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Knothe et al.

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[45] **Jan. 30, 1973**

[54] **VEHICLE BODY BOX EQUIPPED WITH AT LEAST ONE SLIDING DOOR**

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[52] **U.S. Cl.** **296/146,** 49/217

[51] **Int. Cl.** **B60j 5/04**

[58] **Field of Search** ..... 296/146, 155, 28 M; 49/216, 49/217, 222, 224; 105/378

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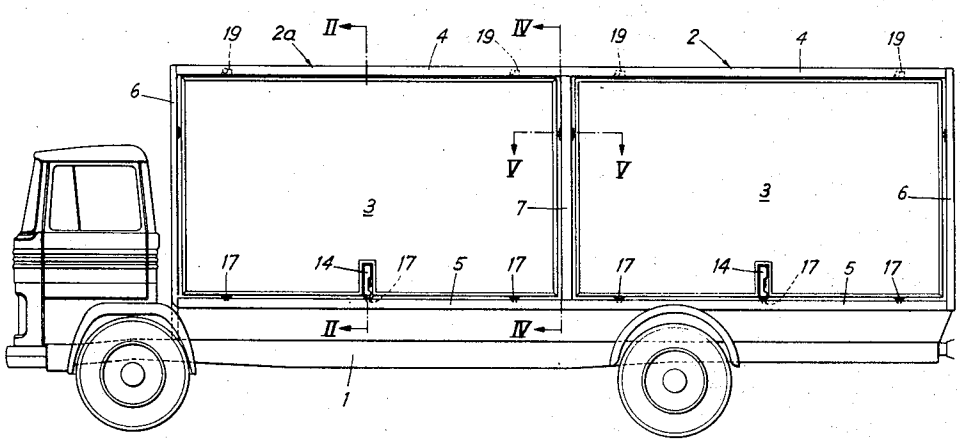
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[57] **ABSTRACT**

A box construction for a vehicle equipped with at least one sliding door which when in its closed position is located in the same plane as a stationary wall located adjacent thereto or as a second sliding door which when in its closed position is similarly located adjacent thereto. The invention contemplates the provision of a mechanism for each sliding door and cooperating with stationary components of the vehicle box and serving to permit displacement of such sliding door out of its closed position, while simultaneously lowering same through an amount greater than its thickness, into a preparatory position. When the sliding door is in such preparatory position, then, displaceable traveling rollers mounted at the sliding door and located over such sliding door bear in freely suspended fashion upon a stationary linear rail located at the edge of the roof of the vehicle box, and the aforesaid mechanism enables the sliding door to again be raised out of its preparatory position and placed back into its closed position.

