Feb. 3, 1970 P. J. McGIRR 3,493,033

DOORS

Filed Aug. 12, 1968 2 Sheets-Sheet 1

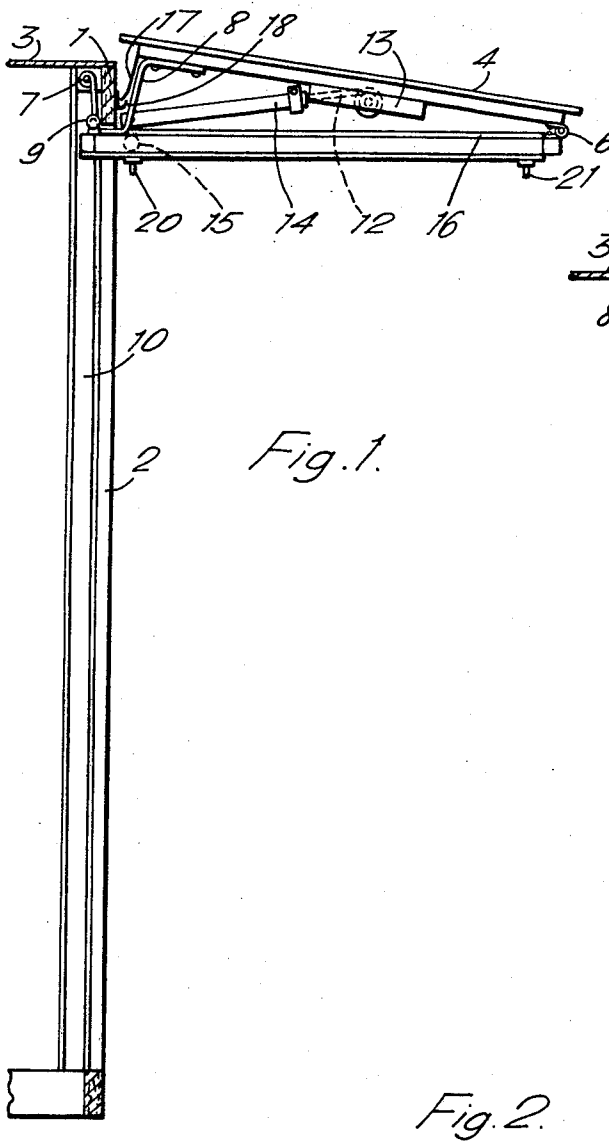


Fig. 1.

