Dec. 12, 1961 G. BARTEL 3,012,269

DOOR HOLDING DEVICE

Filed Sept. 3, 1958

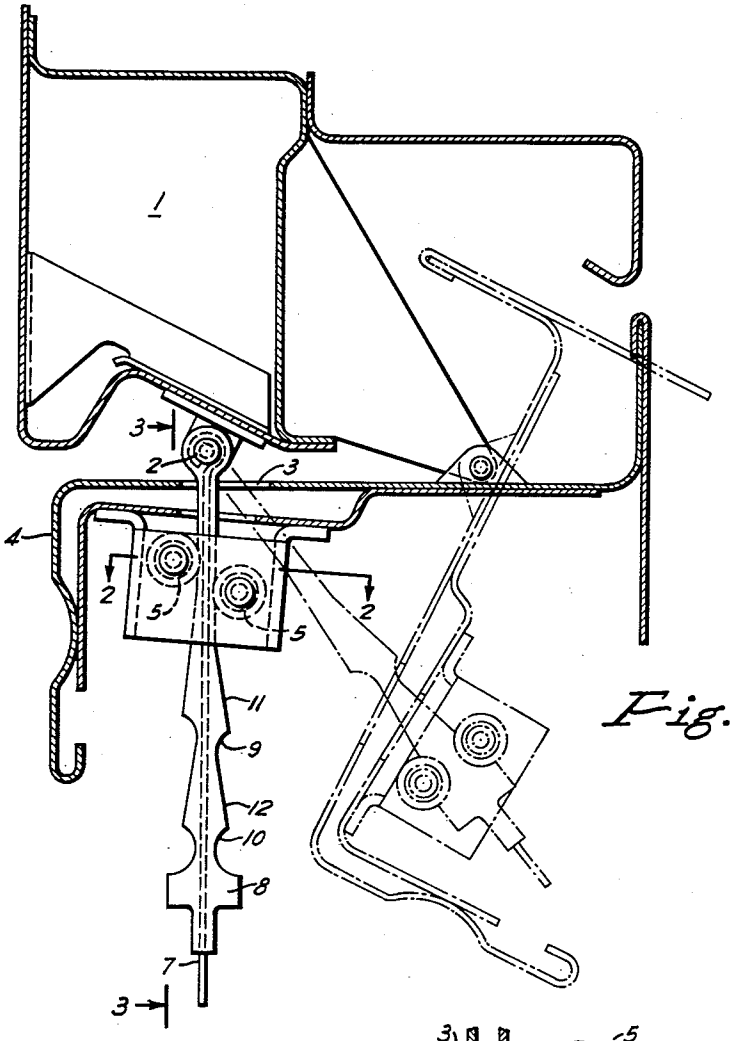


Fig. 1

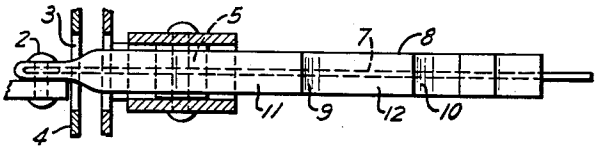


Fig. 3

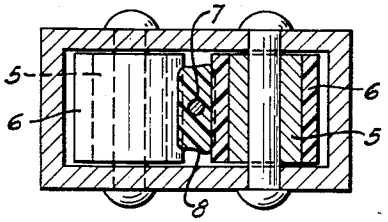


Fig. 2

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United States Patent Office 3,012,269
Patented Dec. 12, 1961

3,012,269

DOOR HOLDING DEVICE

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Filed Sept. 3, 1958, Ser. No. 758,728
Claims priority, application Germany Sept. 6, 1957
8 Claims. (Cl. 16—86)

This invention relates generally to a door holding device and, more particularly, to an improved resilient door holding device for motor vehicles which arrests the movement of the door in certain open positions.

It has been proposed heretofore to provide door holding devices for vehicle doors. When the door is opened, it is held in the open position by the door holding device to prevent closing of the door as persons are entering or leaving the vehicle. The heretofore known door holding devices usually comprise either, a metallic member hinged to a door post which extends into a door through an opening and has near its opposite end a notch which frictionally engages the opening when the door is opened, or a spring-like metallic plate member which acts on a door hinge arm throughout its arc of travel. The plate member has a depression in which the hinge arm will seat in the open position of the door. These arrangements enable the door to be held in an open position even though the vehicle is in such a position that ordinarily the door would swing closed due to the force of gravity. These heretofore known door holding devices, however, have several distinct disadvantages. For example, it is often difficult to move the door from a stop position because of frictional resistance. Moreover, the metallic elements are noisy in their operation; and, usually, the parts become so worn as to eventually destroy their function.

