May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 1

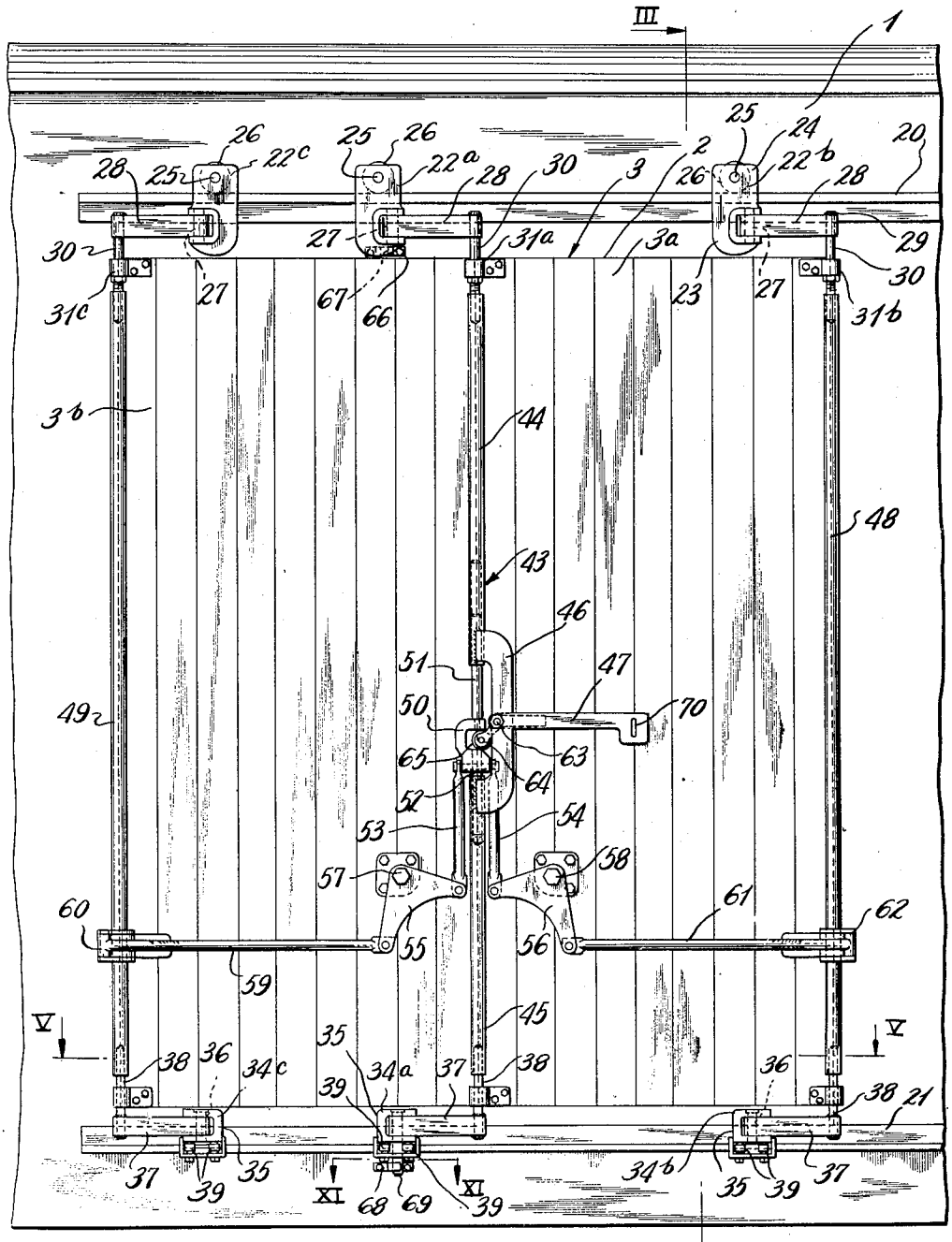


Fig. 1

Inventor
RAY E. DECAMP
By Harold W. Mattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 2

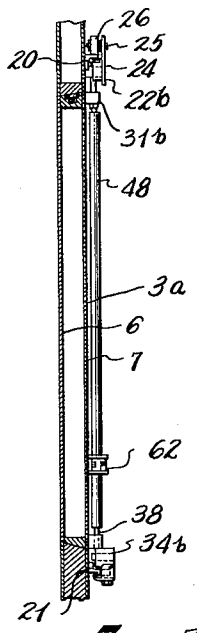


Fig. 3

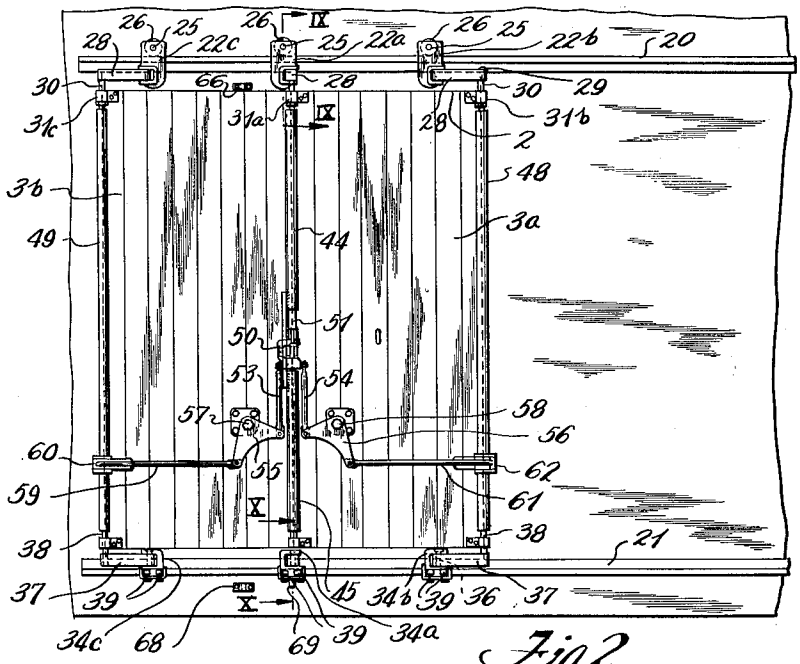


Fig. 2

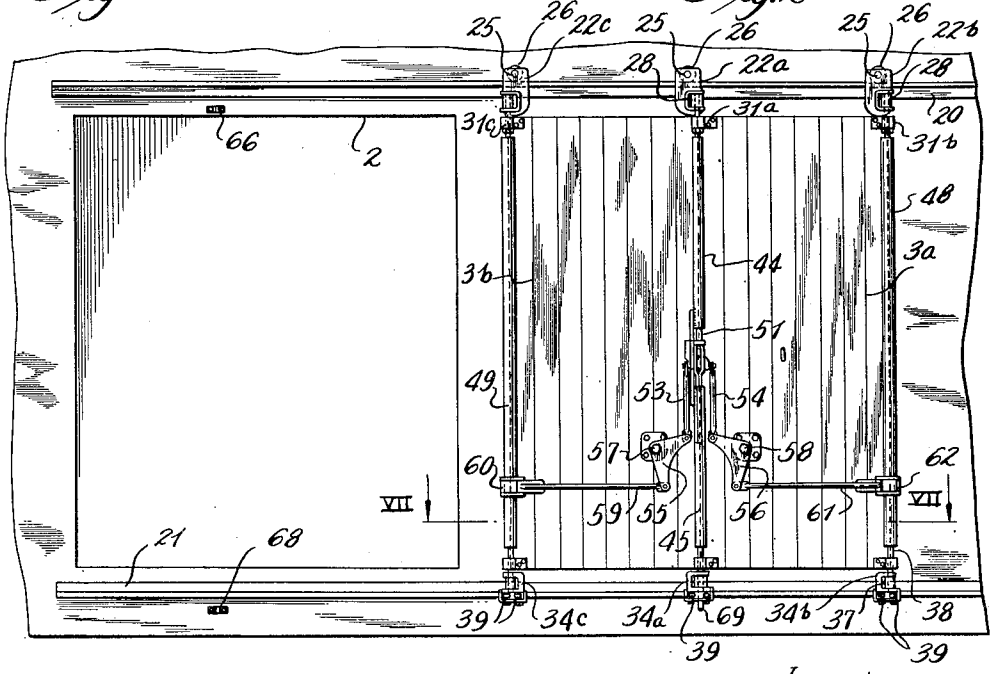


Fig. 4

Inventor
RAY E. DE CAMP
By Harold W. Mattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 3

