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Swaneck, Jr.

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[54] **AIR CONTROL FOR FRESH FOOD COMPARTMENT QUICK CHILL OPERATION**

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[52] **U.S. Cl.** **62/157**, 62/187, 62/231, 62/419

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

[58] **Field of Search** 62/157, 158, 186, 62/187, 231, 408, 414, 419

[56] **References Cited**

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3,093,981	6/1963	O'Grady	62/419
3,659,429	5/1972	McLean	62/157

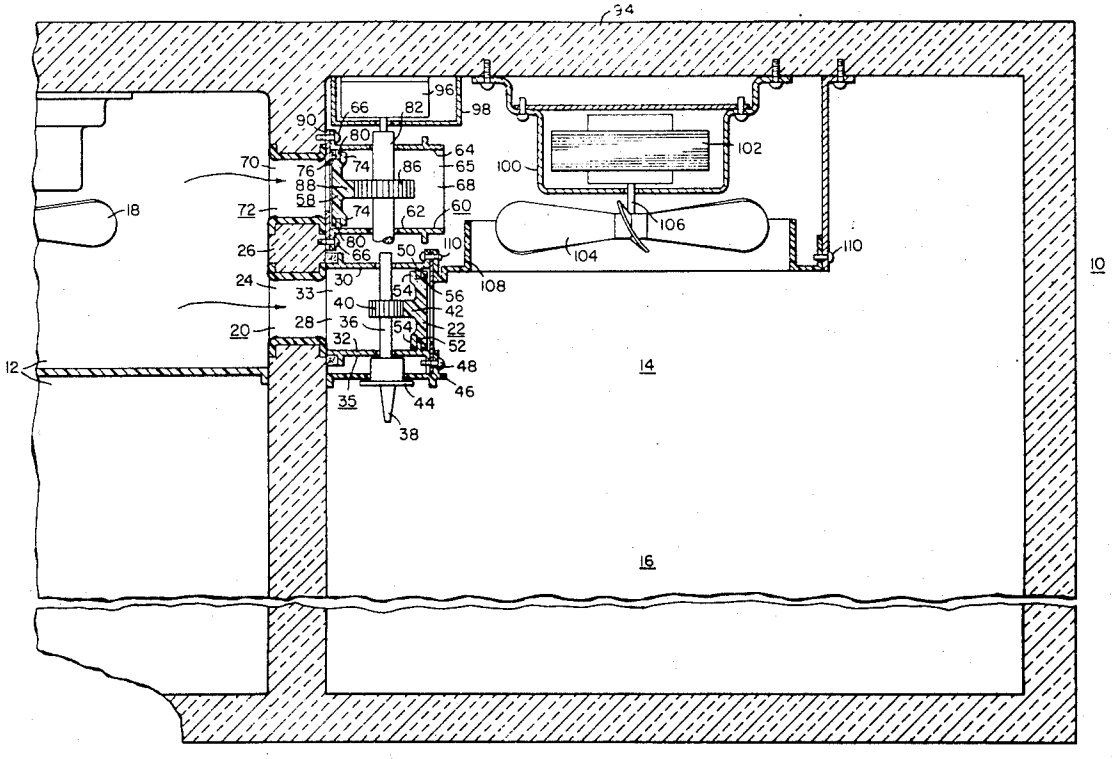
Primary Examiner—Meyer Perlin

Attorney—F. H. Henson et al.

[57] **ABSTRACT**

The invention provides a pair of mechanically controlled air regulating dampers used in the fresh food compartment of a refrigerator. Each of the dampers controls the admission of air from the freezer compartment into the quick chill portion of the fresh food compartment, with one of the dampers being manually set to maintain a desired temperature range within the fresh food compartment during normal operation without quick chill, and the other (quick chill) damper being used to control during a quick chill operation. The quick chill damper is coupled to a timer mechanism so that an increased setting of timer period for quick chill also increases the quick chill damper opening so that those items having a heavy cooling load to obtain quick chill have their requirements met by the simultaneous setting of the quick chill damper and the quick chill timer. The quick chill damper is arranged to be closed for any timer setting of say ten minutes or less. This feature provides for the quick chill cooling of food by only that air which is being circulated within the fresh food compartment.

