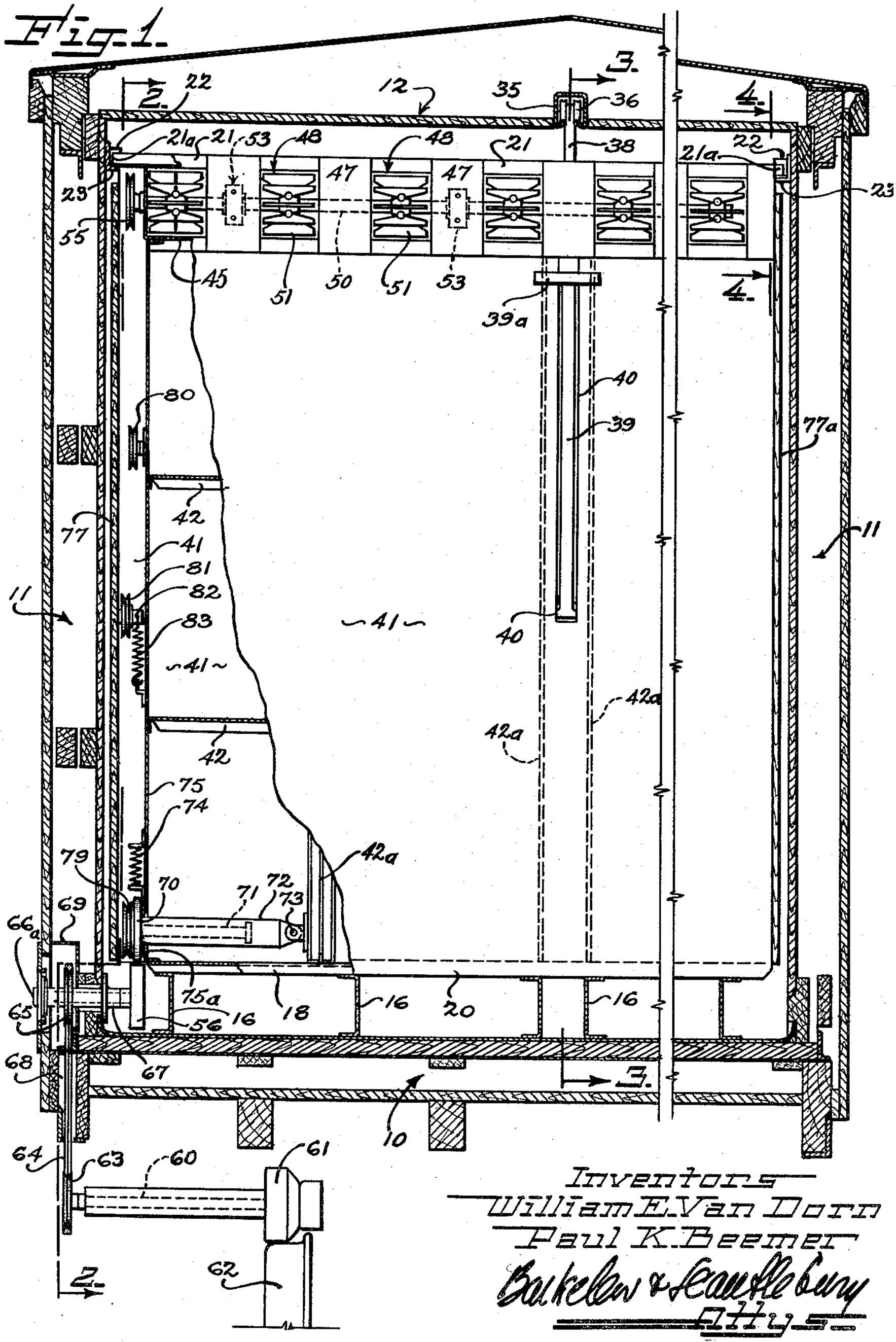
March 6, 1951 W. E. VAN DORN ET AL 2,544,242

CONVERTIBLE BULKHEAD AND AIR CIRCULATING FAN ASSEMBLY FOR REFRIGERATOR CARS

Filed Aug. 9, 1947 3 Sheets-Sheet 1

Fig. 1



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Filed Aug. 9, 1947 3 Sheets-Sheet 2

Fig. 2.