Fig. 5

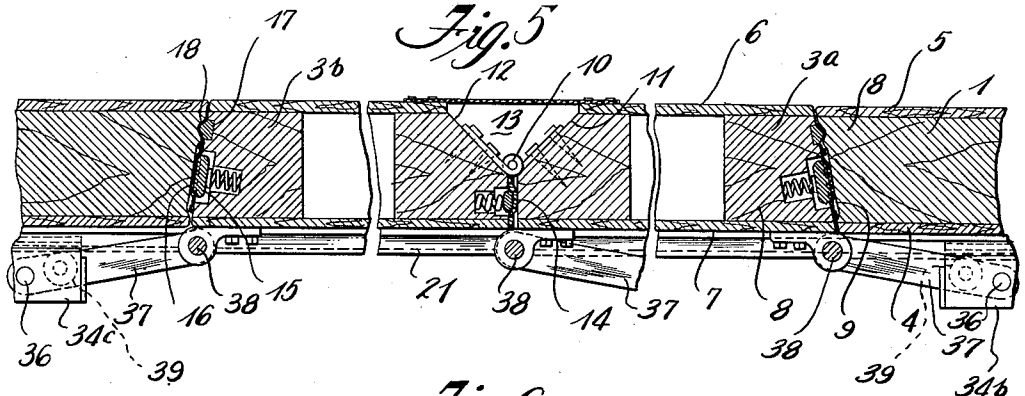


Fig. 6

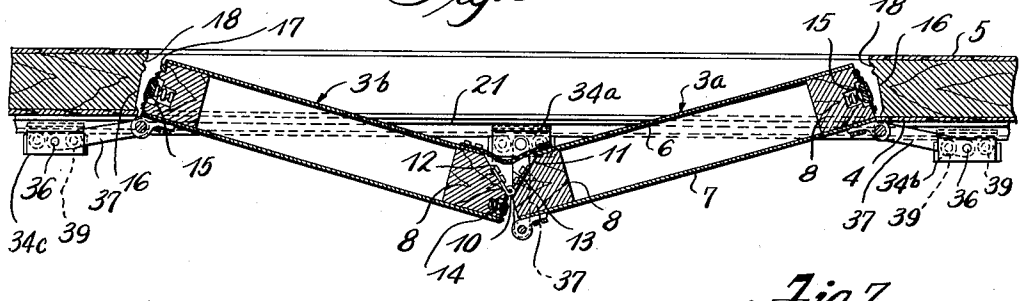
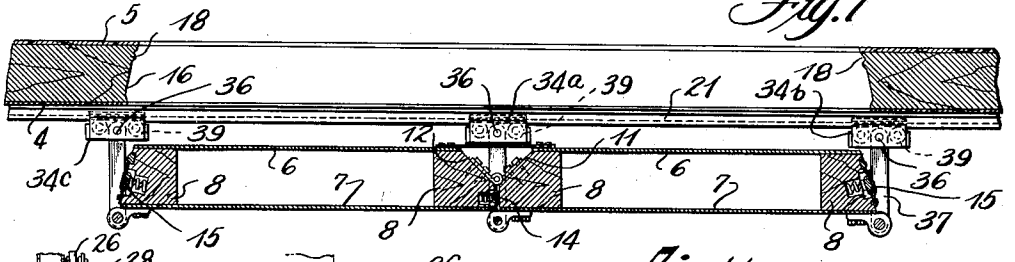


Fig. 7



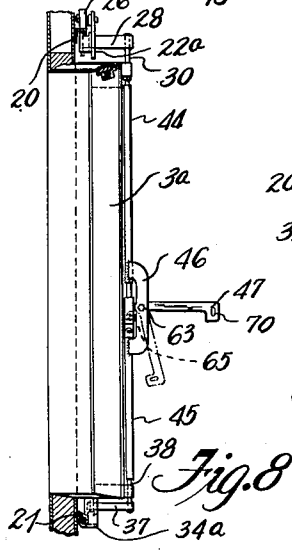


Fig. 8

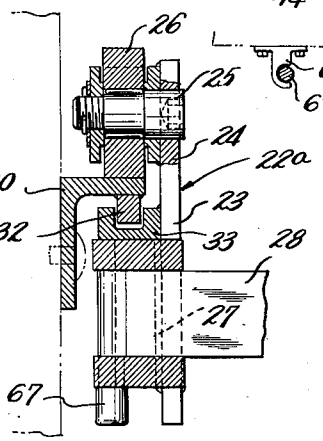


Fig. 9

Fig. 11

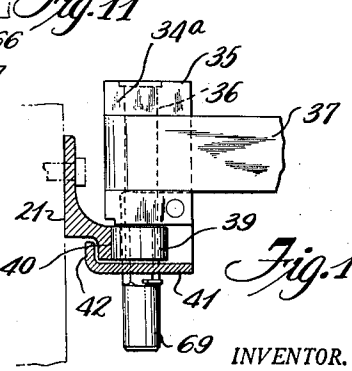


Fig. 10

INVENTOR.
RAY E. DECAMP
BY Harold W. Mattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 4

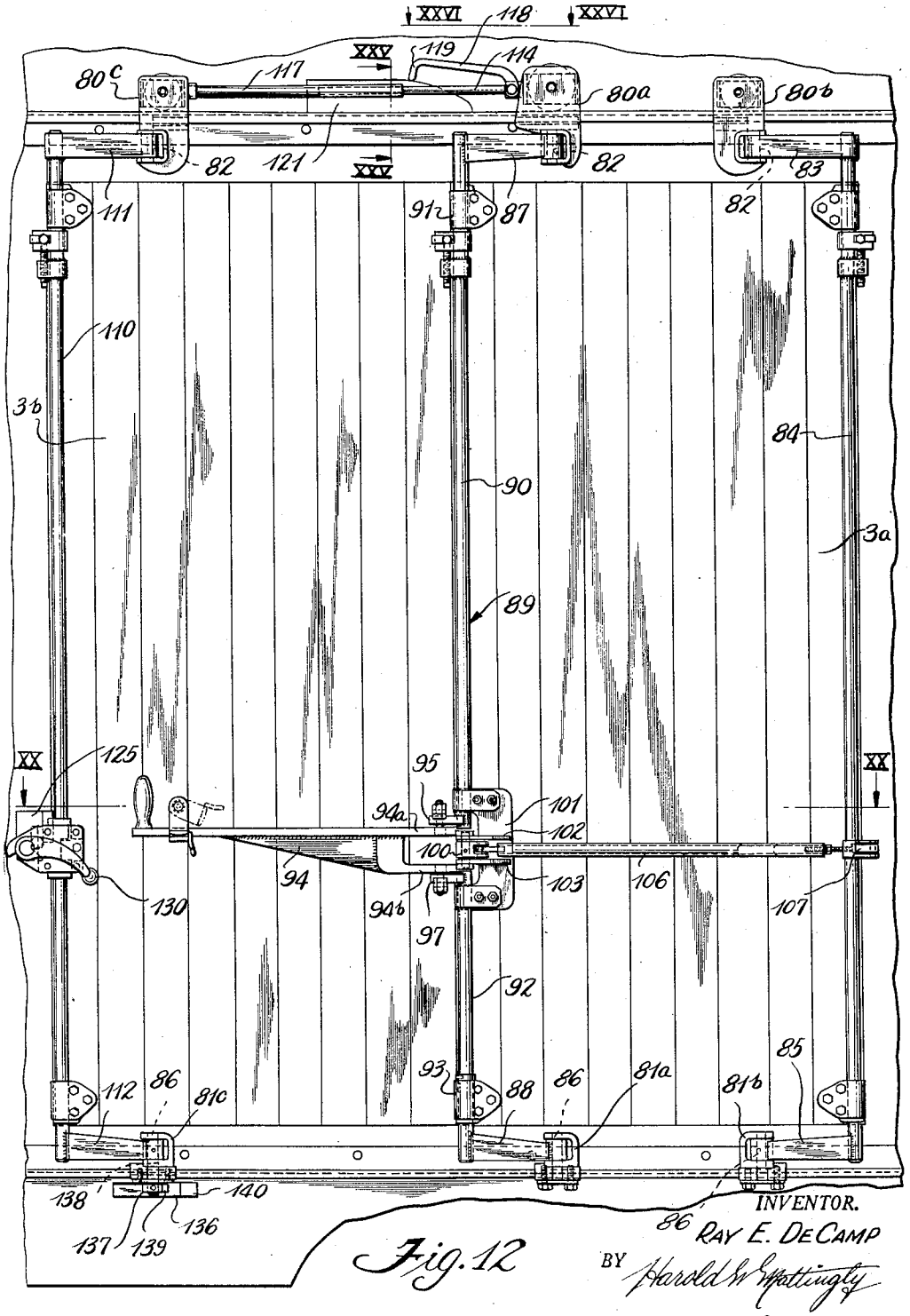


Fig. 12

INVENTOR.
RAY E. DE CAMP
BY Harold W. Mattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 5

