

[54] **ADJUSTABLE DAMPER CONTROL MECHANISM**

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[51] Int. Cl. **F25d 17/04**

[58] Field of Search **62/187, 408, 441, 419**

[56] **References Cited**

UNITED STATES PATENTS

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Primary Examiner—William J. Wye

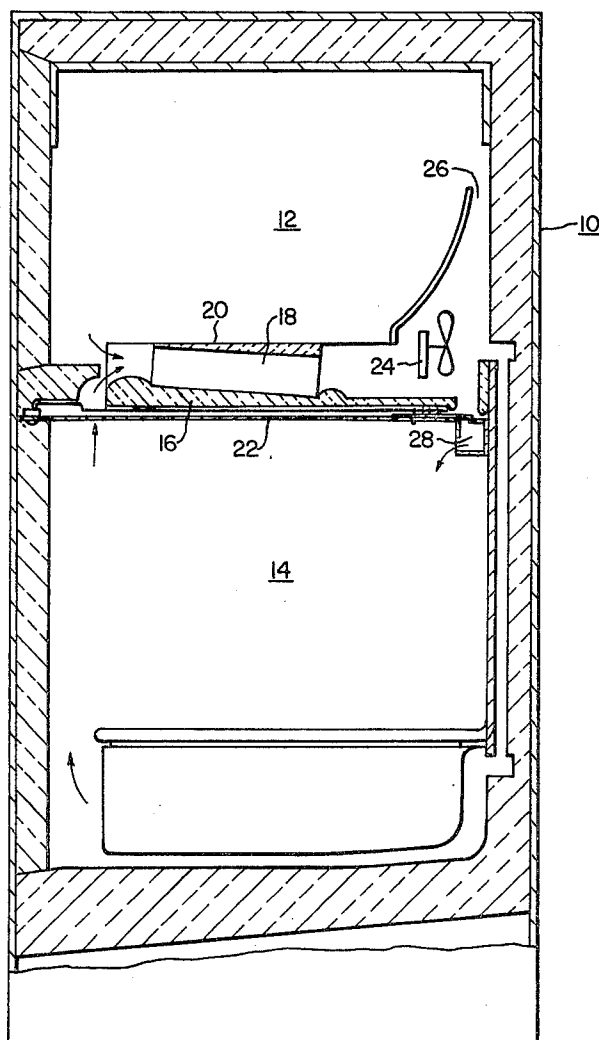
Attorney, Agent, or Firm—F. A. Winans

[57]

ABSTRACT

A damper control mechanism for a single evaporator tow-zone refrigerator, having a damper generally adjacent to the rear wall of the refrigerator for determining air flow into one zone, a forwardly mounted manual control for adjusting the damper between its extreme open and closed position, and enclosed linkage connecting the damper and the manual control that permits correlating the setting as indicated by the manual control and the actual setting of the damper subsequent to complete assembly of the refrigerator to accommodate variations in the length of the linkage as the result of permissible manufacturing tolerances.

8 Claims, 4 Drawing Figures



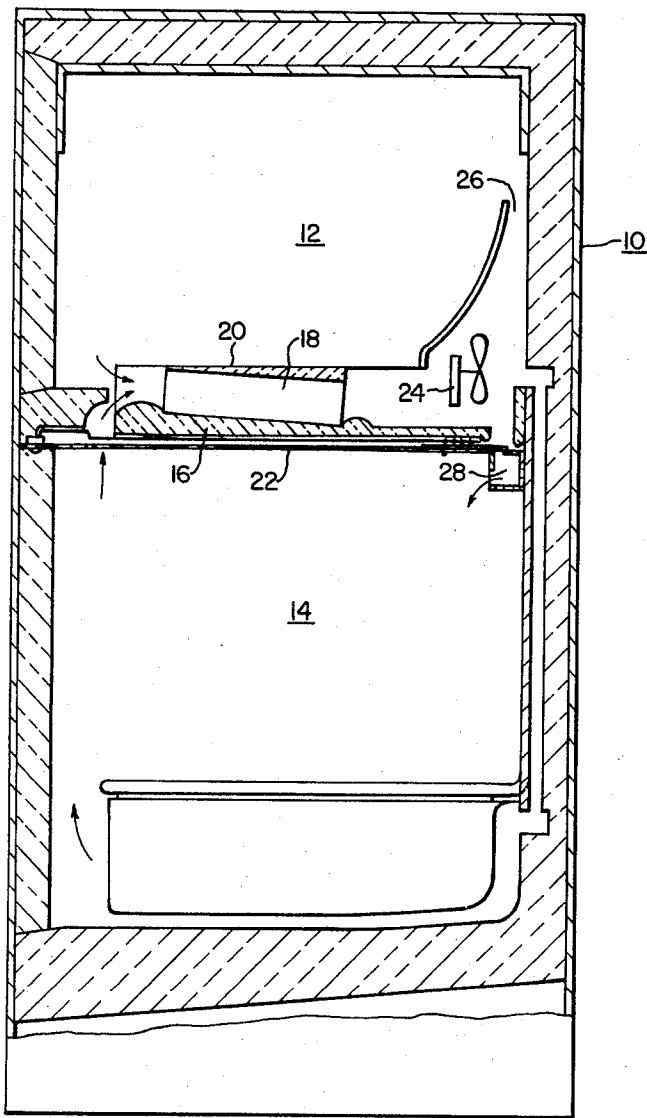


FIG. 1.

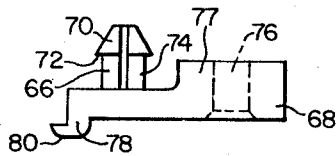


FIG. 4.

FIG. 3.

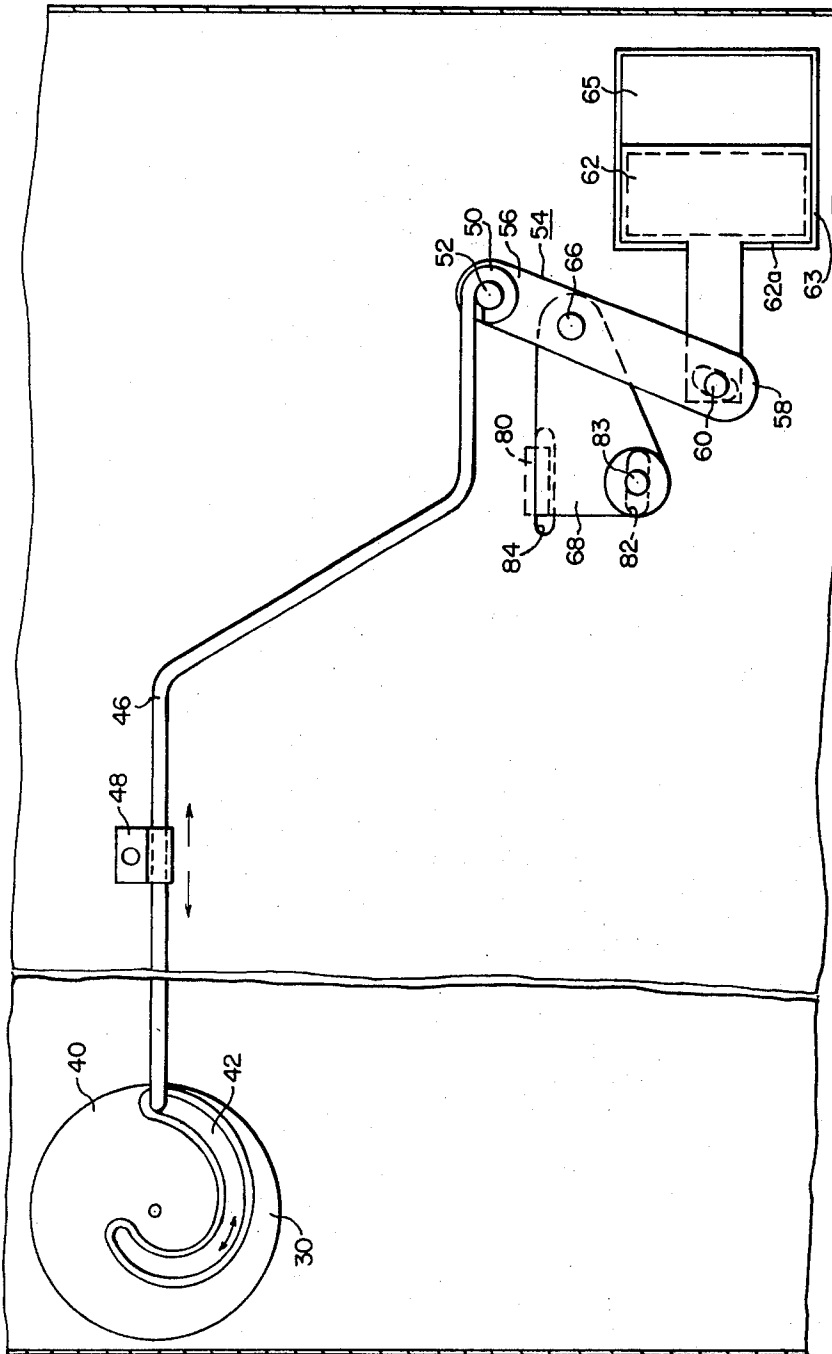
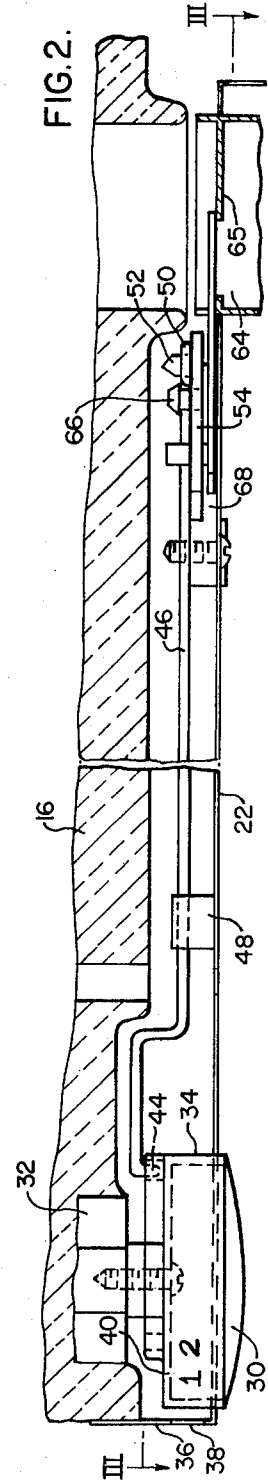


FIG. 2.



ADJUSTABLE DAMPER CONTROL MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a damper control mechanism for a single evaporator two-zone refrigerator, and more particularly to such a damper control mechanism having a manual control generally remote from the damper.

2. Description of the Prior Art

Refrigerators of the type associated with the present invention generally include an upper freezer compartment and a lower fresh food compartment separated by a horizontal divider that in itself comprises a housing for the refrigerator evaporator. The divider includes upper and lower facing walls having forwardly disposed openings for receiving return air from their respective adjacent compartments, and rear discharge openings for returning refrigerated air back into the compartment after it has passed over the evaporator. The relative distribution of the air is such that the freezer is maintained at a substantially reduced temperature in comparison to the fresh food compartment. This is accomplished by an adjustable damper mechanism associated with the return opening into the fresh food compartment to control the amount of return air and thereby regulate, within a range, the temperature of the fresh food compartment.

Heretofore, the damper mechanism was controlled by a manually adjustable knob mounted generally adjacent the damper, and mechanically connected to the damper through a short linkage. In this respect, the damper and the control were assembled within a housing that included an air diffuser, all of which was subsequently attached to the back wall of the fresh food compartment in alignment with discharge openings leading thereinto. Thus, the small assembly could be adjusted so that when the manual knob indicated the damper was closed, the damper could be made to be in a position that would close this duct once the housing was assembled in the refrigerator.

