Oct. 4, 1966 O. C. HUTCHINSON 3,276,222

MEANS FOR IMPROVING MOBILITY OF A REFRIGERATOR

Filed Aug. 23, 1965 3 Sheets-Sheet 1

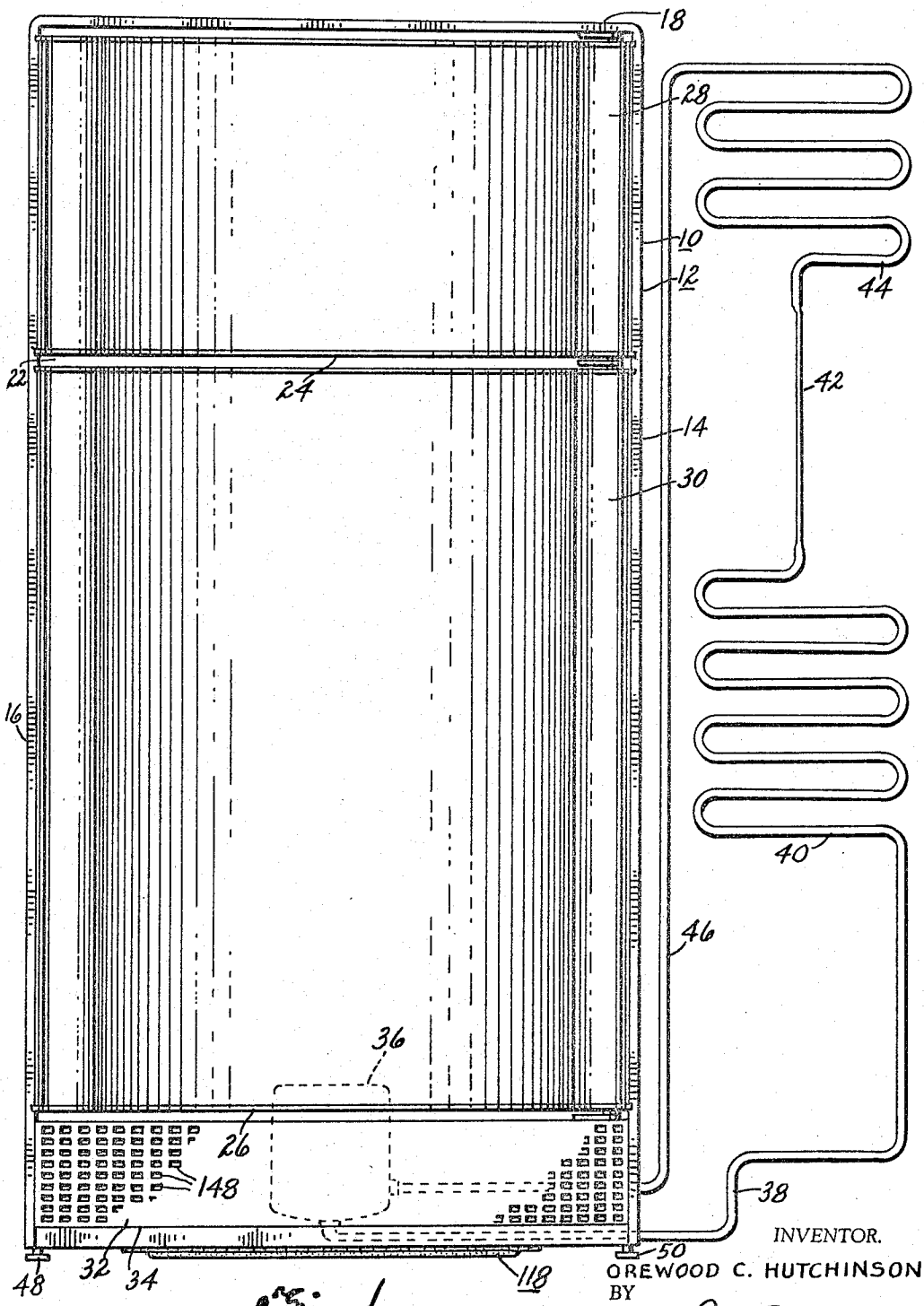


Fig. 1

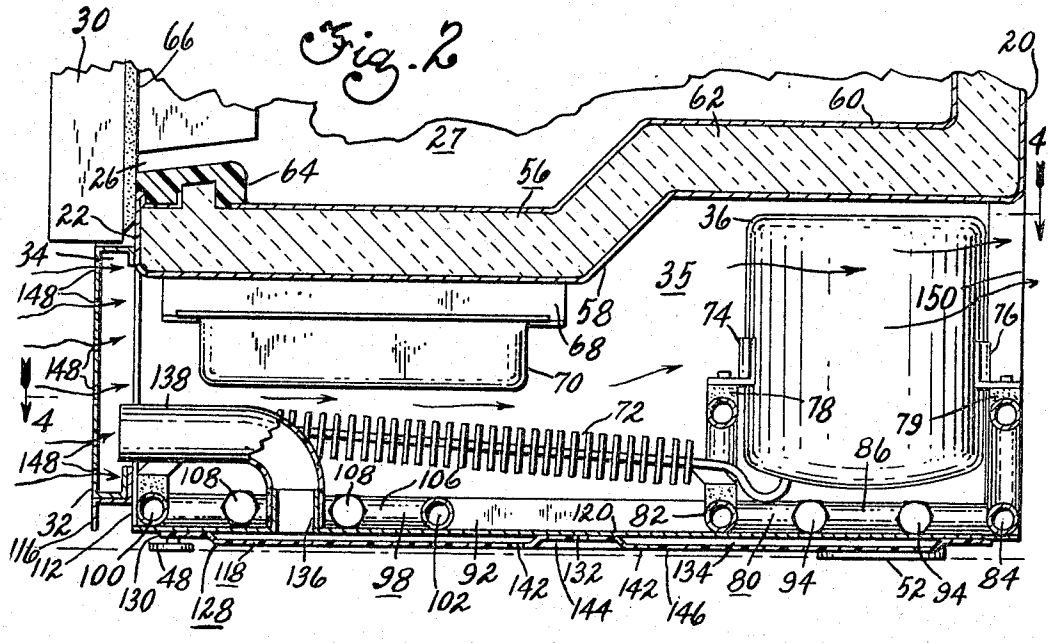
INVENTOR.
OREWOOD C. HUTCHINSON
BY
J. C. Evans
ATTORNEY

