June 21, 1955 E. M. GAUL ET AL 2,711,081

AUTOMATICALLY OPERATED REFRIGERATOR
DRIP-TRAY BAFFLE-DAMPER COMBINATION

Filed Aug. 17, 1953 3 Sheets-Sheet 1

FIG. 1.

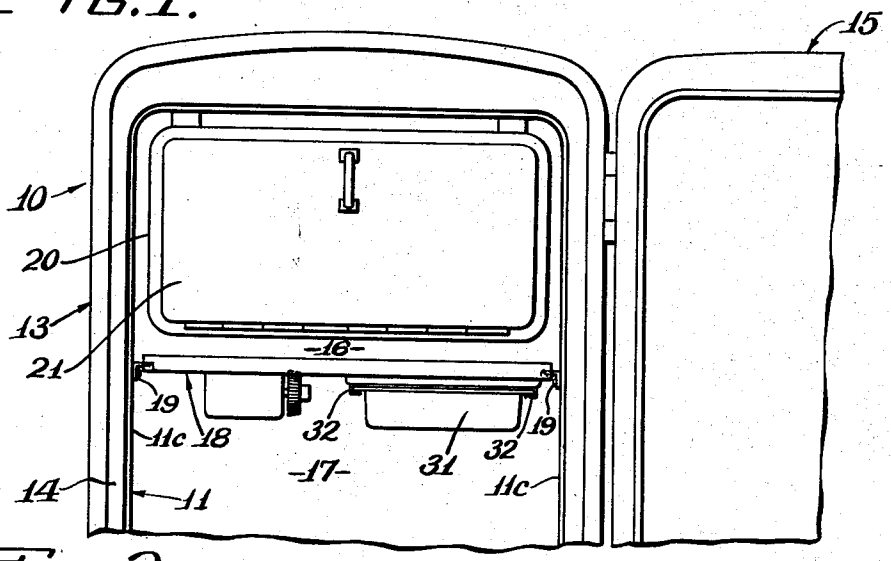
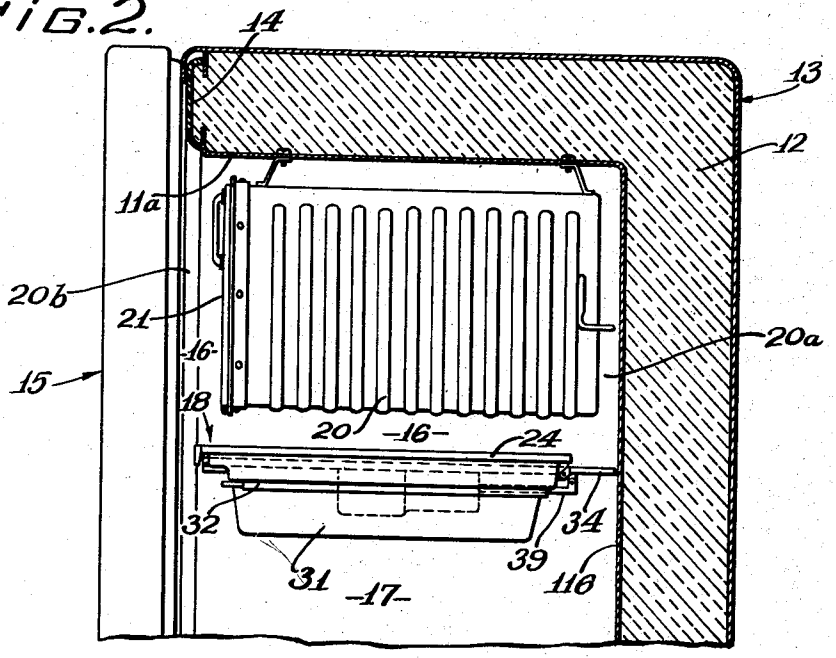


FIG. 2.



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FIG. 3.

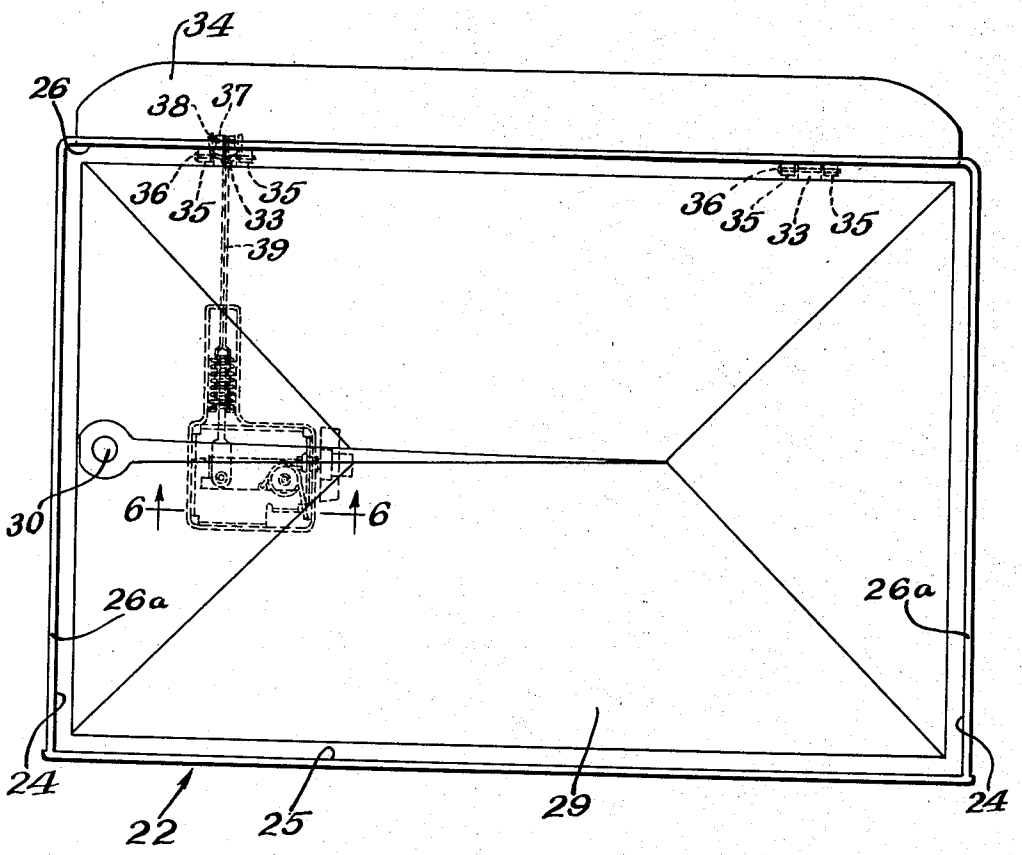


FIG. 4.

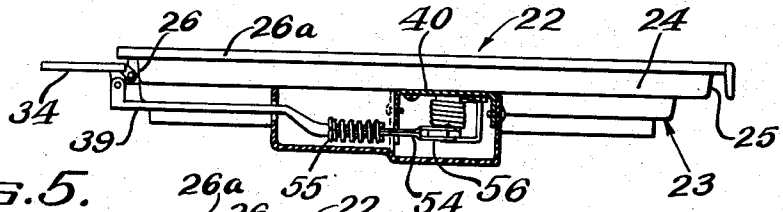
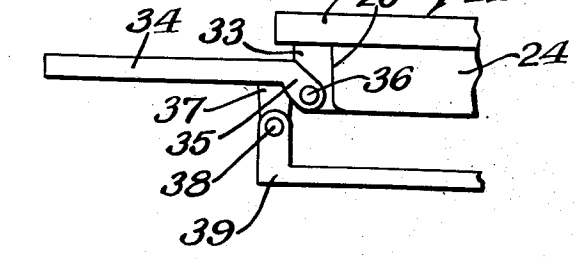


FIG. 5.



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FIG. 6.

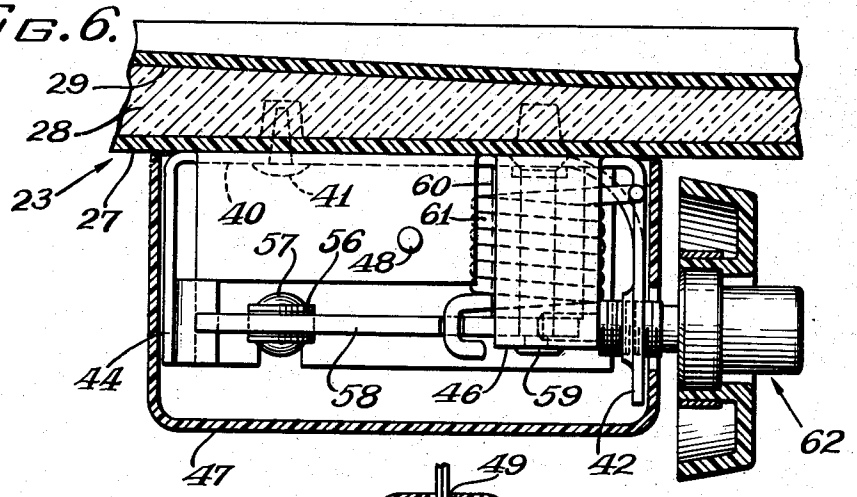
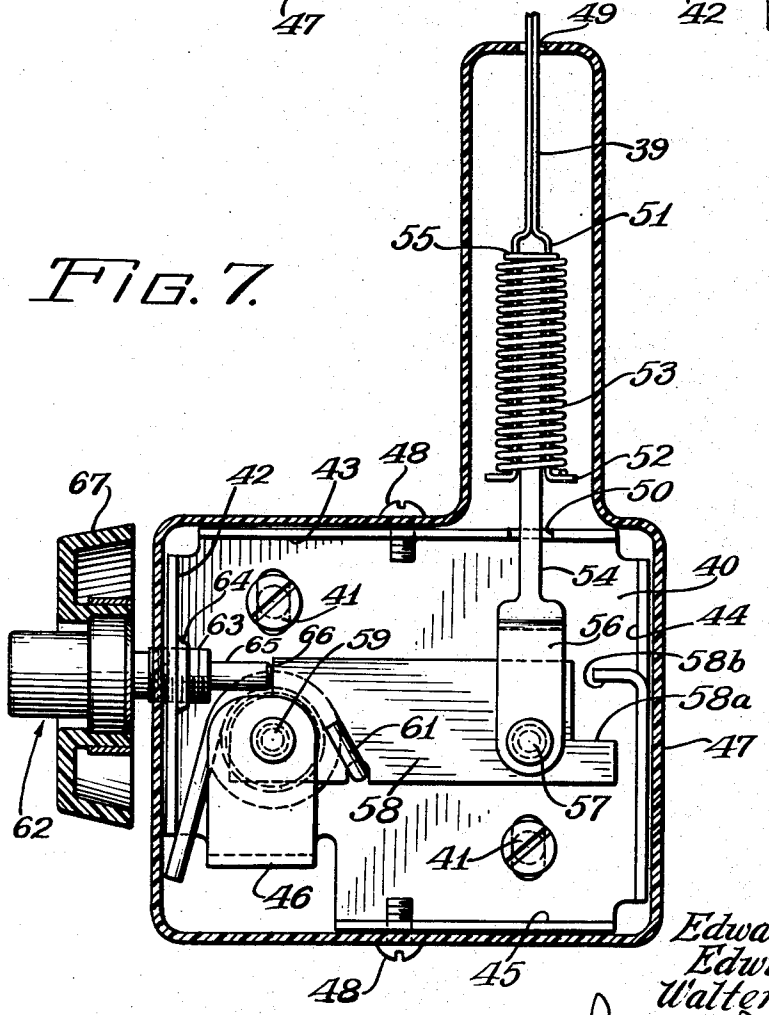


FIG. 7.



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AUTOMATICALLY OPERATED REFRIGERATOR DRIP-TRAY BAFFLE-DAMPER COMBINATION

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Application August 17, 1953, Serial No. 374,801

7 Claims. (Cl. 62—2)

This invention relates to refrigerator cabinets, but more specifically to a combined drip-tray and air baffle or damper adapted for use in a refrigerator cabinet having compartments maintained at different temperatures and cooled by one evaporator.

Heretofore refrigerator cabinets have been provided wherein there is an upper food-storage compartment that is cooled by an evaporator located therein, and a lower food-storage compartment separated from the other compartment by a drip-tray baffle-like partition and cooled by convectional air flow through openings in or around said partition. In structures of this character a damper-like air flow control member is frequently provided to close an opening in the partition between the two compartments so as to regulate the flow of convectional air currents therebetween and thereby control the temperature of the lower compartment. Motivation of this damper is generally accomplished by manual operation but frequently it is operated by thermostatic means responsive to temperatures existing at one of several selected locations such, for instance, as the ambient temperatures, the lower compartment temperatures, the upper compartment temperatures, the machinery compartment temperatures or the temperatures of certain parts of the refrigerating apparatus. Although none of these previous arrangements worked out entirely satisfactorily because of one reason or another the use of the lower compartment temperatures for control initiation purposes is believed to be the most desirable.

This latter arrangement, however, has one serious inherent drawback in that a large temperature variation in the lower compartment is necessary before sufficient power is generated in the conventional thermostat to actuate the damper. Minimizing this difficulty ordinarily requires either the use of a lightweight delicately balanced damper, an extremely sensitive thermostat, or booster means for physical actuation of the damper, each of which serves only to complicate and increase the cost of the mechanism, in a highly competitive and closely costed product, without exercising or accomplishing the most effective and proper control over the temperature in the cabinet's lower compartment.

It is the principal object of this invention, therefore, to provide an improved thermostatically operated damper device that is effective for controlling the temperature in the lower compartment of a refrigerator cabinet in response to temperature variations in said lower compartment.

Another object is to provide an improved air flow control damper assembly adapted for removable securement to a drip-tray baffle slidably positionable beneath a refrigerant evaporator in a refrigerator cabinet.

Another object is to provide improved means for controlling the flow of air currents between the upper and lower compartments of a refrigerator cabinet, and wherein said means is thermostatically responsive to temperatures in the lower compartment of the cabinet.

A further object is to provide an air flow control damper assembly in which the damper member is movably mounted on a partition member slidably positionable below a refrigerant evaporator, and wherein the damper is actuated by an improved thermostat likewise mounted on said partition and directly responsive to temperatures

in the lower of two food storage compartments in a refrigerator cabinet.

A still further object is to provide a compact, inexpensive air flow control means having a rotatable damper and a thermostatically responsive device for the actuation thereof and to have said means removably affixed to a partition member adapted for slidable positioning between the upper and lower compartments in a refrigerator cabinet.

A yet still further object is to provide novel air flow control means for a compartmentized refrigerator cabinet wherein an improved type of thermostatic device, responsive to temperatures in the lower of two compartments in the refrigerator, is utilized to actuate a damper member that is rotatable into a plurality of positions in an air passage between two compartments therein for controlling the flow of air therebetween.

An important object is to provide an improved refrigerator cabinet air flow control means wherein a thermostatic device, responsive to temperature variations in one compartment of the refrigerator, rapidly translates its small magnitude reaction to these variations through quick acting motion amplifying means to a damper member that operates without appreciable time lag to regulate air flow between compartments of the cabinet, and by so doing functions to maintain a substantially constant temperature in the compartment in which the thermostatic device is located.

The foregoing and other objects and features of the invention will become apparent as the disclosure is more fully made in the following detailed description of a preferred embodiment of the invention as illustrated in the accompanying drawings in which:

Fig. 1 is a front elevation of a portion of a refrigerator cabinet incorporating the present invention;

Fig. 2 is a sectional side elevation view of the portion of a refrigerator cabinet shown in Fig. 1;

Fig. 3 is a top elevation view of an improved drip-tray with a damper and its thermostatic control mechanism shown incorporated therein;

Fig. 4 is an end elevation view of an improved drop-tray, partition fashioned according to the present invention and with the cover for the thermostatic control device associated therewith broken away;

Fig. 5 is an elevational view in enlarged dimension of a portion of the drip-tray and damper showing the rear wall hinge mounting for the damper;

Fig. 6 is a sectional view of the thermostatic control mechanism for the damper, and taken on line 6—6 of Fig. 3; and

Fig. 7 is a bottom view of the thermostatic control mechanism for the damper, with portions of the cover therefor shown as cut away.

A preferred embodiment of the present invention is illustrated as incorporated in a conventional household refrigerator wherein a cabinet **10** includes an inner liner **11** formed with a top wall **11***a*, rear wall **11***b*, a pair of side walls **11***c*, and a bottom wall (not shown), separated, by suitable insulating material **12**, from a similarly formed outer liner **13** with the space between the marginal edges of said liners covered with a breaker strip member **14**, and having a closure member such as the door **15** hingedly affixed to a front portion thereof. The inner liner **11** encloses and together with the door **15***a* defines a food storage space within the cabinet which may be divided into an upper compartment **16**, and a lower compartment **17** separated therefrom by a drip-tray baffle or partition member, indicated generally by the reference numeral **18**, which is slidably positioned on guide rails **19** mounted on the side walls of said inner liner. The upper compartment **16** is cooled by a conventional evaporator **20** which extends across the top thereof and re-

ceives compressed refrigerant from refrigerating apparatus generally located in the lower portion of cabinet **10** (not shown), while the evaporator may be provided with a hinged closure such as the door **21**. The evaporator normally is spaced from the rear wall **11***b* and from the closure door **15** thereby providing passages **20***a* and **20***b*, respectively, in the rear and front of said compartments through which air may circulate from one compartment to another.

The partition member **18** is fashioned, preferably, in the form of a drip-tray **22** having an insulated bottom wall **23**, opposite side walls **24**, front wall **25**, and rear wall **26** all upstanding therefrom, while a peripherally extending rim **26***a* may also be provided along the upper edge of said walls. The insulated bottom wall **23** includes a substantially flat lower floor member **27** separated by insulating material **28** from an upper moisture-collecting floor member **29** which, for drainage purposes, slopes in all directions toward an opening **30** in said bottom. In the illustrative embodiment the drip-tray **22** is shown as fashioned from a plastic material but it will be understood other materials, such as glass, rubber, and stainless steel among others, may be used without deviating from the primary concepts of the present invention. A generally conventional meat pan **31** may, if desired, be slidably suspended beneath said drip-tray by any suitable means such as the slide rails **32** secured to said bottom wall. On the rear wall **26** of said drip-tray, and preferably fashioned integral therewith, are two laterally spaced projecting abutment lugs or hinge supports **33** the purpose of which will be apparent hereinafter.

Now in accordance with the more specific teachings of the present invention, a damper or air flow control member is mounted for pivotal movement about the rear wall **26** of said drip-tray. Said damper is fashioned as a relatively thin, flat and light-weight shutter member **34** and has affixed thereto two pair of angularly extending hinge members **35** which are disposed with one pair proximate each end thereof, and with the individual portions of each pair slightly spaced from one another. These hinge members, perferably, are fashioned integral with the damper member, although they may be fabricated separately and affixed thereto by any well known means, and they are disposed so that one such pair may straddle each rear wall hinge support or projecting lug member **33** and a pivotal pin **36** may be positioned in aligned openings therethrough to pivotally secure said damper to the drip-tray rear wall. Depending from one wall surface of the damper member **34** and disposed proximate one pair of said hinge members is a bracket member **37** which, in turn, is pivotally affixed, by suitable means such as the pivot pin **38**, to an actuating lever **39**.

A supporting base or panel member **40** is secured, by suitable means such as the screws **41**, to the lower floor member **27** of said drip-tray bottom wall and is provided with flanges **42**, **43**, **44**, **45** and **46** turned over from and extending normal to the edges thereof. A canopy-like bonnet **47** covers said base member and many of the components supported thereon and may be affixed to the base by suitable means such as the screws **48** which are threadably received in the flanges **43** and **45**. A slotted opening **49** in one wall of said cover slidably accommodates the actuating lever **39** which also passes through a similar opening **50** in the flange **43**.

The end of the actuating lever **39** opposite from that pivotally affixed to the damper is provided with an elongated yoke portion, as indicated at **51**, and each arm of the yoke is outwardly turned at its end to form a flange **52** and the two flanges thus formed cooperate to fashion a shoulder-like abutment or stop for one end of an over-travel coil spring **53** the convolutions of which surround said yoke portion. One end of an actuating lever extension **54** is telescopingly received in the yoke portion **51**, of the actuating lever **39**, and is fashioned with outwardly turned flanges, as indicated at **55**, to provide an abutment or stop for the opposite end of said coil spring. As thus disposed, the spring may be compressed, between the shoulder-like abutments or stops formed by said flanges **52** and **55**, to absorb excess motion of an actuating arm or link and thus prevent excessive downward travel of the damper member **34**. The opposite end of the extension member **54** is provided with a yoke portion **56** which, together with the pivot pin **57**, pivotally secures said member to a transverse link member **58** at a point spaced from the end thereof. The end of said link member has a shoulder **58***a* provided therein that may abut a stop flange **58***b*, fashioned from the upstanding flange **44**, upon rotation of said link member as hereinafter explained. The opposite end of said link is pivotally mounted on a pintle pin or stud **59** which, in turn, is affixed to the base member **40**, while the free end of said stud extends through an opening in a bent over end portion of the flange **46** to provide a bight-like stop or guide means for preventing the link from slipping off the end of the stud. If desired, the end of said stud may be peened over or otherwise suitably anchored to provide a more rugged and secure construction. A sleeve bushing or spacer block **60** positioned around the stud **59** serves to space the link **58** from the base member **40** and additionally provides a bushing for a retraction spring. Intermediate the ends of the link **58** is connected one end of a torsional retraction spring **61**, the convolutions of which surround the sleeve bushing **60**, while the opposite end thereof abuts the edge of the flange **42**.

A thermostatic device, indicated generally by the reference numeral **62**, is threadably mounted by means of a threaded sleeve **63** in a threaded boss **64** affixed to the flange **42**. Said thermostatic device has an operating piston or plunger **65** projecting from one end thereof that engages a notched shoulder portion **66**, formed on one end of the transverse link member **58**, for actuating said link against the reactive force of the retraction spring **61** which normally tends to keep said shoulder pressed tightly against said plunger. An operating knob or dial **67** provides means for manually turning or rotating said thermostat in its mounting in order to vary the temperature setting thereof. As the knob **67** is turned the threaded portion **63** advances or recedes into or out of the threaded boss **64** to change the force that the plunger **65** exerts against shoulder **66** under different temperature conditions. In this way the temperature settings at which the damper member **34** is actuated may be varied, as desired, by the user to meet changing conditions. A thermostatic device of the character shown and described is presently manufactured by the Detroit Controls Corporation and is sold commercially under the trade designation of "Vernatherm". One of the characteristics of this device that makes it particularly suitable for the application proposed herein is the fact that a relatively heavy force is required to return the piston to position after the temperature which caused the initial expansion of the piston has receded. Because of this characteristic a relatively strong spring **61** is provided to effect this return. The use of such a spring, however, offers the advantage that the mechanism may be returned and the damper actuated upon a temperature change without the usual noticeable time lag that is customarily an inherent feature of the thermostatic devices heretofore employed for such purposes. This rapid return and damper control action is highly effective in maintaining a more constant temperature in the lower compartment and is one of the features of the present invention which readily distinguishes it from prior devices of this character.

In the proposed arrangement it was found that a 20 pound spring would accomplish the desired action although deviations from this specific value may be found to be desirable for different installations; hence it is not intended that the present invention be limited to such specific application. Another feature which distinguishes this device is the absence of the feeler bulb, which

ordinarily would have to be connected by a conduit to the power element of the thermostat, and which, when present, would interfere with the ready removal of the air flow control mechanism from the cabinet. In the proposed arrangement the control mechanism is compactly arranged and secured to the drip tray for removal therewith.

Normally the thermostatic device **62** is adjusted so that when the desired temperature prevails in the lower compartment **17** the plunger or piston **65** of said device is withdrawn because of contraction of the responsive medium therewithin, and hence the link **58**, urged by the reactive force of the torsional spring **61**, is rotated clockwise (as viewed in Fig. 3) about its pivotal stud **59** to force the actuating lever **39** rearwardly thereby rotating the damper **34** into a substantially horizontal position. The stop **58***b* serves to prevent the linkage and damper mechanism from being moved beyond a desired position, particularly when the lower compartment is unusually cold. With the damper in the horizontal position the air flow passage **20***a*, adjacent the rear wall **11***b* of the inner liner, is substantially closed off and the circulation of air through the cabinet, accordingly, is considerably restricted. Ordinarily cooled air from the upper cooled or evaporator compartment **16** flows down through the rear passage **20***a* and after being warmed by picking up heat from the lower compartment **17** flows upwardly through the forward passage **20***b*, and back into heat exchange relation with the evaporator cooler **20** where it is recooled before repeating its circulation cycle. Upon restriction of the rear passage **20***a* the circulation of air throughout the cabinet is, of course, considerably reduced and usually the temperature of said lower compartment rises as a result thereof. When this occurs the highly sensitive and rapidly reacting thermostatic device **62** operates to force its plunger **65** forward and hereby rotate the link **58**, in a counterclockwise direcion (as viewed in Fig. 3) about its pivotal stud **59**, and to move the actuating lever **39** forward and thus rotate the damper **34** to the downwardly extending position where it does not appreciably interfere with the free circulation of air through the rear passage **20***a*. The bumper or shock-absorbing over-travel spring **53** serves to prevent over controlling or damage to this mechanism when the temperature is high, such as might be encountered during shipping or storage or during periods of high ambients or when there are numerous door openings which raise the lower compartment temperature. After the temperature of the lower compartment has been reduced to a desired degree, said thermostatic device acts to draw in or retract its plunger and, assisted by the reactive force of the torsional spring **61**, functions to rapidly reposition said damper across the rear passage **20***a* to again restrict the flow of cooled air throughout the cabinet.

From the foregoing it will now be obvious that the present invention provides an improved air flow control means, particularly adaptable for regulating the flow of convectional currents between compartments in a refrigerator, and that said means is responsive without any appreciable time lag to the temperature variations in the lower of two contiguous compartments for maintaining the lower compartment thereof at a substantially constant temperature. Likewise the temperature of the lower compartment is maintained substantially constant regardless of variations in ambient temperatures. Furthermore, the air flow control means is entirely mounted on a drip-tray partition member which, in turn, is easily removable from the refrigerator cabinet for cleaning, adjustment, or like purposes. In addition, the control device is simple, inexpensive, easily adjustable to provide lower cabinet temperatures and is readily adaptable for incorporation in a modern refrigerator cabinet. A further advantage resides in the fact that faster recovery is now provided from sudden loads such as might result from door openings or from the introduction of storage loads into the cabinet.

While only one form of the invention has been shown, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a partition slidably positioned in said chamber dividing it into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near said rear wall to provide circulation of air between said upper and lower compartments; a damper movably mounted on said partition and positionable across said second passage for controlling the flow of air through said second passage; a thermostat carried by said partition and responsive to variations in temperature of the lower compartment; and motion amplifying means removably carried by said partition and operatively connecting said thermostat to said damper, whereby the position of the damper across the second air passage may rapidly be varied in accordance with small temperature variations in the lower compartment.

2. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and a double walled bottom with insulation between said double bottom walls; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; air flow control means for restricting the flow of air through said second passage; said air flow control means being carried by said drip-tray and including, an elongated damper pivotally mounted on the rear wall of said drip-tray and extending into said second air passage, a base panel removably affixed to the exterior bottom wall of said drip-tray, a thermostat responsive to the temperature of the lower compartment and affixed to said base panel, and linkage mechanism pivotally mounted on said base panel and operatively connecting said thermostat to said damper for operatively controlling the position of said damper with respect to said second air passage, whereby the flow of air through said second air passage is adjusted according to the temperature of said lower compartment.

3. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and a bottom wall; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof, and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; air flow control means for restricting the flow of air through said second passage; said air flow control means being carried by said drip-tray and including, a damper pivotally mounted on the rear wall of said drip-tray and extending into said second air passage, a base member adapted for affixment to the bottom wall of said drip-tray, a thermostat responsive to the temperature of the lower compartment and adjustably mounted on said base member and having said thermostat

rotatable in said adjustable mounting so that the actuating temperature setting thereof is adjusted according to the degree of rotation of said thermostat in the mounting, and linkage mechanism pivotally carried by said base and adapted for transmitting motion of an operating element of said thermostat to said damper for operatively controlling the position of said damper with respect to said second air passage, whereby the flow of air through said second air passage is controlled by the temperature of said lower compartment.

4. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and an insulated bottom wall; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; a horizontally extending damper pivotally mounted along one of its edges to the rear wall of said drip-tray, and being rotatable into a position such that its largest surface substantially subtends the area of said second passage and restricts the flow of air therethrough; a support base removably affixed to the exterior bottom wall of said drip-tray; a first lever pivotally mounted at one end thereof on said base, the opposite end thereof being free to rotate about said pivotal mounting; means connecting the free end of said lever pivotally to said damper; a thermostat responsive to the temperature of the lower compartment and secured to said base; said thermostat having an operating element thereof that engages said lever at a point adjacent the pivotally mounted end of said lever, whereby said thermostat is operable for controlling the position of said damper in accordance with the temperature of the said lower compartment.

5. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and a bottom wall; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof, and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; a damper pivotally mounted along one edge thereof to the rear wall of said drip-tray, and being rotatable into a position such that it extends across the area of said second passage for restricting the flow of air therethrough; a mounting base adapted for securement to the bottom of said drip-tray; a first lever pivotally mounted proximate one end thereof on said mounting base, the opposite end thereof being free to rotate about said pivotal mounting; a second lever pivotally secured at one end thereof to said first lever proximate the free end thereof; a third lever pivotally mounted at one end thereof to said damper; resilient means interlocking the free ends of said second and third levers; a thermostat responsive to the temperature of the lower compartment and adjustably secured to said mounting base; and having said thermostat operatively connected to said first lever, whereby said thermostat is operable for controlling the position of said damper in accordance with the temperature of said lower compartment.

6. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and a bottom wall; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof, and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; a damper pivotally mounted along one edge thereof to the rear wall of said drip-tray, and being rotatable into a position such that it extends across the area of said second passage for restricting the flow of air therethrough; a mounting base adapted for securement to the bottom of said drip-tray; a lever pivotally mounted proximate one end thereof on said mounting base, the opposite end being free to rotate about said pivotal mounting; means pivotally connecting said lever with said damper including, a first member pivotally connected at one end to said damper and having a yoke at the opposite end with a stop flange at the end of each portion of said yoke, a second member pivotally connected at one end to said lever the opposite end being provided with a stop flange and adapted for telescoping into the yoke of said first member, a resilient member disposed between the flanged ends of said first and second members whereby in one direction of movement of said means said second member engages said first member to actuate said damper and in movement in the opposite direction the flanges of said first and second members cooperate to compress the resilient member and prevent excessive movement of said damper; a thermostat responsive to the temperature of the lower compartment and removably mounted on said mounting base; and having said thermostat operatively connected to said lever, whereby said thermostat is operable for controlling the position of said damper in accordance with the temperature of said lower compartment.

7. A refrigerator, comprising: an insulated chamber having top, side, rear, and bottom walls, and a vertical door defining at least a part of the front wall of said chamber; a drip-tray having upstanding front, rear, and side walls, and a bottom wall; said drip-tray being slidably positioned in said chamber and extending substantially to the side walls thereof, and dividing said chamber into an upper and a lower compartment; an evaporator cooling unit in said upper compartment; said chamber having a first air passage located near said door and a second air passage located near the rear wall of the chamber for circulating air between said upper and lower compartments; a damper pivotally mounted along one edge thereof to the rear wall of said drip-tray, and being rotatable into a position such that it extends across the area of said second passage for restricting the flow of air therethrough; a mounting base adapted for securement to the bottom of said drip-tray; a lever pivotally mounted proximate one end thereof on said mounting base, the opposite end being free to rotate about said pivotal mounting; means connecting the free end of said lever to said damper; resilient means circumscribing said pivotal mounting and disposed so as to rotatably urge said lever about said pivotal mounting; said lever being fashioned with a notched portion on the end thereof adjacent said pivotal mounting; a thermostat responsive to the temperature of the lower compartment and removably secured to said mounting base; said thermostat having an operating element that engages the notched end portion of said lever and rotates said lever against the action of said resilient means whereby said thermostat is operable for controlling the position of said damper in accordance with the temperature of said lower compartment.

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