July 2, 1940. A. V. BROGREN ET AL 2,206,739

CONCEALED DOOR HINGE

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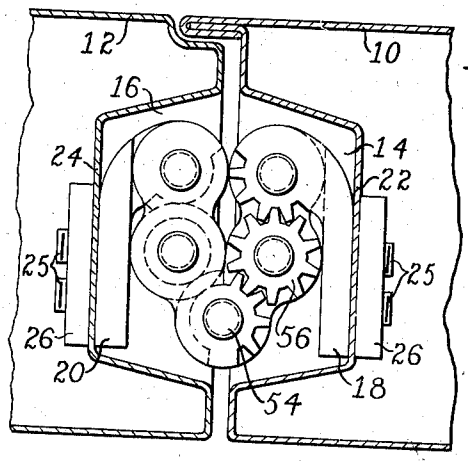
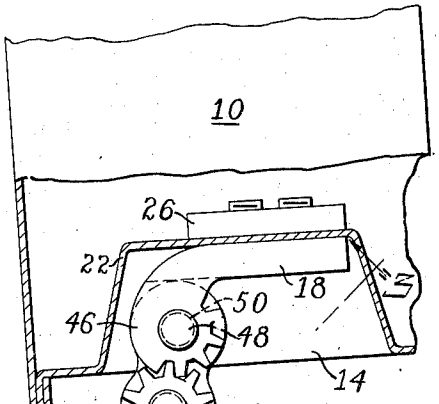


Fig. 1



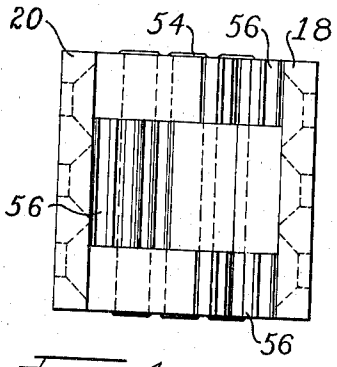


Fig. 4

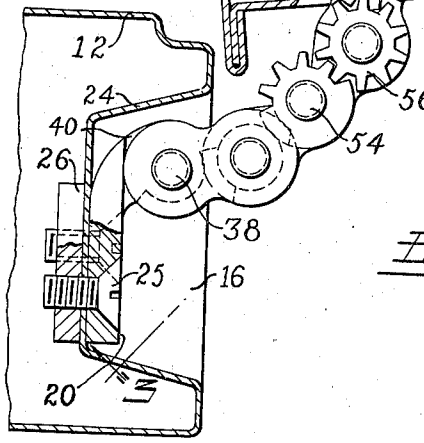


Fig. 2

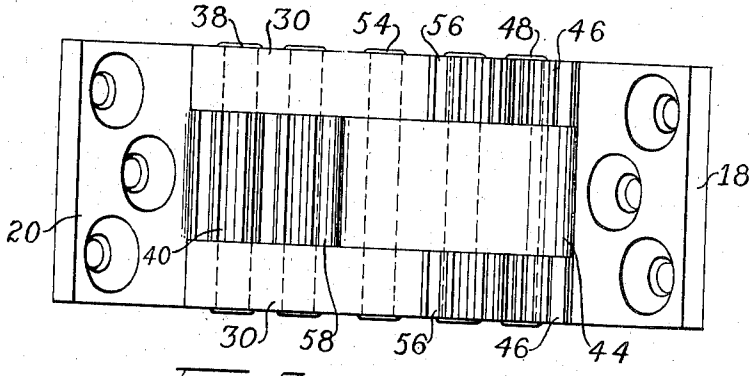


Fig. 3

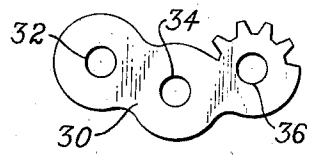
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Fig. 7



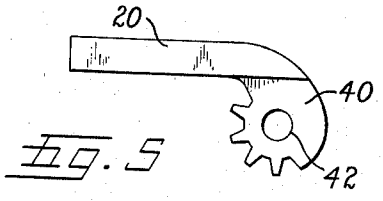


Fig. 5

Fig. 6

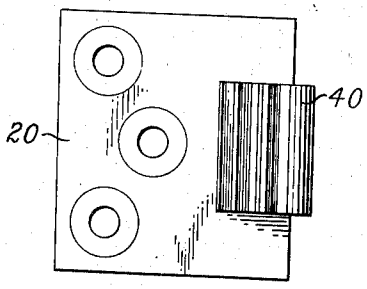
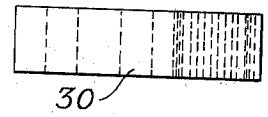