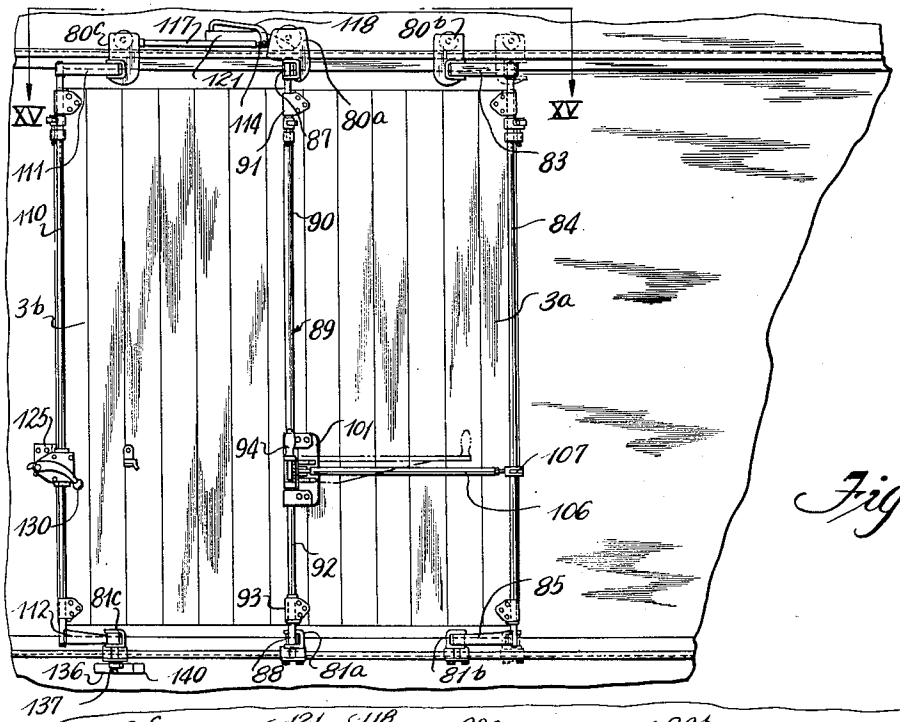


Fig. 13

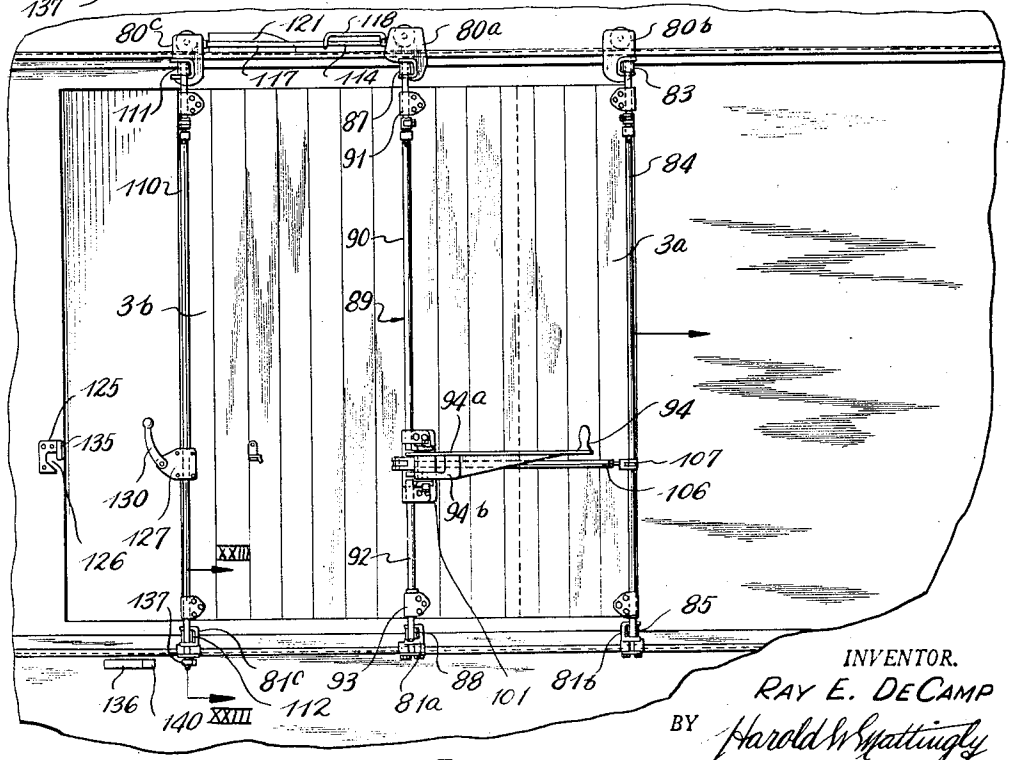


Fig. 14

INVENTOR.
RAY E. DECAMP
BY Harold W. Mattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 6

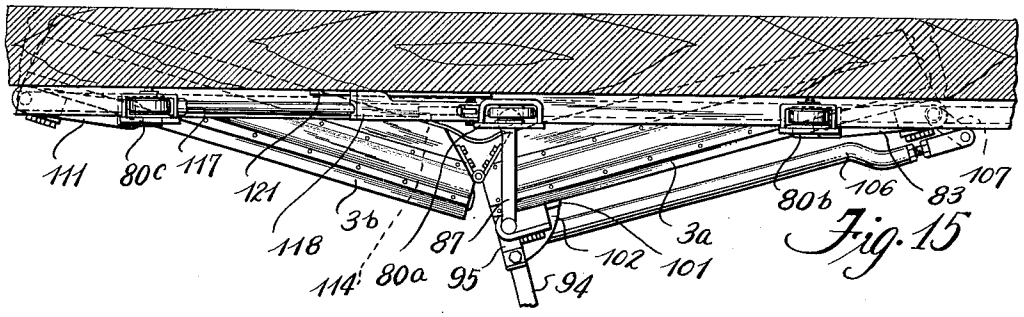


Fig. 15

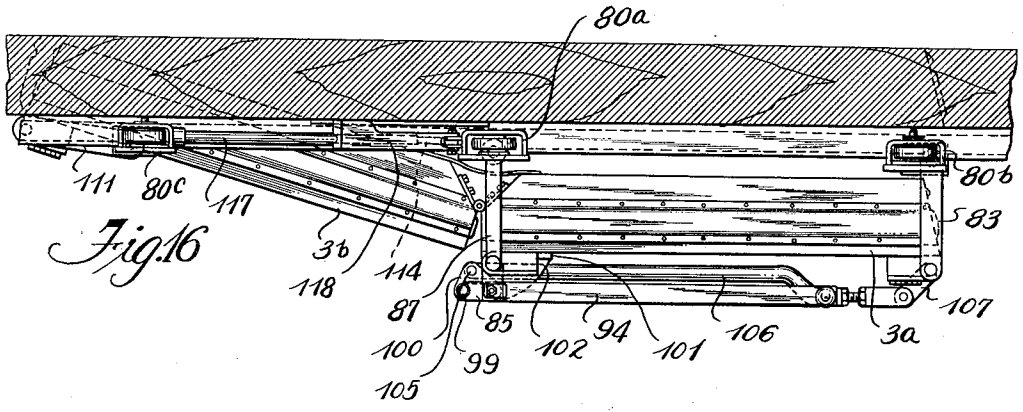


Fig. 16

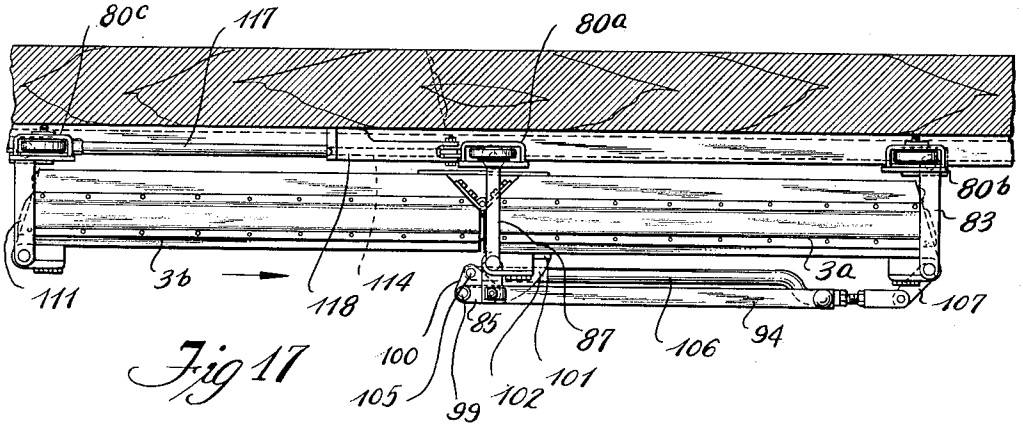


Fig 17

INVENTOR.
RAY E. DECAMP
BY Harold W. Spattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 7

Fig. 18

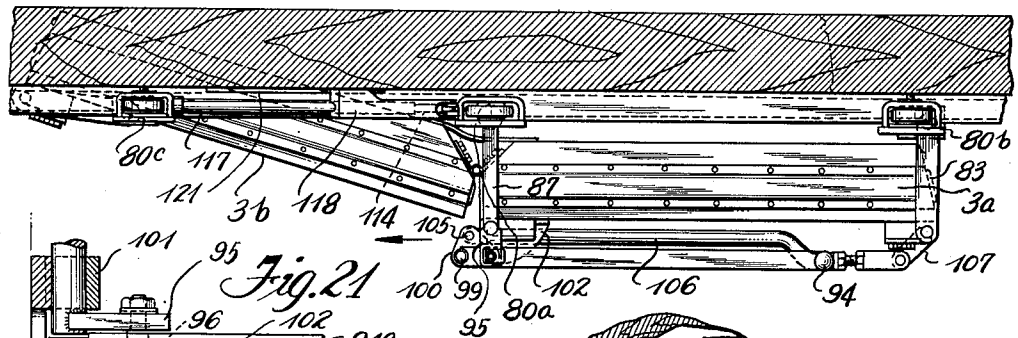
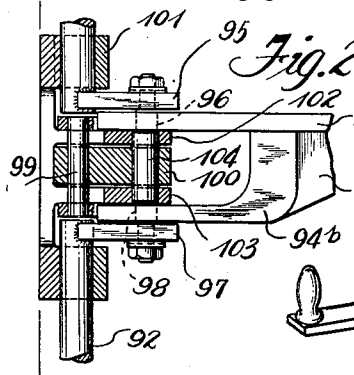