It is, therefore, an object of the present invention to provide a flexible door holding device which assures positive arrest of an automobile door in one or more stop positions. It is another object of the present invention to provide a door holding device which allows the door to move into and out of stop positions easily and without undue resistance due to friction. Still another object of the present invention is to provide a door holding device which in operation is substantially without noise. A further object of the present invention is to provide a door holding device which substantially eliminates frictional wear. Still another object of the present invention is to provide a resilient door holding device which is made of an abrasion-resistant plastic. A still further specific object of the present invention is to provide a resilient door holding device which is manufactured from a homogeneous nonporous rubber-like polyurethane which can be made in a simple economical manner.

Other objects will become apparent with the following detailed description of the invention and with reference to the accompanying drawing in which:

FIGURE 1 is a vertical partial cross-section view illustrating a preferred embodiment of the present invention;

FIGURE 2 is a sectional view taken in the direction of the arrows 2—2 of FIGURE 1; and

FIGURE 3 is a sectional view taken in the direction of the arrows 3—3 in FIGURE 1.

The above objects and others are accomplished in accordance with the present invention, generally speaking, by providing a door holding device comprising essentially two parts, a moveable resilient rod hinged to a door post which extends into a door and within a guide arrangement affixed within the door. The unfastened end of the resilient rod moves with the door in an arc as the door is opened and arrests the movement of the door in certain

stop positions by the inter-action of the resilient rod with the guide arrangement. The relative movement of the resilient rod within the guide arrangement is accomplished through the elastic displacement of the resilient material. It is pointed out that not only the rod may be made of resilient material, but also the guide arrangement may have a covering of resilient material. Once a stop position has been reached, it is securely maintained thereat until a force intended to move the door overloads the elastic energy and forces a relative movement out of this position under a renewed elastic displacement of resilient material.

It has been found useful to provide the resilient rod with tapers which begin to increase as the stop positions are approached by the guide arrangement when the door is being opened. The tapers are essentially increased in cross-section of the resilient rod in a direction away from the hinge point and towards the respective stops on the rod. In a preferred embodiment, the resilient rod is constructed with a reinforcing bar of spring steel or the like embedded therein. The stops, as well as the tapers leading to them, are preferably formed of a flexible rubber-like polyurethane. The shaped flexible resilient rod provided by this invention may be cast from any suitable substantially nonporous rubber-like polyurethane plastic in which may be provided any desired cast-in place reinforcing element.

Any suitable substantially nonporous rubber-like polyurethane may be used to cast the flexible resilient door holding device provided by this invention, but best results are obtained when the polyurethane has a Shore A hardness of from about 70 to about 90°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600%. For example, the polyurethane may be prepared by reacting any suitable organic polyisocyanate with any suitable organic compound having reactive hydrogens and capable of reacting with the polyisocyanate to form a polyurethane. For example, 1,5-naphthylene diisocyanate, p-phenylene diisocyanate, or 4,4'-diphenyl dimethylmethane diisocyanate may be reacted with a polyester, polyalkylene ether glycol, a polythioether glycol or the like having terminal groups which are predominately hydroxyl groups and a molecular weight of at least 750 and the resulting product may be cross-linked with an organic chain extender or cross-linker. Suitable cross-linking agents include ethylene glycol, diethylene glycol, butanediol, diprimary aliphatic and aromatic diamines, such as, toluylene diamine, or the like. Indeed, any organic compound having reactive hydrogen atoms may be reacted with an organic polyisocyanate, and a cross-linker as disclosed in U.S. Patents 2,729,618; 2,621,166; and 2,620,516 to form the polyurethane and any of the processes disclosed in these patents may be followed in making a polyurethane suitable for the present invention. Usually the door holding device will be formed by pouring a molten polyurethane in a suitable mold and about any metal parts to be embedded therein, and the contents of the mold will then be heated until cross-linking and curing has been obtained with solidification of the polyurethane into a flexible rubber-like substantially nonporous product having the shape of the mold.

It has been found that the door holding device provided by the present invention is not adversely affected by prolonged exposure to weather or such materials as oil and the like. The nonporous rubber-like polyurethane plastic is especially highly resistant to abrasion which guarantees a long service life for the door holding device.