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Filed Aug. 23, 1965 3 Sheets-Sheet 2

Fig. 2



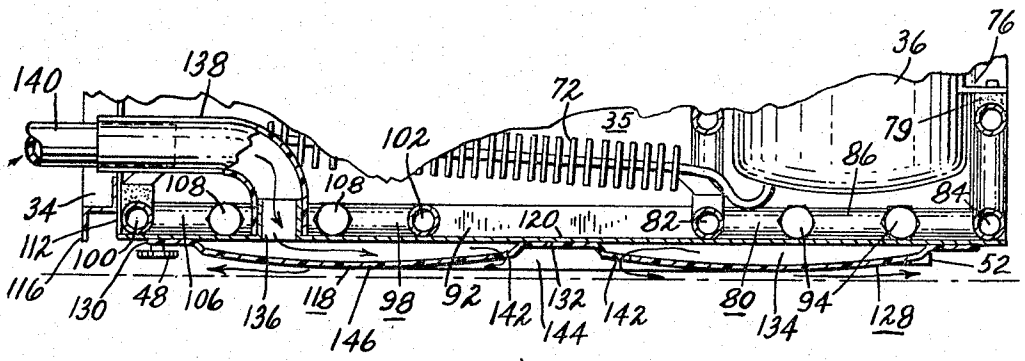


Fig. 3

INVENTOR.
OREWOOD C. HUTCHINSON
BY J. C. Evans
ATTORNEY

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Filed Aug. 23, 1965 3 Sheets-Sheet 3