7 Claims, 6 Drawing Figures



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SHEET 1 OF 4

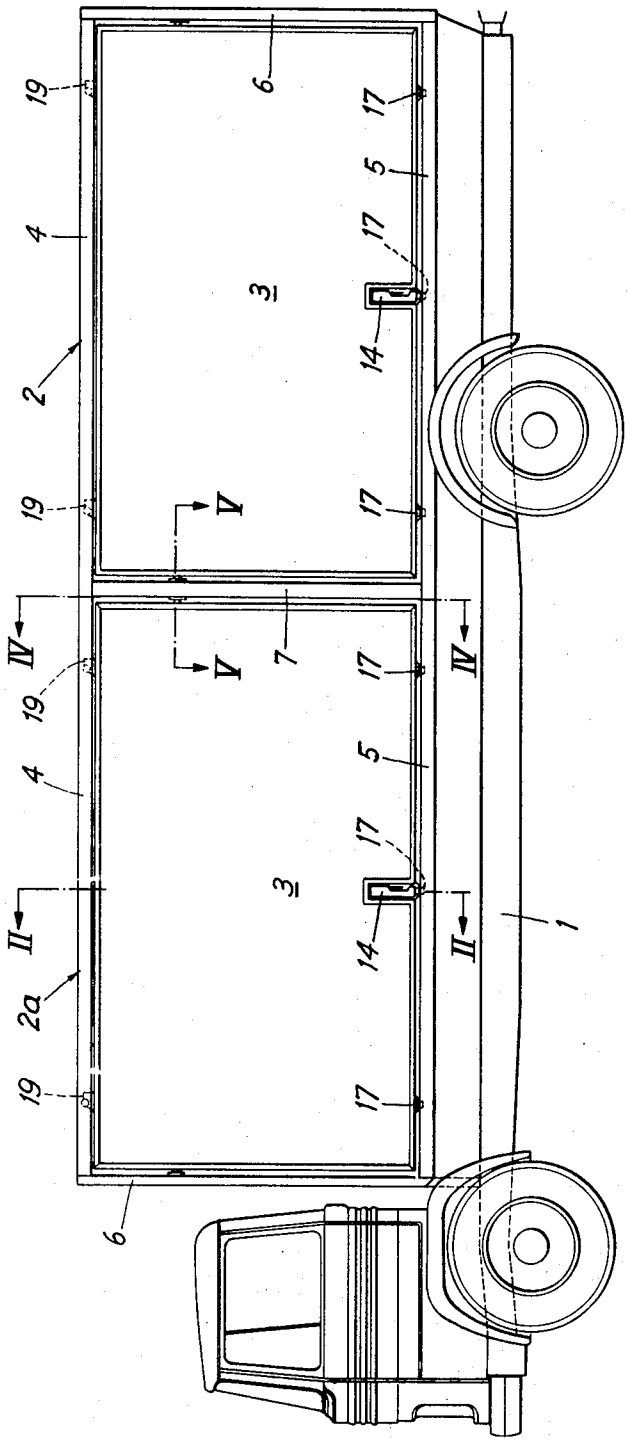


FIG. 1

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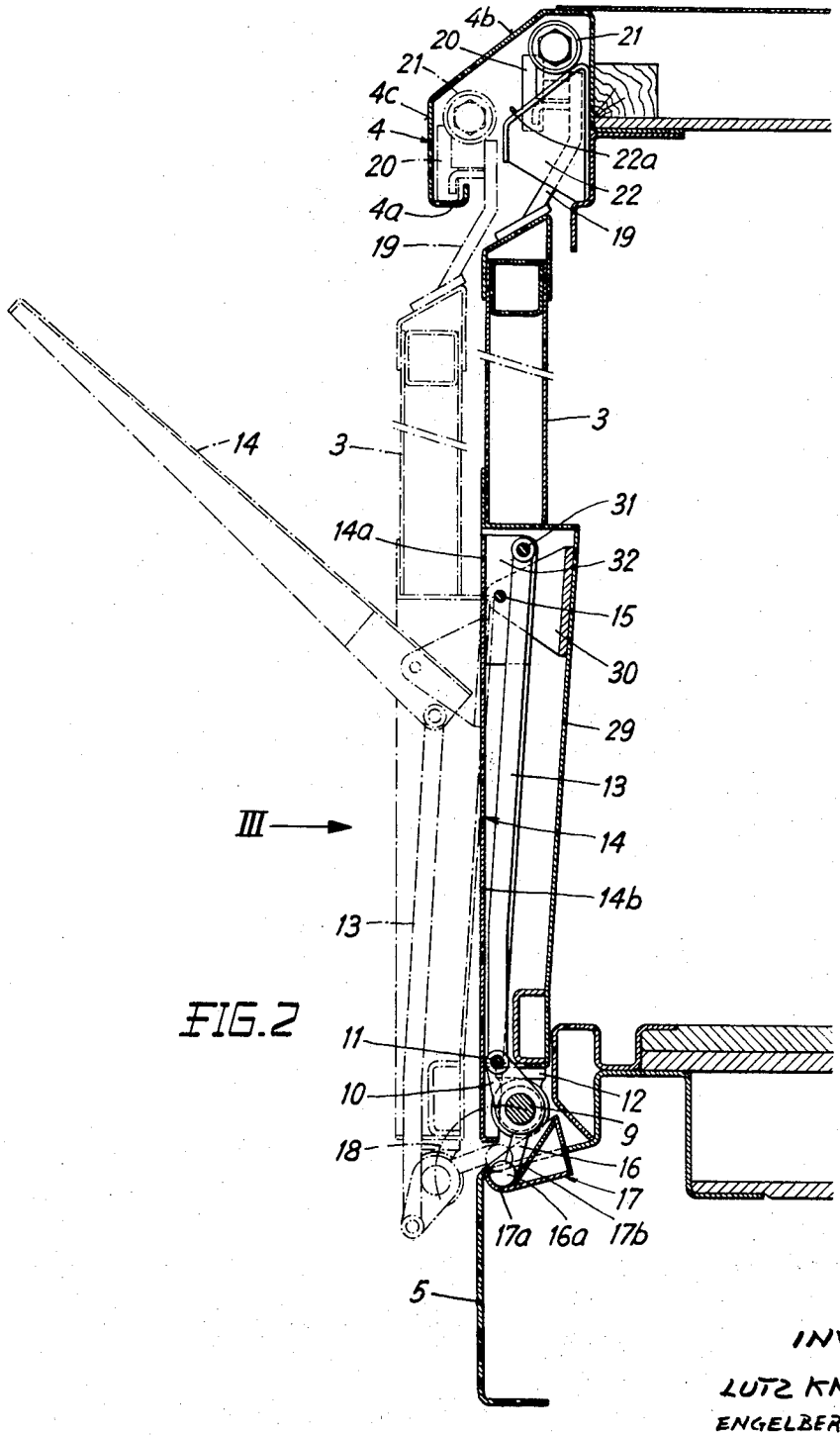