The flexibility of the polyurethane plastic may be increased through the addition, during the manufacturing process, of activators, such as, for example, an alkali metal salt of an organic fatty acid or an aryl sulphonate, alkyl

sulphonate, or aryl alkyl sulphonate, respectively. Examples of alkali metal salts of organic fatty acids are sodium oleate, potassium oleate, sodium stearate, potassium stearate, lithium linoleate, and the like. Examples of suitable sulphonates include dioctyl sodium sulphonate and isopropyl naphthaline sodium sulphonate. An important advantage of the nonporous rubber-like polyurethane as a material consists in the fact that in the molten stage it can be cast or molded into any desired form.

The frictional characteristics, i.e. the coefficient of friction, of the polyurethane plastic may be improved by the addition to the polyurethane melt of lubricating agents, such as, silicone oil, hydrocarbons, and molybdenum disulfide. Each of these lubricating agents may be added in quantities of from about 0.01% to about 5% by weight, and preferably from about 0.1% to about 1% by weight, based on the weight of the cured rubber-like polyurethane plastic.

Any suitable hydrocarbon may be utilized as a lubricant, such as, for example, high boiling petroleum fractions including kerosene and conventional lubricating oils and waxes including paraffin, beeswax, ceresin, and the like.

The molybdenum disulfide should preferably be of a high technical grade and of high purity. Methods for preparing substantial pure molybdenum disulfide are disclosed in U.S. Patents 2,367,946 and 2,686,156. The products of the methods disclosed in these patents are particularly well suited for use in this invention.

Any suitable liquid organo-polysiloxane may be used as the silicone oil, provided the viscosity thereof is from about 50 to about 500 centistokes at 20° C. Examples of suitable silicone oils include dimethylsiloxane polymers having a viscosity of about 50 centistokes at 20° C., dimethylsiloxane polymers having a viscosity of about 140 centistokes at 20° C., and dimethylsiloxane polymers having a viscosity of 440 centistokes at 20° C., and mixtures thereof.

It has been found that bearing surfaces of rubber-like polyurethane plastics having molybdenum disulfide, hydrocarbons, and silicone oil incorporated therein display an extraordinarily low coefficient of friction. For example, the coefficient of friction between the rubber-like polyurethanes and steel is about 0.1.

Referring again to the drawing for a more detailed description of the invention; FIGURE 1 illustrates in a partial section a door **4** hinged to a door post **1**. The door post is provided with a pin **2** which anchors one end of the resilient rod to the door post. The resilient rod comprises a reinforcing metallic element **7** about which has been cast a substantially nonporous rubber-like polyurethane **8** having a Shore A hardness of from about 70 to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600%. A slot **3** is provided in door **4** so that the resilient rod will not interfere with the movement of the door **4**. Affixed to the interior of door **4** is a guide arrangement comprising two offset rollers **5** which have a covering **6** of a nonporous rubber-like polyurethane having a Shore A hardness of from about 70 to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600%. With the opening of the door **4**, the free end of the resilient rod moves in an arc arresting the movement of the door in stop positions **9** and **10** by inter-action with the rollers **5** of the guide arrangement. A taper **11** or an increase in cross-section begins in an area nearest the hinge point and increases towards the first stop position **9**. Thereafter, another increase in cross-section or taper **12** is provided towards the stop position **10**. FIGURE 2 illustrates the elastic displacement between the resilient rubber-like polyurethane **8** of the rod and the covering **6** of the rollers **5** of the guide arrangement. FIGURE 3 is a side elevation view of the door holding device in which the guide arrangement and the door **4** are taken in section.

The following example illustrates the preparation of one polyurethane suitable for forming the door holding device provided by this invention:

Example 1

1,000 parts by weight of an hydroxyl polyester obtained by thermal esterification of about 11 mols of adipic acid with about 12 mols of ethylene glycol and having an hydroxyl number of about 52 and an acid number of about 1 are heated to a temperature of about 135° C. and under a vacuum of about 12 mm. until the formation of bubbles has stopped and the polyester is completely free from water. Now, 180 parts by weight of naphthylene-1,5-diisocyanate are added at 135° C. to the dehydrated polyester while stirring. As soon as the temperature starts to drop, 20 parts by weight of butylene glycol-1,4 are stirred into the mixture at about 135° C. The resulting mixture is poured into a suitable mold. This has been so designed that any rigid element may be inserted in the mold in properly alined relation and the polyurethane is cast thereabout and solidified by curing. The above mixture is maintained in the mold at a temperature of about 110° C. for about 24 hours to form a homogeneous polyurethane rubber. After 24 hours the resilient rod is removed from the heating chamber and the material then shows the following properties: Shore A hardness 90°, resiliency 35%, elongation 450%.