Fig. 8



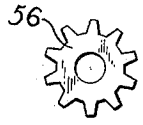


Fig. 9

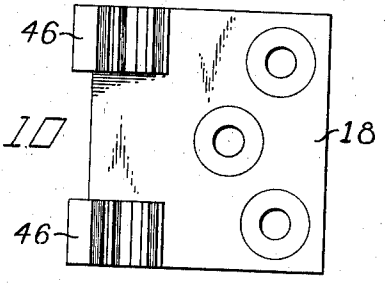


Fig. 10

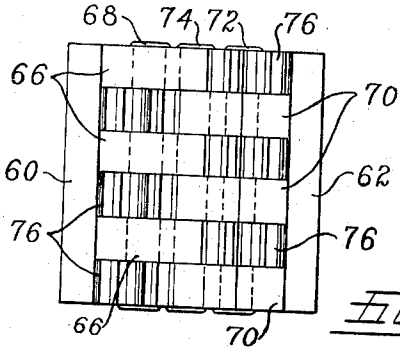


Fig. 12

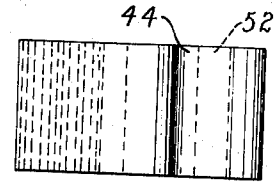


Fig. 11

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CONCEALED DOOR HINGE

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Application June 8, 1938, Serial No. 212,468

4 Claims. (Cl. 16—164)

This invention relates to door hinges and particularly to a concealable hinge especially adaptable for use on motor vehicles.

An important object of this invention is to provide an improved door hinge which may be readily installed on motor vehicles in such a manner that when the doors are closed the hinge parts are concealed from view. As a result, the appearance of a motor vehicle is enhanced and the dangers associated with projecting parts on the motor vehicle removed.

Another important object of this invention is to provide an improved door hinge of the concealable type which is relatively easy to manufacture and install and which is rugged in construction and able to withstand unusual shocks and stresses imposed upon the door carried thereby. Another important object of this invention is to provide a concealable hinge structure which is composed of simple parts easily manufactured and assembled. Heretofore, attempts which have been made in this particular art have utilized parts which are difficult and expensive to manufacture and which when assembled together operate upon complex principles requiring constant attention and repair while in use. A meritorious feature of this invention is the simplicity of construction and operation. The movement of the parts of the hinge are constrained within particular paths and swing about axes which extend parallel to one another and to the plane of the door body. This provides a rugged construction and one in which the door is prevented from bodily movement beyond its prescribed path.

Various other objects, advantages, and meritorious features of this invention will become more fully apparent from the following specification, appended claims, and accompanying drawings, wherein:

Fig. 1 is a cross-sectional view through a door and the body of a motor vehicle to which it is hinged showing the door in closed position with a hinge of the invention in collapsed concealed position within recesses provided in the door and vehicle body,

Fig. 2 is a cross-sectional view through a motor vehicle body on the same plane as in Fig. 1 but showing the door in open position with the hinge of this invention in substantially fully extended position,

Fig. 3 is a side view of the hinge in extended position showing it separate from its attachment to a door and vehicle body taken on line 3—3 of Fig. 2,

Fig. 4 is a side view of the hinge in collapsed position,

Fig. 5 is a top view of one of the hinge butts employed in the hinge assembly,

Fig. 6 is a side view of the hinge butt shown in Fig. 5,

Fig. 7 is a top view of one of the links employed in the hinge assembly,

Fig. 8 is a side view of the link shown in Fig. 7,

Fig. 9 is a top view of one of the pinions employed in the hinge assembly,

Fig. 10 is a side view of the other hinge butt employed in the hinge assembly,

Fig. 11 is a side view of another link employed in the hinge assembly, and

Fig. 12 is a view of a modification of the invention showing a modified form of hinge construction in collapsed position.

The invention in general comprises a plurality of links, one or more of which are pivotally attached to the door body and one or more of which are pivotally attached to the supporting body to which the door body is hinged. These links are pivoted to one another about an axis separate from the door and supporting body and disposed between these two bodies. Novel means is provided for operatively coupling each link to the body opposite to that to which it is pivotally attached. In the invention illustrated herein, this novel means constrains all the links to swing about their pivots in equal regular movements, those attached to the door in a direction equal to but opposite those links attached to the supporting body.

More particularly, the hinge structure comprises two hinged leaves or butts which are separately attached to the door and the body or frame to which the door is hinged. Each hinge butt has one or more links pivotally connected at one end to the butt and at their opposite ends these links are connected to each other by a hinge pin. Associated with each link is a movable element which is continuously in operative engagement with the butt to which the link is attached and is continuously in operative engagement with a link pivotally attached to the opposite butt. In the illustrated embodiment of the invention herein these movable elements are rotatable pinions meshing simultaneously with teeth on the adjacent butt and with teeth on the opposite link. Through the medium of these pinions, the link or links of one butt are rotatably operatively coupled with the other butt and with the link or links pivoted thereto so that when the door is swung relative to its supporting body, the links of one

butt move equally but oppositely to those of the other butt.