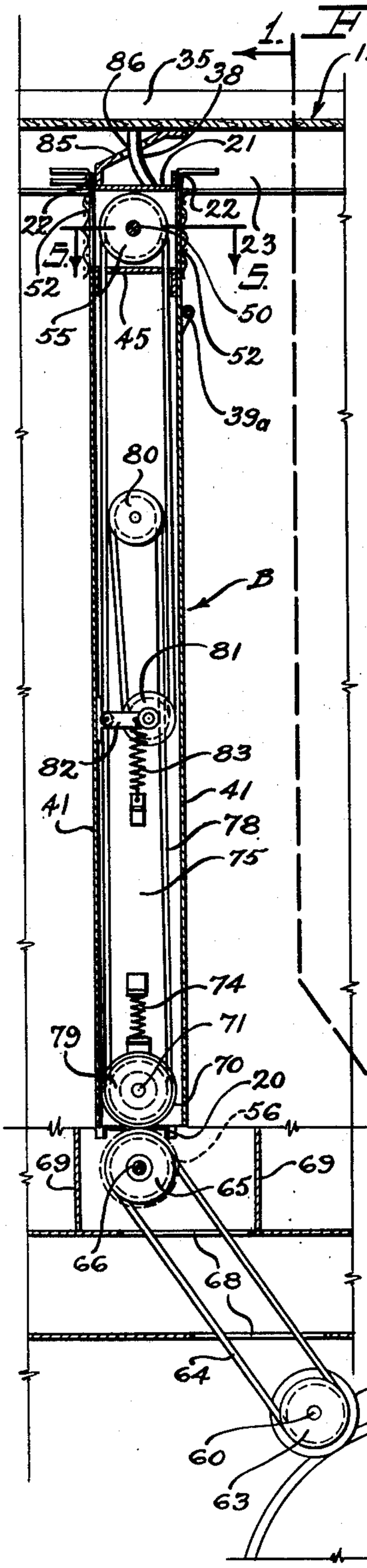
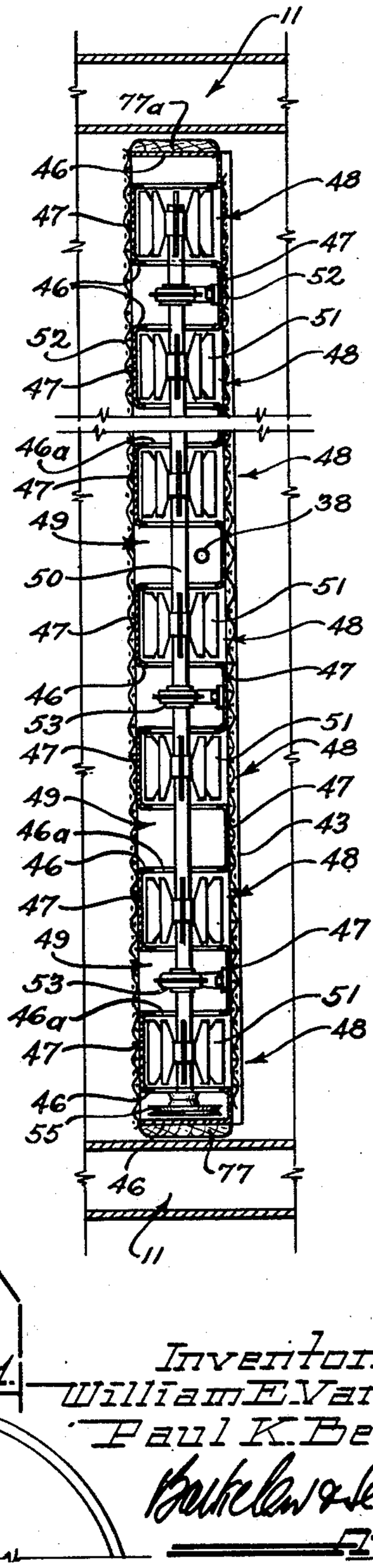


Fig. 5.



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Filed Aug. 9, 1947 3 Sheets-Sheet 3

Fig. 3

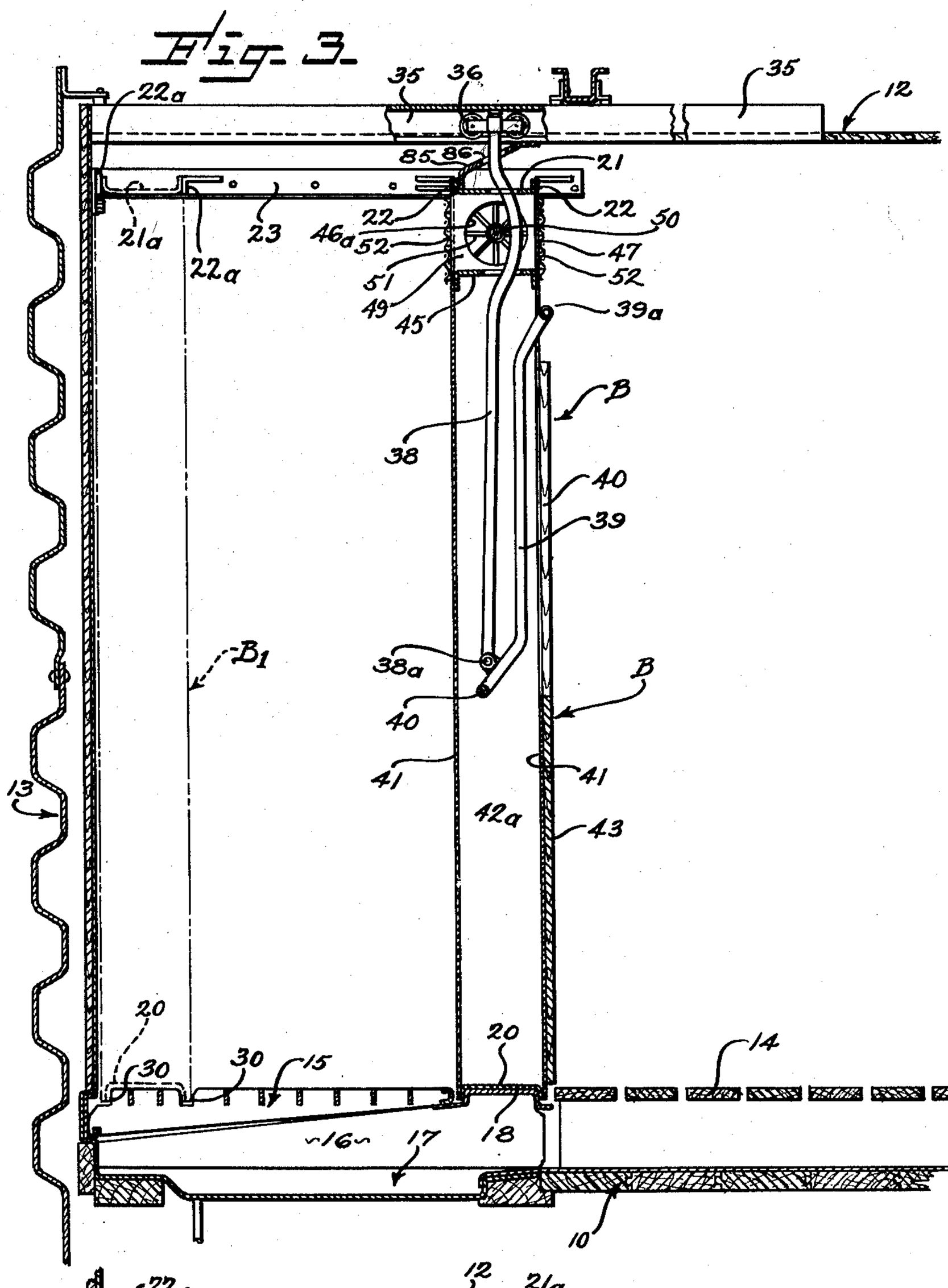

Fig. 4

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UNITED STATES PATENT OFFICE

2,544,242

CONVERTIBLE BULKHEAD AND AIR CIRCULATING FAN ASSEMBLY FOR REFRIGERATOR CARS

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Application August 9, 1947, Serial No. 767,820

5 Claims. (Cl. 98—6)

1

This invention has reference to the structure and design of refrigerator cars equipped with forced air circulation; and the general purpose of the invention is to combine the structure and design of a movable convertible bulkhead (the bulkhead which forms one wall of the ice bunker) with the air circulating fan structure, with the fan located at the upper edge of the bulkhead, and to provide suitable driving means for the fan mechanism so located.

For certain purposes it is desirable to locate the air circulating fan at a high level or above the car floor. Such location removes the fan from the locality of debris falling to the floor either in the ice bunker or in the lading compartment and thus serves to protect the fan mechanism from injury. The general object of this invention may also be expressed as the provision of combined structure and design whereby a driven fan may be located at the upper part of a movable or convertible bulkhead, and carried by the bulkhead so that when the latter is moved from its normal position where it forms the forward wall of the ice bunker to a position against the end wall of the car, the fan structure is also moved to a position against the end wall of the car where it does not then obstruct the ceiling of the lading compartment which is then extended to include the major portion of the ice bunker space. In such an arrangement it is also one of the purposes of the invention that the fan structure or housing shall form a structural part of the bulkhead, capable of taking the load thrusts to which the bulkhead is subjected.

These and other purposes of the invention, and its corresponding accomplishments, will be best understood from the following detailed descriptions of a preferred structure and design in which the invention is illustratively embodied, and which are shown in the accompanying drawings where:

Fig. 1 is a transverse sectional view taken substantially as indicated by line 1—1 on Fig. 2 and illustrating the application of an illustrative form of the invention to a refrigerator car;

Fig. 2 is a side view, partially in elevation and partially in section as indicated by line 2—2 on Fig. 1;

Fig. 3 is a vertical section in the same aspect as that of Fig. 2, taken as indicated by line 3—3 on Fig. 1;

Fig. 4 is a detail section taken as indicated by line 4—4 on Fig. 1;

Fig. 5 is a plan section taken as indicated by line 5—5 on Fig. 2.

In the drawings the car structure, as well as certain other parts, are shown more or less diagrammatically. The car structure thus shown is intended to be typical of any car structure

2

suited to the present invention. As here shown the car floor structure is indicated generally by the numeral 10, the side walls by numeral 11, the ceiling and roof structure by numeral 12 and the end wall structure by numeral 13. The normal lading compartment of the car is shown as being provided with an elevated lading floor formed by the lading racks 14 supported above floor structure 10 in any suitable manner. The bulkhead in its normal position defining the forward wall of the ice bunker is designated generally by the letter B; and the ice grate is designated generally by the numeral 15. The ice grate may be fixed or movable, in either instance occupying such a position as shown in Fig. 3, at the level of lading floor 14 when the bulkhead B is moved to the position indicated at B1 against the car end wall to make the ice bunker space available for lading. As here shown, the ice grate is supported in that position upon a series of laterally spaced supporting members 16 which are in the form of beams which bridge the drip pan 17 and which, at their forward ends, support the transverse fixed beam member 18 which forms the locating and supporting member for the lower edge of bulkhead B when in its normal position.

The bulkhead may be of any suitable design and structure, and it may be moved from its normal position as shown at B to any other position in the car where it opens up the ice bunker space for lading purposes. It is preferred to move it to a position against the car end wall; and for purposes of illustration here the bulkhead and the means for anchoring it in position and the means for lifting and moving it may be the same as fully shown and described in the application of Herbert J. Wieden, et al., Ser. No. 685,510, filed July 22, 1946, now Patent No. 2,474,563, dated June 28, 1949.

Utilizing that type of bulkhead structure and movement, the lower edge of the bulkhead structure is equipped with an inverted channel 20 which, in the normal position shown at B, fits over the fixed locating beam 18 to support and position the bulkhead at its lower edge. Beam 18 is located with its upper surface at the level of the lading floor so that it becomes in effect a part of that floor when the bulkhead is moved. In position B, the upper end of the bulkhead is fixedly located by the projecting ends 21*a* of an upper transverse beam formation 21. This beam formation 21 forms a structural part of the combined bulkhead and fan housing structure, as will be explained, and the projecting ends 21*a* thus constitute in effect a pair of locating lugs projecting from the side edges of the combined structure. In the position shown at B these projections 21*a* are received in locating sockets which are formed by a pair of spaced stop members 22

attached to mounting irons 23 secured to the side wall of the car directly under the ceiling as is best shown in Fig. 4. The upper edge of the combined bulkhead and fan housing structure is normally spaced a short distance below ceiling 12, allowing the structure to be lifted to disengage projections 21*a* from socket formation 22 and to disengage bottom channel 20 from the locating and supporting beam 18. When raised to that disengaging level the bulkhead may then be moved rearwardly to position B1 against the car end wall, and then dropped down to a position where its upper projections 21*a* engage in sockets formed by lugs 22*a* on mounting members 23, and where the flanges of its lower channel 20 engage in notch formations 30 in the structure of ice grate 15.

The typical arrangement shown in the drawings for lifting and moving the combined bulkhead and fan housing structure, comprises a central longitudinal rail 35 recessed upwardly into ceiling structure 12, and a trolley 36 riding that rail. The rail extends from the car end wall longitudinally into the car at least far enough to accommodate trolley 36 when the bulkhead is in the position shown at B in Fig. 3, or it may extend onwardly as indicated over the normal lading compartment so that the bulkhead may be moved forwardly into the lading compartment as well as rearwardly against the car end wall. Movement of the bulkhead structure forwardly into the normal lading compartment, and then swinging the bulkhead around on its central suspension to a position where the plane of the bulkhead structure is more or less longitudinal of the car, gives access to the ice bunker for ice removal or cleaning directly from the front, and also enables the bulkhead structure to be placed, if desired, flatly against one of the car side walls. Such arrangements and movements are included in the subject-matter of said Wieden application and need not be detailed here; except to remark that in the present invention the fan structure is moved with the bulkhead structure to whatever position the bulkhead structure is moved from its normal position shown at B. In the lifting and moving mechanism as here shown a single central suspension rod 38 is swivelly suspended from trolley 36 and extends down into the bulkhead and fan structure. At its lower end 38*a* this rod is pivotally connected with an operating lever 39 which is pivoted at 40 in the bulkhead structure. The normal position of lever 39, shown in Fig. 3, is with the lever in an upper position and substantially completely housed within the bulkhead structure with its transverse handle 39*a* bearing against the outer face of that structure at opposite sides of the slot 40 which accommodates the handle movement. By throwing the handle forwardly and down the bulkhead structure will be raised with reference to suspension rod 38 and trolley 36. With the bulkhead raised, it is suspended completely from trolley 36 and may then be moved to any desired position and then lowered by throwing lever 39 back to the position shown in Fig. 3. Suitable means may be provided for locking lever 39 in either its upper or lower position, but need not be described here.

The structure and design of a preferred and illustrative form of fan mechanism, incorporated with the bulkhead structure, is shown more particularly in Figs. 1, 3 and 5. As there shown, the bulkhead structure proper includes an upper horizontal plate 45 which extends from face to face of the bulkhead structure and also extends substantially continuously between the opposite vertical side edges of the bulkhead structure and is integrated therewith, as by welding. As here shown in simplified form, the bulkhead structure comprises two opposite facing sheets 41 spaced apart by suitable internal structure, such as the horizontal and vertical members 42 and 42*a* which are fragmentarily illustrated in Fig. 1. This structure is typically a welded unit of sheet metal members, and the upper plate 45 is integrated in that welded unit. A wood facing 43 (shown only in Figs. 3 and 5) is preferably provided on the face sheet 41 which faces toward the lading compartment.

Upper bulkhead plate 45 also forms the bottom plate of a fan housing which is made up of that plate, the substantially coextensive beam formation 21 which forms the top plate, and a vertical wall structure intermediate the top and bottom plates. This vertical wall structure, as is best shown in Fig. 5 comprises a series of transverse vertical walls 46 which are spaced apart in a direction longitudinal of the fan housing (in a horizontal direction in the plane of the bulkhead), and of a series of vertical side wall portions 47, arranged in staggered relationship at opposite sides of the fan housing substantially in the two planes of the opposite faces of the bulkhead. These staggered-opposed side wall portions are so arranged that, together with the several transverse walls, they form what may be described as a zig-zag vertical wall formation which forms and encloses alternate compartments 48 which, as here shown, are open at the face of the bulkhead structure which faces the lading compartment; and alternate compartments 49 which are open in a direction facing the ice bunker space. The complete vertical wall formation may be made up of a single long strip of sheet metal bent to the desired form, or of a number of separate pieces welded together. In any event the whole vertical wall formation is preferably made substantially integral, and is integrated with the upper and lower housing plates by welding or otherwise. The entire fan housing structure is thus made to be of ample strength to withstand all thrust that may be exerted against it by car loads and/or by ice. Those loads, exerted mainly against the bulkhead proper in its face areas below the fan housing, are transmitted through the fan housing structure to the locating lugs 21*a* and thus to the car body.

A single continuous fan shaft 50 extends lengthwise and centrally through the fan housing and carries radial bladed fan units 51 in alternate compartments of the fan housing. As here shown and as is preferred, the fans are located in the compartments 48 which open in a direction facing the lading compartment of the car, as that location is one which causes upward circulation of air through the ice bunker, and downward circulation of air through the car load. The air circulation enters the bottom of the ice bunker under the level of the ice grate through the openings below the lower edge of the bulkhead structure and between the several supporting beams 16, and flows up through the bunker. The air flows directly into the open sides of the fan housing compartments 49 and then flows axially through the openings 46*a* with which certain or all of the transverse walls 46 are provided. Thence the air flows axially into fan units 51 and is centrifugally thrown outwardly by these fan

units and out through the open sides of compartments 48 into the lading compartment, regardless of the direction in which the fan units and fan shaft 50 are being rotated. The circulated air then flows down through the load and re-enters the ice bunker at the bottom. To prevent ice, salt or debris from entering or being drawn into compartments 49 and thence into the fan units, and to prevent contact of the load with the fan units in compartments 48, the open sides of those compartments may be protected by the screens 52, shown in Figs. 2, 3 and 5, but omitted from Fig. 1 for clarity of illustration. The circulation direction can be reversed by placing fan units 51 in the other set 49 of alternate housing compartments.

Suitable bearings 53 for shaft 50 are located in some of compartments 49, and one end of shaft 50 projects beyond the outermost fan unit 51 and/or bearing 53 and carries a member, such as a belt sheave 55, through which the shaft is driven. The immediate means by which the shaft is driven is more or less immaterial to the broader aspects of the invention, but for practical and economic reasons a belt drive from the running gear of the car is preferred and certain features of the invention pertain to that preferred drive. Fan shaft 50 might be driven directly from a power source, such for instance as an electric motor, mounted on the bulkhead itself, for instance mounted directly on shaft 50 in the location of sheave 55. On the other hand it is preferred to drive the fan, through a suitable drive transmission, from a driving wheel such as that shown at 56, mounted at or near the car floor. Again that driving wheel 56 might be driven by a direct source of power such for instance as an electric motor. And when the car is standing, wheel 56 is designed to be so driven by an electric motor or other primary power drive applied to the member 66*a* which is carried on the outer end of shaft 66 and available at the exterior face of the car wall. This is primarily for pre-cooling operations while the car is standing. But it is preferred normally to drive the driving wheel 56 from the running gear of the car. In a typical preferred form, the driving arrangements for the fan shaft are briefly described as follows.

A driving shaft 60 is mounted under the car floor in such position that a traction roller 61 on one of its ends is engageable with some part of the running gear of the car, preferably with the car wheel as shown at 62. The other end of shaft 60 carries a belt sheave 63, and a belt 64 is trained over that sheave and over a sheave 65 on shaft 66 which carries driving wheel 56. Shaft 66 may be conveniently mounted in a bearing member 67 which extends through the wall of the car so that driving wheel 56 is located inside the car wall and so that sheave 65 may be located either exteriorly of the car wall or in a recess within the car wall as here shown. As here illustrated, sheave 65 is encased within the wall interior by a casing which is shown at 69 in Figs. 1 and 2; and belt 64 is accommodated by openings 68 in the lower part of the wall structure. The details of these arrangements may vary with different car structures.

Driving shaft 60, and its traction roller 61 and sheave 63, may be supported in any suitable manner under the car floor to enable roller 61 to effectively engage the car wheel. The parts referred to are here shown merely diagramatically. Reference may be had to the driving mechanisms shown in Patent No. 2,413,158, dated December 24, 1946, for the full particulars of suitable means for supporting driving shaft 60 under the car floor.

As will be noted from Figs. 1 and 2, driving shaft 66 is located on a horizontal axis substantially in the medial plane of the bulkhead structure when it is in the normal position shown at B in Fig. 2. In that position of the bulkhead structure a traction wheel 70, mounted in the lower part of the bulkhead structure, tractively engages the periphery of driving wheel 56. To press wheel 70 into good tractive engagement with wheel 56, and to allow for minor variations in the dimensions of the various parts, and also to allow for wear, wheel 70 is mounted on one end of a shaft 71 which is carried in a bearing tube 72. The end of tube 72 opposite wheel 70 is pivoted at 73 to any suitable part of the internal bulkhead structure, as for instance to one of the upright members 42*a*. The axis of pivot 73 is horizontal so that bearing tube 72 and the axis of shaft 71 may swing in a vertical plane. A spring 74 tends to force the swinging end of bearing tube 72 down to press wheel 70 into good tractive engagement with driving wheel 56. Any suitable stop means may be used to limit the downward movement of wheel 70 so that it cannot drop too far below the extreme lower edge of the bulkhead structure; preferably so that it cannot drop below the level of the lower edges of lower channel 23, when the bulkhead is moved away from the position shown at B in Figs. 2 and 3. In the preferred present form and design of the structure, the bulkhead structure includes a sheet metal end wall 75 which is located in a vertical plane a short distance inside the extreme outer ends of the opposite face sheets 41 of the structure. Wall 75 has an opening 75*a* to accommodate bearing tube 72; and the lower edge of that opening may, for instance, form the stop to limit downward swinging of wheel 70.

At the extreme outer ends of bulkhead face sheets 41 there is a vertically elongate end wall 77 which is preferably composed of wood and forms a wooden end facing for the bulkhead structure coming close to or contacting with the inside face of the car wall. The opposite end face of the bulkhead structure may be equipped with a similar wooden facing strip 77*a*. The end wall strip 77, located as shown and described, encloses a vertically elongate well in the edge portion of the bulkhead structure to accommodate the driving means between traction wheel 70 and fan shaft 50. Preferably this driving means involves a belt drive such as illustrated, composed of an endless belt 78 (shown only in Fig. 2) trained over a sheave 79 associated with wheel 70, over sheave 55 on fan shaft 50 and also over two idler sheaves 80 and 81. Sheave 80 is fixedly journaled on the bulkhead structure and sheave 81 is journaled on a swinging arm 82 pivoted on the bulkhead structure and urged by spring 83 in a direction to keep belt 78 taut. Spring 83 of course exerts less force than spring 74.

As here illustrated, sheave 79 is directly associated with traction wheel 70 on shaft 71 which is here shown as a relatively short shaft. However that shaft could be extended in length and sheave 79 mounted on its end opposite wheel 70, much as traction roller 61 and sheave 63 are mounted at opposite ends of shaft 60. Thus, shaft 71 could be extended through the bulkhead from one side edge to the other, with sheave 79, belt 78 and fan shaft sheave 55 all located

at the edge of the bulkhead which is opposite the edge at which traction roller 70 is located.

The invention is adaptable to car bodies which are not equipped with an elevated lading floor above the car floor proper, and also adaptable to ways and means of moving the bulkhead structure other than as have been described. The first adaptation may readily be visualized by considering the lading rack 14 to be a part of the floor structure proper. In that event the air circulation opening which has been described as being provided under the lower edge of the bulkhead below the level of the lading floor would be provided with by spacing the lower edge of the bulkhead above the floor structure proper, or, as is ordinarily done, by providing openings through the lower part of the bulkhead.

It is preferred to provide for bulkhead movement involving the small vertical movements described, because that facilitates secure anchoring with simple and strong devices. The required vertical movement is relatively small and thus requires only a small vertical clearance between the top of the bulkhead structure (upper plate 21) and the ceiling 12. As here shown, that clearance is designed to be large enough to accommodate a closure for the ice bunker hatch and also allow the clearance necessary for the vertical bulkhead movement (see for instance the Wieden et al. application previously referred to). With such a hatch closure in place the effective air passage area over the top of the bulkhead is substantially smaller than the effective cross sectional total area of the air passage through the fan housing. Short circuiting of the air stream over the bulkhead top is thus minimized. That short-circuiting, however, can be and usually will be substantially completely eliminated. Ordinarily the closure for the ice bunker hatch is movably mounted directly under the car ceiling and is connected to the movable bulkhead to move with it longitudinally as the bulkhead moves between positions B and B_1, as shown at 195 in Patent 2,474,563. That hatch closure and its appurtenant parts may be arranged to effectively wholly close the clearance between the car ceiling and upper bulkhead plate 21. However, as the hatch closure in itself forms no part of the present invention it is not shown here. For the purpose of schematically showing a means for closing the clearance, typifying a closing by any suitable means, a flexible flap 85 is shown in Figs. 2 and 3 mounted on upper plate 21 and contacting or coming close to the ceiling. To accommodate rod 38 it may have an opening 86, but otherwise it typifies an imperforate closure extending along the whole length of the top of the bulkhead.

However, movable and convertible bulkheads have been proposed for simple horizontal transposition involving no vertical movements, such bulkheads being anchored in fixed position or positions by any suitable locking means which does not involve vertical bulkhead movement. In such arrangements the bulkhead may be carried, for movement, with only the necessary slight non-contact clearance at the floor and ceiling. The invention is adaptable to such bulkhead movements, with substantially no change. As described in its preferred arrangement, traction wheel 70 on the bulkhead is moved directly down onto the driving wheel 56 when the bulkhead is lowered; and when the bulkhead is raised for moving the wheel 70 does not drag on the floor or ice grate. And that is preferred, because, among other things it allows driving wheel 56

to be located wholly below the upper surface of the floor structure. However, in a bulkhead having simple horizontal movement, traction wheel 70 could drag on the floor; or driving wheel 56 could be located to project a short distance above the floor surface.

We claim:

1. In a car body having a car floor structure, side walls, roof and an end wall; the improvement which comprises a movable unitary bulkhead structure of a width adapted to extend across the car interior substantially from side wall to side wall and of a height adapted to extend from the level of the floor structure to a level closely under the car roof, said unitary bulkhead structure being composed of a lower wall structure and an upper fan housing structure, the fan housing structure being composed of a lower horizontal plate which also forms an integral part of the lower bulkhead wall structure, an upper horizontal plate spaced above the lower plate, and a vertical wall structure between the lower and upper plates and integrated with each plate, said vertical wall structure including parts forming face wall portions arranged in staggered interrelation and interconnecting cross-wall portions, the vertical wall structure enclosing alternate housing compartments having open sides at opposite faces of the bulkhead structure, certain of the cross walls having openings, a fan shaft extending through the openings lengthwise of the fan housing, and fan units on said shaft in housing compartments which are open at one face of the structure, and means for holding the bulkhead in at least one predetermined position across the car interior, said means including an anchoring member at the lower edge of the structure and also end extensions of the upper fan housing plate beyond the side edges of the bulkhead structure, and cooperating anchoring members incorporated with the car body.

2. In a car body having a car floor structure, side walls, roof and an end wall; the improvement which comprises a movable unitary bulkhead structure of a width adapted to extend across the car interior substantially from side wall to side wall and of a height adapted to extend from the level of the floor structure to a level closely under the car roof, said unitary bulkhead structure being composed of a lower wall structure and an upper fan housing structure having openings at opposite faces of the bulkhead structure, an air impelling fan in the fan housing structure, means for anchoring the bulkhead structure in at least one predetermined position across the car interior, and fan driving means including a downwardly pressing power transmitting traction wheel mounted in the lower part of the bulkhead structure, and an initially driven power transmitting traction wheel mounted on the car body in a position to be tractively engaged by the first mentioned wheel when the bulkhead structure is in its said anchored position.

3. The improvement as defined in claim 2, and in which the initially driven traction wheel is located substantially wholly below the upper surface of the car floor structure.

4. The improvement defined in claim 2 and in which the bulkhead structure has an enclosed vertical well, and power transmitting means located in said well and operatively connecting the first mentioned traction wheel with the air impelling fan.

5. In a car body having a car floor structure, side walls, roof and an end wall; the improvement

which comprises a movable unitary bulkhead structure of a width adapted to extend across the car interior substantially from side wall to side wall and of a height adapted to extend from the level of the floor structure to a level closely under the car roof, said unitary bulkhead structure being composed of a lower wall structure and an upper fan housing structure having openings at opposite faces of the bulkhead structure, an air impelling fan in the fan housing structure, means on the bulkhead structure and on the car body adapted to interengage on bulkhead lowering to anchor the bulkhead in at least one predetermined position across the car interior, and fan driving means including a power transmitting traction wheel mounted in the lower part of the bulkhead structure, and an initially driven power transmitting traction wheel mounted on the car body in a position substantially flush with the

level of the floor structure and adapted to be tractively engaged by the first mentioned wheel when the bulkhead structure is lowered into its said anchored position.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,102,182	McCormick	Dec. 14, 1937
2,314,463	Schwebs	Mar. 23, 1943
2,324,749	Wieden	July 20, 1943
2,328,820	Lundvall	Sept. 7, 1943
2,331,002	Small	Oct. 5, 1943
2,349,315	Van Dorn	May 23, 1944