Fig. 21



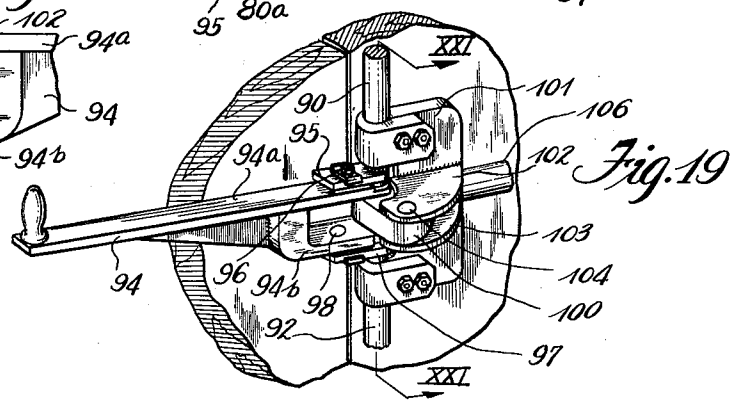


Fig. 19

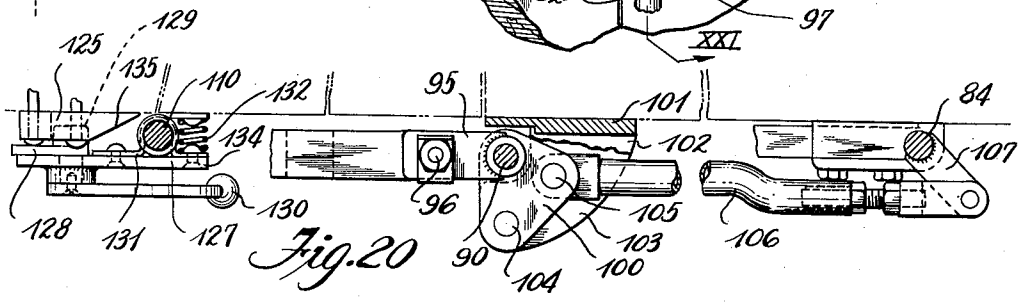


Fig. 20

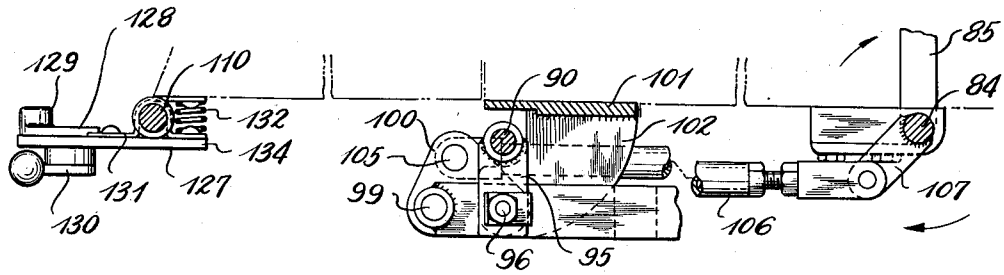


Fig. 22

INVENTOR.
RAY E. DECAMP
BY Harold W. Spattingly
Attorney

May 22, 1951 R. E. DE CAMP 2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Filed March 29, 1946 8 Sheets-Sheet 8

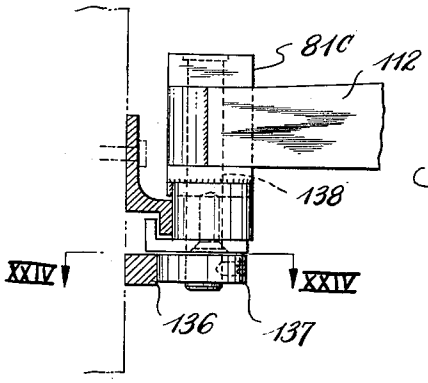


Fig. 23

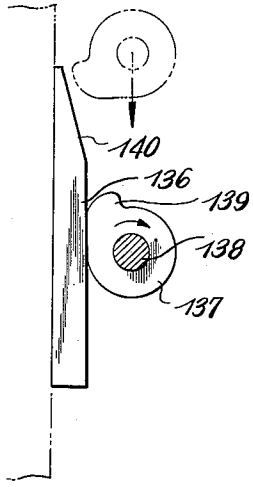


Fig. 24

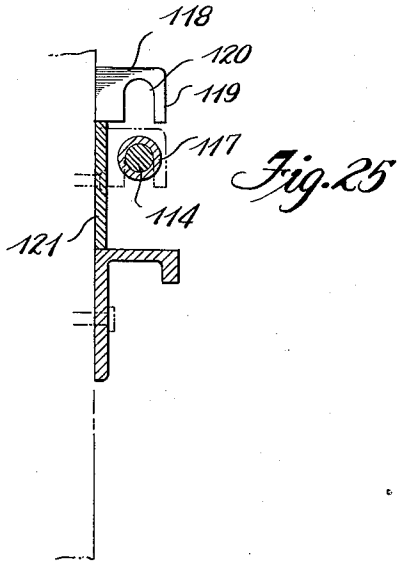


Fig. 25

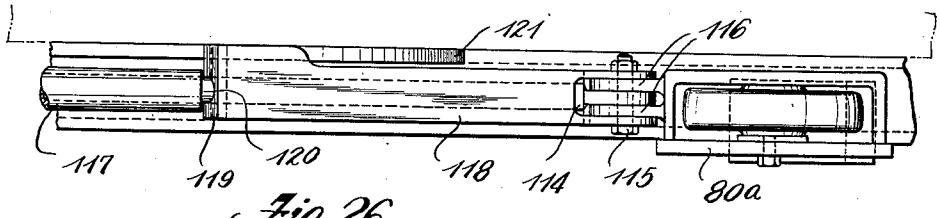


Fig. 26

INVENTOR.
RAY E. DE CAMP
BY Harold W. Mattingly
Attorney

Patented May 22, 1951

2,553,637

UNITED STATES PATENT OFFICE

2,553,637

DOOR AND OPERATING MECHANISM THEREFOR

Ray E. De Camp, Glendale, Calif., assignor, by mesne assignments, to Consolidated Western Steel Corporation, Los Angeles, Calif., a corporation of Delaware

Application March 29, 1946, Serial No. 658,344

5 Claims. (Cl. 160—201)

1

This invention relates to doors and operating mechanisms therefor and has particular reference to a door construction especially adapted for thick-walled structures such as refrigerated railroad cars, trucks and the like.

In the construction of doors and door openings for structures having relatively thick walls such as refrigerated railway cars and the like, it is the common practice to provide a door opening through the wall adapted to receive a relatively thick door which is required not only to close over the door opening but to seat well within the door opening, frequently to have the outer surface of the door flush with the outer surface of the structure wall. The most common type of door in use for structures of this character are double-paneled doors, each panel being hinged in the door opening at its outside edge, requiring the panels to be swung outwardly through an arc, the radius of which is determined by the width of each of the panels of the door.

In view of the fact that the door opening must have substantial width to permit the ready loading and unloading of the vehicle, it follows that whenever the door is to be opened ample space must be provided between the wall of the vehicle and any adjacent obstruction and it frequently occurs that the vehicle is located so close to building walls or other obstructions that the standard type of door described above cannot be opened. This condition is particularly true with respect to refrigerated railway cars wherein the cars may be located upon a siding adjacent a warehouse or unloading platform disposed so close to the tracks as to prevent the opening of the doors even though there may be ample space provided for the removal of the contents of the car after the door has been opened.

With the standard types of hinged door constructions, the doors after being opened do not lie close to the side walls of the vehicle, with the result that the door is subject to being inadvertently engaged with other vehicles or stationary obstructions adjacent the track or pathway of the vehicle, resulting in accidental damage at least to the doors, if not to the remainder of the vehicle.

It is therefore an object of this invention to provide a door for refrigerated vehicles which when in closed position may be disposed flush with the sides of the vehicle and which when in open position will be disposed parallel to the sides of the vehicle but in close relation thereto.

Another object of this invention is to provide a device of the character described wherein the door is mounted upon tracks extending longitudinally along the sides of the vehicle and along which the door may be slid from its closed position to an open position.

2

Another object of this invention is to provide a device of the character described wherein the mounting mechanism is so arranged that when the door is in its closed position it is disposed flush with the sides of the vehicle and is moved to open position by a series of steps which include at least a step of moving the door laterally of the vehicle out of its closed position and a second step in which the door is moved longitudinally of the vehicle away from the door opening to expose the complete area of the door opening.

Another object of this invention is to provide a door construction of the character described wherein the door is constructed of at least two panels hinged together at the junction of the two panels, permitting the door to be inserted into the door opening while in a bent condition with the panels partially folded together about their interconnecting hinge, the construction providing a toggle action between the door panels, aiding in the insertion of the door into its door opening and aiding in the retention of the door in tight sealing relation within the door opening.

Another object of the invention is to provide a door construction of the character described wherein the outer edges of the door panels are provided with interlocking means which engages cooperating means on the side edges of the door opening to hold the outer edges of the door in tight sealed relation with the door opening when the panels are disposed in the door opening and unfolded into straight line positions relative to each other.

Another object of this invention is to provide a door construction of the character described with an operating mechanism which includes mechanism for opening the door by first moving the center of the door laterally with respect to the body of the vehicle to partially fold the assembled door panels and thus withdraw the side edges of the door panels away from the sides of the door opening, the operating mechanism being provided with additional mechanism for subsequently moving the outer edges of the door panels laterally with respect to the body of the vehicle to dispose the door assembly in a flat position parallel with the side of the vehicle.

Another object of the invention is to provide an operating mechanism for doors of the char-

acter described wherein operation of a single control lever or handle is adapted to perform the sequence of operations necessary to partially fold the door panels, then move the panels laterally out of the door opening into a flat position (both panels disposed in the same plane) spaced laterally from the side of the vehicle.

Another object of the invention is to provide an operating mechanism of the character set forth in the preceding paragraph wherein when the door is in a position spaced laterally from and parallel to the side of the vehicle, the panels are locked in the parallel position.