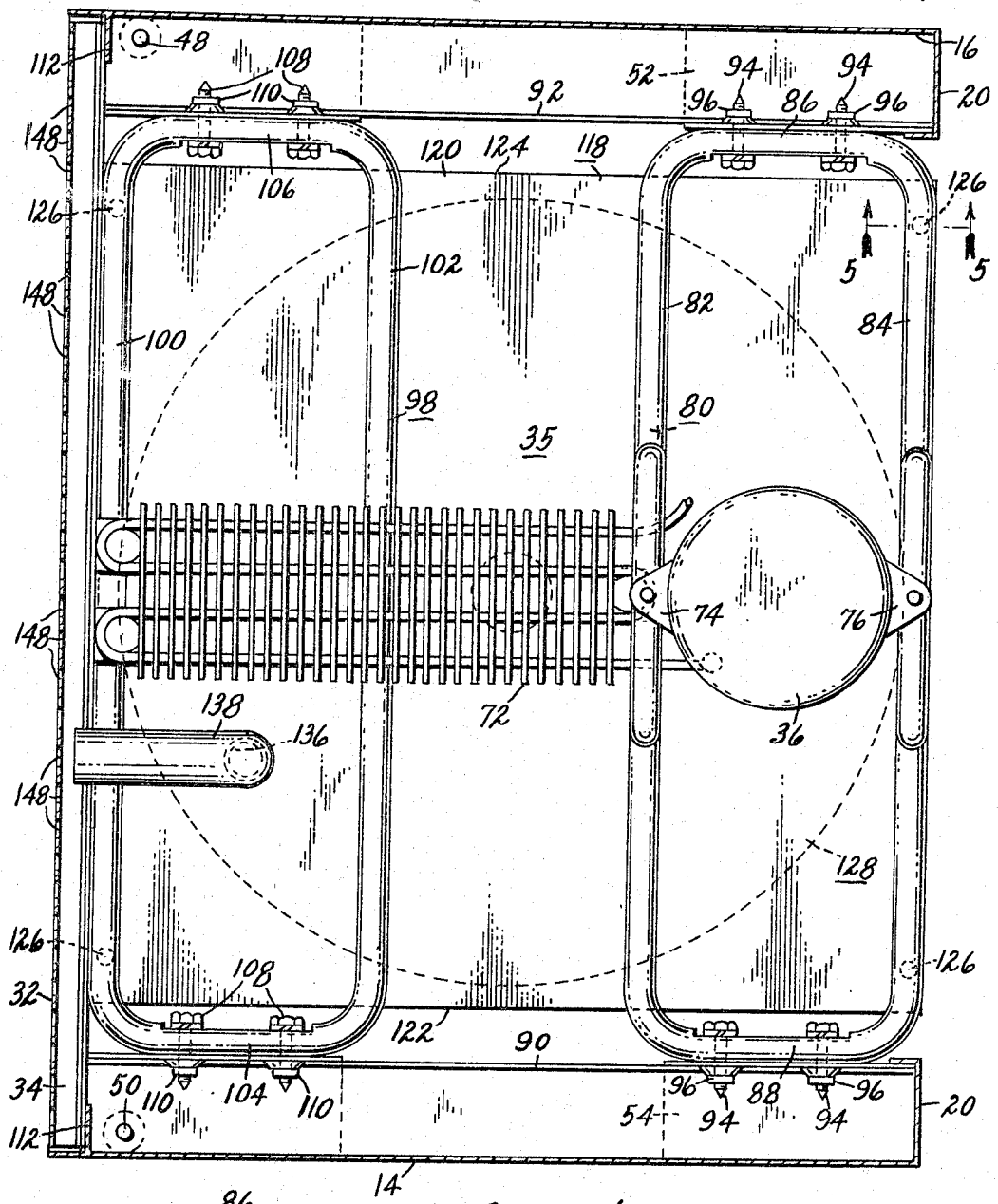


Fig. 4

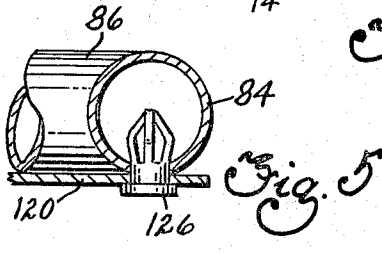


Fig. 5

INVENTOR.
OREWOOD C. HUTCHINSON
BY
J. C. Evans
ATTORNEY

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MEANS FOR IMPROVING MOBILITY OF A REFRIGERATOR

Orewood Clarence Hutchinson, Don Mills, Ontario, Canada, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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7 Claims. (Cl. 62—239)

This inveniton relates to refrigerator assemblies and more particularly to mobile refrigerator assemblies.

Present-day refrigerator assemblies are characterized as having relatively slim-line outer dimensional configurations made possible in part by improvement in thermal insulation and in fabrication of the outer cabinet of the refrigerator. Such refrigerators are typically supported by depending members off a base framework on the refrigerator that engages a floor beneath the refrigerator to more or less immovably locate the refrigerator in a stationary position.

Another feature of present-day refrigerators is that the volume enclosed by the outer cabinet of the refrigerator can be utilized as much as possible for the storage of food. It is also desirable to maintain the space between the bottom of a refrigerator and a supporting surface to a minimum in order that the vertical height of the refrigerator and a supporting surface to a minimum in order that the vertical height of the refrigerator is maintained within limits that enable the cabinet to be located in spaces in a kitchen arrangement whereby the refrigerator will have a built-in appearance. In such cases there is a limited clearance between the refrigerator and adjoining cabinets both in the vertical direction and of the sides of the refrigerator.