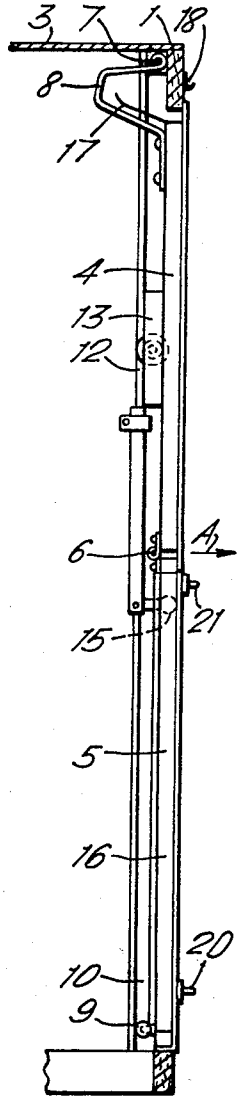


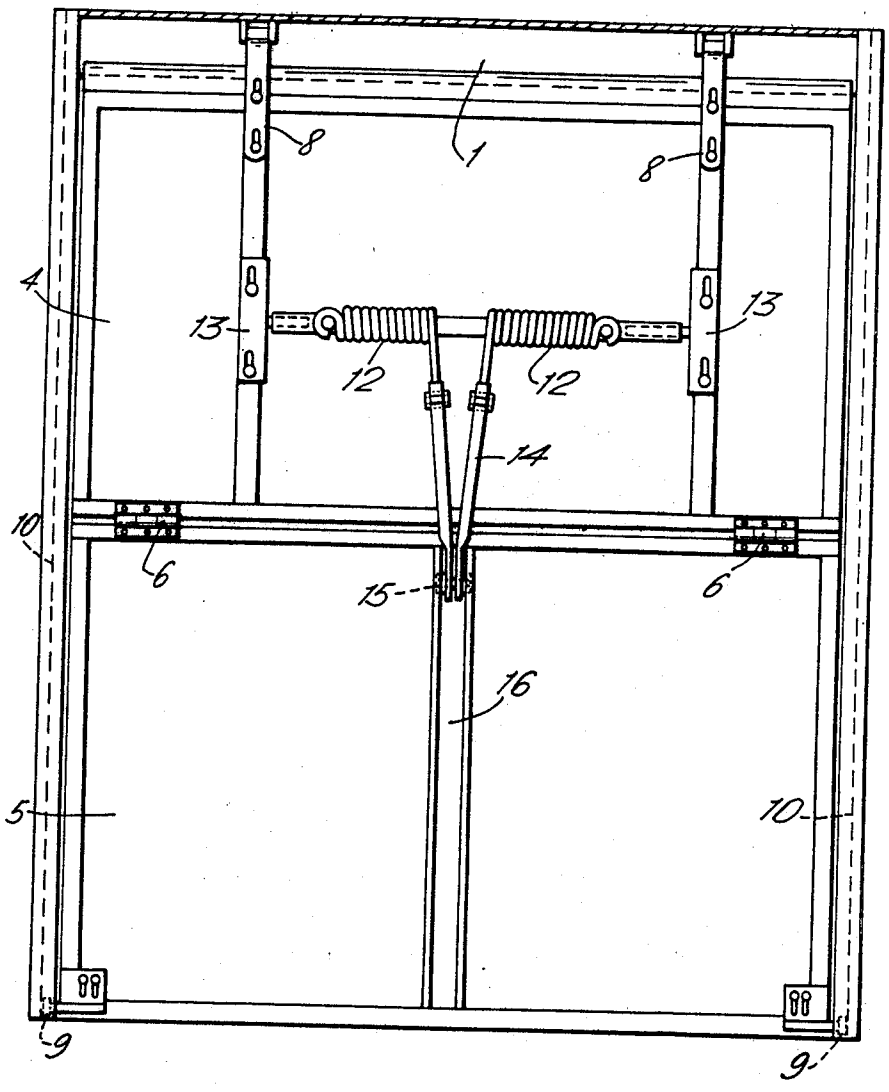
Fig. 2.

Feb. 3, 1970 P. J. McGIRR 3,493,033

DOORS

Filed Aug. 12, 1968 2 Sheets-Sheet 2

Fig. 3



United States Patent Office

3,493,033

Patented Feb. 3, 1970

3,493,033

DOORS

Patrick Joseph McGirr, 2 Kilbarrack Ave., Dublin 5, Ireland

Filed Aug. 12, 1968, Ser. No. 752,035
Int. Cl. E05d *15/26;* E05f *11/02*
U.S. Cl. 160—207 13 Claims

ABSTRACT OF THE DISCLOSURE

A foldable door for a delivery van having upper and lower door sections hingably connected together, pivot means connecting the upper door section to the top of a door in said van, track means alongside the edges of said door, and biasing means secured to one of the door sections adapted to exert a leverage upon the other door section.

This invention concerns foldable doors of the kind which comprise a plurality of sections hinged together, the door hinges, as also the hinges between the sections having their pivotal axes arranged horizontally. A door of this kind is described, for example, in British patent specification No. 1,017,836, as applied to a van body, with the door at the rear of the van hinged to the van body and counterbalanced so that it is a simple matter to raise or lower the door whenever desired, the sections of the door folding towards each other as the door is raised. Very little effort on the part of the attendant is thus required to move the door either up or down, to expose or cover the door opening as desired.

In the construction described in the aforesaid patent specification, the lower door section is guided at the bottom in vertical tracks at either side of the door opening so as to be movable upwards beneath the upper door section, and in order to counter-balance a substantial portion of the weight of the door, a spring-loaded roller is mounted horizontally near the top of the door opening, tapes which are attached at their free ends to the lower door portion being wound on the roller. An object of the present invention is to provide an improved construction whereby the weight of the door sections is substantially counter-balanced in a simple manner without employing a spring-loaded roller upon which tapes attached to the lower door section may wind or unwind as the door is raised or lowered. The present invention also provides an improved hinge construction for the mounting of the door.