Other objects and advantages of this invention will be apparent from a study of the following specifications read in connection with the accompanying drawings, wherein

Fig. 1 is a side elevational view of a portion of a side of a refrigerated railway car having a door and door operating mechanism construction in accordance with this invention assembled together;

Fig. 2 is a view similiar to Fig. 1 but illustrating the position of the door panels and the operating mechanism during the first step of opening the door;

Fig. 3 is a vertical sectional view taken along line III—III of Fig. 1 and illustrating the door and operating mechanism with the door in its closed position;

Fig. 4 is a side elevational view similar to Fig. 1 and illustrating the door and its operating mechanism when the door is in its fully open position;

Fig. 5 is a transverse horizontal sectional view taken along line V—V of Fig. 1 and illustrating the position of the parts when the door is in its closed position;

Fig. 6 is a view similar to Fig. 5 and illustrating the position of the parts in the first step of opening movement of the door;

Fig. 7 is a view similar to Fig. 6, illustrating the position of the parts during the next step in the opening of the door;

Fig. 8 is a vertical sectional view similar to Fig. 3 but illustrating the position of one of the panels of the door during the first step of movement of the door toward open position;

Fig. 9 is a vertical sectional view through one of the door hangers employed in the practice of this invention, the section being taken along line IX—IX of Fig. 2;

Fig. 10 is a vertical sectional view taken along line X—X of Fig. 2;

Fig. 11 is a detail sectional view taken along line XI—XI of Fig. 1;

Fig. 12 is a side elevational view similar to Fig. 1 but illustrating a modified form of door operating mechanism which may be employed in the practice of this invention and illustrating the position of the parts with the door in closed position;

Fig. 13 is a view similar to Fig. 12 but illustrating the position of the parts with the door in the first step of its movement toward open position;

Fig. 14 is a view similar to Fig. 13 and illustrating the position of the parts in the next step in the operation of the door toward open position;

Fig. 15 is a top plan view of the door and operating mechanism shown in Fig. 12 and illustrating the position of the parts in the first step of movement of the door toward open position;

Fig. 16 is a view similar to Fig. 15 and illustrating the position of the parts in the movement of the door and its operating mechanism toward the door open position;

Fig. 17 is a similar view to Figs. 15 and 16 and illustrating the position of the parts when the door is in its next step of movement toward open position;

Fig. 18 is a view similar to Figs. 15 and 16 and illustrating the position of the parts when the door is in its next step of movement toward closing position;

Fig. 19 is a fragmentary perspective view of a portion of the door operating mechanism shown in Figs. 12 through 18;

Fig. 20 is a horizontal sectional view taken along line XX—XX of Fig. 12;

Fig. 21 is a transverse sectional view taken in the plane XXI—XXI of Fig. 19 and illustrating the position of the parts therein during the first step of movement of the door toward closing position;

Fig. 22 is a view similar to Fig. 20 but illustrating the position of the parts when the door is in its fully open position;

Fig. 23 is a vertical sectional view taken along line XXIII—XXIII of Fig. 14;

Fig. 24 is a horizontal sectional view taken along line XXIV—XXIV of Fig. 23;

Fig. 25 is a vertical sectional view taken along line XXV—XXV of Fig. 12; and

Fig. 26 is a fragmentary top elevational view taken along line XXVI—XXVI of Fig. 12.

Referring to the drawings, there is illustrated in Figs. 1 through 11 one embodiment of the invention as applied to a standard railway refrigerator car though it will be understood by those skilled in this art that the same type of construction may be readily adapted to other types of vehicles such as trucks and the like.

Door and doorway construction

In Fig. 1 the side 1 of the standard railroad refrigerator car is shown as having a door opening 2 of standard dimensions into which is fitted a door indicated generally by the reference character 3 consisting of two separate panels 3*a* and 3*b*.

As will be noted from an inspection of Fig. 5, the side wall 1 of the car is constructed in the usual manner as an outer skin structure 4 and an inner skin structure 5 spaced from each other in such fashion as to accommodate the usual insulation. It will also be noted that the door panels 3*a* and 3*b* are likewise formed with inner and outer skin members 6 and 7 spaced from each other to provide for the accommodation of suitable insulation, the thickness of the door panels 3*a* being substantially identical with the thickness of the wall structure of the side of the car.

In the usual construction of such refrigerator car doors, the door frame is formed of relatively thick door frame strips such as is indicated in Fig. 5 at 8 while the edges of the door panels are similarly provided with relatively thick strips 8 of wood or other suitable material. The door frame is usually beveled so as to be somewhat wider adjacent the outer side of the car wall than at the inner side thereof so that the side edge of the door panel meets the edge of the door opening along a diagonal line 9, as indicated in Fig. 5. Similarly, the upper and lower door frame strips are beveled or stepped so as to present a larger area of opening at the outside of the car wall than at the inside thereof, the door panels fitting into the door opening with a wedge-like motion for the purpose of insuring

a relatively air-tight seal between the door panels and the door frame.

Whereas in the usual construction of the door panels, wherein each of the panels is mounted upon the side of the car by hinges at the side edges of the door opening and wherein the meeting edges of the two panels are complementarily beveled relative to each other, the door construction of the present invention is formed with the meeting edges of the two door panels hinged together by means of a hinge shown at 10 in Fig. 5, the vertical meeting edges of the two panels being beveled as indicated at 11 and 12 for a portion of their width to provide a recess 13 for the reception of the hinge 10. The remaining part of the width extends at right angles to the outer skin 7.

With the structure thus far described, it will be apparent that the two panels hinged together at their meeting edges provides a toggle structure which will permit the two door panels, when partially folded about the hinge 10, to present an effective width relative to the door opening considerably narrower than the door opening, that is, when the center portion of the assembled door is moved outwardly as indicated in Fig. 6, the outer side edges of the door panels will be moved bodily away from the adjacent door frame edges in the direction of the length of the side of the car.

After the door has been moved to the position shown in Fig. 6, the outer side edges of the door panels may then be bodily moved laterally from the door opening to the position shown in Fig. 7, in which both of the door panels are spaced laterally of the side of the car. With the door panels completely free of the door opening, the entire door assembly may then be moved lengthwise of the car to completely expose the door opening therein.

It will be observed from the foregoing that the door construction is such that only a relatively small amount of motion is required to be imparted to the door panels in a direction laterally of the side of the car in order to free the door from the opening and to dispose it alongside the car in such spaced relation thereto that it may be moved entirely clear of the door opening and yet not dispose any portion of the door panels at a sufficient distance laterally of the car to interfere with adjacent building walls or other vehicles located relatively close to the side wall of the car. In fact, it is preferred that the total amount of lateral movement of the door panels should not be more than one or two inches in excess of the thickness of the door panels so that with the door in its open position it will be disposed so close to the side wall of the car as to constitute no obstruction presented to buildings or other vehicles located adjacent the side wall of the car.

The meeting edges of the adjacent door openings may be provided with sealing devices such as spring-pressed shoes indicated at 14 in Fig. 5 and similar shoes 15 may be provided along the outside edges of the door panels to engage seats 16 formed in and extending along the vertical edges of the door opening while sealing keys 17 may be provided along the outer side edges of the door panels to be received in vertically extending keyways 18 formed in the edges of the door frame adapted to interlock with each other to not only effectively seal the door and door opening against the passage of appreciable quantities of air but also to interlock the outer edges of the door in place within the door opening against inadvertent lateral movement when the door is in its closed position.

The employment of the key strips interengaging the keyways is permitted in the door construction described herein by reason of the fact that with the door in its partially collapsed position as shown in Fig. 7, it may be inserted into the door opening with the outside edges of the door panels spaced inwardly of the door opening a sufficient distance as to permit the ready lateral movement of the door into the door opening. Then when the toggle-like structure provided by the interhinged panels 3*a* and 3*b* is straightened out by a lateral movement of the hinge between the panels, the keys and keyways will be disposed in such alignment with each other as to permit the ready reception of the keys within the keyways.

Hence with the structure thus far described the door may be effectively held in closed position within the door opening merely by providing some means which will hold the panels in their straight line relationship as shown in Fig. 5 until a door opening device is consciously manipulated to move the hinge 10 laterally with respect to the door opening. Hence the door may be safely locked in place by a simple latching mechanism to be hereinafter described.

Door mounting

In view of the fact that the foregoing door construction requires the operation through a series of steps consisting of, first, a movement of the center portion of the door laterally of the car, second, a lateral movement of the outside edges of the door out of the door opening, and finally, a sliding movement of the door lengthwise of the car out of alignment with the door opening, while the replacement of the door requires a reverse of these operations, namely, a sliding movement of the door to a position in front of and aligned with the door opening, then a movement of the outside edges of the door panels into the doorway opening and, finally, a lateral movement of the hinged center portion of the door into the door opening to straighten out the toggle-like structure. A door mounting must be provided which will permit the door to go through this series of steps in the desired sequence during either an opening or closing movement of the door.

In Figs. 1 through 11 there is illustrated one form of mounting which may be successfully employed for the desired operation of the door as comprising an upper track 20 extending lengthwise of the car and disposed immediately above the door opening while a lower track 21 is similarly disposed immediately below the bottom of the door opening, the tracks supporting rolling hangers upon which the door structure is supported. The upper door hangers, indicated at 22*a*, 22*b* and 22*c*, are preferably formed as substantially C-shaped body members 23, the upper leg of the C being extended to provide a bearing 24 through which extends a shaft 25 adapted to mount a roller 26 which rests upon the upper surface of the track 20. The open side of the C-shape is provided with a vertically extending pin 27 to which is pivotally mounted one end of a short hanger lever 28, the opposite end of which is rigidly secured as indicated at 29 to a vertical hinge shaft 30.

The shaft 30 associated with the hanger 22*a* extends downwardly through a bracket 31*a*

which is secured to the outer surface of the door panel 3a in such position that the shaft 30 is aligned with the meeting faces of the adjacent door panels 3a and 3b. The shaft 30 associated with the hanger 22b extends through a bracket 31b disposed on the same door panel 3a but at the extreme outer edge thereof to align the shaft 30 with the line of junction between the outer edge of the door panel 3a and the adjacent side edge of the door opening. Similarly, the shaft 30 associated with the hanger 22c extends downwardly through a bracket 31c disposed in alignment with the outer edge of the door panel 3b.