The above had a disadvantage of requiring the users to reach the back wall of the compartment to make any relative adjustment in the temperature. To provide a more accessible manual knob, it was decided to move it forwardly, requiring as a result, a rather lengthy linkage joining the damper to the knob. Further, it was determined that for esthetics, the linkage should remain covered and in this respect was placed within the divider wall. This also required the linkage to be assembled during preliminary assembly of the refrigerator. To accommodate permissible manufacturing tolerances within the parts comprising the linkage, a final adjustment for correlation between manual knob setting and the actual position of the damper was required.

SUMMARY OF THE INVENTION

An adjustable damper control mechanism is disclosed which includes a forwardly disposed manual control knob and a remotely disposed damper with the joining linkage being generally inaccessible subsequent to the final assembly of the refrigerator. The linkage includes a wire connecting rod joining the control knob to one end of a pivotal lever. The lever itself is mounted intermediate its ends on a pivot mount with the remaining end of the lever connected to the damper. The pivot

mount includes portions that extend through slots in the divider wall and into the fresh food compartment for access therefrom. The mount can thus be manually moved within the slots to accommodate, within the range of permitted tolerances, any variations in the length of the wire form. Thus, with the control knob set at a closed position, the pivot mount can be manually moved until it is felt through an abutment between the damper and a shoulder adjacent the air return opening, that the damper is in fact closed, the mount is then secured in this position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional side elevational view of a refrigerator schematically illustrating the invention;

FIG. 2 is an enlarged side elevational view of the invention;

FIG. 3 is a top plan view of the invention; and

FIG. 4 is a front elevational view of the pivot mount.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The damper control mechanism of the present invention is particularly applicable to a single system refrigerator/freezer such as shown for example in U.S. Pat. No. 3,656,314 of common assignee. For a more complete description of the air flow and control of such a refrigerator, reference should be made to that patent. However, for the purpose of disclosing the present invention in the proper environment reference is made to FIG. 1 which shows a refrigerator/freezer 10 in cross-section to illustrate an upper compartment 12 and a lower fresh food compartment 14 separated by a horizontal partition or dividing wall 16 which itself houses an evaporator 18 horizontally sandwiched between the upper generally planar wall member 20 (which also forms the bottom wall of the freezer compartment) and the lower planar wall member 22 (which forms the upper wall of the fresh food compartment). The interior of the partition between walls 20 and 22, in addition to housing evaporator 18, defines air passages or ducting for directing return air flow from the respective compartments, over the evaporator, and to a fan 24 from whence it is forced to outlets 26, 28 for the freezer and fresh food compartments respectively.

The temperatures of the two compartments are primarily controlled by a thermostat which controls the on/off cycling of the refrigerator unit. However, the two compartments are maintained at distinct temperatures by regulating the relative quantity of refrigerated air delivered by the fan to them. This is accomplished by a shutter-plate or damper disposed in the air outlet to the fresh food compartment which is generally movable between the position associated with the maximum air flow into this compartment and a closed position blocking the outlet.

For various design considerations (i.e., size of fan housing, availability of space, etc.) the air ducts for delivering air to the compartment are preferably located adjacent the rear wall of both compartments, which in turn dictate the location of the damper, and, as previously stated, the damper control was also located adjacent the rear wall. However, to make it more accessible it was determined to position it in a forward location which would require linkage joining the control to the damper. As such linkage, if exposed, would be esthetically undesirable, it was determined the linkage should

be disposed within the divider wall. Thus, in this location it is necessary to assemble the linkage as a preliminary step in assembling the refrigerator. And, as the linkage must provide for tolerances, it is inescapable that it must be adjustable. However, in that it is disposed between the two walls, it is generally inaccessible for adjustment. The hidden linkage connecting the forwardly disposed manual control knob to the rearwardly disposed damper of the present invention permits adjustment so that the position of the damper corresponds to the position indicated on a visual indicator on the manual control knob in the following manner.

Referring now to both FIGS. 2 and 3, the mechanism of the present invention is seen to include a manual control knob 30 rotationally mounted in the forward portion of the refrigerator as through a screw attaching it to a plastic anchor 32 which can be held in place by the foam insulation within the dividing wall 16. The knob extends through an appropriately sized aperture in wall 22 to project sufficiently for manual operation. The peripheral upstanding lip 34 of the knob can include indicia (such as numbers) indicating the relative position of the damper with respect to the air outlet. Also, the forward upwardly extending terminal edge 36 of the wall 22 can include an opening in front of the knob, covered by a clear plastic window 38 for easy visual readout of the indicia.

The upper face 40 of the knob 30 defines a volute shaped cam-groove 42. A wire linkage extends from the knob to generally adjacent the damper in a space generally between wall 22 and the insulation. The wire linkage includes a cam following finger 44 on one end received within the groove 42, and a laterally, horizontally extending portion 46 terminating in an eyelet 50. A guide member 48 engages the lateral portion 46 for limiting the movement of the wire, as the finger 44 follows the groove 42, to linear motion. The eyelet 50 rotationally engages an upstanding pin 52 extending from one end 56 of a lever member 54. The opposite end 58 of the lever 54 in turn defines an opening for rotationally engaging an upstanding pin 60 associated with a linearly movable damper 62 mounted for horizontal sliding engagement over the air duct 64 leading to the fresh food compartment.

The damper 62 is generally T-shaped with the leg of the T engaging the pin 60 and the head of the T slidably guided by a peripheral lip 63 surrounding the opening of the duct and a horizontal platform 65 extending adjacent the opening but rearwardly thereof. In the extreme open position, the head of the T-shaped damper overlies the platform, and in the fully closed position, the head of the T overlies the opening with the base edge 62a of the head abutting the upstanding peripheral shoulder 63 surrounding the opening.

The lever member 54 is fulcrumed such that the linear movement of the wire form as the finger moves within the cam groove 42 is transferred to a linear movement of the plate to cause it to move between its fully opened and fully closed position.

However, because of the variations incurred by permissible manufacturing tolerances, the total length of the linkage (i.e., wire form, lever, T-shaped damper) is variable. Therefore, to accommodate these variations, and permit adjustability of the linkage subsequent to complete assembly of the refrigerator, the pivot point on which the lever 54 is fulcrumed is made linearly ad-

justable in a line parallel to the linear motion of the linkage.

The pivot point is determined by a pin 66 projecting upwardly from, and integral with, a pivot plate 68 which, as clearly shown in FIGS. 3 and 4, preferably comprises a plastic molded planar member having a triangular configuration. One face of the plate 68 slidably rests on the inner surface of the wall 22, whereas the opposite surface carries the pivot pin 66 which has a conically tapered end 70 forming a shoulder 72 on a stem 74 for clipingly retaining the lever by insertion of the stem through an appropriately size aperture in the lever member 54. This pin is preferably formed in one corner of the triangular shape, with one of the remaining corners having an aperture 76 encircled by a raised portion 77 therearound to provide some thickness to the plate in this area. A downwardly projecting tab member 78 extends from the surface of the plate 68 opposite the pin and the raised portion and generally adjacent the remaining corner and terminates in an outwardly formed lip 80.

The plate 68 is mounted on the wall 22 by aligning the aperture 76 and the tab 78 with slots 82 and 84, respectively provided in the wall 22, with the slots having their greatest dimension along lines parallel to the linear movement of the wire form. The plate is retained in this position by the lip 80 engaging the undersurface of the wall 22 and by a headed self-tapping screw 83 inserted into the elongated aperture 82 and aligned aperture 76. In this position, plate member can be linearly moved along a line parallel to the linear movement of the linkage with the elongated tab member maintaining a proper orientation to prevent cocking of the plate member.

Thus, after complete assembly of the refrigerator, the screw 83 can be loosened, the manual knob adjusted so that the indicia indicates the extreme closed position in which case the head of the T-shaped damper should abut the peripheral shoulder surrounding the duct. Assuming this abutment occurs prior to the knob being in its extreme position, with the screw 83 loose, further turning of the knob will adjust the position of plate member 68 within the elongated slots and thus the pivot point while the damper remains stationary. Or, should the knob be turned to its extreme position and the damper not yet abut the peripheral shoulder (which would be evident by the lack of a positive stop) the plate 68 can be moved by manually gripping the screw head and extending tab and adjusting the pivot point until the abutting position is felt. In either case, after the abutting position is obtained at the extreme setting of the knob, the screw can be tightened and the linkage maintained at the setting so that the relative degree of openness of the duct thereafter corresponds to the setting indicated on the knob.

I claim:

1. An adjustable damper control mechanism for a refrigerator/freezer having two compartments separated by a divider wall, said damper control mechanism providing means to set the position of a damper movable between open and closed positions with respect to an air duct to regulate the relative air flow to said two compartments, said mechanism including:

a manually settable control knob mounted generally remote from said damper; and
linkage means connecting said damper to said knob so as to correlate the position of said damper to be

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as indicated by said knob, said linkage means being generally disposed within said divider wall and including:

a rotatable lever member attached to said damper; and

a movable pivot plate for pivotally engaging said lever member, said movable pivot plate having a portion extending exteriorly of said divider wall and being manually accessible to adjust the final position of said pivot plate with respect to said damper so that the position of said damper as determined by said linkage means can be adjusted to correspond to the position indicated on said control knob.

2. Structure according to claim 1 including abutment means for positively abutting said damper in at least either said open or closed position and means for securing said pivot plate in a position where said abutment is felt after said control knob has been manually set to a corresponding position and said pivot plate adjusted to said abutment position.

3. Structure according to claim 1 wherein said linkage includes:

a cam means defined in said control knob;

a connecting rod having one end engaging said cam and the opposite end rotationally engaging said lever mechanism;

guide means for confining said rod to substantially linear movement;

elongated aperture means within said divider wall for receiving said portion of said movable pivot plate for limited guide movement of said structure within said aperture means and manually accessible from within one of said compartments; and,

means for securing said pivot plate at any selected position within said aperture means.

4. Structure according to claim 3 including abutment means for cooperating with said damper at either of said open or closed positions to indicate a positive stop, whereby said control knob can be manually set to either of said extreme position and said pivot plate moved within said elongated aperture means until said positive stop is felt whereupon said securing means is engaged to maintain this correlation between said knob and said damper position.

5. Structure according to claim 3 wherein the direction of movement of said pivot plate as guided by said elongated aperture means is substantially parallel to the linear motion of said connecting rod.

6. An adjustable damper control mechanism for a refrigerated compartment enclosed by wall structure, air

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duct means within at least one wall of said wall structure for the ingress of refrigerated air into said compartment, and movable damper means cooperatively associated with said duct to regulate the volumetric air flow through said duct between various positions from a first position of maximum permitted air flow and a second position of minimum permitted air flow, said damper control mechanism comprising:

a manually settable control member mounted within said compartment generally remote from said damper means;

a linkage mechanism for interconnecting said control member and said damper means for transmitting motion of said control member to position said damper means to any of said various positions, said linkage mechanism including a lever member; and,

a movable pivot mount for receiving said lever member for rotation thereabout, said mount generally movably attached to said wall structure externally of said compartment and defining means extending into said compartment for ready access for manual movement to adjust said mount to a final position so that the position indicated on said control member corresponds to the desired position of said damper member.

7. Structure according to claim 6 including:

abutment means for positively abutting said damper means in either said first or second position;

and said means of said pivot mount extending into said compartment defining means for securing said mount at any selected final position, whereby said control member can be manually set to indicate either of said positions and said pivot mount manually moved until said abutment is felt whereupon said mount can be secured to maintain a proper correlation between said control member and said damper means.

8. Structure according to claim 7 wherein said linkage mechanism further includes a connecting rod interconnecting said control member to said lever mechanism, said rod being confined to substantially linear movement; and,

said wall structure on which said pivot mount is attached defines elongated aperture means for receiving said means of pivot mount extending into said compartment with the axis of the greatest dimension of said aperture means being generally parallel to said linear movement of said connecting rod.

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