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G. ERB ETAL

3,484,993

SWINGABLE SLIDING CAR DOOR ASSEMBLY

Filed April 17, 1968

3 Sheets-Sheet 1

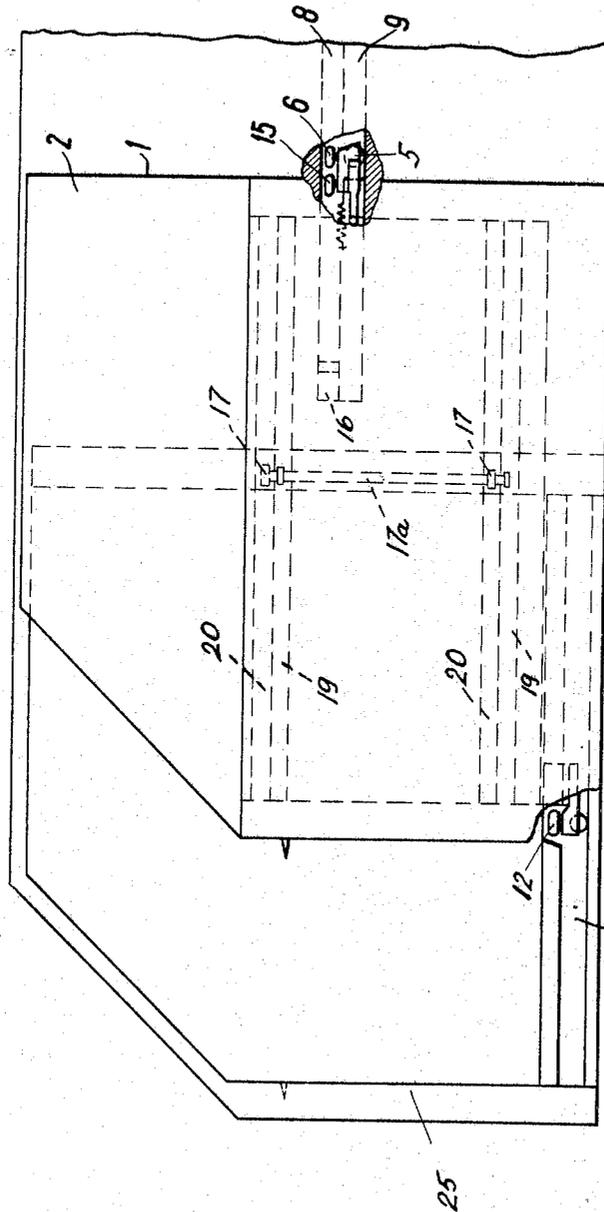


Fig. 1

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3 Sheets-Sheet 2

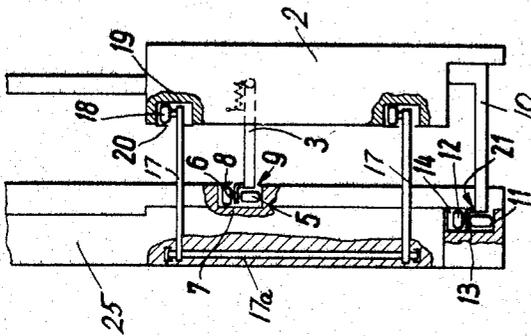


Fig. 3

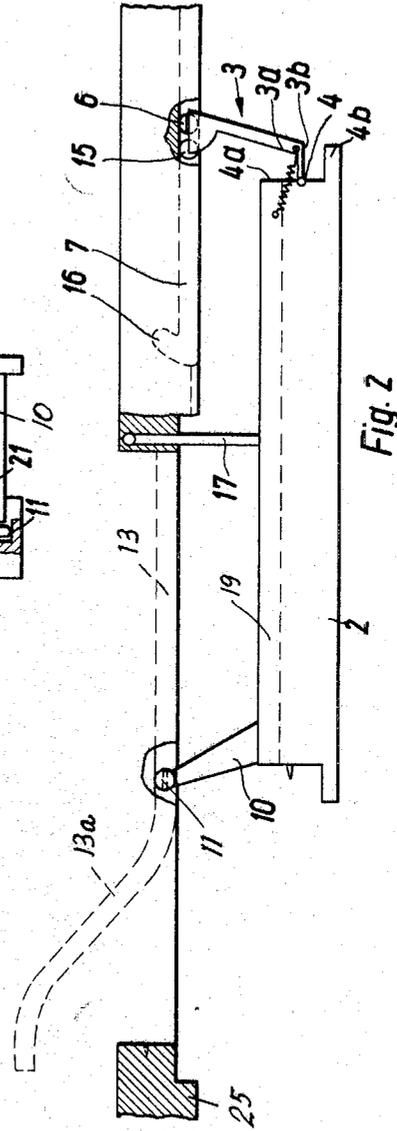


Fig. 2

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3 Sheets-Sheet 3

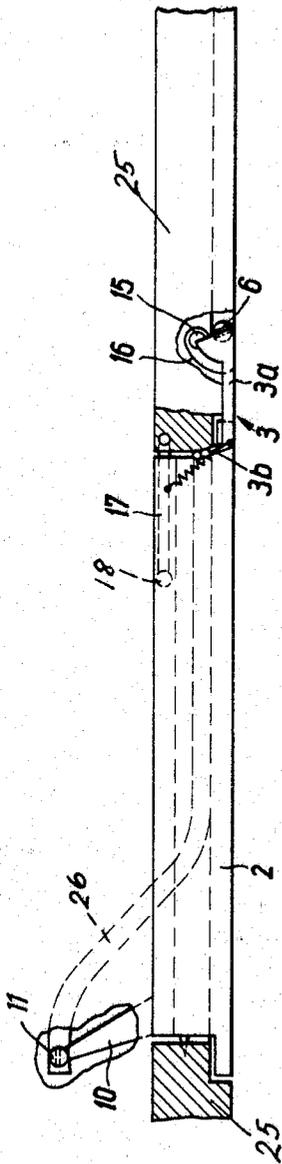


Fig. 4

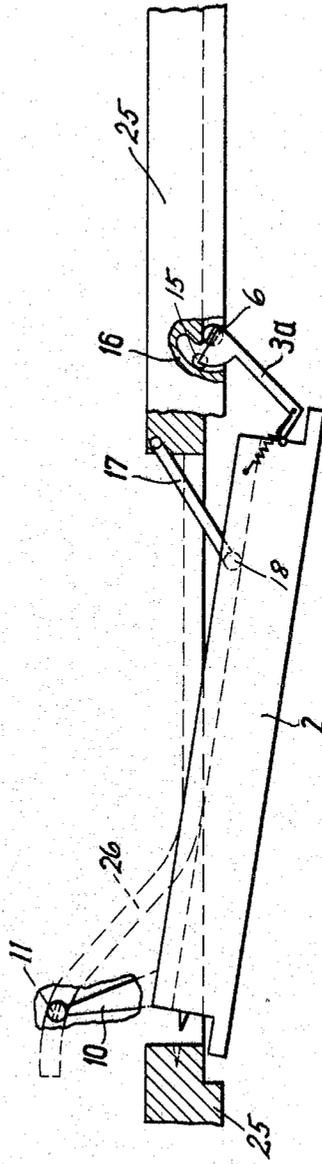


Fig. 5

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SWINGABLE SLIDING CAR DOOR ASSEMBLY
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 Claims priority, application Germany, Apr. 21, 1967,
 W 43,822

Int. Cl. E05d 15/10

U.S. Cl. 49—216

5 Claims

ABSTRACT OF THE DISCLOSURE

A door for a car, particularly for a passenger car, which can be opened and closed by a combined swinging and sliding movement. Linkage means support and steady the door in all positions thereof. The links and other components associated therewith are concealed, except for an elongate narrow slot per door on the outside of the car body. Closing of the door can be effected either slowly or by slamming similar to slamming of a hinged door.