By referring particularly to Fig. 9, it will be observed that the track 20 is constructed with an inverted L-shaped cross section, the horizontal leg of the L being provided with a guide strip 32 on its under side adapted to be straddled by a channel-shaped guide member 33 secured to the body member 23 and extending laterally thereof a sufficient distance to prevent rotation of the hanger body relative to the track but permitting ready sliding movement of the hanger body along the track.

Thus it will be observed that a rotation imparted to the shaft 30 will pivot the lever 28 about its pivot pin 27, causing the hanger to slide along the track while at the same time the shaft 30 will be bodily moved laterally away from the side of the car by a distance equal to the effective length of the lever 28.

Disposed upon the lower track 21 are bottom hangers 34a, 34b and 34c, each of which comprises a substantially C-shaped body member 35 having a vertical pivot pin 36 extending across the open side of the C to pivotally mount one end of a lever 37, the opposite end of which is rigidly secured to a shaft 38. A pair of rollers 39 is mounted upon vertical shafts secured to the lower side of the C-shaped body 35 and are adapted to engage a vertical track surface 40 formed on the lower track 21, each of the hanger bodies 35 being provided with a flange member 41 having a vertically extending flange 42 adapted to engage behind a portion of the track 21 so as to prevent lateral movement of the hangers 35 away from the track.

Operating mechanism

Each of the levers 37 associated with the bottom hangers is equal in length to the levers 28 employed with the top hangers and the shafts 38 associated with each of the bottom hangers will therefore be aligned with the shafts 30 forming a part of the top mounting construction. Thus the shafts 30 and 38 for the top hanger 22a and the bottom hanger 34a will be aligned with each other and with the junction of the two panels 3a and 3b. Thus by interconnecting the shafts 30 and 38 by means of an operating shaft 43 both of the levers 28 and 37 will be moved simultaneously upon rotation of the operating shaft 43.

While the operating shaft 43 may be constructed as an integral part of the shafts 30 and 38, it is preferred to form the operating shaft 43 as a separate assembly including an upper section 44 telescopically assembled at its upper end upon the shaft 30 and welded thereto while a lower section 45 is telescopically assembled and welded upon the shaft 38, the two sections 44 and 45 being interconnected by means of a bracket 46 welded to the adjacent ends of the shaft sections 44 and 45.

The bracket 46 preferably constitutes a mounting for an operating lever or handle 47, the bracket 46 and handle 47 being so disposed on the shaft sections 44 and 45 that when the door is in its closed position as shown in Fig. 1 the handle 47 will lie parallel to and substantially flat against the door panel 3a. The handle 47 is preferably of considerable length so as to provide ample leverage by which the shaft assembly 43 may be rotated when it is desired to open the door, the opening movement for the central portion of the assembled door panels 3a and 3b being accomplished by swinging the handle 47 laterally with respect to the door, which will result in disposing the levers 28 and 37 at right angles to the side of the car and "break" the toggle formed by the central hinging of the two sections of the door panels 3a and 3b.

With the door partially collapsed by the movement of the handle 47 through an arc of 90°, the door assembly will be in the position shown in Fig. 6, freeing the outside edges of the door from their adjacent door frame side jambs and the outside edges of the door assembly may be then moved outwardly to the position shown in Fig. 7. This outward movement is accompanied by a partial rotation of the levers 28 and 37 associated with the hangers 22b—34b and 22c—34c, respectively, to dispose these levers at right angles to the side of the car and placing the door assembly in a straight line condition spaced slightly from the side of the car as shown in Fig. 7, thus disposing the door in a position relative to its hangers to permit the door to be slid longitudinally along the side of the car to completely expose the door opening.

The lever 28 associated with the right-hand hanger 22b and the lever 37 associated with the right-hand lower hanger 34b should be operated in unison and to accomplish this the shafts 30 and 38 associated with these hangers are preferably interconnected by means of an operating shaft 48 which is telescopically assembled upon the shafts 30 and 38 and rigidly secured thereto. Similarly, the shafts 30 and 38 associated with the left-hand hangers 22c and 34c are interconnected by means of a shaft 49 to rigidly interconnect the associated levers and cause them to be operated in unison.

While the shafts 48 and 49 may be operated independently of each other and independently of the central shaft assembly 43 to accomplish the opening or closing motions of the outside edges of the door assembly, it is preferred to so interconnect these three shafts and the operating handle 47 that the entire door motion may be accomplished by a manipulation of a single handle 47.

To accomplish this the shaft assembly 43 is provided with a C-shaped yoke member 50, from the upper and lower legs of which extend rods 51 and 52 telescopically received in bores extending longitudinally of the shaft sections 44 and 45. The yoke member has a pair of links 53 and 54 pivotally secured adjacent the lower leg of the C-shape and extending downwardly into pivotal engagement respectively with a pair of bellcranks 55 and 56. The bellcranks are pivoted, respectively, as indicated at 57 and 58, upon the door panels 3b and 3a.

The bellcrank 55 has one of its legs connected to the link 53 while the other leg is coupled by means of a link 59 to a crank 60 rigidly secured to the shaft 49, the corresponding leg of the bellcrank 56 being similarly connected by means of

a link 61 to a crank 62 rigidly secured to the shaft 48.

With the construction thus far described it will be apparent that a vertical upward movement imparted to the yoke 50 will cause the bellcranks 55 and 56 to simultaneously rotate through a considerable arc, sufficient to rotate the cranks 60 and 62 and their associated shafts 48 and 49 to swing the levers 28 and 37 associated with these shafts from the position shown in Fig. 1 in which the levers are parallel to the side of the car to the position shown in Fig. 7 in which the levers are disposed at right angles to the side of the car.

To permit the manipulation of a single operating handle 47 to accomplish both the result of rotating the shaft assembly 43 and subsequently a rotation of the shafts 48 and 49, the handle 47 is pivoted at 63 upon the bracket 46 and has an extension 64 formed thereon extending downwardly into the open side of the C defined by the yoke 50. The length of the extension 64 is such as to dispose the end of the extension 64 approximately at the axis of rotation of the shaft assembly 43 and thus when the handle 47 is rotated through 90° of horizontal movement necessary to rotate the shaft 43 and operate the central portion of the door assembly, the extension 64 will remain within the yoke 50 in a position to elevate the yoke when the handle 47 is disposed at right angles to the side of the car. A roller 65 is preferably rotatably mounted upon the extension 64 to minimize the friction between the handle 47 and the yoke 50 when the handle is given a movement through an arc extending in a vertical plane at right angles to the side of the car to actuate the yoke and the bellcranks to swing the shafts 48 and 49 through a partial rotation necessary to laterally move the outside edges of the door assembly to the position shown in Fig. 7.

From the foregoing it will be apparent that the operation of the handle 47 from its normal position, as shown in Fig. 1, to a position at right angles to the side of the car, as shown in Fig. 2, will cause the central portion of the door assembly to be moved laterally to thus dispose the door assembly to the position shown in Fig. 6 and then a vertical swinging movement of the handle 47 through approximately 90° will cause the yoke, bellcrank and link assembly to manipulate the outside shafts 48 and 49 to complete the lateral movement of the entire door assembly out of the door opening and thus dispose the door in a position to be slid lengthwise of the car free of the door opening, as is shown in Fig. 4.

By referring particularly to Figs. 1, 2, 9, 10, and 11, it will be observed that immediately above the door opening there is mounted a hook 66 extending from the side of the car to a position to be engaged by a projecting pin 67 formed upon the hanger 22*a*, the location of the hook relative to the center line of the door opening being such that when the shaft assembly 43 is rotated to a position to dispose the central portion of the door assembly flush with the side of the car (the position shown in Figs. 1 and 6), the pin 67 will engage the hook 66 and positively hold the lower end of the hanger against lateral movement with respect to the car but without interfering with the movement of the hanger longitudinally of its track 20 when the door is to be subsequently opened. This arrangement relieves the hanger 22*a* of any lateral strains while the door is in its completely closed position.

Similarly, a hook 68 is disposed immediately below the door opening in a position to be engaged by a pin 69 on the lower hanger 34*a* when the lower hanger is disposed in the position it will assume when the door is completely closed (see Fig. 1).

The operating handle 47 may be utilized as a lock for holding the door in its closed position by merely forming the outer end of the handle 47 with an elongated opening 70 adapting the handle to constitute one element of a hasp which can be disposed over a hasp loop through which any desired type of padlock (not shown) may be secured. The handle, being thus locked against the side of the car, it is obvious that no movement of any part of the door panels or their mounting structure can occur until the lock is removed, permitting the handle 47 to be swung away from the side of the car.

Modified operating mechanism

In Figs. 12 through 22, there is illustrated a modified form of operating mechanism which may be utilized to manipulate a door assembly of the type hereinbefore described, such operating mechanism including top hangers 80*a*, 80*b* and 80*c* and bottom hangers 81*a*, 81*b* and 81*c*.

The top hangers 80*a*, 80*b* and 80*c* are similar in all respects to the hangers 22*a*, 22*b* and 22*c* hereinbefore described while the lower hangers 81*a*, 81*b* and 81*c* are similar in all essential respects to the lower hangers 34*a*, 34*b* and 34*c* hereinbefore described. The hanger 80*b*, for example, is provided with a pin 82, to which is pivotally mounted one end of a lever 83, the opposite end of which is rigidly secured to the upper end of an operating shaft 84 which extends vertically along the right-hand edge of the door panel 3*a*. The lower end of the operating shaft 84 is rigidly secured to a lever 85, the outer end of which is pivoted upon a pin 86 on the hanger 81*b*.