FIG. 2

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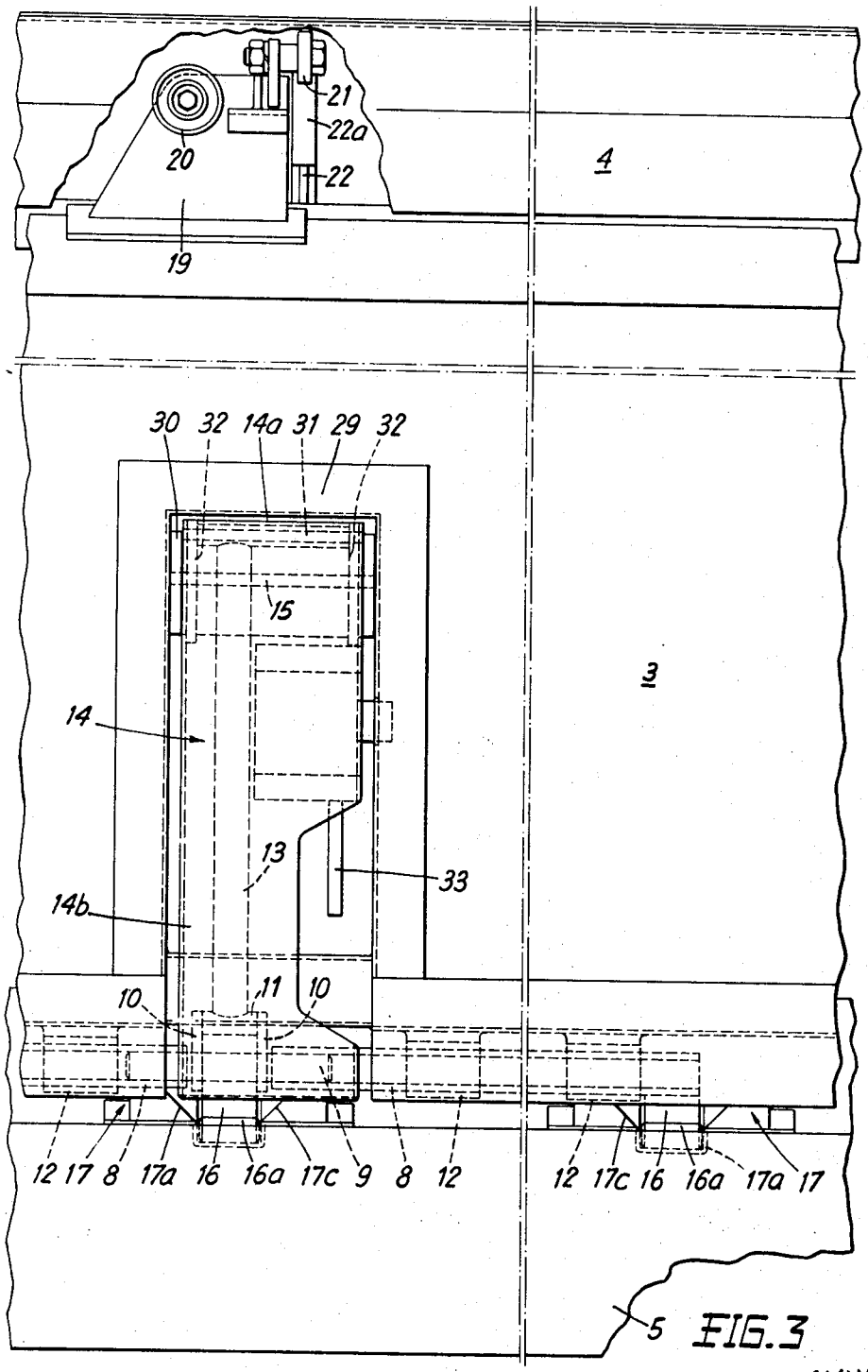