Although in carrying out the invention it is necessary to provide a vertical track at each side of the door opening in order to guide the bottom of the door to move in a vertical plane, the fact that a spring roller adjacent to the top of the door is dispensed with also enables the hinges at the top of the door, if desired, to be pivoted on the inside and to pass below, the top rail of the door opening instead of passing over said top rail, so that when the door is closed the hinges are not visible from the outside of the door (i.e. from the side of the door opening on which the door is adapted to open).

Accordingly the invention provides a foldable door of the kind referred to wherein the lower door section is guided at the bottom by vertical tracks, one at each side of the door opening, and a force tending to fold said lower door section towards the upper door section to which it is hinged is applied by spring means secured to one of the door sections and adapted to exert a leverage upon the other door section. The arrangement may be so contrived that the point of application of the spring force tending to fold the lower door section towards the upper door section changes as the angle between the door sections changes in such a way as substantially to compensate for the increase or decrease in the spring tension which occurs as the angle between the two door sections increases or decreases. Preferably the spring means which advantageously comprise coiled springs, torsion bars or the like, are mounted in a radial position on one of the door sections so as to exert a turning moment upon the other door section hinged thereto, through the agency of a lever arm, the free end of which movably engages the last mentioned door section.

According to a further feature of the invention the upper door section is carried by hinges mounted adjacent to the horizontal rail which defines the top of the door opening with their pivot pins on the opposite side to that on which the door is adapted to open, said hinges having U-shaped portions which pass through the door opening beneath said rail and thereby raise the upper end of the upper door section above said opening when the door is fully open. This enables substantially the full height of the door opening to be utilised. The construction may be so carried out that when the lower door section is in its fully open position, the upper door section lies at an angle thereto while the lower door section is in such a position relatively to the guide tracks that the forces acting on the lower door sections, due to their respective weights and the reaction of said tracks, tend to close said angle, such closure being prevented by abutment means, whereby the door sections are held in a position of equilibrium.

SUMMARY OF THE INVENTION

In accordance with the invention the objective is achieved by providing a foldable door having an upper and lower door section. The lower door section is hingedly connected to the upper door section about a horizontally disposed axis and guide track means are disposed along the edges of the door for guiding the lower door section. Pivotable means are disposed near the top edge of the upper door section. Biasing means mounted on one of the door sections and engaging the other door section by movable connection means, the movable connection means exerting on the other door section a leverage compensating for the change in tension which occurs in the biasing means as the angle between the door sections varies during opening and closing of same.

A preferred construction of folding door according to the invention (particularly suitable for application to the back of a delivery van), is hereinafter described by way of example with reference to the accompanying drawings, wherein:

FIGURE 1 is a side sectional elevation showing the folding door when fully open,

FIGURE 2 is a similar view of the door in its closed position, and

FIGURE 3 is an elevation corresponding to FIGURE 2, with the door closed, as seen from inside a van body.

Referring to the drawings, the door opening to be covered by the door is defined at the top by the head rail **1**, and at each side by posts **2**, as is customary. In the case of a van body, as shown, the rail **1** may adjoin the roof **3**.

The door comprises two sections **4**, **5** hinged together by hinges **6** so as to be foldable about a horizontal axis. The upper door section **4** is suspended from hinge pins **7** mounted on the side of the head rail **1** remote from that on which the door opens. The leaves **8** of the hinges to which the door section **4** is secured are extended to form substantially U-shaped arms as viewed in FIGURES 1 and 2, said arms passing through the door opening. Thus, when the door is in the open position as shown in FIGURE 1, the upper portion of the door section **4** is raised

above the door opening, while when the door is closed as shown in FIGURE 2, the hinges are not visible from the other side of the door, i.e. the outside. The shape of the hinges and the position of the hinge pins **7** in relation to the head rail are such that when in its fully open position the hinge arms **8** rest against the lower side of the head rail. At the bottom of the lower door section **5** is mounted, at each side, a roller **9** which engages an upright guide track **10** secured to the post **2**. The rollers **9** are preferably adjustable vertically in relation to their position as seen in FIGURE 3.

It will be evident that with this construction, when the door is fully closed, the door sections **4** and **5** will lie in the same plane, as shown in FIGURE 2. In order to open the door, the hinge **6** connecting the two sections is moved outwards, in the direction of the arrow A in FIGURE 2. A handle **20** may be provided on the outside of the door section **5** to enable it to be moved upwards, while, if desired, a second handle **21** may be mounted near the hinge **6** to enable the latter to be pulled outwards. The lower edge of the door section **5** is constructed to move vertically by the engagement of the rollers **9** with the tracks **10**, while the hinges **8** move the upper door section **4** into a raised position, as shown in FIGURE 1, until ultimately the lower door section may be substantially horizontal in position immediately below the head rail **1**. Full use may thus be made of the door opening.