Referring particularly to the drawings, numerals 10 and 12 denote respectively a door and a supporting body to which the door is hinged. The hinge structure of this invention is especially adapted for use on motor vehicles of the passenger car type and the door 10 illustrated herein is of the type which is employed on such a vehicle and the body 12 constitutes the body of such a vehicle. The side edges of the door and the vehicle body are deformed or recessed back to form chambers or pockets 14 and 16 respectively in which the hinge structure is mounted as shown in Fig. 1.

The hinge proper comprises the hinge leaves or butts 18 and 20 secured to the back walls 22 and 24 of the recesses 14 and 16 respectively. Reinforcing members 26—26 may be provided on the inner sides of the back walls 14 and 16 for strongly securing the hinge butts in place in the recesses. Suitable attaching elements, such as screws 25, may be used to secure the hinge butts 18 and 20 to the back walls 22 and 24 by threading the screws into the reinforcing members 26 as shown in Fig. 2. The screws 25 are countersunk as is also shown in Fig. 2 so that their heads will not interfere with the hinge parts when the hinge is collapsed upon itself in the position shown in Fig. 1.

The two hinge butts 18 and 20 are pivotally secured together through the medium of a plurality of members or links which are pivotally secured at one of their ends to the hinge butts and at their opposite ends to each other about a common axis. These links are of substantially the same formation although they may be of varying widths depending upon the particular structure employed. In Figs. 7 and 8 one such link is shown. It is referred to by reference numeral 30 and two such links are employed in the embodiment of the invention illustrated herein as is probably best shown in the extended side view of the hinge assembly in Fig. 3. Three holes 32—34—36 are provided in each link 30 for the purpose of receiving pins as will be more fully described hereinafter. In the illustrated embodiment, the two links 30 are both secured to the hinge butt 20 by a pin 38 extending through the holes 32 of the links. The butt 20 is shaped to pivotally support the links. In Figs. 5 and 6 the butt 20 is shown as provided with a laterally projecting rounded portion 40 which is centrally located on one side of the butt as shown in Fig. 6, so that the links may be disposed on opposite sides of it when the hinge is assembled. This projecting portion 40 is provided with a hole 42 through which the pin 38 previously referred to extends when the hinge is properly assembled, as shown in Fig. 3. This portion 40 has its outer end provided with teeth as shown for meshing with a pinion as hereinafter described.

The butt 18 in the illustrated embodiment of the invention carries only one link 44. This link may be of the same width as the projecting portion 40 of the opposite butt 20 so that it may be centrally disposed in the hinge assembly as shown in Fig. 3 opposite to the projecting portion 40. In a similar manner but offset to the projecting portion 40 of the butt 20 the butt 18 is provided with two spaced projecting rounded portions 46—46 which overlap upon the one end of the link 44. These portions 46—46 are provided with teeth as shown for meshing with pinions hereinafter described. A pin 48 like pin 38 is capable of extending through an aperture 50 in the projecting portions 46 and hole 52 at one end of the link to pivot the link to the butt.

Thus, when the links are properly assembled upon their butts their free ends will overlap upon one another and a pin 54 is capable of pivotally securing these overlapping ends together when the holes in the free ends of the link are in alignment. The hinge structure thus far described, although it will support the door for swinging movement relative to the vehicle body, is not satisfactory because the links are swingable in various directions relative to the butts and to each other. The door would not swing about a fixed axis because of this freely movable character of the links.

In order to constrain or limit the links in their movement so that links 30 of one butt move equally and oppositely to link 44 of the other butt, each link has means associated therewith which may be in the form of a rotatable pinion. This pinion serves to rotatably couple or intermesh the butt pivoted to its link with a link pivoted to the opposite butt so that the links of the two butts are constrained to swing in unison and in opposite directions.

The rotatable pinions are all of the same pitch diameter in the illustrated embodiment of the invention but are of different lengths. One such pinion is shown at 56 in Fig. 9. Each pinion is provided with a central hole so that it may be rotatably supported upon its link by a pin passing therethrough.

As shown in Fig. 3 two pinions 56 are mounted on opposite sides of the link 44 at an intermediate point between its outer and inner ends. The two links 30, which are pivoted to the opposite butt 20, however, carry a single pinion 58 disposed between them. As shown, the outer end of each link 30 is provided with teeth for meshing with one of the pinions 56 carried by the link 44. Each pinion 56 also meshes with a toothed section 46 on hinge butt 18 to which link 44 is pivoted. The single pinion 58 journalled between links 30 meshes with the teeth on the outer end of link 44 and the teeth on the sector 40 of hinge butt 20.