CROSS REFERENCES

Copending application Ser No. 721,993 filed Apr. 17, 1968; copending application Ser. No. 722,039 filed Apr. 17, 1968.

SPECIFICATION

The invention relates to a swingable sliding door for cars, especially passenger cars, and more particularly to a swingable sliding car door which is held in vertical position by two rigidly joined support bars hingedly secured on the door frame of the car body in vertically spaced and mutually parallel relationship. The free ends of the support bars are slidably guided in guide tracks on the inside of the door, which is further guided by a guide arm extending from a side edge of the door and linked to a carrier guided on a guide track provided on the car body, generally near the door opening thereof.

There are known, for instance, from British Patent 389,061, swingable sliding car door assemblies in which below the lower edge of the door opening a guide track is mounted along which a slide is rollably guided. A guide bar is hinged to the slide and guided between two pairs of rolls which are fixedly mounted on the inside wall of the door.

As is evident, in such door assembly the door, after having been swung by means of a pivotally secured arm into the swung-out position, slides along the guide bar. One end of the guide bar is simultaneously moved along with the slide in the guide track mounted below the lower edge of the door.

A door assembly of the kind disclosed in the aforesaid British patent has the disadvantage that due to unfavorable directions of force and an unfavorable distribution of the load, a convenient slamming of the door—as is possible with hinged doors and as is also desirable for sliding doors—is not possible. Moreover, the door is not safely guided at all points, particularly when the door is in the swung-out position; as a result, the door cannot sustain additional loads as may be caused, for instance, by a person leaning on the open door.

It is an object of the invention to provide a novel and improved swingable sliding door which is fully supported in all positions, can be conveniently slammed and the manufacture of which is simple and inexpensive.

Another more specific object of the invention is to provide a novel and improved swingable sliding door, the entire guiding and supporting mechanism of which is concealed except for a narrow slot per door so that the outer

appearance of the car body is not adversely affected to any appreciable extent.

The aforepointed out objects, features and advantages, and other features and advantages which will be pointed out hereinafter, are obtained by linking to approximately the middle of one of the vertical door edges one end of a guide arm, the other end of which has secured thereto a support roll rotatable about a horizontal axis. A guide roll on said other guide arm end, preferably disposed above the support roll, is rotatable about a vertical axis and both rolls are slidable in a guide track, which preferably has a rectangular cross-section, in an outside wall of the car body. The guide track is partly lengthwise covered by a strip secured to the car body, preferably flush therewith. The overhang of the strip locks the guide roll in the guide track and thus also the support roll and the guide arm.

The support roll, that is, the roll which rotates about a horizontal axis, has advantageously a somewhat outwardly curved peripheral surface so that it can perform a corresponding turning movement with reference to its rotational axis, as is necessary or at least desirable at the beginning of the swinging out movement of the door.

An arrangement as just described assures smooth movements of the guide arms and of the associated rollers within the guide track and such smooth movements of all components with reference to each other is obtained with a minimum of structural components. Moreover, the arrangement also makes possible an easy slamming of the door.

It is known to secure to about the middle of a vertical edge of a swingable sliding car door a guide arm for supporting the respective door end by a roll, which is guided by a guide track mounted on a cross beam above the door opening. Such an arrangement has the disadvantage of seriously affecting the outer appearance of the car body.

According to a further aspect of the invention, a support arm is rigidly secured to the edge of the door opposite to the one referred to in the next preceding paragraph. The support arm mounts a support roll rotatable about a horizontal axis and above the support roll a guide roll rotatable about a vertical axis. Both rolls are guided within a track disposed in an outside wall of the car body below the sill of the door frame. The upper part of this horizontal track is lengthwise covered by a cover strip preferably substantially flush with the outside wall of the car body for locking the guide roll and with it the support bar in the guide track. Such an arrangement does not appreciably affect the outer appearance of the car body since merely a narrow slot per door having a width approximately corresponding to the thickness of the guide arm or the support arm is visible.