FIG. 3

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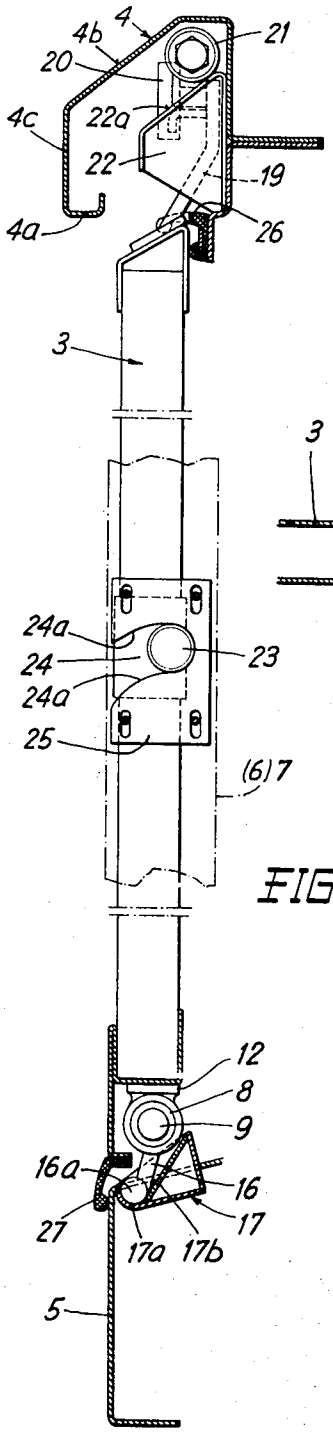


FIG. 4

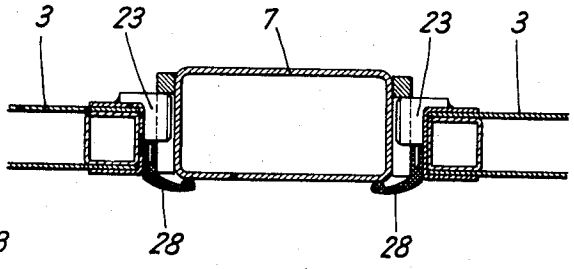


FIG. 5

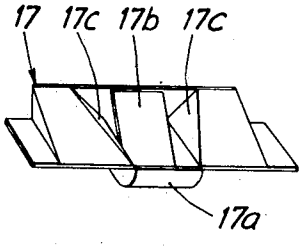


FIG. 6

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VEHICLE BODY BOX EQUIPPED WITH AT LEAST ONE SLIDING DOOR

BACKGROUND OF THE INVENTION

The present invention relates to a novel construction of body box for a vehicle equipped with at least one sliding door, this sliding door in its closed position being disposed in the same plane as a stationary wall located adjacent such sliding door or in the same plane as a second sliding door located thereadjacent and also in its closed position.

The box construction considered above can constitute the body of a truck or a trailer, but it also can be the box of a closed railroad box car. Hence, in the context of this description the term "vehicle" is to be considered in its broadest sense and the novel construction of body box can be used in conjunction with various types of vehicles where the nature of the invention would permit. Now, with the specific type of vehicles discussed above oftentimes the need exists of completely opening a lengthwise extending side of the vehicle for the purpose of loading and unloading. Yet, during these operations oftentimes it is not necessary to completely open the entire side of the vehicle at any given instance of time. In many cases it is absolutely satisfactory if the side wall is opened in increments or stepwise, wherefore different constructions of vehicle boxes have become known to the art which are equipped with laterally displaceable sliding doors permitting an alternate and selective opening of the front and rear half of such side wall. Yet, the drawback of most of the previously known state-of-the-art sliding door constructions is that these sliding doors require greater space than folding doors or even revolving shutters which can be upwardly displaced when it is desired to open same. This is so, because the sliding doors must be displaced either before or behind a side wall or before or behind a second door. Since the external dimensions of vehicles, in other words the width of the vehicle, is fixed in most countries by law, yet require as large as possible loading surface for receiving standard size pallets or for accommodating other situations, a large number of different solutions aimed at solving such problem have been proposed which require rather complicated door constructions. For instance, the prior art doors have been equipped with hinges, so that they can be pivoted out of a plane in which they are located when closed. Yet, these devices are expensive to manufacture, complicated to operate, difficult to maintain and subject to malfunction during operation.

