view of a vehicle having a retractable top and power inner tonneau cover made in accordance with the present invention with the retractable top in its nearly fully retracted position.

[0032] FIG. 14 is a fragmentary side elevation view of a vehicle having a retractable top and power inner tonneau cover with the top in its fully retracted position and the tonneau cover disposed above a portion of the top.

[0033] FIG. 15 is the partial exploded perspective view of one side of a retractable top and power inner tonneau cover and a portion of their associated linkages.

[0034] FIG. 16 is a fragmentary side elevation view of a vehicle having a trunk lid linkage made in accordance with the present invention in its fully raised position with the retractable top shown in phantom partially retracted.

[0035] FIG. 17 is a fragmentary side elevation view of a vehicle having a trunk lid linkage made in accordance with the present invention partially closed with retractable top shown in phantom fully stowed.

[0036] FIG. 18 is a fragmentary side elevation view of a vehicle having a trunk lid linkage made in accordance with the present invention closed over the retractable top shown in phantom in its fully retracted position.

[0037] FIG. 19 is an exploded perspective view of a trunk lid and linkage made in accordance with the present invention.

[0038] FIG. 20 is a fragmentary side elevation view of a vehicle having a trunk lid linkage with an alternative embodiment of the drive mechanism shown in its fully raised position with the retractable top shown in phantom partially retracted.

[0039] FIG. 21 is a side elevation view of a vehicle having a trunk lid made in accordance with the embodiment of FIG. 20 showing the trunk lid partially closed and the retractable top shown in phantom in its fully retracted position.

[0040] FIG. 22 is a side elevation view of the trunk lid made in accordance with the embodiment of FIG. 20 showing the trunk lid closed and the retractable top in its fully retracted position.

[0041] FIG. 23 is an exploded perspective view of the trunk lid and linkage made in accordance with the embodiment of FIG. 20 showing a drive system interconnecting two parts of the linkage.

[0042] FIG. 24 is a fragmentary side elevation view of a vehicle and a trunk lid cover and linkage made in accordance with the present invention with an alternative embodiment of the drive mechanism shown in its fully raised position with the retractable top shown in phantom partially retracted.

[0043] FIG. 25 is a fragmentary side elevation view of a vehicle and a trunk lid embodiment of FIG. 24 in its partially closed position with the roof shown in phantom in its fully retracted position.

[0044] FIG. 26 is a fragmentary side elevation view of the vehicle and trunk lid cover according to the embodiment of FIG. 24 shown with the trunk lid closed over the retractable top in its fully retracted position.

[0045] FIG. 27 is an exploded perspective view of the trunk lid and linkage made in accordance with the embodiment of FIG. 24 showing a drive system interconnecting a part of the linkage to the vehicle or frame.

[0046] FIG. 28 is a perspective view of a trunk lid including a retractable outer tonneau cover formed as a part of the deck lid in conjunction with a moveable inner tonneau cover.

BEST MODE FOR CARRYING OUT THE INVENTION

[0047] Referring now to FIG. 1, a retractable top 10 for a vehicle 12 is shown as a modular construction including a frame 14, inner tonneau cover 16 and trunk lid 18 that are installed as a unit in the partially assembled vehicle 12. The frame 14 is secured to the retractable top 10, inner tonneau cover 16 and trunk lid 18 that will be more particularly described below. The trunk lid 18 includes an outer tonneau cover 20 that is assembled to the trunk lid 18 in a sliding relationship similar to the sliding mechanism used for power sunroofs. The front edge of the trunk lid 22 and a rear edge of the inner tonneau 24 define the space covered by the outer tonneau cover 20 when it is extended from the trunk lid 18. Main bracket 26 and right and left wheel housing brackets 28 and 30, respectively, are secured to or are formed as parts of other components of the vehicle such as the floor and wheel housings. Holes 32 are provided for fasteners to be received in for securing the modular assembly to the vehicle 12.