The hangers 80*a* and 81*a* are, as illustrated in Fig. 12, disposed to the right-hand side of the meeting edges of the door panels 3*a* and 3*b* so that the lever 87 associated with the hanger 80*a* and the lever 88 associated with the hanger 81*a* will be extended toward the right, as viewed in Fig. 12, when the door is in its closed position, the levers 87 and 88 being rigidly connected to an operating shaft assembly 89 which includes an upper element 90 rotatably mounted upon a bearing bracket 91 disposed adjacent the top of the door panel 3*a* while a lower element 92 is rotatably mounted in a bracket 93 disposed adjacent the bottom of the panel 3*a*.

The elements 90 and 92 are interconnected, respectively, through an operating handle 94 which constitutes a part of a lever and link system by which the shaft assembly 89 may be rotated through an arc of 90° upon the movement of the handle 94 from its normal position, as shown in Fig. 12, (disposed parallel to and closely adjacent to the surface of the door panel 3*b*) to the position shown in full lines in Fig. 13. A further movement of the handle 94 through a further arc of 90° on a vertical axis will, by reason of the lever system, cause the partial rotation of the right-hand operating shaft 84 without further rotation of the central shaft assembly 89.

By referring particularly to Figs. 19, 20 and 21, it will be observed that the handle 94 has its inner end bifurcated to form two legs 94*a* and

94b spaced vertically from each other. The upper shaft element 90 has rigidly secured thereto a horizontally extending bar 95 which is pivotally connected to the upper leg 94a by means of a short pin 96. The lower shaft element 92 is similarly provided with a bar 97 pivoted to the lower leg 94b of the handle 94 by means of a short pin 98. It will be noted from an inspection of Figs. 19, 20 and 21 that the longitudinal axis of the pins 96 and 98 are in vertical alignment with each other and spaced outwardly from the extreme inner end of the legs 94a and 94b of the operating handle, the inner end of the operating handle 94 having a pin 99 extending through both of the legs 94a and 94b and through a bellcrank plate 100.

Secured to the side of the car is a mounting bracket 101 which may be employed as the bearing for the lower end of the upper shaft element 90 and the upper end of the lower shaft element 92. Extending laterally from the bracket 101 are a pair of bracket leaves 102 and 103, between which is pivotally mounted the bellcrank 100.

By referring particularly to Figs. 20 and 22, it will be observed that the bellcrank 100 is pivoted on the bracket leaves 102 and 103 for rotational movement about an axis pin 104, one leg of the bellcrank being connected to the operating handle 94 at the pivot point 99 while the opposite leg is connected by means of a pin 105 to a link 106 which extends lengthwise of the car to connect with a crank 107 rigidly secured to the operating shaft 84.

With the lever and link system described, it will be apparent that upon moving the operating handle from the position shown in Figs. 12 and 19 through a horizontal arc of 90°, will cause the operating handle 94 to pivot about the pin 99 as a center, thus moving the bars 95 and 97 through an arc of 90°, rotating the shaft elements 90 and 92 to rotate the levers 87 and 88 to a position at right angles to the side of the car to thus dispose the door panels in the position shown in Figs. 13 and 15 in which the outer side edges of the door are still within the door opening while the hinge line of the two door panels will have been moved laterally to partially collapse the toggle formed between the two door panels.

When the operating handle 94 arrives at a point making a right angle with the door panel 3a, a further movement of the handle 94 in a horizontal direction will cause the bellcrank 100 to begin rotating about its pivot pin 104. Prior to this time the movement of the bellcrank was restrained since all reaction force resulting from the initial rotation of the handle through its first 90° of movement was exerted in a straight line intersecting the pins 99 and 104. The extreme inner end of the operating handle 94 is prevented from movement away from the pin 104 by reason of the interconnection of the pin 104 and the pin 99 by the bellcrank. However, as soon as the extreme inner end of the handle is free to move to the left, as viewed in Figs. 19 and 20, further rotational force imparted to the handle will cause the handle to pivot about a new center, namely, the pins 96 and 98 which interconnect them with the bars 95 and 97.

By referring particularly to Figs. 16 and 22, it will be seen that a rotational movement imparted to the bellcrank 100 will draw the link 106 to the left, rotating the crank 107 through an arc of 90° to dispose the top and bottom levers 83 and 85 at right angles to the side of the car, thus disposing the panel 3a parallel to but spaced from the door opening. With the door in the position shown in Fig. 16, the sliding movement of the door as a whole may be started, even though the panel 3b is still extending at an angle into the door opening. As the door starts its longitudinal movement along the side of the car, the frictional resistance to the movement of the top and bottom hangers associated with the left-hand side edge of the door assembly will be such that the shaft 110 which interconnects the upper and lower levers 111 and 112 on the upper and lower hangers at the left side edge of the door assembly will be rotated so as to swing the left-hand edge of the door outwardly into alignment with the door panel 3a in the position shown in Figs. 14 and 17 and thereafter the door may be moved to its final open position, completely exposing the door opening.

When the door approaches its open position and the panels have been moved laterally into alignment with each other, it is desirable that they should be locked in this position against inadvertent collapse back against the side of the car and for the purpose of accomplishing this a latching mechanism is provided to interlock the top hangers 80a and 80c, as is illustrated in Figs. 12, 13, 14, 25 and 26, as comprising a rod 114 having one of its ends pivoted as indicated at 115 to a pair of bracket members 116 secured to and forming a part of the hanger 80a. The rod 114 extends longitudinally of the side of the car to telescopically engage a tube 117 which is secured to the hanger 80c. A latch finger 118 is pivotally mounted upon the brackets 116 and extends along and over the rod 114, the outer end 119 of the latch 118 being turned downwardly and formed with a vertical notch 120 therein, the width of which is just sufficient to pass the rod 114 but insufficient to pass the larger diameter of the tube 117.

Thus with the door in the position shown in Figs. 14 and 17, with the mounting brackets 80a and 80c spaced apart at their maximum distance, the latch 118 may drop over the rod 114 and constitute an abutment against which the outer or free end of the tube 117 will bear, the length of the tube 117 and the effective length of the latch 118 being such as to hold the two hangers against movement toward each other should the shaft 110 at the left-hand side of the door assembly tend to rotate to permit the left-hand edge of the door to swing toward the side of the car.

With the parts in this position, the door may be started toward its closed position by bodily moving the door assembly longitudinally of the side of the car toward a position disposing the door in front of the door opening.

As the door approaches a position of alignment with the door opening, the left-hand edge of the door should be swung inwardly into the door opening. To accomplish this result a cam plate 121 is mounted either directly to the side wall of the car above the door opening or to the upper track, the right-hand end of the cam plate being beveled to engage the approaching finger 119 of the latch 118 and cause the latch 118 to rise from its position of engagement with the rod 114 and the tube 117.

Thus the tube 117 may now move toward a hanger 80a and in so doing permits the shaft 110 to rotate back through an arc of 90°, disposing the levers 111 and 112 in their original positions parallel to the sides of the car. At this point in the operations the door assembly is substantially in the position shown in Figs.

13 and 16 though placed somewhat slightly to the right with respect to the door opening. Further force exerted longitudinally of the car will move the door assembly to the left until the left-hand edge of the door seats against the left-hand edge of the door opening, at which time the handle 94 of the operating mechanism may be swung back toward its left-hand position, resulting in first a rotation of the shaft 84 to move the right-hand edge of the door into the door opening and finally to allow the center hinged portion of the door assembly to move laterally into the door opening until the toggle formed between the two door panels has been straightened out and the door assembly is seated firmly in place within the door opening.

To aid in pressing the left-hand edge of the door assembly into tight relation with the left-hand side of the door opening as the door approaches its closed position, it is preferred to provide a lever mechanism illustrated particularly in Figs. 12, 13, 14, 20 and 22 wherein it will be noted that there is a keeper 125 secured to the side wall of the car immediately adjacent the left-hand edge of the door opening, the keeper being provided with a notch 126 directed toward the edge of the door opening. Secured to the door panel 3a is a frame 127 which constitutes a pivotal mounting for a crank 128 having a pin portion 129 adapted to be aligned with the notch 126 in the keeper 125 and which, after being engaged within the notch 126, may be rotated by a hand lever 130 to so rotate the pin 129 in the notch 126 as to exert a relatively strong force, urging the door assembly toward the left and thus into tight engagement with the left-hand side edge of the door opening.

To prevent inadvertent injury to the crank 129 and the keeper 125, it is preferred to mount the frame 127 in such fashion that it may have a partial rotation about a vertical axis such as is shown in Figs. 20 and 22 wherein the frame 127 is mounted, not directly to the door panel surface, but is rotatably mounted upon the shaft 119 as by means of a strap 131. A spring 132 interposed between an overhanging end 134 of the frame 127 normally urges the frame to a position of parallelism with the surface of the door panel but will permit the opposite end of the frame to be moved outwardly slightly if the operating lever 130 has not been disposed in an unlocked position such as that shown in Fig. 14. The right-hand edge of the keeper 125 is preferably provided with a paneled surface 135 as indicated particularly in Figs. 14 and 20, which will provide a wedging interengagement between the pin 129 and the keeper 125 and will cause the frame to rock slightly about its mounting to permit the pin 129 to slide over the keeper and into a position within the notch 126.

For the purpose of automatically moving the left-hand edge of the door into the door opening as the door is approaching its closed position, it is preferred to provide a cam plate 136 secured to the side of the car immediately below the door opening in a position to engage a dog 137 rigidly secured to the pin 138 by which the lever 112 is mounted upon the lower left-hand hanger 81c.

By referring particularly to Figs. 12, 23 and 24, it will be noted that the dog 137 is generally cylindrical in shape but has a radially extending projection or finger 139 which, when the operating shaft 119 has been rotated to dispose the levers 111 and 112 perpendicular to the side of the car, will be in the position shown in broken lines in Fig. 24.