The teeth on all these elements, the pinions, butts, and links, are all of the same pitch so that when the links are swung relative to their butts, the pinions are caused to be rotated by the relative displacement of the teeth on the link with which they are engaged relative to the teeth on the butt with which they are engaged. This is clearly apparent from the closed and open views in Figs. 1 and 2 of the drawings.

The amount of swinging movement of the door relative to the body of the vehicle may be controlled by the arrangement of the teeth on the hinge butts and links. As shown in Figs. 1 and 2, the rounded projecting portions 40 and 46 on the hinge butts have teeth which extend only part way around their circumference. Likewise the free ends of the links are provided with a limited number of teeth. The termination of the toothed portions on the butts and links are so arranged that when the door has swung to a maximum desired position the teeth on the pinion will have arrived at the end of these toothed portions. In Fig. 2, the door has been swung to substantially its maximum open position and it is clearly apparent that upon slight further opening movement the next succeeding teeth of the pinions will strike the unindented surface of the links and butts respectively and thus stop fur-

ther opening movement. Although this manner of using the toothed portions of the hinge to limit the opening movement of the door is satisfactory, it is preferred to use some form of a stop member, such as the customary door check, for stopping the opening movement of the door prior to the time that the teeth of the pinion are in position to abut the unindented surfaces of the link and butt with which they are engaged.

In the modification of the invention in Fig. 12, a plurality of links of equal dimensions are pivotally attached to the hinge butts. The butts are indicated as 60 and 62 and are similar to one another except that the spaced projection portions carrying segment gears are offset to one another. One end of each link 66 of butt 60 is pivoted to the projecting portions of such butt by pin 68. One end of each link 70 of butt 62 is likewise pivoted to butt 62 by pin 72. The opposite ends of the links overlap upon one another and are pivotally secured together about the floating hinge pin 74. Each link carries a pinion 76 intermediate its length which like pinions 56 mesh with the adjacent butt and the overlapping end of the opposite link. The operation of this modification is the same as the first described embodiment of the invention. The number and size of teeth may be varied so long as there is an enmeshed engagement which will result in controlled relative rotative actuation of the links of the butts and of one butt with respect to the other. The links are somewhat arcuate in shape to facilitate the required movements of opening and closing of the hinge and accommodation of the parts during such movements.

We claim:

1. A door hinge comprising, in combination, a butt for attaching the hinge to a door and a separate butt for attaching the hinge to a door post, a link pivotally connected at one end to one butt, a second link pivotally connected at one end to the other butt, said links being offset relative to one another so that their opposite ends overlap upon one another, a pin common to both links extending through their overlapping ends and pivotally connecting the links together, said overlapping end of each link provided with teeth, the portion of each butt opposite the toothed end of said links likewise provided with teeth, and a pinion rotatably carried by each link intermediate its ends and interengaging the teeth on the overlapping end of the other link and the teeth on the butt to which the link is pivoted.

2. A door hinge comprising a pair of hinge butts each provided with a toothed sector portion, an arcuate link pivoted at one end to each butt and having its opposite end provided with a toothed sector portion, means pivotally connecting said opposite ends of said links together to swing together with their concave surfaces in facing relationship, and a rotatable pinion pivotally supported upon each link between the toothed sector portion of the opposite link and the toothed sector portion of the butt to which the link supporting the pinion is pivoted interconnecting said toothed sector portions.

3. A hinge comprising, in combination, a pair of hinge butts, a single link pivoted at one end to one butt and having its opposite end provided with a toothed sector, a pair of links pivoted to the other butt and having their opposite ends each provided with a toothed sector, the toothed sector end of the single link being pivoted between and overlapping the toothed sector ends of the pair of links, a pinion rotatably supported by the said pair of links interconnecting the toothed sector end of the single link with the hinge butt to which the pair of links are pivoted, and a pair of pinions supported upon opposite sides of said single link and interconnecting the toothed sector ends of the pair of links with the hinge butt to which the single link is pivoted.

4. A hinge comprising, in combination, a pair of hinge butts, a plurality of links pivoted in axially spaced apart relationship at one end of each link to one butt, each of said links having its opposite end provided with a toothed sector, a second plurality of links pivoted in axially spaced apart relationship at one end of each link to the other butt, each of said links having its opposite end provided with a toothed sector, the toothed sector ends of the links pivoted to one butt being interleaved with and overlapping the toothed sector ends of the links pivoted to the other butt, a pivot pin connecting said overlapped toothed sector ends of the links together, each butt provided with a plurality of toothed sector portions, an idler pinion enmeshed between the toothed sector end of each link and the toothed sector portion of the opposite butt and pivotally mounted upon a link which link is directly pivotally connected to the butt with which the pinion is enmeshed.

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