[0048] Referring to FIGS. 2-8, the structure and operation of the retractable roof 10 is described. The retractable top 10 in the illustrated embodiment includes a front roof assembly 36 and a rear roof assembly 38. The front and rear roof assemblies 36 and 38 are interconnected by a hinge pin 40 and hinge flange 42. The hinge pin 40 is associated with the rear roof assembly 38 and the hinge flange 42 extends rearwardly from the rear edge of the front roof assembly 36. The roof linkage generally indicated by reference numeral 44 controls retraction and extension of the retractable top 10. The roof linkage 44 is symmetrical and includes right and left roof linkages on the right and left sides of the vehicle 12. For brevity, only the left side of the roof linkage 44 is shown. However, it should be understood that a right side linkage is also provided as part of the roof linkage 44. The right side roof linkage is substantially identical in all material respects to the left side linkage and its description will not be repeated.

[0049] The roof linkage 44 includes a roof pivot bracket 46 comprising a generally y-shaped member having a track follower member 48 on one part of the roof pivot bracket 46 that is received for sliding movement along the roof guide track 50. A pivot connector 52 is provided on another portion of the roof pivot bracket 46. The pivot connector 52 connects the roof pivot bracket 46 to the rear roof assembly 38. A pivot pin 54 connects another part of the roof pivot bracket 46 to a balance link 56. Balance link 56 interconnects the roof pivot bracket 46 to the front roof assembly 36 at front

roof pivot 58. A control link 60 is connected to a body mount pivot 62 and a roof assembly pivot 64.

[0050] A rear quarter window 66 spans the space between the belt line 68 of the vehicle 12 and the lower edge 70 of the rear roof assembly 38. A window/top control arm 72 is connected by pivot 74 to the rear roof assembly. Pivot 76 connects the other end of the window/top control arm 72 to the rear quarter window 66. A roller cam 78 is connected to the rear quarter window 66 and is longitudinally extensible to move the rear quarter window 66 outboard as the roof is retracted and is longitudinally retracted to move the rear quarter window 66 into engagement with the belt line 68 and lower edge 70 of the rear roof assembly 38 when the top 10 is in the top up position.

[0051] Referring now to FIG. 2, the roof pivot bracket 46 is located at the upper and rear end of the roof guide track 50 and the rear quarter window 66 is in engagement with the belt line 68 and edge 70 of the rear roof assembly 38. The front roof assembly 36 and rear roof assembly 38 are contiguous to form a hard top over the passenger compartment of the vehicle.

[0052] As shown in FIG. 3, the roof is in an early stage retraction position wherein the roof pivot bracket 46 has begun to move downwardly and forwardly in the roof guide track 50. The rear quarter window is extended outwardly to provide clearance between the window 66 and the outboard sides of the retractable top 10. The roof pivot bracket 46 is held in the same angular orientation by the track follower member 48 in the roof guide track 50. The front roof assembly 36 and rear roof assembly 38 are not contiguous at this phase of the retraction cycle but are held together by the hinge pin 40 and hinge flange 42 as they begin folding toward each other. The balance link 56 holds the front roof assembly 36 in a generally horizontal orientation. The balance link 56 is held in place by the roof pivot bracket 46. The rear roof assembly 38 is rotated upwardly on its front end and downwardly on its rear end by the movement of the pivot connector 52 and the control link 60. Control link 60 is anchored to the vehicle at the body mount pivot 62 and is rotated about roof assembly pivot 64. The rear quarter window 66 is rotated by the window/top control arm 72 that is connected to the rear roof assembly 36 at pivot 74. The window is connected to the window/top control arm by pivot 76 that rotates the rear quarter window 66 about the roller cam 78.

[0053] Referring now to FIG. 4, the retraction of the roof has continued to its approximate midpoint wherein the roof pivot bracket 46 has been moved by a cylinder or motor to the approximate midpoint of the roof guide track 50. The front roof assembly 36 is held in its generally horizontal orientation by the balance link 56 while the rear roof assembly has been rotated to a partially inverted position by the pivot connector 52 on the roof pivot brackets 46. The control arm 60 supports the rear roof assembly on the body mount pivot 62 as it rotates about the roof assembly pivot 64. The rear quarter window 66 is rotated by the window/top control arm 72 about the roller cam 78.