Typically, refrigerators have been provided with floor engaging members on the base thereof that produce a high unit loading on the floor and because of the relatively great weight of refrigerator assemblies the cabinet becomes more or less immovably located during its operation once it has been located within a particular space in the kitchen arrangement.

As a result, it has been difficult to move the refrigerator in order to clean the space therearound. Moreover, even though sufficient manual force is exerted to move such refrigerators, there is a problem of damaging the outer cabinet of the refrigerator or adjoining cabinets or the surface over which the refrigerator is moved.

One arrangement for enhancing the mobility of refrigerators for movement with respect to adjoining cabinets and the like is the provision of casters on the base of the refrigerators. Such casters, however, still direct relatively high unit loadings against the floor that will often damage indentable coverings on kitchen floors or the like.

An object of the present invention, therefore, is to improve the mobility of refrigerator assemblies by the provision of an improved suspension system therein including depending leg members and a low-pressure air-cushioned device located inwardly of the outer cabinet on the refrigerator and operative to raise the normal ground engaging leg members on the refrigerator away from the floor and to support the refrigerator appliance on an air bearing for mobility merebly by overcoming the inertia of the refrigerator.

A further object of the present invention is to improve refrigerator assemblies by means of a supporting arrangement in association therewith that utilizes the base framework of a refrigerator to support and reinforce a low-profile, low-pressure air caster assembly that includes a flat plate member underlying substantially the full planar extent of the bottom of the refrigerator, and means responsive to air pressurization to produce an air cushion beneath the appliance for raising it out of an immovable or stationary position with respect to a supporting floor wherein the air caster assembly is located beneath the work compartment of the refrigerator and configured to the remainder of the refrigerator assembly thereby necessitating no changes in the machinery compartment thereof or the vertical height of the refrigerator.

Still another object of the present invention is to improve the mobility of refrigerator assemblies of the type having an outer cabinet forming a food storage compartment and a machinery compartment that includes a compressor and heat exchanger of a compressed refrigerant cooling system by the provision of an air lifting device including a flat rigid plate that is reinforced by a base framework on the outer cabinet of the refrigerator and located completely exteriorly of the machinery compartment of the refrigerator and extending substantially across the complete planar extent of the machinery compartment, and wherein the air lifting device includes a movable, flexible diaphragm that forms in cooperation with the flat plate a pressurizable chamber, and wherein means are provided for directing pressurized air into the chamber and for venting air beneath the flexible diaphragm so that an air cushion will be produced on which the refrigerant is floated for free frictionless mobility with respect to the supporting floor.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a view in front elevation of a refrigerator assembly including the present invention;

FIGURE 2 is an enlarged fragmentary view in vertical section of the refrigerator in FIGURE 1 showing the machinery compartment therein and an integral low-pressure air caster device;

FIGURE 3 is a view like FIGURE 2 showing the refrigerator conditioned for free frictionless mobility with respect to its supporting surface;

FIGURE 4 is a view in horizontal section taken along the lines **4—4** of FIGURE 2 looking in the direction of the arrows; and

FIGURE 5 is an enlarged fragmentary view in vertical section taken along the line **5—5** of FIGURE 4.

Referring now more particularly to FIGURE 1 of the drawings, an upright vertical refrigerator assembly **10** is illustrated including an outer cabinet **12** having side walls **14**, **16**, a top **18**, a rear wall **20**, and a front wall **22**. The front wall **22** is representatively shown as including an upper access opening **24** to a freezer compartment and a lower access opening **26** to a food storage compartment **27**. The access opening **24** is closed by a door member **28** pivotally supported on the outer cabinet **12** by suitable hinge means for pivotal movement about a vertical axis at the right side of the door. The access opening **26** is closed by a door member **30** likewise pivotally secured to the outer cabinet **12** for movement about a vertical axis at the right end of the door **30**. In the illustrated arrangement, the refrigerator includes a front bottom scuff plate **32** secured by suitable means to the outer cabinet **12** to close an access opening **34** into a machinery compartment **35** located below the food storage compartment **27**.

In the illustrated arrangement, a representative refrigerant system for cooling the freezer and food storage compartments is shown diagrammatically as including a compressor **36** located within the machinery compartment having a discharge line **38** directed therefrom that com-

municates with a condenser coil 40 from whence refrigerant is directed through an elongated capillary tube 42 for expanding the refrigerant prior to entry thereof into an evaporator coil 44 which is in heat transfer relationship with the interior space within the refrigerator. Refrigerant is returned from the evaporator coil 44 through a suction line 46 back to the compressor 36.