A proposal has also been advanced in the art which relies upon a construction where a number of these drawbacks can be overcome. This prior art construction is designed such that during displacement of a door such remains parallel to itself and is displaced along a considerable portion of its displacement path in its own plane, yet prior to reaching the other closed door and at the end of the displacement path this door is displaced at an angle to its own plane towards the inside of the box. This door construction possesses, among others, the disadvantage that complicated rails must be provided, these rails possessing cross-over locations, and wherein the runners or wheels which are mounted at the door travel poorly at the rail sections which are angularly disposed. A further disadvantage prevailing with this prior art construction is that it is hardly possible to provide any real effective seal about the door because the section of the displacement path which is disposed at the region of the closed position of the door extends angularly or at an inclination to the plane of the door.

SUMMARY OF THE INVENTION

Hence, with the foregoing in mind, it will be recognized that there is still a real need in the art for improvements in the construction of vehicle body boxes equipped with one or more sliding doors. Hence, a primary objective of this invention is to provide such novel and improved type of body box structure which is not associated with the aforementioned drawbacks of the prior art constructions, and which effectively and reliably fulfills the existing need in the art.

Yet, a further object of this invention relates to an improved construction of body box for vehicles equipped with at least one sliding door wherein such structure is relatively inexpensive to manufacture, easy to operate, requires a minimum of space, not readily subject to breakdown or malfunction, and permits reliable and positive opening and closing action for the sliding door.

Now, in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates a novel vehicle box construction which embodies a mechanism arranged at each sliding door and which cooperates with stationary components of the vehicle box, this mechanism enabling displacement of the sliding door out of its closed position, and through simultaneous lowering thereof by approximately more than its thickness, into a preparatory position. When the sliding door is located in this preparatory position, rollers for displacing the door which are mounted at the sliding door bear in freely suspended fashion upon a stationary linear rail located at the roof of the vehicle box. In this position the sliding door can be laterally displaced. Further, the sliding door can be again raised out of the aforementioned preparatory position into its closing position by means of the aforesaid mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a side view of a vehicle, here shown as a truck which is equipped with a preferred embodiment of vehicle box possessing sliding doors;

FIG. 2 is an enlarged cross-sectional view of a portion of the vehicle box of FIG. 1, taken substantially along the line II—II thereof, and wherein the phantom-line showing depicts the sliding door in the position it assumes when displaced into its preparatory position;

FIG. 3 is a front view on an enlarged scale of a portion of the structure depicted in FIG. 2 as seen when viewing same in the direction of the arrow III;

FIG. 4 is a cross-sectional view of the truck box of FIG. 1, taken substantially along the line IV—IV thereof and in the same scale as the showing of FIGS. 2 and 3;

FIG. 5 is a fragmentary cross-sectional view of the vehicle box depicted in FIG. 1, taken substantially along the line V—V thereof and on the same scale as the showing of FIGS. 2 to 4; and

FIG. 6 is an enlarged perspective view of a counter support.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As already previously considered above, the concepts of the invention have applicability for various types of vehicle boxes, yet for convenience in description and purely for purposes of illustration the vehicle box will be discussed in the environment of a truck. Therefore, in FIG. 1 there is illustrated a roadbound truck embodying a chassis 1 upon which there is mounted a vehicle body box 2, hereinafter sometimes merely referred to as simply a box. The box 2 incorporates a stationary box framework 2*a* and at each side wall two sliding doors 3 which in their closed position are located adjacent one another. Forming part of the box framework 2*a* is a roof profile member 4, a floor or bottom profile member 5, two end posts 6, and a center post 7.