As the support of the door at different points is effected by means of the support arm and the guide arm guided in partly concealed tracks similar but displaced with reference to each other, the upper part of the car body is kept entirely free of guide tracks.

Support of the door against lateral tilting is effected by support bars pivotally secured to the door frame. Each support arm mounts on its free ends a roll rotatable about a vertical axis and guided on a branch of a track of U-shaped cross-section provided on the inside wall of the door, preferably flush with the same.

To facilitate the final closing movement of the door when the same approaches its closed position, a second guide roll is provided on the guide arm next to the guide roller rotating about a vertical axis. The second guide roll enters in a curved track section at the end of the guide track just before the door reaches its closed position.

In the accompanying drawing, a preferred embodiment

of the invention is shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is an elevational inside view, partly in section, of a swingable sliding car door assembly according to the invention;

FIG. 2 is a plan view, partly in section, of FIG. 1;

FIG. 3 is a righthand side view, partly in section, of FIG. 1;

FIG. 4 is a plan view, partly in section, of the door in its closed position; and

FIG. 5 is a sectional plan view similar to FIG. 4, but showing the door in an intermediate position such as a partly opened position.

Referring now to the figures more in detail, there is shown a door 2. A two-arm link 3 is linked with one arm 3b to a lining 4a of vertical door edge 1, at about the mid-point of the door lining which is continued by a lip 4b. The angle of link 3 is such that in the closed position of the door, arm 3a is substantially flush with the outer wall of a car body 25 and arm 3b extends into the door opening, as best shown in FIG. 4. Arm 3a of link 3 mounts a support roll 5 rotatable about a horizontal axis and a guide roll 6 rotatable about a vertical axis is mounted above the support roll. Both rolls 5 and 6 are guided in a guide track 7 formed in the outside wall of car body 25. This track is partly covered along its length by a strip 8, preferably substantially flush with the outer surface of the car body. The strip defines a narrow slot 9 through which arm 3a of bell crank arm 3 extends into track 7. As can best be seen in FIG. 3, counter roll 6 abuts preferably against strip 8 thereby preventing arm 3a and support roll 5 from leaving track 7.

Roll 5 has preferably a slightly outwardly curved peripheral surface, thereby assuring a smooth movement of the roller within the track. At the left hand or front side edge of the door as shown in FIG. 1, a support arm 10 is rigidly mounted. The free end of this arm has mounted thereon a support roll 11 rotatable about a horizontal axis and a guide roll 12 rotatable about a vertical axis. Both rolls 11 and 12 are displaceable in a track 13 continued by a curved track portion 13a for guiding the door inwardly and into the door opening. Track 13 is also partly lengthwise covered by a strip 14 secured to a wall portion of the car body substantially flush therewith. As can best be seen in FIG. 3, the strip retains rolls 12 and 11 in track 13.

The free end of guide arm 3 mounts, in addition to guide roll 6, a guide roll 15, also displaceable in track 7. Just before the door reaches its closed position, roll 15 enters a hook portion 16 contiguous of track 7 and facing backwardly in the direction of movement of the door toward its closed position. As is evident, movement of roll 15 into hook portion 16 forces the door fully into its closed position.

The door is further supported by support arm 10 and link 3 mounting rolls 6 and 11, which as previously described, slides in similar arranged guide tracks 7 and 13, respectively.

Tilting of the door out of its normal perpendicular plane is prevented by support bars 17 pivotal on and rigidly joined on one end by a shaft 17a in vertically spaced apart and mutually parallel relationship. The other end of each bar 17 mounts a roll 18 rotatable about a vertical axis and slidable in a guide track 19 formed in the inner inside wall of the door. Both rolls 18 are retained in track 19 by a strip 20 partly lengthwise overlying track 19.