The cabinet 12 is normally stationarily located with respect to a supporting floor by a plurality of depending members on the base of the refrigerator shown as including forwardly located adjustable legs 48, 50 at the front corners of the refrigerator and depending members 52, 54 located at the rear corners of the base of the refrigerator. The legs and depending members direct a high load unit loading against the supporting floor whereby the refrigerator 10 is effectively immovably supported with respect to the floor.

In certain cases where the floor surface is characterized by being relatively indentable as is the case with many kitchen floor coverings the depending members on the base of the refrigerator can become embedded in the floor covering and unless extreme care is used in applying the manual force to the refrigerator, the depending members can cause substantial damage to the covering on the supporting surface. Therefore, in order to move the refrigerator for cleaning, servicing or the like, it has been necessary to exert a very substantial manual force thereagainst in order to first of all dislodge the depending members from the floor and then to lift the refrigerator off the floor to move the refrigerator across the floor. Thus, the mobility of refrigerators of the type illustrated in FIGURE 1 has been, at best, very limited in nature. One attempt to increase the mobility of refrigerators of the illustrated type has been to provide rollers or casters on the base of the refrigerator. These supporting members, however, still direct a very substantial unit loading against the supporting surface and while they tend to reduce the forces required to move the refrigerator, nevertheless tend to mar the covering on many supporting surfaces.

Another characteristic of vertical refrigerators of the above-described type is that the lower extremities of the side walls 14, 16, rear wall 20 and the front wall 22 are located in close proximity to the supporting floor by the depending legs on the base of the refrigerator. It is important to maintain such a close spaced relationship between the base of the refrigerator and its supporting floor both from an appearance standpoint and to maintain the overall height of the refrigerator at a predetermined dimension that is suited for many built-in kitchen arrangements wherein the refrigerator is located within a space in the cabinetry of the kitchen so that the top surface 18 thereon closely underlies an overhead storage cabinet or the like.

Additionally, in vertically upstanding refrigerators of the above-described type, the bottom machinery compartment, or space, has a limited height whereby the total volume bounded by the outer cabinet 12 of the refrigerator is utilized primarily for the storage of food. Referring now more particularly to FIGURES 2 through 5, the machinery compartment 35 is illustrated as being separated from the food storage compartment 27 by a wall section 56 including an outer wall member 58 formed integrally with the rear wall 20 of the refrigerator and a liner 60 having a suitable thermal insulating material 62 located therebetween. The liner 60 has a continuous collar 64 formed thereon continuously around the access opening 26 that sealingly engages an annular continuous sealing member 66 located on the outer periphery of the inner surface of the door member 30. In the illustrated arrangement a bracket 68 is secured to the outer wall 58 to support a drip pan 70 that receives condensate from the food storage compartment 27 through suitable conduit means (not shown). The condensate pan 70 is located immediately above a tube and fin heat exchanger 72 that communicates with the interior of the shell of the compressor 36 to remove heat from refrigerant being discharged therefrom in a manner more specifically set forth in Patent No. 3,097,509, issued July 16, 1963, to Mann et al.

In the illustrated arrangement the compressor 36 is a hermetically sealed motor compressor unit of the type well known in the refrigerator appliance field. The outer casing of the compressor 36 is located in close spaced relationship to the underside of wall 56 and has brackets 74, 76 on either side thereof supported on resilient mounting assemblies 78, 79, respectively, that are supportingly received on a supporting framework 80 located adjacent the rear wall 20. The framework 80 more particularly includes a pair of transversely directed tubular portions 82, 84 located in spaced parallelism and extending completely across the width of the machinery compartment 35. The portions 82, 84 are joined at their opposite ends by curved portions 86, 88 of the bracket 80. The curved portions 86, 88 are connected in turn to reinforced channel-shaped flanges 90, 92 on the side walls 14, 16, respectively, by suitable means shown as screws 94 and lock nuts 96. The reinforced channel-shaped flanges 90, 92 are located at the lower extremities of the side walls 14, 16 and extend across the full width thereof as best seen in FIGURE 4.

Adjacent the front wall 22 of the refrigerator cabinet 12 the channel-shaped flanges 90, 92 are connected to a framework 98 having a planar configuration similar to the framework 80 and including transverse portions 100, 102 located in spaced parallelism and directed across the width of the machinery compartment 35 that are joined at their opposite ends by U-shaped portions 104, 106, respectively. The U-shaped portions 104, 106 are secured to the channels 90, 92 by suitable means representatively shown as screws 108 and lock nuts 110.

The transverse portion 100 of the framework 98 is located in juxtaposition with a bottom edge 112 of the front wall 22 that is directed completely across the front of the refrigerator to form in conjunction with the front edge of the wall section 56 a front access opening 34 into the machinery compartment that is closed by the scuff plate 32 which is more particularly shown in FIGURE 2 as being supportingly received off the bottom edge 112 on an S-shaped channel 116 secured to the edge 112 and directed across the width thereof.

The machinery compartment 35 illustrated in FIGURES 2 through 5 is representative of many arrangements found in refrigerator assemblies and is characterized by a limited space in which a compressor, heat exchanger and other operative components of a refrigerant system can be located in a compact fashion. Furthermore, the base framework illustrated is representative of one preferred form of reinforcing the bottom skirt or lower extremities of an outer cabinet having sheet form outer walls to prevent undesirable buckling of the walls in the vicinity of the machinery compartment.

In accordance with certain of the principles of the present invention, to improve the mobility of a refrigerator having a machinery compartment of such limited configurations with a relatively flexible enclosing skirt, an improved low-unit pressure, low-profile air cushion assembly 118 is located in the limited space beneath the base of the refrigerator in a manner to underlie substantially the full planar extent of the base of the refrigerator without requiring any substantial modification of the space occupied by the machinery compartment and without unduly increasing the overall height of the refrigerator 10. More particularly, the assembly 118 is illustrated as including a flat plate 120 having a planar extent best illustrated in FIGURE 4 as underlying almost the complete planar extent of the base of the refrigerator and including side edges 122, 124 spaced from the adjacent U-shaped reinforcing channels 90, 92 on the lower extremities of the side walls 14, 16. In the illustrated arrangement the front

and rear edges of the plate **120** underlie the transverse portion **100** of the reinforcing framework **98** and the transverse portion **84** of the reinforming framework **80**, respectively. The plate is connected to these transverse members by a plurality of push-type fasteners **126**, one being shown in FIGURE 5.

The plate **120** has a flexible diaphragm **128** depending therefrom that has its outer peripheral edge fastened by suitable means such as heat bonding to the plate at **130** and includes a central portion thereof likewise suitably secured to the underside of the plate **120** by suitable means such as heat bonding at **132**. The plate **120** and diaphragm **128** thereby form in cooperation with one another an annular pressurizable cavity **134**. The pressurizable cavity **134** communicates with an let **136** on the plate **120** that has a flexible inlet conduit **138** connected thereto and adapted to be connected to a supply conduit **140** through the access opening **34** from a suitable source of pressure as best seen in FIGURE 3. Pressurized air is thereby directed interiorly of the pressurizable chamber **134** from whence it is discharged through a plurality of openings **142** in the diaphragm **128** into a plenum space **144** formed by a perimetric portion **146** on the diaphragm **128** and then beneath the base of the refrigerator. The appliance thereby is support on an air cushion so that it can be readily moved for cleaning, servicing or the like merely by overcoming the inertia of the refrigerator **10**.

In accordance with certain principles of the present invention, the improved mobility of the refrigerator **10** is produced without undesirably interfering with a convective air flow pattern through the machinery compartment **35** that serves to dissipate heat from the heat exchanger **72**. In the illustrated arrangement such convective flow may occur through openings **148** in the scuff plate **32** thence across the heat exchanger and through an opening **150** in the rear wall **20**. Additional convective currents may occur beneath the bottom extremity of the side walls thencethrough the space between the reinforcing flanges **90**, **92** and the edges **122**, **124** of the support plate **120**.

In accordance with other of the principles of the present invention, when the flexible diaphragm **128** is deflated as illustrated in FIGURE 2, it assumes a position raised a slight amount from the supporting floor as best seen in FIGURE 2. In one working embodiment, the height of the adjusted legs **48**, **50** and depending members **52**, **54** is such that the bottom extremity of the side walls **14**, **16** is raised approximately one-half inch from the supporting floor and the diaphragm **128** is raised one-eighth inch from the supporting floor. Upon inflation of the diaphragm **128**, as seen in FIGURE 3, the diaphragm initially moves into engagement with the supporting floor to cause the depending members on the framework (the legs **48**, **50** and portions **52**, **54** of the side walls) to be forcibly detached from the supporting floor in cases where the depending members have become embedded therein. Additional pressurization of the diaphragm causes it to assume the configuration shown in FIGURE 3 to form a truncated plenum space and a perimetric boundary on the diaphragm located in close spaced relationship from the floor a distance approximately one-eighth of an inch through which air escapes to cushion and float the appliance for ease of mobility with respect to the supporting surface. At no time during the operation of the air cushioned refrigerator **10** does the air assembly **118** encroach upon the limited confines of the machinery compartment of the refrigerator.

A further feature of the present invention is that the front and rear base frameworks **98**, **80**, in addition to reinforcing the bottom skirt of the refrigerator that encloses the machinery compartment **35**, further has the transverse portions **82**, **84**, **100** and **102** thereof engaging the upper surface of the flat plate **120** throughout their transverse extent. Accordingly, the frameworks **98**, **80** reinforce the plate **120** against buckling upwardly within the machinery compartment **35** upon pressurization of the diaphragm **128** whereby the low-unit pressure forces exerted across the full planar extent of the refrigerator are effectively transferred into its outer cabinet to assure a uniform and continuously effective support thereof with respect to the floor beneath the refrigerator.

While the embodiment of the present invention as herein disclosed constitutes a preferred form it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator assembly comprising means forming a food storage compartment, means including side walls and a rear wall for forming a machinery compartment beneath said food storage compartment, an insulated wall located between said food storage compartment and said machinery compartment for thermally isolating said food storage compartment from said machinery compartment, a compressor located in said machinery compartment, a base framework on the lower extremity of said side walls for reinforcing said side walls, said base framework having a plurality of depending members thereon engageable with a floor for supporting the refrigerator thereon and for locating the lower extremities of said base framework above the floor, means for cooling said food storage compartment including a compressor located within said machinery compartment, a first bracket for supporting said compressor within said machinery compartment extending transversely across the width thereof, a second bracket extending across the width of said machinery compartment, a flat plate located below said first and second brackets extending throughout substantially the full planar extent of said machinery compartment, means for securing said flat plate to said first and second brackets, said brackets having surface portions thereon engaging the upper surface of said flat plate for preventing flexure of said flat plate interiorly of said machinery compartment, a flexible member depending from said flat plate, said flexible member having its outer periphery secured to said plate, said flexible member having an inner portion thereof secured to said plate, said flexible member and said flat plate forming a pressurizable chamber, means for directing pressurized air into said chamber, and means for venting air from said pressurizable chamber into a space between the undersurface of said flexible member and the floor supporting said refrigerator.

2. In the assembly of claim **1**, means for directing a separate convective air flow through said machinery compartment for dissipating heat from said compressor.

3. A refrigerator assembly comprising, an outer cabinet including side walls, an insulated liner forming in cooperation with said outer cabinet a food storage compartment, said outer cabinet having a skirt portion forming a work compartment beneath said food storage compartment, said insulating liner thermally isolating said food storage compartment from said machinery compartment, a refrigerant system for cooling said food storage compartment including a compressor, a condenser and evaporator and means for connecting said compressor, condenser and evaporator in serial refrigerant flow relationship, said compressor being located in said machinery compartment, a first support bracket directed across the front of said machinery compartment at the lower extremity of said skirt portion, means for fixedly securing said first support bracket to said side walls, a second support bracket directed across the rear of said machinery compartment at the lower extremity of said side walls, means for fixedly securing said second support bracket to said side walls, said first and second support brackets serving to reinforce said outer cabinet, said second support bracket having said compressor mounted thereon rearwardly in said machinery compartment, depending members on said side walls engageable with a floor for supporting said outer cabinet on the floor, said supported cabinet having its lower extremity raised from said floor in close spaced relationship therewith, a flat plate underlying both said first and second brackets and extending across substan-

tially the full planar extent of said machinery compartment, means for securing said flat plate to said brackets, said brackets engaging the upper surface of said flat plate to limit upward flexure of said plate, said plate being located in a plane formed by the lower extremity of said side walls, passageway means for directing convective cooling currents through said machinery compartment above said plate for dissipating heat from said compressor, a flexible member depending from said flat plate into a spaced relationship with the supporting floor closer than that of the spaced relationship of the lower extremities of said side walls, said flexible member having an outer peripheral edge secured to said plate, said member having an inner peripheral edge thereof secured to said plate, said plate and said flexible member together forming a pressurizable chamber, means for directing pressurized air into said chamber, means for venting air from said pressurizable chamber into a plenum space between said flexible member and the supporting floor, said flexible member upon initial inflation having a surface portion thereof engageable with the floor to raise said depending members from the floor, said surface portion on said flexible member upon a predetermined pressurization of said plenum space being located above the floor on an air cushion for floating said cabinet on the supporting floor whereby the refrigerator assembly is manually movable solely by overcoming its inertia.

4. In a refrigerator assembly the combination of, a cabinet including a food storage compartment and a lower machinery compartment, means for cooling said food storage compartment including a compressor and a heat exchanger located within said machinery compartment, means for directing convective air currents through said machinery compartment for cooling said compressor and heat exchanger, a flat plate located beneath said refrigerator cabinet and below said machinery compartment, means for connecting said flat plate to said refrigerator cabinet, and means associated with said flat plate for directing an air lifting force thereagainst for raising said cabinet out of engagement with the supporting floor so that the refrigerator can be moved merely by overcoming the inertia thereof.

5. In a refrigerator assembly the combination of, a cabinet having a food storage compartment therein and a machinery compartment located below said food storage compartment, a base framework at the lower extremities of said machinery compartment located in close spaced relationship with a floor beneath the refrigerator, depending members on the refrigerator cabinet engageable with the floor for supporting the cabinet in a stationary location on the floor, said depending members locating the lower extremity of said cabinet in close spaced relationship with the supporting floor, a flat plate located below the base framework having a surface portion thereon engageable with said base framework, and means on said flat plate for producing an air cushion beneath said refrigerator for raising said depending members out of engagement with the floor so that the refrigerator assembly can be moved merely by overcoming its inertia.

6. In a refrigerator assembly the combination of, an outer cabinet including a food storage compartment and a machinery compartment located below the food storage compartment, a divider wall for thermally insulating said food storage compartment from said machinery compartment, said outer cabinet having a skirt thereon with its lower extremity disposed in close spaced relationship with a floor, depending members on said cabinet for supporting the weight of said refrigerator on the floor, a low-pressure air cushion assembly supported beneath said machinery compartment including an upper surface portion directed across substantially the full planar extent of said machinery compartment, means for connecting said upper surface portion to said outer cabinet, said air cushion assembly including a second movable member carried on said upper surface portion, said movable member being disposed in close spaced relationship with respect to said floor when in a relaxed position, said movable member being positioned upon energization of the air cushion assembly to move with respect to the floor a distance greater than the location of the lower extremity of said refrigerator skirt when the refrigerator is supported by said depending members in its stationary position for raising the depending members out of engagement with the floor.

7. In a refrigerator assembly the combination of, an outer cabinet including side walls, an insulated lining forming in cooperation with said outer cabinet a food storage compartment, said outer cabinet forming a work compartment beneath said food storage compartment, said insulating liner including a wall member between said food storage and said machinery compartment for thermally isolating said compartments from one another, a framework for reinforcing the lower extremity of said cabinet, depending members on said cabinet engageable with a floor for stationarily locating said cabinet thereon, said framework including first and second members directed across the width of said machinery compartment at the bottom thereof, one of said brackets serving to support a compressor, a flat plate located below said first and second brackets, means for securing said flat plate to said brackets, said flat plate extending throughout substantially the full planar extent of said machinery compartment, said first and second brackets including portions thereon engageable with the upper surface of said flat plate adjacent its front edge and its rear edge, said first and second brackets including portions thereof engageable with the upper surface of said flat plate inwardly of the forward and rear edges thereof, a flexible member located between said flat plate and the floor for supporting said cabinet, said flexible member having an outer peripheral edge secured to said flat plate and an inner portion thereof secured to said flat plate, said first plate and flexible member forming an annular pressurizable chamber therebetween, means for directing pressurized air into said annular chamber, means for venting air from said annular chamber beneath said flexible member, said vented air flowing beneath said flexible member producing an air cushion for raising said depending members out of engagement with the supporting floor so that said cabinet can be moved with respect to the floor merely by overcoming its inertia.

References Cited by the Examiner

UNITED STATES PATENTS

2,780,826	2/1957	Coons	180—7
2,918,183	12/1959	Petersen	180—7
3,052,483	9/1962	Petersen	180—7
3,055,446	9/1962	Vaughen	180—7
3,094,223	6/1963	Smity	180—7
3,097,718	7/1963	Jay	180—7
3,161,247	12/1964	Mackie	180—7
3,164,103	1/1965	Lathers	180—7

WILLIAM J. WYE, *Primary Examiner.*