Now, at each sliding door 3 there is provided a mechanism, the details of which will be discussed more fully hereinafter, this mechanism cooperating with stationary components of the vehicle box 2 and by means of which each such sliding door 3 can be moved out of its closed position, while simultaneously lowering same by an amount which is greater than its thickness, and placed into a preparatory position. When this sliding door assumes its preparatory position, displaceable-traveling rollers mounted at and over such sliding door can bear in a freely suspended manner upon a stationary linearly extending rail which is located at the edge of the roof of the box. Further, through the provision of this mechanism the sliding door can again be raised out of the aforedescribed preparatory position back into its closed position.

This mechanism forms a significant aspect of the invention and is an essential component of the novel box construction of this invention. Considering such in greater detail, then, it will be understood that forming part of this mechanism is a shaft arrangement assembled from two tubular-shaped sections 8 and a central section 9 equipped with the crank webs 10 and a crank pin 11. This shaft arrangement is rotatably and non-displaceably supported in bearings 12 secured to the lower edge of the associated sliding door 3, as best seen by referring to FIG. 3. The crank pin 11 is connected by means of a rod 13 and a pivot volt 31 with the shorter arm 14*a* of an actuation lever 14 which, in cross-section, possesses a substantially U-shaped configuration. The shorter arm 14*a* of this actuation lever 14 is laterally reinforced by plates 32. Actuation lever 14 is mounted by means of the shaft 15 in the side portions of a substantially U-shaped support or bearing element 30 which is attached to a closure cabinet or box 29 embedded in the associated sliding door 3.

Now, in the closed position of the sliding door 3 this actuation lever 14 is flush at its outside surface with the outside surface of the sliding door, the longer arm 14*b* of this lever 14 then extending approximately up to the lower edge of the sliding door. There is further provided a conventional locking mechanism, which is not particularly considered herein, since such does not form part of the heart of the invention, but which incorporates as a component thereof the operating element 33, and by means of which locking mechanism the actuation lever 14 can be locked in this position. Three similarly directed support arms 16, one of which is welded or otherwise connected to the central shaft portion 9 and both of the others of which are each connected, as by welding, to a given one of the shaft sections 8, each have a cylindrically shaped free terminal portion 16*a*, by means of which, when the sliding door 3 is located in its closed position, as such has been depicted in FIGS. 2 and 4, these support arms 16 bear upon a respective support surface 17*a* located in a trough of an associated counter support, generally collectively referred to by reference character 17. These counter supports 17 are embedded at the edge of the bottom profile element or member 5.

Now, during such time as the actuation lever 14 is upwardly rocked into the position indicated in phantom lines in FIG. 2, the shaft arrangement 8, 9 is rotated through the agency of the connecting rod 13 in a counterclockwise direction. Since the terminal portions 16*a* of the support arms 16 bear upon the support surfaces 17*a* of the counter support 17, there results a movement of the axis of rotation of the shaft arrangement 8, 9 along the arcuate-shaped path 18 towards the outside and downwardly while entraining the lower edge of the sliding door by means of the shaft support or bearing arrangement 12. As a result, the sliding door 3 assumes a preparatory position for sliding movement. Now, during the above-described displacement of the actuation lever 14 and the movement of the above-described components of the mechanism under consideration the sliding door 3 is guided by additional components which will be more fully described shortly, and which are arranged at the top of such sliding door, such that the guiding action ensures the door will remain in essentially vertical position.

In order to more fully explain this aspect of the overall construction, attention is directed to FIGS. 1 to 4 where it will be recognized that two similar support elements 19 are secured to the upper edge of each sliding door 3, and at each support element 19 there is mounted a respective displaceable traveling roller 20 and a guide roller 21. Now, when the sliding door has assumed the previously considered preparatory position both displaceable traveling rollers 20 bear upon a rail 4*a* formed by the lower inwardly extending first cross-sectional portion of the continuous roof profile element 4 forming a supporting member of the vehicle framework 2*a*. This roof profile element 4 will also be seen to possess an inclined second cross-section portion 4*b* which is accommodated to the average inclination of the path 18 along which the axis of rotation of the shaft arrangement 8, 9 moves during displacement between the closing- and preparatory position. Further, profile element 4 will be seen to embody a cross-section portion 4*c* which extends vertically and connects the inclined portion 4*b* with the inwardly directed first-mentioned portion 4*a*. In short, then, the roof edge profile member 4 consists of a predetermined inclined upper portion 4*b*, merging with a downwardly vertically extending intermediate portion 4*c* which, in turn, is fol-