According to the present invention, the weight of the door sections is substantially counter-balanced during the pivotal movement thereof, and this is achieved by spring means tending to close the hinge **6**. This may be effected in several ways, but the construction shown in the drawings is particularly simple and effective. Coil springs **12** are mounted in a medial position on the door section **4**, as shown more clearly in FIGURE 3. The springs are mounted on a rod or tube carried by angle members **13** and their tension can be adjusted in known manner. At one end the springs are extended and telescopically secured in an adjustable manner to arms **14**, the free ends of which extend across the axis of the hinges **6** and carry rollers **15** which engage in a guideway **16** secured to the door section **5**. The angle members **13** carrying the springs **12** are also advantageously adjustable on the door section **5**.

The springs **12** are suitably tensioned so that a leverage is applied tending to close the hinges **6**. This has the effect of tending to move the door sections from the position shown in FIGURE 2 to the position shown in FIGURE 1, in which the door section **5** can be raised no farther, the rail **1** acting as an abutment limiting the upward movement of said door sections. It will be evident from a consideration of FIGURES 1 and 2, that when the parts are in the position shown in FIGURE 2, although the springs are fully tensioned, the leverage exerted on the door section **5** tending to turn it about the hinges **6** is relatively small. By suitable adjustment of the angle members **13** in a vertical direction combined with adjustment of the telescopic arms **14** the most advantageous point along track **16** for applying the spring pressure may be selected. If, to open the door, the handle **21** is pulled in the direction of arrow A, the component of the weight of the door section **5** (as well as that of the door section **4**) resisting the pull upon the handle **20** is relatively small, so that the doors move easily during this initial movement aided, of course, by the action of the springs **12**. As the movement proceeds further, however, the leverage exerted upon the door section **5** by the springs **12** increases as the rollers **15** move along the guideway **16**, the component of the weight of the door sections resisting such movement as the doors swing into their fully raised position, may be entirely counterbalanced in spite of the fact that the springs partially unwind during this movement. In order words, the change in the position of the point of application of the force exerted by the spring arms **14** on the door section **5** compensates for the partial unwinding of the spring as the door is raised. The turning moment tending to fold the lower door section towards the upper door section may therefore increase as the sections close together, in which case the door will remain in a raised position until the handle **20** is pulled downwards.

It, is however, not necessary to rely upon the effect of the springs **12** to retain the door sections in the position in which the lower door section is fully raised. By suitable choice of the dimensions and arrangement of the hinges **6**, the position of the tracks **10** in relation thereto, and the relative measurements of the door section, the result may be achieved that when the lower door section **5** is horizontal the weight of the door sections **4** and **5** acting downwards will cause a reaction between the rollers **9** and the tracks **10** in a direction perpendicular to said tracks and passing near to the axis of the hinge **6**. When this reaction intersects the hinge axis, the parts will be in unstable equilibrium, whereas if the line of action of said reaction passes above said hinge axis the two door sections will tend to close together by reason of their own weight. Such closure will be prevented, however, if further upward movement of the rollers **9** in the tracks **10** is blocked. Therefore, in the preferred construction according to the invention the head rail **1** affords an abutment preventing further upward movement of the adjacent portion of the lower door section just when the position of unstable equilibrium above mentioned is passed upon the raising of the lower door section. In this position said door section will be approximately horizontal as shown in FIGURE 1, while the angle between the two door sections is preferably between 10° and 15°.

It will thus be apparent that the door sections will tend to remain in the fully raised position by reason of their own weight and irrespective of the action of the springs **12**, and this condition is not affected even if the van or the like on which the door is mounted stands on a gradient. The effect produced is to offer a definite resistance to the initial downward movement of the door sections when the handle **20** is pulled to lower the door, until the point of equilibrium is passed, beyond which the weight of the door sections acting downwards is resisted only by the tension of the springs **12**.