[0054] Referring now to FIG. 5, the action of the roof linkage 44 is continued to a fully retracted position and the pivot bracket 46 has moved further downwardly and forwardly on the roof guide track 50. The balance link 56 continues to hold the front roof assembly in a generally

horizontal orientation as it is further folded on the hinge pin 40 and hinge flange 42 over top of the rear roof assembly 38. The rear roof assembly 38 is nearly inverted as it is rotated by the further forward advancement of the pivot connector 52 and rotated about the roof assembly pivot 64. The control link 60 moves in a clockwise direction about the body mount pivot 62. The window/top control arm 72 continues to rotate the rear quarter window 66 about the roller cam 78 that holds the window outboard of the retractable top 10 as it progresses through its retraction cycle.

[0055] Referring now to FIG. 6, the retractable top 10 is shown in its fully retracted position. The roof pivot bracket 46 is at the forward and downward end of the roof guide track 50. The roof pivot bracket 46 is held in the same angular orientation by the track follower members 48 to the roof guide track 50. The control arm 56 continues to hold the front roof assembly in a generally horizontal orientation while the rear roof assembly 38 has been inverted so that the front roof assembly 36 may rest on the rear roof assembly 38. The hinge pin 40 and hinge flange 42 connect the front roof assembly 36 and rear roof assembly 38 together. The control arm 60 is disposed in a generally downward orientation suspending the rear roof assembly 38 on the roof assembly pivot 64 from the body mount pivot 62. The window/top control arm 72 is moved by the control arm 60 to a substantially inverted position relative to its position in the top up position.

[0056] When the roof is in its retracted position, as shown in FIG. 7, it may be covered by the inner tonneau cover 16 and an outer tonneau cover 20 on the trunk lid 18 of the vehicle 12. The front roof assembly 36 and rear roof assembly 38 are shown folded against one another.

[0057] Referring now to FIG. 8, the tonneau parts of the retractable top are shown in exploded perspective. A drive 80 is shown that is connected to the vehicle body on one end and the pivot bracket 46 on the other end. The drive 80 may be a cylinder, cable drive, motor driven screw drive or other device that is capable of moving the roof pivot bracket 46 within the roof guide tracks 50. The track follower member 48 is shown as an extruded t-shaped member formed on one part of the roof pivot bracket 46. To reduce friction, the track follower member 48 may include a roller or other friction reducing structure. The front roof assembly 36 includes the hinge flange 42 that is connected to the rear roof assembly by the hinge pin 40. Balance link 56 is connected by pivot pin 54 to the roof pivot bracket 46 on one end while the front roof pivot 58 connects the balance link 56 to the front roof assembly 36. Window/top control arm 72 is connected a pivot 74 to the control link 60 on one end and is connected to the pivot 76 on the rear quarter window 66. Rear quarter window 66 is further controlled by the roller cam 78 about which it pivots and that is effective to move the window outward during the retraction and extension cycles.

[0058] Referring now to FIGS. 9-11, an alternative embodiment of the roof retraction mechanism is described that is similar in many respects to the embodiment of FIGS. 2-8 but includes a different arrangement wherein the control link 82 is connected to the body mount pivot 62 on one end and is connected by a pivot 84 on the balance link 56. The control link 82 connects the balance link 56 to the vehicle at body mount pivot 62. The balance link 56 is connected by pivot pin 54 to the roof pivot bracket 46 on its lower end and

to the front roof pivot **58** on the other end. In **FIG. 9**, the retractable top **10** is shown in its top up position. In **FIG. 10**, the alternative embodiment is shown with the roof at the approximate midpoint of the retraction cycle. In **FIG. 11**, the roof is shown in its fully retracted position with the control link **82** suspended from the body mount **62** and supporting the balance link **56**.

[0059] Referring now to **FIGS. 12-14**, the inner tonneau cover in combination with the retractable top is shown and its operation is described in conjunction with the operation of the top. A front pivot flange **90** extends from the inner tonneau cover **16** and is connected by a pivot pin **92** to the vehicle body. A rear pivot link flange **94** also extends downwardly from the inner tonneau cover **16** and is connected by a pivot link pin **96** to bell crank **98**. Bell crank **98** is connected by pivot connector **100** to the roof pivot bracket **46**. Roof pivot bracket **46** has previously been described as it relates to the roof retraction mechanism. A front tonneau cover control link **102** interconnects the rear pivot link flange **94** to the bell crank **98** at pivot pin **104**. Rear tonneau cover control link **106** interconnects the bell crank **98** to a rear tonneau cover control link flange **108** that extends downwardly from the lower edge of the rear roof assembly **38** when the rear roof assembly **38** is in its top up position. The bell crank pivot **110** connects the rear tonneau cover control link **106** to the bell crank **98**.