It is to be understood that any suitable organic polyisocyanate, organic compound having reactive hydrogen atoms, and cross-linking agent may be substituted for those in the foregoing example. Examples of these materials suitable for this purpose are found in the aforesaid patents. Moreover, it is to be understood that variations are permissible in the temperatures and processing steps as long as the product obtained has the required physical characteristics.

As indicated hereinbefore, the molecular weight of the organic compound having reactive hydrogen atoms which is reacted with the organic polyisocyanate in the preparation of the polyurethane should be at least about 750. Although the chemistry involved in the preparation of the polyurethane is not specifically involved in this invention because any polyurethane having the required physical characteristics may be used to form the door holding device, it is considered advisable to point out that the polyester may be prepared by esterification of any suitable polycarboxylic acid, such as, for example, adipic acid, succinic acid, and the like. A desirable polyalkylene ether glycol may be prepared by the condensation of a lower alkylene oxide, such as, for example, ethylene oxide, propylene oxide, butylene oxide, and the like.

Although the invention has been described in considerable detail in the foregoing for the purpose of illustration, it is to be understood that such detail is solely for this purpose and that variations can be made by those skilled in the art without departing from the spirit and scope of the invention except as is set forth in the claims.

What is claimed is:

1. A door holding device for motor vehicles comprising a tapered solid resilient rod of a nonporous polyurethane plastic having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30 percent to about 50 percent and an elongation of from about 300 percent to about 600 percent, said rod adapted to be hinged to a door post and having a free end adapted to extend into a door hinged on said door post, a pair of spaced-apart rollers adapted to be affixed in the door, means provided in said rod and operating in conjunction with said rollers for arresting the movement of said door comprising at least one area of constriction on said resilient rod into which said rollers move by compressing said resilient rod adjacent said constriction.

2. A door holding device comprising a pair of spaced

apart rollers affixed with a door adjacent a slot provided in said door, a solid tapered resilient rod pivotally connected to a door post and extending into said door through said slot and between said rollers, the distance between said rollers being less than the smallest width between the edges of said rod engaged by said rollers, said rod having at least one depression therein for engagement with said rollers for arresting the movement of said door in the open position.

3. The combination according to claim 2, wherein said resilient rod comprises a nonporous polyurethane plastic having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600%.

4. A door holding device comprising a pair of spaced apart rollers affixed within a door adjacent a slot provided in said door, a solid tapered resilient rod pivotally connected to a door post and extending into said door through said slot and between said rollers, the distance between said rollers being less than the smallest width between the edges of said rod engaged by said rollers, said rod having an increasing width in a direction away from said pivot connection and at least one depression therein for engagement with said rollers for arresting the movement of said door in the open position.

5. The door holding device of claim 4 wherein said resilient rod comprises a non-porous polyurethane plastic having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600%.

6. A door holding device comprising a pair of spaced apart rollers affixed within a door adjacent a slot provided in said door, a solid tapered resilient rod pivotally connected to a door post and extending into said door through said slot and between said rollers, said resilient rod comprising a non-porous polyurethane plastic portion having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600% and a metallic reinforcing member substantially embedded in said polyurethane plastic, the distance between said rollers being less than the smallest width between the edges of said rod engaged by said rollers, said rod having an increasing width in a direction away from said pivot connection and at least one depression therein for engagement with said rollers for arresting the movement of said door in the open position.

7. A door holding device comprising a pair of spaced apart rollers affixed within a door adjacent a slot provided in said door, a solid tapered resilient rod pivotally connected to a door post and extending into said door through said slot and between said rollers, said resilient rod comprising a non-porous polyurethane plastic portion having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600% and a metallic reinforcing member substantially embedded in said polyurethane plastic, the distance between said rollers being less than the smallest width between the edges of said rod engaged by said rollers, said rod having at least one depression therein for engagement with said rollers for arresting the movement of said door in the open position.

8. A door holding device for motor vehicles comprising a tapered solid resilient rod adapted to be hinged to a door post and having a free end adapted to end into a door hinged on said door post, a pair of spaced apart rollers adapted to be affixed in the door, said resilient rod comprising a non-porous polyurethane plastic portion having a Shore A hardness of from about 70° to about 95°, an elasticity of from about 30% to about 50%, and an elongation of from about 300% to about 600% and a metallic reinforcing member substantially embedded in said polyurethane plastic, means provided in said rod and operating in conjunction with said rollers for arresting the movement of said door comprising at least one area of constriction on said resilient rod into which said rollers move by compressing said polyurethane plastic adjacent said constriction.

References Cited in the file of this patent

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,012,269 December 12, 1961

Günter Bartel

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 1, for "with" read -- within --; column 6, line 24, for "end" read -- extend --.

Signed and sealed this 15th day of May 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents