Aug. 18, 1970 R. SMITH ETAL 3,524,329

REFRIGERANT CONDENSER WITH KEY CONNECTOR

Filed Oct. 28, 1968 2 Sheets-Sheet 1

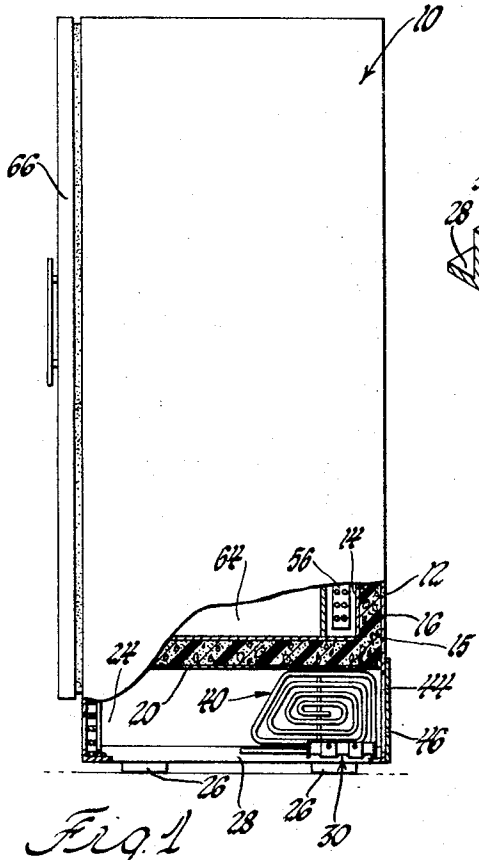


Fig. 1

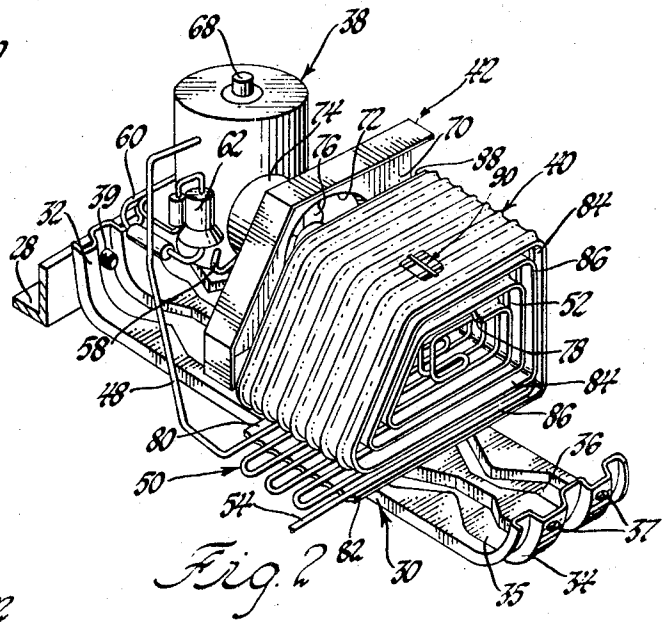


Fig. 2

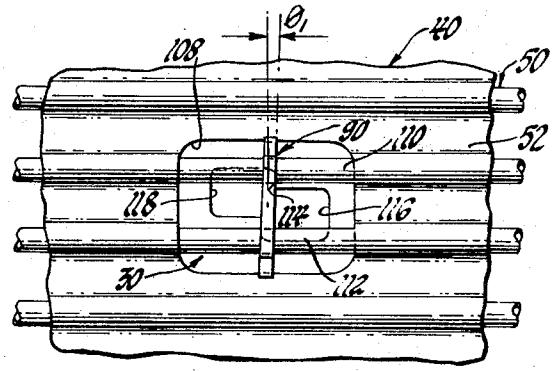


Fig. 3

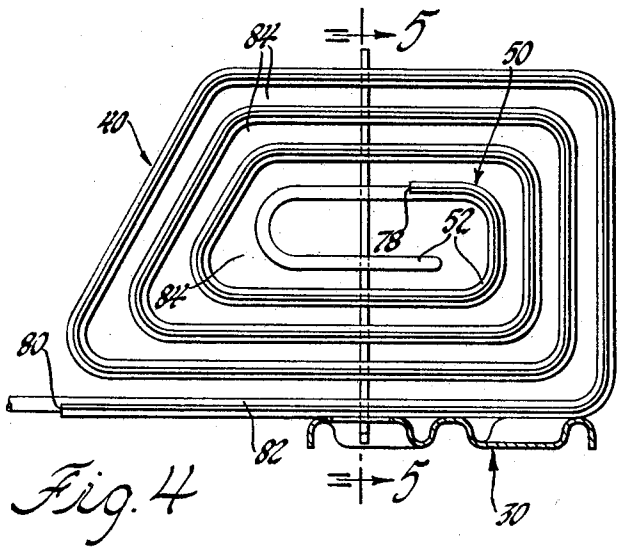


Fig. 4

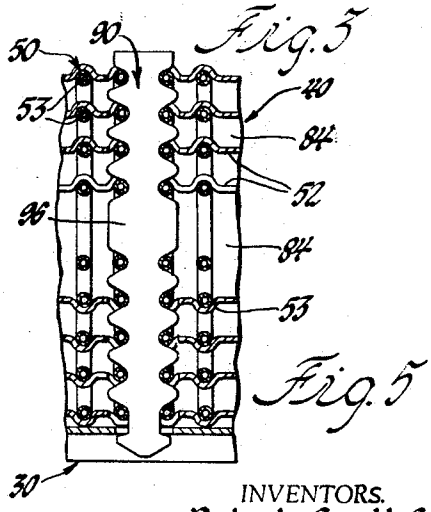


Fig. 5

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REFRIGERANT CONDENSER WITH KEY CONNECTOR

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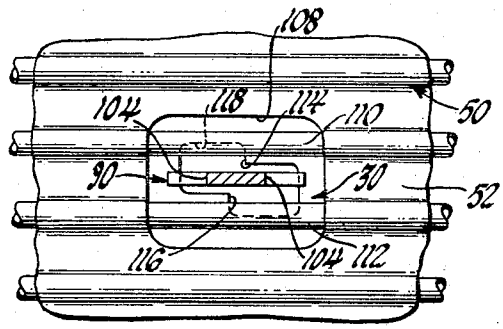


Fig. 6

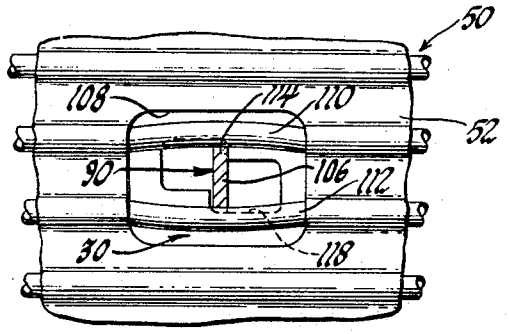


Fig. 7

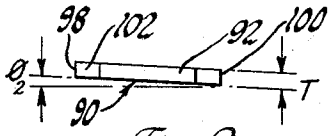


Fig. 9

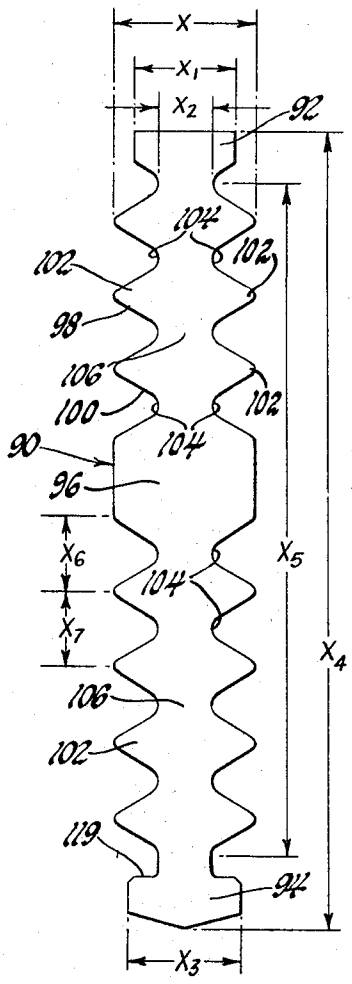


Fig. 10

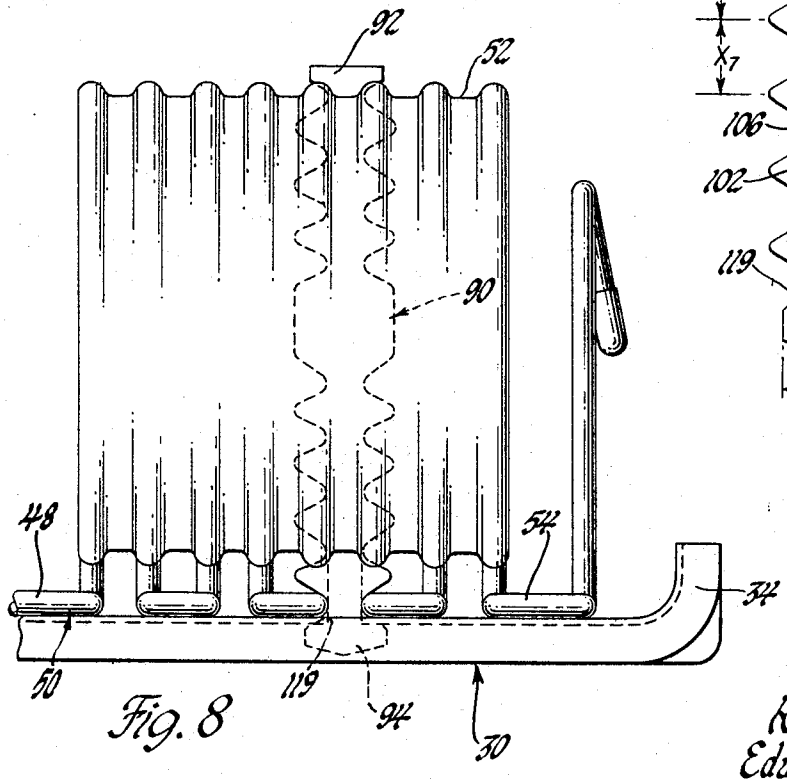


Fig. 8

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3,524,329

REFRIGERANT CONDENSER WITH KEY CONNECTOR

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Int. Cl. F25d 19/00
U.S. Cl. 62—295 4 Claims

ABSTRACT OF THE DISCLOSURE

In preferred form, a refrigerant compressor and condenser support system for use in a domestic refrigerator including a pad supporting a compressor unit. An air-cooled refrigerant condenser of the tube and sheet type is wound on itself and is fixedly secured to the pad by means including an elongated multi-toothed key member directed through segments of the wound condenser sheet. The key engages refrigerant tube passes on the wound condenser sheet segments to maintain a desired air flow spacing between wound segments of the sheet while reducing vibration noises in a domestic refrigerator machinery compartment.

This invention relates to refrigerating apparatus having compressors operated at high revolutions per minute and more particularly to an improved suspension system for supporting an hermetically sealed refrigerant compressor, cooling fan and condenser component on a single support pad adapted to be connected within the machinery compartment of a domestic refrigerator and removable therefrom for repair.

Domestic refrigerator apparatus often includes an hermetically sealed compressor and drive motor operated at a high rate of rotation to produce a maximum refrigerating capacity for a given compressor piston displacement.

Such units are characterized by having a relatively compact dimensional configuration and are generally located in a lower machinery compartment of a domestic refrigerator in close association with refrigerant condenser components and the like. One problem with systems of this type is that the hermetically sealed motor compressor unit often produces high frequency vibrations in supporting structures of the unit. Furthermore, refrigerant discharged from the compressor can produce pulsing noises in a closed refrigerant circuit. Where the refrigerator is used in a domestic household such noises are objectional.

In certain cases, it is found desirable to mount the hermetically sealed motor compressor unit and a refrigerant cooling condenser adjacent one another whereby a single fan can direct a forced draft of air across the condenser and hermetically sealed compressor for cooling them during the operation of the domestic refrigerator.

In order to improve the serviceability of such a plurality of operating components, it is further desirable to secure each of the components to a single support pad that is readily inserted into and removed from a lower refrigerator machinery compartment.

Such an arrangement of refrigerating components increases the noise problems mentioned above and require a substantial number of separate sound dampening components and connectors to maintain a low level of noise during refrigeration apparatus operation. This is especially the case when the condenser unit is of the sheet tube type wherein the sheet heat transfer component of the condenser is wound on itself to form a compact refrigerant cooling package occupying a limited extent of the working machinery compartment of the refrigerator.

It is found that where the hermetically sealed motor compressor unit is supported on the same pad assembly as the condenser that noise level during operation is reduced where the tube and sheet type of condenser is securely fastened to the pad assembly. In the past, this has been attained by the provision of a plurality of separate connector elements interposed between horizontal segments of a wide, thin heat transfer sheet in the condenser. In this case, the connector elements include segments thereon interleaved with the sheet of the condenser and fixedly secured thereto. Typically, plural connector elements are required at each end of the wound tube and sheet condenser unit to reinforce the condenser so that it can be fixedly secured to the pad assembly to produce a degree of structural integrity between the condenser and the supporting pad assembly that is sufficient to produce a reduction in noise during refrigerator operation.

While existing systems are suitable for their intended purpose, they require the placement and securing of a substantial number of separate parts that results in a substantially increased cost of manufacture. Further, the connectors often collect lint, dust and the like which can block cooling air flow across the condenser.

Accordingly an object of the present invention is to reduce noise levels in a domestic refrigerator where the refrigerator has a wound sheet tube type refrigerant condenser in its machinery compartment and to do so by firmly securing the condenser to its support frame or pad by a single connector element which can be quickly assembled at low cost and which is self-cleaning during refrigerator operation to prevent an accumulation of lint or dust in air flow passageways through the condenser.

One working embodiment of the invention which accomplishes the above object is in a domestic refrigerator having a refrigerant compressor and condenser unit on a single support pad adapted to be connected between the side frame members of a bottom machinery compartment of a refrigerator. The embodiment includes a key configured element that is removably seated in place through a plurality of loop segments in a wound sheet member of the condenser to relatively rigidly, fixedly interconnect adjacent ones of a plurality of refrigerant tube passes on the wound segments of the sheet to one another and to the support pad to define a fixed connection of the condenser to the pad for reducing vibrations therebetween.

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.

FIG. 1 is a view in side elevation of a domestic refrigerator having the base thereof partially sectioned to show a machinery compartment including the combination compressor and condenser support system of the present invention;

FIG. 2 is a view in perspective showing a removable support pad and refrigeration components constituting the main operative parts of a domestic refrigerator incorporating the present invention;

FIG. 3 is an enlarged fragmentary view in top elevation showing the relationship of a key connector in its interlocked, seated relationship with tube or conduit passes in the condenser unit of the improved system;

FIG. 4 is an enlarged, end elevational view of the improved refrigerant condenser arrangement of the present invention;

FIG. 5 is a fragmentary view in vertical section taken along the line 5—5 of FIG. 4, looking in the direction of the arrows;

FIG. 6 is a fragmentary, top, elevational view showing the relationship between the key connector of the

present invention and the condenser when the connector is unlocked.

FIG. 7 is a view like FIG. 6 with the key connector perpendicular to the tubes on the condenser.

FIG. 8 is a side elevational view of the condenser and pad assembly showing the key connector in place therein;

FIG. 9 is a top elevational view of the key connector of the invention; and

FIG. 10 is a front elevational view of the key when it is in its seated relationship with respect to the assembled condenser unit.

Referring now to the drawings, in FIG. 1, a domestic refrigerator **10** is illustrated having an outer shell **12** surrounding an inner liner **14** in spaced relationship thereto. The outer shell **12** and inner liner **14** define a space **15** which is filled with suitable thermal insulating material **16**, such as formed in situ foamed polyurethane material.

In the illustrated arrangement, a base **20** of the shell **12** includes a front kick-panel thereon which defines a raised segment in the base **20** below which is located a machinery compartment or space **24**. In the illustrated arrangement, which is merely representative of a domestic refrigerator arrangement suitable for association with the present invention, the side walls of the outer cabinet **12** are illustrated to have integrally formed depending pads or support feet **26** and an integrally formed rail **28** serving as a reinforcing framework around the base of the refrigerator outer shell **12**.

A stamped sheet metal support pad **30** is directed through the machinery compartment **24** from rail **28** at one side of shell **12** to the rail **28** on the opposite side of the outer shell **12**. It includes upwardly turned ends **32, 34** thereon. A pair of spaced apart channels **35, 36** reinforce the length of the pad **30**. At the turned up ends **32, 34** the channels **35, 36** have openings **37** therethrough to receive screws **39** that fixedly secure these ends to the side rail **28**.

Thus, the pad **30** is relatively fixedly secured to the outer shell **12**.

In accordance with certain principles of the present invention, the single pad **30** supports an hermetically sealed motor compressor unit **38** on one end thereof and a sheet and tube type refrigerant condenser **40** on the opposite end thereof. Intermediate the compressor unit **38** and the condenser **40** is located an air cooling fan unit **42**. The hermetically sealed, motor compressor unit **38**, condenser **40** and fan assembly **42** are supported by the pad **30** to be handled as a unit that can be readily inserted through a rear access opening **44** in the rear wall of the outer cabinet **12** into the machinery compartment **24**. The access opening **44** is closed by a baffle plate **46** that is readily removed when it is desired to service any one or more of the components on the pad.

Units of the above-described type are desirable in that it definitely improves ease of service, and, furthermore, enables a substantial number of component parts in the refrigeration system to be handled as one unit during manufacture and assembly thereof.

In the illustrated arrangement, the basic refrigeration system includes a discharge line **48** from the hermetically sealed motor compressor unit **38** that connects to one end of a continuously formed condenser tube **50** that is wound sinusoidally along the length of a heat transfer sheet **52** of the condenser **40**.

The tube **50** includes a plurality of parallel passes seated in longitudinal grooves **53** in the sheet member **52**. The member **52** is fixedly secuerd to the passes of tube **50** by suitable means such as spot welds. An outlet **54** from condenser **40** is directed through the machinery compartment and upwardly through the base **20** of the refrigerator cabinet to be connected to a suitable refrigerant expansion means (not shown) such as an elongated capillary tube to the inlet of a refrigerant evaporator unit **56** that is connected by a suction line **58** to the inlet of the compressor in the unit **38**.

In the illustrated arrangement, the hermetically sealed, motor compresor unit **38** is of the high side type including an external superheat exchanger **60** that includes an inlet connected directly to the discharge line of the compressor and an outlet that is directed through a muffler **62**, thence into the interior of the hermetically sealed compressor unit **38**. The cooling action of the interchanger **60** serves to reduce the temperature of the refrigerant gas so that it will, upon returning to the shell interior, cool the operating electric motor therein prior to passage thereof through the discharge line **48** and to the condenser **40**.

When the motor compressor unit **38** is operated during a refrigeration cycle of operation, it discharges hot gas from its compressor through the superheat coil **60** and the muffler **62**, thence through the discharge conduit **48** and the continuously formed, sinusoidally wound conduit **50** on the sheet member **52** of condenser **40**. Hot gas flow to the condenser **40** is cooled and liquefied and discharged through the outlet **54** across the capillary tube into the inlet of the evaporator **56**. Expansion of the liquid refrigerant passing through the evaporator **56** will remove heat from a refrigerator food storage compartment **64** which, in one working embodiment, is divided into a side-by-side below freezing compartment and an above freezing compartment, both of which have access openings thereto closed by vertically hinged doors **66**.

In the illustrated arrangement, the motor for driving the compressor in the unit **38**, in one working embodiment, has a ⅓ horsepower rating and an operating speed, when energized, of 3,550 revolutions per minute. To prevent direct transfer of vibrations in the unit **38** to the pad **30**, the unit includes resilient pads **68** on either end thereof.

Furthermore, the illustrated system includes a rotary compressor connected to the high speed drive motor that produces a discharge pulse through the line **48** on each revolution of the motor. These pulsations are, to a degree, nullified by the muffler **62** but, in order to further reduce these vibration noises in the system, in accordance with the invention, improved means are provided to fixedly secure the condenser **40** in place on the pad **30** for movement therewith. This system has been found to noticeably reduce the noise level of operation of systems of this type and will be more specifically described in following material.

The fan assembly **42** interposed between the noise producing motor-compressor unit **38** and the closely adjacent located condenser **40**, more particularly, includes a sheet metal housing **70** having its base fixedly connected to the pad **30** and a fan opening **72** coaxially aligned with the condenser **40** between it and the hermetically sealed motor compressor unit **38**. A fan motor **74** is secured on one side of the housing **42** and it includes a shaft which has a fan impeller **76** secured thereto and rotated within the fan opening **72**.

During refrigeration operation, to improve heat removal from the condenser **40**, the fan impeller **76** is rotated by the motor **74** at a substantially high r.p.m. in the order of 1250 to draw air from the right side of the condenser **40** as viewed in FIG. 2 to the left side thereof, thence to be discharged across the unit **38**. In order to maintain effective air cooling of the condenser **40**, it is important that it have a predetermined configuration to define a substantial, cross sectional, planar extent for air flow produced by the operation of the fan impeller **76**. Accordingly, in the illustrated arrangement, the sheet member **52** includes an inwardly located end **78** about which the sheet element **52** is wound to define a plurality of looped segments around the end **78**, terminating in a sheet end segment **80** opposite to the end **78** at a point immediately above the pad **30**.

In the illustrated embodiment of the invention, the sheet member **52** runs from the end **80** to define a base **82** carried on flat upper surface portions of the pad assembly **30** as is best illustrated in FIG. 4.

Each of the looped segments includes a generally trapezoidally shaped end elevational view and they are of progressively reduced perimetrical length from the outside end **80** to the inwardly located end **78** through the total winding of the member **52.**

Furthermore, each of the looped segments includes an upper and lower horizontal extent that is separated from an adjacent upper and lower horizontal extent of a contained loop progressing from the outside of the unit to the inside thereof. Between each of the loops is formed a plurality of air flow passageways **84** extending from the inlet end **86** of the condenser to the outlet end **88** thereof. Each of the passageways **84** is in communication with one another to form a spiral-like path through the full extent of the winding of the sheet member **52** from the inner end **78** to the outer end **80** thereof and all of the openings **84** define a cross-sectional, flow area in coaxial alignment with the fan opening **72** whereby, during rotation of the impeller **76,** air will be drawn through the openings **84** without obstruction and across the conduit **50** wound on the sheet element **52** in good convective heat transfer relationship therewith.

In accordance with certain principles of the present invention, in order to reduce noise level in the combination condenser and compressor support system and to assure an unobstructed air flow across the tube **50,** a single, elongated, key connector element **90** is disposed with respect to the condenser **40** and support pad **30** so as to interlock each of the looped segments of the condenser **40** with respect to one another so as to maintain a desired vertical spacing of the air flow passageways **84** and, furthermore, to hold each of the horizontally disposed segments of the wound sheet member **52** against relative movement with respect to each other because of the air flow. Additionally, the single key connector element **90** is included to interlock the joined segments of the condenser **40** securely to the pad assembly **30** thereby to prevent vibratory movement between the condenser **40** and pad **30** so as to maintain a desired operating noise level in the completely integrated system.

More particularly, and as is best illustrated in FIGS. 9 and 10, the connector element **90** includes an upper handle portion **92** and a tapered, depending nose portion **94.** Intermediate the handle **92** and nose portion **94** is a central enlarged body segment **96** which, as is best seen in FIG. 5, fits between the horizontal segments of the wound sheet member **52** above the inner end **78** to reinforce the core of the wound element **52.**

The opposite edges **98, 100** of the key element **90** each include a plurality of outwardly directed teeth **102,** together forming an edge recess or tube seat **104** between which is located a thin section waist segment **106** of the element **90.**

In accordance with certain principles of the present invention, the horizontal segments of the wound sheet member **52** each includes an opening **108** and the openings **108** are vertically aligned to define a path to insert the key element **90** completely through the condenser **40** from its top to its bottom.

Each of the openings **108** is bridged by first and second segments **110, 112** of the continuously formed tube **50.** The opening bridging segments **110, 112** are each seated in one of the recessed seats **104** in the edges **98, 100** of the key element **90** and the thickness or width of the waist segment **106** is substantially equal to the distance between the outer diameter of the adjacent bridging segments **110, 112** when the key is arranged at a slight inclination ϕ_1 from being perpendicular to the longitudinal axes of the segments **110, 112.**

Furthermore, the teeth **102** along the opposite edges of the key element **90** are interposed between the adjacent

horizontal segments of the sheet element **52** and function to maintain a desired vertical separation therebetween, as is best seen in FIG. 5.

As is best seen in FIG. 9, the edges **98, 100** of the key element **90** have a taper or lead angle. Thus, when the key element **90** has a head-on view as in FIG. 10, it is located ϕ_2 degrees from a horizontal reference line as seen in FIG. 9. The lead angle enables the key element **90** to be easily located in an interlocked relationship with each of the pairs of bridging segments **110, 112** across the sheet member openings **108.**

Thus, when the key element **90** is positioned as shown in FIG. 6 during assembling of the condenser **40** to the pad **30** and rotated to the position shown in FIG. 7 where key element **90** is perpendicular to the bridging elements **110, 112,** the teeth **102** will move into an interleaved relationship with the horizontal segments of the sheet member **52** without any undesirable interference therebetween and the waist segments **106** will slightly spread the adjacent ones of the pairs of bridging segments **110, 112,** as is seen in FIG. 7.

The bridging segments will spring back to a substantially parallel relationship as is seen in FIG. 3 when the key element **90** is at its ϕ_1 angular relationship with respect to the perpendicular of FIG. 7 whereby the bridging segments **110, 112** serve to effectively spring urge or bias the key element **90** against limit stops or edges **114, 116** formed in a generally S-shaped opening **118** in the pad **30** through which the nose **94** of the key element **90** is inserted prior to rotation of the key connector element into its interlocked position.

The nose segment, as it is rotated within the S-shaped opening **118,** has an upper edge **119** thereon in underlying relationship with the pad **30** at the opening **118** therethrough so as to interlockingly connect the key element **90** to the pad against vertical movement with respect thereto. Additionally, the movements of the teeth **102** on each of the edges of the key connector element **90** will further secure each of the horizontal segments of the sheet member **52** vertically with respect to one another as well as with respect to the pad **30** to thereby produce a good, positive interconnection of the condenser unit **40** to the pad **30.** The connection has been found to result in a low level of noise in the total assembly and, further, produces a positive maintenance of the air flow passageways **84** through the wound condenser structure from the inlet end **86** to the outlet end **88** thereof.

By virtue of the unique configuration of the key element **90,** the interconnection is produced merely by inserting the key element **90** into the vertically aligned openings **108** and thereafter twisting it by grasping the handle **92** and moving the key element slightly more than 90 degrees from the position shown in FIG. 6 to that shown in FIG. 3.

In one working embodiment of the invention, the key was configured in accordance with the following schedule.

CONDENSER KEY CONFIGURATION

$X=1.44''$	$X_5=6.75''$
$X_1=1.00''$	$X_6, X_7=.75''$
$X_2=.57''$	$\phi_1=4°$
$X_3=1.13''$	$\phi_2=3°$
$X_4=8.00''$	$T=.14''$

It is important to note the relative rigidity of the key **90** as compared to that of the tubing and sheet material interlocked therewith. The key in the illustrated embodiment is .135 inch thick and the thin, good heat dissipating sheet member of the condenser is .015 inch thick and held by the key element so that the unit is maintained in a firmly retained relationship with the pad **30** while maintaining the vertical height of the air flow passageways through the condenser.

Another feature of the above-described arrangement is that the key connector element **90** is arranged with its edges **98, 100** in line with the air flow path through pas-

sageways 84. This presents a knife-edge profile, best seen in FIG. 5, which offers little or no surface for accumulation of dust, lint or the like to obstruct air flow. The connector element thereby tends to be self-cleaned by cooling air flow through condenser 40 during refrigerator operation. Accordingly, product reliability is improved.

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:

1. A compressor and condenser support assembly adapted to be removably located within a bottom machinery compartment of a domestic refrigerator comprising, a bottom pad, an hermetically sealed motor driven compressor unit, means for connecting said compressor unit on one end of said pad, a fan housing supported on said pad in close spaced relationship to said hermetically sealed motor driven compressor unit, a fan within said housing for drawing air therefrom to be discharged against said compressor unit for cooling same, a thin sheet member having a length greater than its width, said sheet having one end edge thereon located above and in spaced relationship to said pad, said sheet member being wound from said one end edge continuously therearound to form a plurality of looped segments, a refrigerant tube on said thin sheet member formed sinusoidally across the width of said member and including an inlet and an outlet adapted to be connected in a refrigerant circuit, said refrigerant tube including a plurality of tube passes extending longitudinally of said sheet member along the length thereof, said loop segments of said wound sheet member defining a plurality of air passageways through said wound sheet member, said plurality of passageways being in coaxial relationship with said fan, said fan operative to draw air through said passageways and across said tube passes for cooling refrigerant flowing therethrough, means defining a plurality of vertically aligned openings through said wound sheet member, a pair of said plurality of tube passes bridging each of said openings and being spaced apart a predetermined distance, an elongated key connector element extending through the vertically aligned openings of said sheet member from top to bottom of said wound segments, said key connector element having side edges and a plurality of outwardly directed teeth on each edge forming a plurality of tube seats at spaced apart points along the length of said element, said teeth each including inclined surfaces thereon holding each of said pairs of tube passes in engagement with said tube seats thereby to reinforce said looped sheet segments, said teeth being located between said looped sheet segments to hold them apart from each other and thereby maintain said air passageways, and coacting means on said key connector element and pad for removably fixedly securing said element and pad to one another.

2. A refrigerant condenser comprising, a base support member, a sheet member having a length greater than its width, said sheet member having first and second ends thereon and being wound about said first end to form a plurality of looped segments of said sheet material above said support member, a refrigerant tube on said sheet member formed sinusoidally across the width thereof and including a plurality of parallel, longitudinal reaches, a plurality of vertically aligned openings through said sheet member, a plurality of pairs of longitudinal tube reaches bridging said aligned vertical openings, an elongated key member directed through said plurality of vertically aligned openings and including a nose segment on one end thereof interlockingly connected to said bracket, said key member having a handle on the opposite end thereof, a plurality of outwardly directed crests on the opposite edges of said key member defining a plurality of spaced apart waist segments on said key element along the length thereof, each of said waist segments being in engagement with a pair of said tube passes bridging one of said vertical openings, said crests including a segment on the edge of said key located outwardly of the waist segment and serving to maintain segments of said wound sheet member apart from one another to define a plurality of open air passageways through said wound sheet for cooling refrigerant passing through said tube passes, said key member serving to securely fasten all portions of said wound sheet adjacent to said pairs of waist-engaging tube passes to prevent vibratory movement between said sheet and said bracket.

3. A refrigerant circuit subcombination comprising a support pad adapted to be connected to side frame members of a refrigerator cabinet, an hermetically sealed motor driven compressor connected to one end of said pad, a discharge conduit from said compressor, a fan housing connected on one side of said hermetically sealed motor compressor unit including an opening therein, a fan drive motor supported on said housing including a drive shaft, a fan impeller secured to said shaft within said opening for drawing air therethrough across said hermetically sealed motor compressor unit and said drive motor, a refrigerant condenser including a continuously formed sinusoidally shaped refrigerant tube having one end thereof connected to said compressor discharge conduit, said tube having an outlet adapted to be connected to an evaporator of a refrigerant system, a sheet member of heat transfer material secured to said tube, said sheet member having a length greater than its width, said sheet member including opposite ends thereon and being wound about one of said ends to form a plurality of looped segments each including part of the continuously formed tube thereon, said plurality of looped segments having a predetermined spacing therebetween to form an axial opening across the width of said sheet member coaxially aligned with said condenser fan housing to define air transfer passageways in intimate convective heat transfer relationship with said refrigerant tube, a plurality of openings in said sheet member being aligned vertically therethrough and extending through each looped segment of said sheet member, a pair of tube passes bridging each of said vertically aligned openings, a key element located within said opening including a first plurality of teeth on one edge thereof defining a plurality of tube receiving seats at spaced apart points along the length of said key element, first vertically aligned tubes in said plurality of pairs of tube passes located in said seats, a second plurality of teeth directed outwardly of the opposite edge of said key element and defining a second plurality of spaced apart seats along the opposite edge of said key element, second vertically aligned tubes in said plurality of pairs of tubes located in said second seats, said first and second vertically aligned tubes being a predetermined vertical distance apart from one another thereby to hold said looped segments in a predetermined plurality of vertically spaced horizontal planes to positively maintain a predetermined planar extent of heat transfer air flow passageway through the width of said wound sheet member, said support pad including an offset opening therein defining a pair of spaced apart stop edges, said key element including a nose portion having surfaces thereon engageable with said stop edges to locate said first and second plurality of teeth on said key element in a plane slightly to one side of a perpendicular alignment with said pairs of tube passes, said key element including a plurality of spaced apart waist segments along the length thereof between the tube seats on the opposite edges thereof, said waist segments having a width slightly greater than the distance between the outer diameter of adjacent tubes in each pair of tube passes whereby said waist segments will be in biased engagement with said tube passes when said key element is in its one side of a perpendicular alignment to interlock said tube pass pairs to said key element, coacting means on said nose portion and said support pad for vertically interlocking said pairs of opening

bridging tube passes with respect to said support pad and thereby serving to connect said looped segments of said sheet material securely to said support pad to prevent vibratory movements therebetween.

4. A refrigerant condenser comprising, a support pad adapted to be removably connected to side frame members of a refrigerator cabinet, a refrigerant condenser including a continuously formed sinusoidally shaped refrigerant tube having an inlet and an outlet, a sheet member of heat transfer material secured to said tube, said sheet member having a length greater than its width, said sheet member including opposite ends thereon and being wound about one of said ends to form a plurality of looped segments each including part of the continuously formed tube thereon, said plurality of looped segments having a predetermined spacing therebetween to form an axial opening across the width of said sheet member to define air transfer passageways in intimate convective heat transfer relationship with said refrigerant tube, a plurality of openings in said sheet element being aligned vertically therethrough and extending through each looped segment of said sheet member, a pair of tube passes bridging each of said vertically aligned openings, a key element located within said opening including a first plurality of teeth on one edge thereof defining a plurality of tube receiving seats at spaced apart points along the length of said key element, first vertically aligned tubes in said plurality of pairs of tube passes located in said seats, a second plurality of teeth directed outwardly of the opposite edge of said key element and defining a second plurality of spaced apart seats along the opposite edge of said key element, second vertically aligned tubes in said plurality of pairs of tubes located in said second seats, said first and second vertically aligned tubes being a predetermined vertical distance apart from one another thereby to hold said looped segments in a predetermined plurality of vertically spaced horizontal planes to positively maintain a predetermined planar extent of heat transfer air flow passageway through the width of said wound sheet member, said support pad including an offset opening therein defining a pair of spaced apart stop edges, said key element including a nose portion having surfaces thereon engageable with said stop edges to locate said first and second plurality of teeth on said key element in a plane slightly to one side of a perpendicular alignment with said pairs of tube passes, said key element including a plurality of spaced apart waist segments along the length thereof between the tube seats on the opposite edges thereof, said waist segments having a width slightly greater than the distance between the outer diameter of adjacent tubes in each pair of tube passes whereby said waist segments will be in biased engagement with said tube passes when said key element is in its one side of a perpendicular alignment to interlock said tube pass pairs to said key element, coacting means on said nose portion and said support pad for vertically interlocking said pairs of opening bridging tube passes with respect to said support pad and thereby serving to connect said looped segments of said sheet material securely to said support pad to prevent vibratory movements therebetween.

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