[0060] When the retractable top **10** is in its top up position, the inner tonneau cover **16** is preferably maintained in a generally horizontal orientation as shown in **FIG. 12**. On the beginning of the retraction cycle, the inner tonneau cover **16** is moved to a generally vertical position to provide clearance for the passage of the retractable top **10**. The inner tonneau cover **16** pivots on pivot pin **92** in a counter clockwise direction as viewed from the left side of the vehicle. The front tonneau cover control link **102** is driven by movement of the bell crank **98** in a downward and forward direction as the roof pivot bracket **46** is moved along the roof guide tracks **50** with the roof pivot bracket being guided in the roof guide tracks **50** by track follower members **48**. As the front tonneau cover control link **102** is moved by the bell crank to a position in front of the pivot pin **92**, the inner tonneau cover **16** is pulled down to a generally horizontal orientation as shown in **FIG. 14**. Rear tonneau cover control links **106** connect the bell crank **98** to the rear tonneau cover control link flange **108**. The bell crank rotates and carries the rear tonneau cover control link **106** that in turn supports the rear roof assembly **38**. The bell crank **98** transfers the motive force of the rear roof assembly **38** to the tonneau cover and coordinates the movement of the retractable top **10** with the inner tonneau cover **16**.

[0061] **FIG. 15** is an exploded perspective view of the left side of the inner tonneau cover and its associated linkage to the retractable top **10**. The drive illustrated in **FIG. 15** is a hydraulic cylinder **81**. The front pivot flange **90** and rear pivot link flange **94** are shown on the underside of the inner tonneau cover **16**. Front tonneau cover control link **102** connects the rear pivot link flange **94** to the bell crank **98**. Bell crank **98** includes three connection points. One connecting the bell crank **98** to the front tonneau cover control link **102**, another connecting the bell crank **98** to the rear tonneau cover control link **106**, and a third comprising pivot connector **112** connecting the bell crank **98** to the roof pivot

bracket **46**. Operation of the retractable top **10** and inner tonneau cover was previously described with reference to **FIGS. 12-14**.

[0062] Referring now to **FIGS. 16-19**, the trunk lid assembly for a vehicle **12** and retractable top **10** is shown. Right and left sides of the trunk assembly are shown in **FIG. 19** with the reference numerals for the left side of the vehicle being duplicated by the same reference numerals with a prime designation designating the corresponding parts on the right side of the vehicle. A description of the structure and operation of the trunk lid assembly will be made with reference to the left side with the understanding that the right side is a mirror image of the left side. The trunk lid **18** is connected by arcuate support arms **120** at the back end **122** of the arcuate support arms **120**. A hinge roller **124** is received as a track **126** on the front end **128** of the arcuate support arms **120**. The track **126** includes a forward end **130** and a rearward end **132**. Referring to **FIG. 16**, the trunk lid is in its full open position and the hinge roller **124** is disposed in the rearward end **132** of the track **126**. As shown in **FIG. 17**, with the trunk between its full opened and full closed position, the hinge roller **124** is located between the forward end **130** and the rearward end **132** of the track **126**. As shown in **FIG. 18**, when the trunk is in its full closed position the hinge roller **124** is disposed near the forward end **130** of the track **126**.

[0063] A control arm **134** is connected to the vehicle **12** by a pivot body connector **136** on its rearward end **138**. A pivot arm connector **140** interconnects the control arm **134** to the arcuate support arm **120** on the forward end **142** of the control arm **134**. A drive **144** is shown schematically at the forward end of the track **130**. The drive **144** may be a hydraulic cylinder, a motor driven screw or other linear drive motor that would be capable of driving the hinge roller **124** longitudinally in the track **126**.