As previously described, FIG. 4 shows clearly that arm 3a of each door link 3 is substantially flush with the outside wall of car body 25 and that arm 3b is located between the door edge 1 and the wall of car body 25 so that each link is invisible for all practical purposes.

As is now apparent, a swingable sliding door assembly when closed according to the invention presents sub-

stantially the same appearance as a hinged door, except for the narrow slot 21 (defined by strip 14) and slot 9 (defined by strip 8).

To sum up, the invention provides a novel and improved swingable sliding car door assembly which can be opened and closed with very little effort and requires merely two slots on the outside of the car. As these slots are very narrow due to the provision of cover strips, they are very nearly invisible with respect to the outer appearance of the car body. The tracks required on the door also do not materially affect the appearance of the inner wall of the door. Accordingly, the door of the invention may be used with highly styled passenger cars.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

We claim:

1. A swingable sliding door assembly for a car comprising in combination:

- (a) a car body including an opening for a door;
- (b) a door swingable and slidable into and out of a position closing said door opening;
- (c) a pair of support bars (17);
- (d) a pivot shaft secured to the car body in vertical position, said shaft mounting said support bars pivotally in vertically spaced and mutually parallel relationship;
- (e) said door having in its inner side wall a pair of horizontal elongate and vertically spaced first guide track grooves, the other end of each of said support bars extending into one of said track grooves positively and slidably retaining therein, said bars supporting the door in vertical position in any of its positions;
- (f) a support arm (10) fixedly secured on one end to the inside wall of the door adjacent to the lower corner of the front edge thereof, said car body having a second guide track groove in a wall below the bottom edge, said second guide track groove being engaged by the other end of said support arm and having a curvature such that the door is displaced between a door closing position substantially flush with the respective outside wall of the car body and a door opening position outwardly spaced from said outside wall of the car body parallel thereto upon sliding of said other ends of the support arms along said second guide track groove;
- (g) a link (3) pivotally secured on one end to the door at the rear edge thereof;
- (h) a support roll mounted on the other end of said link rotatable about a horizontal axis, said car body having in an outside wall portion adjacent to the rear edge of the door a third guide track groove slidably engaged by the support roll on the other end of said link, said link being pivotal about said support roll;
- (i) a guide roll also fixedly mounted on the other end of said link and slidably guided in said third guide track groove rotatable about a vertical axis; and
- (k) a cover strip lengthwise secured to said outside wall portion of the car body partly overlying said third guide track groove to retain said guide roll and thus said link therein.

2. The car door assembly according to claim 1 wherein each of said support bars pivotally supported on the car body mounts at its free end a guide roll rotatable about a vertical axis and slidable in the respective first guide track groove in the inside wall of the door, and wherein a cover strip is secured to said inside wall substantially flush therewith and partly overlying the first guide track

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groove therein, said cover strip retaining the guide roll positively in the track groove.

3. The car door assembly according to claim 1 wherein a support roll rotatable about a horizontal axis and slidably guided in said second guide track groove and a guide roll rotatable about a vertical axis and also slid- 5
able in said second guide track groove are mounted on the free end of said support arm (10), and wherein a cover strip is secured to the car body extending along said second guide track groove partly overlying the same, 10
said cover strip positively retaining said last mentioned guide roll and thus said support arm therein.

4. The car door assembly according to claim 1 wherein said third guide track groove terminates at its free end in a rearwardly facing hook portion, and wherein a second 15
guide roll is mounted on said link and slidably disposed in said third guide track groove on the side of the first guide roll facing said hook portion, said second guide roll entering said hook portion just prior to the door reaching its closed position to pull the door into 20
said closed position.

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5. The car door assembly according to claim 1 wherein said link has two arms defining an angle therebetween, one arm being linked to the rear edge of the door and the other arm rotatably supporting said support roll and said guide roll, the angle defined by the link arms being such that said one arm extends between the rear edge of the door and the adjacent wall portion of the car body and said other arm is substantially flush with said outside wall portion of the car body when the door is in its closed position.

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