By referring particularly to Fig. 12, it will be observed that the location of the cam plate 136 relative to the left-hand side of the door opening is such that the finger 139 will be engaged by the right-hand edge 140 of the cam plate when the door assembly is still spaced a short distance away from lateral alignment with the door opening and the location of the cam plate 136 relative to the cam 121 is such that the cam 121 will act to lift the latch member 118 out of engagement with the tube 117 at approximately the same instant that the finger 139 will have engaged the edge 140 of the cam plate 136.

Thus the hanger 80c will be free to move toward the hanger 80a at the same time that the dog 137 will be moved by its passage over the cam plate 136 to positively rotate the dog and the pin 138 to fold the lever 112 back to a position parallel to the side of the car. Thus a mere thrust on the door assembly in a direction longitudinally of the car toward door closing position will effectively move the left-hand edge of the door panel 3b into the door opening, aligning the left-hand side edge of the door with the left-hand edge of the door opening, ready to engage the key along that side edge of the door with the key slot in that side edge of the door opening.

From the foregoing it will be apparent that there has been provided a door construction for refrigerator cars or other vehicles in which the door, when in closed position, is seated within a door opening in such fashion as to make the exterior of the door substantially flush with the exterior walls of the vehicle surrounding the door opening while the door may be moved to an open position exposing the door opening in the vehicle without requiring the projection of any portion of the door to any appreciable extent laterally of the vehicle wall. It will be also apparent that by forming the door of a plurality of panels hinged together along vertical axes, the door assembly so provided will act through a toggle motion to contract the effective width of the door to a width less than the width of the door opening to thereby facilitate the lateral movement of the door out of its position within the door opening and when the door is to be moved toward its closed position the toggle action will be reversed after the door has been partially moved into the door opening, with the result that the effective width of the door will be expanded into a tight engagement within the door opening.

Such door construction not only provides for a tight sealing of the door but in addition thereto makes the door substantially self-locking within the opening, it being necessary only to provide a locking or latching mechanism which will hold the hinge between adjacent panels against lateral movement out of the door opening in order to maintain the door in its fully closed position.

In addition, it will be noted that there is provided a door mounting and operating mechanism by which a relatively thick door adapted to seat within a deep door opening may be arranged to be slid along the side of the vehicle as a sliding door but without sacrificing the sealing characteristics desired for such door construction, the mounting and operating mechanism providing for at least a two-step operation of the door in each of its opening and closing movements, namely, as one step, a sliding movement longi-

tudinally of the side of the vehicle away from or back to a position of lateral alignment with the door opening, and as a second step, a positive lateral movement relative to the side of the vehicle either outwardly of the door opening or inwardly toward the door opening a distance which will accommodate the thickness of the door structure.

While as hereinbefore pointed out such a door construction as is illustrated and described herein may be manipulated between this open and closed position by independent manipulation of the central portion of the door assembly and the side portions of the door assembly, there is illustrated operating mechanisms whereby relatively simple lever and link devices may so interconnect the central and side portions of the door as to permit the manipulation of the door through successive steps required to open or to close the door by simple movements of a single door operating handle.

While there is illustrated and described herein the preferred embodiments of the invention, the same is not to be limited to any of the details of construction shown or described herein, except as defined in the appended claims.

What is claimed as new is:

1. In a door construction for use in door openings of thick-walled structures, the combination of a door comprising a pair of panels disposed side by side and hinged together at their meeting side edges said assembled panels being dimensioned to fit within the door opening, a hanger for each outside side edge of said door and a middle hanger for the hinged edges of said panels, all slidable along said track, a hanger lever pivotally mounted on each of said hangers, an elongated member extending along and rotatably supported by one of said panels and having one end rigidly connected to the middle hanger lever, an elongated member extending along and rotatably supported by each of said panels adjacent the outside side edge thereof, each of said last named elongated members having one end rigidly attached to the lever adjacent thereto, and means for rotating the elongated member depending from the middle lever independently of the other two elongated members to bring about movement of the middle lever between one position substantially parallel to said wall and a second position perpendicular to said wall to hingedly move said panels relative to each other to facilitate movement of the door into and out of said opening.

2. In a door construction for use in door openings of thick-walled structures, the combination of a door comprising a pair of panels disposed side by side and hinged together at their meeting side edges, said assembled panels being dimensioned to fit within the door opening, a hanger for each outside side edge of said door and a middle hanger for the hinged edges of said panels, all slidable along said track, a hanger lever pivotally mounted on each of said hangers, an elongated member extending along and rotatably supported by one of said panels and having one end rigidly connected to the middle hanger lever, an elongated member extending along and rotatably supported by each of said panels adjacent the outside side edge thereof, each of said last named elongated members having one end rigidly attached to the lever adjacent thereto, means for rotating the elongated member depending from said middle lever to bring about movement of the middle lever between one position substantially parallel to said wall and a second position perpendicular to the wall to move the associated edges of the door laterally of the wall, operating means for moving said door laterally between a position within said door opening and a second position clear of said opening including an operating lever, means mounting said lever for movement between a first position, means connecting said operating lever to the hanger lever of said middle hanger to move only that hanger lever between its two positions when the operating lever is moved between its first and second positions, and means independently coupling at least one of the other hanger levers to said operating lever for movement thereby only when said operating lever is moved between its second and third positions.

3. In a door construction for use in door openings of thick-walled structures, the combination of a door comprising a pair of panels disposed side by side and hinged together at their meeting side edges, said assembled panels being dimensioned to fit within the door opening, a hanger for each outside side edge of said door and a middle hanger for the hinged edges of said panels, all slidable along said track, a hanger lever pivotally mounted on each of said hangers, an elongated member extending along and rotatably supported by one of said panels and having one end rigidly connected to the middle hanger lever, an elongated member extending along and rotatably supported by each of said panels adjacent the outside side edge thereof, each of said last named elongated members having one end rigidly attached to the lever adjacent thereto, means for rotating the elongated member depending from said middle lever to bring about movement of the middle lever between one position substantially parallel to said wall and a second position perpendicular to the wall to move the associated edges of the door laterally of the wall, operating means for moving said door laterally between a position within said door opening and a second position clear of said opening including an operating lever, pivot means mounting said operating lever for movement about a vertical axis, means coupling said pivot means to the middle hanger lever to move the same between its two positions when said lever is moved about said vertical axis, means mounting said operating lever for movement about a horizontal axis, and means coupling said operating lever to at least one of the other hanger levers to move the same between its two positions when said operating lever is moved about said horizontal axis.

4. In a door construction for use in door openings of thick-walled structures, the combination of a door comprising a pair of panels disposed side by side and hinged together at their meeting side edges, said assembled panels being dimensioned to fit within the door opening, a hanger for each outside side edge of said door and a middle hanger for the hinged edges of said panels, all slidable along said track, a hanger lever pivotally mounted on each of said hangers, an elongated member extending along and rotatably supported by one of said panels and having one end rigidly connected to the middle hanger lever, an elongated member extending along and rotatably supported by each of said panels adjacent the outside side edge thereof, each of said last named elongated members having one end rigidly attached to the lever adjacent thereto, means for rotating the elongated member depending from said middle lever to bring about movement of

the middle lever between one position substantially parallel to said wall and a second position perpendicular to the wall to move the associated edges of the door laterally of the wall, operating means for moving said door laterally between a position within said door opening and a second position clear of said opening including an operating lever, means mounting said operating lever for movement about a vertical axis between a first position, a second position and a third position, means coupling said lever to the middle hanger lever to move only said middle hanger lever when the operating lever is moved between its first and second positions, and means coupling said operating lever to at least one of the outer hanger levers to move only that hanger lever when the operating lever is moved only between its second and third positions.

5. In a door construction for use in door openings of thick-walled structures, the combination of a door comprising a pair of panels disposed side by side and hinged together at their meeting side edges, said assembled panels being dimensioned to fit within the door opening, a hanger for each outside side edge of said door and a middle hanger for the hinged edges of said panels, all slidable along said track, a hanger lever pivotally mounted on each of said hangers, an elongated member extending along and rotatably supported by one of said panels and having one end rigidly connected to the middle hanger lever, an elongated member extending along and rotatably supported by each of said panels adjacent the outside side edge thereof, each of said last named elongated members having one end rigidly attached to the lever adjacent thereto, means for rotating the elongated member depending from said middle lever to bring about movement of the middle lever between one position substantially parallel to said wall and a second position perpendicular to the wall to move the associated edges of the door laterally of the wall, operating means for moving said door laterally between a position within said door opening and a second position clear of said opening including an operating lever, means mounting said operating lever for movement about a vertical axis between a first position, a second position and a third position, means coupling said lever to the middle hanger lever to move only said middle hanger lever when the operating lever is moved between its first and second positions, means coupling said operating lever to at least one of the outer hanger levers to move only that hanger lever when the operating lever is moved only between its second and third positions, and means responsive to sliding movement of said door longitudinally of said wall for moving the other outer hanger lever between its two positions.

RAY E. DE CAMP.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
712,926	Grigg	Nov. 4, 1902
755,551	Richardson	Mar. 22, 1904
778,250	Kennedy	Dec. 27, 1904
1,051,762	Reynolds	Jan. 28, 1913
1,086,603	Merker	Feb. 10, 1914
1,441,349	Henry	Jan. 9, 1923
1,787,302	Bakehouse	Dec. 30, 1930
2,083,708	Haseltine	June 15, 1937
2,108,224	Haseltine	Feb. 15, 1938
2,141,353	Fuchs	Dec. 27, 1938