[0064] Referring now to **FIGS. 20-23**. An alternative embodiment of the trunk lid assembly as shown. Once again the trunk lid assembly includes mirror image right and left sides that are shown in **FIG. 23** in corresponding reference numerals on the right side of the vehicle are provided with the same reference numerals as used for the left side but include a prime designation. For brevity, the same reference numerals have been provided to similar components of the trunk lid assembly that were used for **FIGS. 16-19**. The trunk lid assembly includes a trunk lid **18** for a vehicle **12** that is provided with a retractable top **10**. The trunk lid is moved upwardly by means of the arcuate support arm **120** that is connected by hinge roller **124** to a track **126**. The hinge roller **124** is movable within the track **126** in the position shown in **FIG. 20**, the full up position, **FIG. 21**, the partially closed position, and **FIG. 22** the fully closed position. A control arm **134** is connected to the vehicle by pivot body connector **136** and is connected to the arcuate support arm **120** by a pivot arm connector **140**. In the embodiment of **FIGS. 20-23**, the drive mechanism shown is a hydraulic cylinder **150** connected between arcuate support arm **120** and control arm **134**. The drive cylinder **150** is connected to an opening **152** on the control arm **134** and is connected to an opening **154** on arcuate support arm **120**. The drive cylinder **150** contracts as the trunk lid is lifted and is expanded as the trunk lid is closed as shown in **FIG. 22**. An air spring **156** may be provided to assist lifting the trunk lid.

[0065] Referring now to FIGS. 24-27, another alternative embodiment of the trunk lid assembly is shown. Once again the trunk lid assembly includes mirror image right and left sides that are shown in FIG. 27 with corresponding reference numerals on the right side of the vehicle being provided with the same reference numeral as used for the left side but including a prime designation. For brevity, the same reference numerals have been provided to similar components of the trunk lid assembly as were used for FIGS. 16-19. The trunk lid assembly includes a trunk lid 18 for a vehicle 12 that is provided with a retractable top 10. The trunk lid is moved upwardly by means of the arcuate support arm 120 that is connected by hinge roller 124 to a track 126. The hinge roller 124 is movable within the track 126 in the position shown in FIG. 24, the full open position, FIG. 25, the partially closed position, and FIG. 26 the fully closed position. A control arm 134 is connected to the vehicle or to the frame 14 in a modular construction by pivot body connector 136 and is connected to the arcuate support arm 120 by a pivot arm connector 140. In the embodiment of FIGS. 24-27, the drive mechanism is a drive cylinder 160 connected between arcuate support arm 120 and control arm 134. The drive cylinder 160 is connected to an opening 162 on the control arm 134 and is connected to an opening 164 on arcuate support arm 120. The drive cylinder 160 contracts as the trunk lid is lifted and is expanded as the trunk lid is closed, as shown in FIG. 22.

[0066] Referring now to FIG. 28, a trunk lid 18 is shown to include a rear tonneau cover 20 that is slidably received on tracks 172 and 172'. The outer tonneau cover 20 extends outwardly from the front edge 22 of the trunk lid 18 to expand the gap formed between the rear edge 24 of the inner tonneau cover 16 when it is in its horizontal position and the front edge 22 of the trunk lid 18. The outer tonneau cover is moved by a motor 174 and cables 176 on both sides of the trunk lid to move the outer tonneau 20 in the tracks 172 and 172'. The operation of the outer tonneau cover drive is similar in many respects to a sunroof drive wherein the outer tonneau slides and is lifted on links 178 when extended to be flush with the trunk lid 18.

[0067] While several embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A trunk lid assembly for a vehicle having a retractable top comprising:

- a trunk lid having a closed position and a raised position;
- right and left support arms affixed to right and left sides of the trunk lid on their back ends and having a roller on their front ends;
- right and left tracks each having a forward end and a rearward end, the tracks being mounted on right and left sides of the vehicle, the rollers on the front ends of the support arms being received in the tracks;

right and left trunk lid control arms being pivotally secured to right and left sides of the vehicle on their rear end and being pivotally secured to right and left

supports arms on their forward ends, wherein said rollers are disposed in the forward ends of the tracks and the control arms are pivoted forward when the trunk lid is in the closed position and wherein said rollers are disposed in the rearward ends of the tracks and the control arms are pivoted upwardly from their forward position when the trunk lid is in the raised position such that the trunk lid is raised up as the trunk lid support arms are pivoted to move the trunk lid to the raised position.