Thus, by the construction according to the invention the doors may be raised or lowered by the application of a very small force to the handle **20** or **21** in the desired direction of movement. The doors are firmly held when raised, as described, in the preceding paragraph, while latch means, not shown, may be provided if desired to secure the doors in their fully closed positions. Other refinements may be added if desired, for example, a small drainage channel **17** (FIGURES 1 and 2) may be provided in association with the hinges **8** to catch and conduct laterally any moisture entering between the top of the door section **4** and the top rail **1** when the door is raised, together with a deflector **18** mounted on the top rail. Alternatively, a flexible cover may be provided to cover the space between said rail and the adjacent edge of the door section. The door sections may also be sealed along their side edges when closed so as to prevent the ingress of dust and moisture, and the sections may be made of any desired thickness to afford thermal insulation.

The invention is applicable not only to the rear doors of vans, but wherever doors of the kind referred to may be required, for example, as doors for garages, containers, as window shutters and so forth, to enable substantially the full door opening to be unobstructed when the door is opened.

What is claimed is:

1. A foldable door comprising an upper door section, a lower door section hingedly connected to said upper door section about a horizontally disposed axis and guide track means disposed along the edges of said door for guiding said lower door section, pivotal means near the top edge of said upper door section, and biasing means mounted on one of said door sections and engaging said

other door section by movable connection means, said movable connection means exerting on said other door section a leverage compensating for the change in tension which occurs in said biasing means as the angle between said door sections varies during opening and closing movement of said door sections.

2. The foldable door according to claim 1, wherein said movable connection means is slidable relative to said lower door section to counter-balance a proportion of the weight of said door sections and to compensate for the change in tension which occurs as the angle between said door sections varies.

3. The foldable door according to claim 2, wherein said biasing means is a spring.

4. A foldable door comprising an upper section, a lower section hingably connected to said upper section and guide track means disposed along the side edges of said door for guiding said lower section, pivotable means near the top edge of said upper section, spring means secured to one of said door sections in a medial position and adapted to exert a leverage upon the other door section whereby said sections tend to fold back-to-back toward each other about said hinge, the point of application of the spring force tending to fold said door sections toward each other being a function of the angle between said door section and movable to compensate for the change in spring tension which occurs as the angle between said door sections varies, and said spring exerting a turning movement upon the other door section by means of a lever arm, the free end of which has a movable connection with said other door section.

5. The foldable door according to claim 4, wherein said movable connection of said lever arm is provided by a guideway on one of said door sections in which is engaged a roller carried upon the free end of said lever arm, the other end of which is connected to the spring mounted on said other door section.

6. The foldable door according to claim 4, wherein said lever arm is a telescopic member.

7. The foldable door according to claim 4, wherein the position of the anchorage of said spring to one of the door sections is adjustable.

8. A foldable door according to claim 5, wherein said doors are hinged and arranged such that when said lower door section is in its fully open position said upper door section lies at an angle thereto, and said lower door section is in a position relative to said guide tracks that

forces which act on said lower door section, due to its respective weight and the reaction of said guide tracks, tend to close said angle, and abutment means preventing such closure and maintaining said door sections in equilibrium.

9. The foldable door according to claim 8, wherein said abutment means is adapted to stop the further upward movement of the lower door section immediately after said lower door section passes the position in which it extends perpendicularly from said guide tracks when being moved into a fully open position.

10. The foldable door according to claim 1, wherein said pivotable means comprises hinges mounted adjacent to a horizontal rail defining the top of the door opening, the axis of said hinges being on the opposite side of said rail to that on which the door is adapted to open, and said hinges being shaped so that the upper portion of said upper door section is raised above said opening when said foldable door is fully open.

11. The foldable door according to claim 9, wherein said horizontal rail of the door opening provides the abutment means for said lower door section limiting the opening movement of same when said lower door section is in a substantially horizontal position.

12. The foldable door according to claim 10, wherein said lower door section is in a position of maximum opening when said upper door section is disposed at an acute angle thereto of between about 10° and 15°.

13. The foldable door according to claim 10, wherein said door opening is part of a truck van body.

References Cited

UNITED STATES PATENTS

784,896	3/1905	Schommer	160—207 X
1,529,973	5/1927	Rush et al.	160—207
1,716,394	6/1929	Trammell	160—191
2,274,216	2/1942	Sanders	160—207 X
2,362,789	11/1944	Workman	160—190
2,592,027	4/1952	Hagerup	160—191
2,722,273	11/1955	Taylor	160—191
3,085,622	4/1963	Burgin	160—207 X

DENNIS L. TAYLOR, Primary Examiner

U.S. Cl. X.R.

160—192