lowed by a substantially inwardly directed and horizontally extending portion 4*a*, as best seen by referring to FIG. 2. Additionally, it will be recognized that guide members 22 are secured to the roof edge profile element 4 at the region of the guide rollers 21 (with the sliding door located in its closed position or in its preparatory position or in an intermediate position), and such guide elements or members 22 possess guide surfaces 22*a* which extend parallel partially with regard to the second portion 4*b*, and partially with regard to the third portion 4*c* of the roof edge profile element 4, again best seen by referring to FIG. 2. The guide rollers 21 cooperate with both the second portion 4*b* of the roof edge profile element 4 and such guide surfaces 22*a* during movement of the sliding door 3 from the closed position into the preparatory position, or vice versa, in order to thus maintain this door in essentially vertical position at all times.

From what has been discussed above, it will be recognized that the rail 4*a* formed from the horizontally inwardly directed portion of the roof edge profile element 4 serves as guide means for each of both sliding doors 3 during their lengthwise displacement. Since such rail 4*a* forms a cross-sectional portion of the roof edge profile element 4, there is attained a considerable simplification and saving and the roof edge profile element is very stiff and stable in shape notwithstanding the fact that it possesses only slight wall thickness.

During displacement of one of the sliding doors 3 into its preparatory position it impacts against a suitable and therefore non-illustrated impact buffer or equivalent device. Such impact buffers are mounted at each of the end posts 6. It can happen that during displacement of the door it will rebound from such buffer or will not fully bear against same. If no additional measures were provided the danger exists that the support arms 16 possibly could not properly bear upon the counter support 17. Therefore, each counter support 17 is provided to both sides of a slide surface 17*b* upon which initially bears the support arm end 16*a* until sliding down to the region of the support surface 17*a*, with a centering surface 17*c* which is inclined both in the transverse direction as well as in the lengthwise direction and which extends up to the region on the aforementioned sliding surface 17*b*. Therefore, if the sliding door is not exactly in the desired displaced position where the support arm end portions 16*a* are located exactly opposite the sliding surfaces 17*b*, then the end portions 16*a* come to bear with their one or other edge upon one of the centering surfaces 17*c* and at which such edge then slides under the weight of the sliding door itself and the components mounted thereat, until the entire support arm end portion 16*a* of each support arm 16 bears upon the associated sliding surface 17*b* in order then to be able to slide downwardly along such sliding surface 17*b* which is inwardly and upwardly inclined.

Continuing, and as best seen by referring to FIGS. 4 and 5, it will be recognized that at both side edges of each sliding door 3 there is attached, as by welding, a load-relief bolt member 23 which, following the movement of the sliding door into its closed position, finally falls without play into a slot or recess 24 bounded by arcuate edges 24*a* provided at an associated load support plate 25. These load support plates 25 are secured elevationally displaceable at the required position at the posts 6 and 7. Through the provision of the above-described means the support arms 16, when the sliding doors 3 have assumed their closed position, are partially relieved from the burden of the weight of the associated sliding door.

As also best seen by referring to FIGS. 4 and 5, rubber-elastic sealing ledges 26, 27, 28 are arranged at portions of the door as well as the vehicle framework, these sealing ledges 26, 27 and 28, when the door is in the closed position, bearing against appropriate counter surfaces to thus provide an effective sealing of the interior of the vehicle box against the outside. As a matter of convenience in illustration, the sealing ledges or sealing members 26, 27 and 28 have been conveniently omitted from the showing of FIG. 2. During movement of the sliding doors from the closed position into the preparatory position and also during displacement of the sliding doors these sealing members 26, 27 and 28 are not subjected to any wear, because movement of the sliding doors at the region of the closed position is practically horizontal. In this connection there is further to be mentioned that during this portion of the movement one passes through a dead-center position, because in the closed position the axis of the shaft arrangement 8, 9 is located along the displacement path 18 inwardly of the vertical plane where there is located the line of contact between the end portions 16*a* of the support arms 16 and the support surfaces 17*a* of the counter supports 17. Therefore, the door has the tendency of remaining in its closed position even then if the actuation lever 14 has not been locked in the appropriate terminal position at the closure cabinet or box 29.