2. The trunk lid assembly of claim 1 further comprising a motor driving the control arm and trunk lid support arm to move the trunk lid between the closed position and the raised position.

3. The trunk lid assembly of claim 1 further comprising right and left hydraulic cylinders connected to the right and left sides of the vehicle and right and left trunk lid support arms to move the trunk lid between the closed position and the raised position and to drive the rollers between the forward and rearward ends of the tracks, respectively.

4. The trunk lid assembly of claim 1 further comprising right and left hydraulic cylinders connected to the right and left trunk lid control arms and right and left trunk lid support arms to move the trunk lid between the closed position and the raised position and to move the drive the rollers between the forward and rearward ends of the tracks, respectively.

5. The trunk lid assembly of claim 1 further comprising right and left hydraulic cylinders connected to the right and left sides of the vehicle and the right and left trunk lid control arms to move the trunk lid between the closed position and the raised position and to move the drive the rollers between the forward and rearward ends of the tracks, respectively.

6. A trunk lid assembly for a vehicle having a retractable top comprising:

a trunk lid for closing a trunk compartment, the trunk lid having a closed position and a raised position, the trunk lid having a forward end proximate a central portion of a forward edge of a trunk compartment opening when the trunk lid is in its closed position and a rearward end proximate a rearward edge of the trunk compartment opening when the trunk lid is in its closed position;

right and left linkages attached to the trunk lid, said linkages also being attached to the vehicle, the trunk lid being supported by the right and left linkages in its raised position above the trunk compartment opening with the rearward end of the trunk lid being raised above the central portion of the forward end thereof when in its raised position; and

the retractable top having a top up position and a retracted position, the retractable top when in the retracted position being at least partially disposed directly beneath the central portion of the trunk lid in the trunk compartment, the central portion of the trunk lid remaining forward of the forward edge of the trunk compartment opening, and wherein the retractable top is moved under the central portion of the forward end of the trunk lid when the top is moved between the top up and retracted positions.

7. In combination, a retractable top and a trunk lid covering a trunk compartment of a vehicle in a closed position that may be shifted to a raised position to provide access to the trunk compartment, comprising:

a linkage connecting the trunk lid to the vehicle for supporting the trunk lid as it is moved between the raised position and its closed position, the linkage lifting the trunk lid upwardly to its raised position with a rearward end of the trunk lid being raised to a greater extent than a central portion of a forward end of the trunk lid to provide access to the trunk compartment below the rearward end of the trunk lid, the central portion of the forward end of the trunk lid being raised by the linkage to provide clearance relative to the central portion of the forward end of the trunk lid for moving the retractable top between a top up position and a retracted position, the trunk lid being moved to the same raised position for providing access to the trunk compartment as for moving the retractable top between the top up position and the retracted position; and

wherein the retractable top is disposed in the trunk compartment at least partially disposed below the trunk lid in its retracted position.

8. A retractable top stowage arrangement for a vehicle having a trunk, the arrangement comprising:

a retractable top movable between an extended position wherein the top covers the passenger compartment of the vehicle and a retracted position wherein the top is disposed at least partially within the trunk;

a trunk lid moveable upwardly with the forward edge of the trunk lid remaining forward of a rear portion of the

top stack, the trunk lid being movable in one manner with respect to the vehicle for opening and closing the trunk and pivotable in the same manner when the top is moving between its extended and retracted positions; and

a linkage mechanism connecting at least one side of the vehicle and trunk lid and operable when the top is moved between extended and retracted positions to pivot the trunk lid in the one manner sufficiently in opening the trunk that the top can move to its retracted position with respect to the trunk and to pivot the trunk lid in the same manner sufficiently in closing the trunk wherein the top is stowed at least partially within the trunk.

9. The retractable top stowage arrangement of claim 8 wherein the trunk lid is pivotable to provide access to the trunk from the rear end of the vehicle.

10. The retractable top stowage arrangement of claim 8 wherein the retractable top is formed by at least two rigid panels that are pivotally connected to each other.

11. The retractable top stowage arrangement of claim 8 wherein the linkage mechanism comprises two linkages connected at two spaced locations on the trunk lid and at two spaced locations on the vehicle.

12. The retractable top stowage arrangement of claim 11 wherein the two linkages are connected to right and left sides of the trunk lid.

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