Naturally, various modifications could be undertaken in connection with the described embodiment of the invention without departing from the essential aspects of the invention and while remaining within the underlying concepts thereof. Thus, for instance, it would be possible to provide at one side of a vehicle body box a single or even more than two sliding doors.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. A box construction for a vehicle equipped with a vehicle box and at least one sliding door which when in its closed position is located in the same plane as a stationary wall located adjacent thereto or in the same position as a second sliding door which when in its closed position is similarly located adjacent thereto, the improvement comprising means provided for each sliding door for displacement of such sliding door out of its closed position, while simultaneously lowering same through an amount greater then its thickness, into a preparatory position, displaceable traveling rollers mounted at the sliding door and located over such sliding door, stationary linear rail means positioned at the region of an edge of the roof of the vehicle box for cooperating with said traveling rollers, said displaceable traveling rollers bearing in freely suspended fashion upon said stationary linear rail means when said sliding

door is in said preparatory position, and said means further enabling said sliding door to again be raised out of said preparatory position and placed back into said closed position, said means provided for each sliding door comprising a shaft arrangement, means for rotatably and non-displaceably mounting said shaft arrangement at the lower edge of the sliding door, actuation means with which said shaft arrangement cooperates, a number of support arms attached to said shaft arrangement, each of said support arms being provided with a free end portion, a bottom edge profile element located at the vehicle box at the region of the lower edge of the sliding door, a counter support means provided for each support arm and mounted at said bottom edge profile element, each said counter support means possessing a trough containing a support surface, said free end portion of each support arm bearing upon the support surface of each associated counter support means when the sliding door is in its closed position and during movement of said sliding door into its preparatory position and back into its closed position.

2. The vehicle box as defined in claim 1, wherein each free end portion of each support arm possesses a substantially cylindrical construction.

3. The vehicle box as defined in claim 1, wherein said shaft arrangement is arranged at said sliding door and said counter support means are arranged at said bottom edge profile element in such a manner that at the location of the closed position of the sliding door during displacement of such sliding door from said closed position into the preparatory position, and vice versa, there is traversed by said support arms an upper dead-center position.

4. The vehicle box as defined in claim 1, further including a vehicle framework, wherein said linear rail means is formed from a roof edge profile element located at the upper edge of the sliding door and having a lower inwardly directed first portion, said roof edge profile element being continuous along the upper edge of said sliding door and forming a supporting portion of the vehicle framework, said roof edge profile element further possessing a second inclined portion which is inclined in accommodation to the average inclination of the path along which the axis of rotation of said shaft arrangement moves during displacement between said closing position and said preparatory position, said roof edge profile element further possessing a third vertically extending portion, guide element means secured to said roof edge profile element, said guide element means having guide surfaces which partially extend parallel to said second portion of said roof edge profile member, support elements mounted at the upper edge of the sliding door, each of said support elements carrying at least one of said displaceable traveling rollers as well as a guide roller, said guide roller cooperating with said second portion of said roof edge profile element as well as with said guide surfaces of the associated guide element means.

5. The vehicle box as defined in claim 4, wherein each counter support means further comprises a pair of centering surface means located to each side of said slide surface and neighboring such slide surface, said centering surfaces being inclined both in the displacement direction of the sliding door as well as in the transverse direction.

6. The vehicle box as defined in claim 1, wherein each counter support means is equipped with a slide surface which extends from the associated support surface towards the interior of the vehicle box and is upwardly inclined, said free end portion of each support arm having a thickened cylindrical configuration and at the beginning of its rotation, during movement of the sliding door from its preparatory position into the closing position, such cylindrical end portion initially slides upon such sliding surface and thereafter comes to bear upon the support surface.

7. The vehicle box as defined in claim 1, wherein said shaft arrangement possesses a crank section having an eccentric crank pin, a closure cabinet mounted at said sliding door, said actuation means incorporating an actuation lever pivotably mounted at said closure cabinet, said actuation lever having a shorter arm and a longer arm, an upwardly extending rod connecting said eccentric crank pin with said shorter arm of said actuation lever, said actuation lever in the closed position of the sliding door bearing flushly with its outer surface against the outer surface of the sliding door, the longer arm of said actuation lever then extending down to the lower edge of the sliding door.

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