8 Claims, 7 Drawing Figures



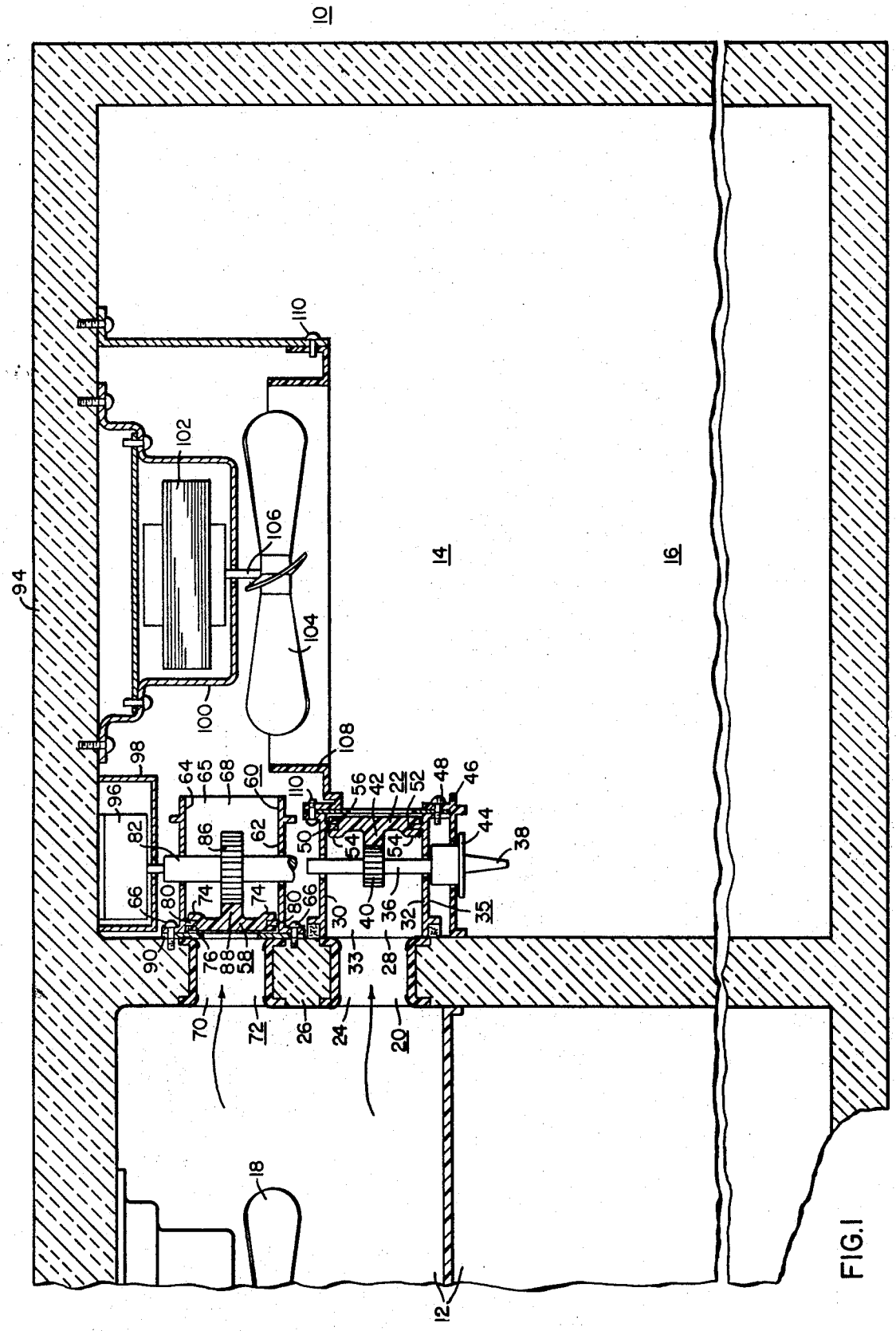

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FIG. 1

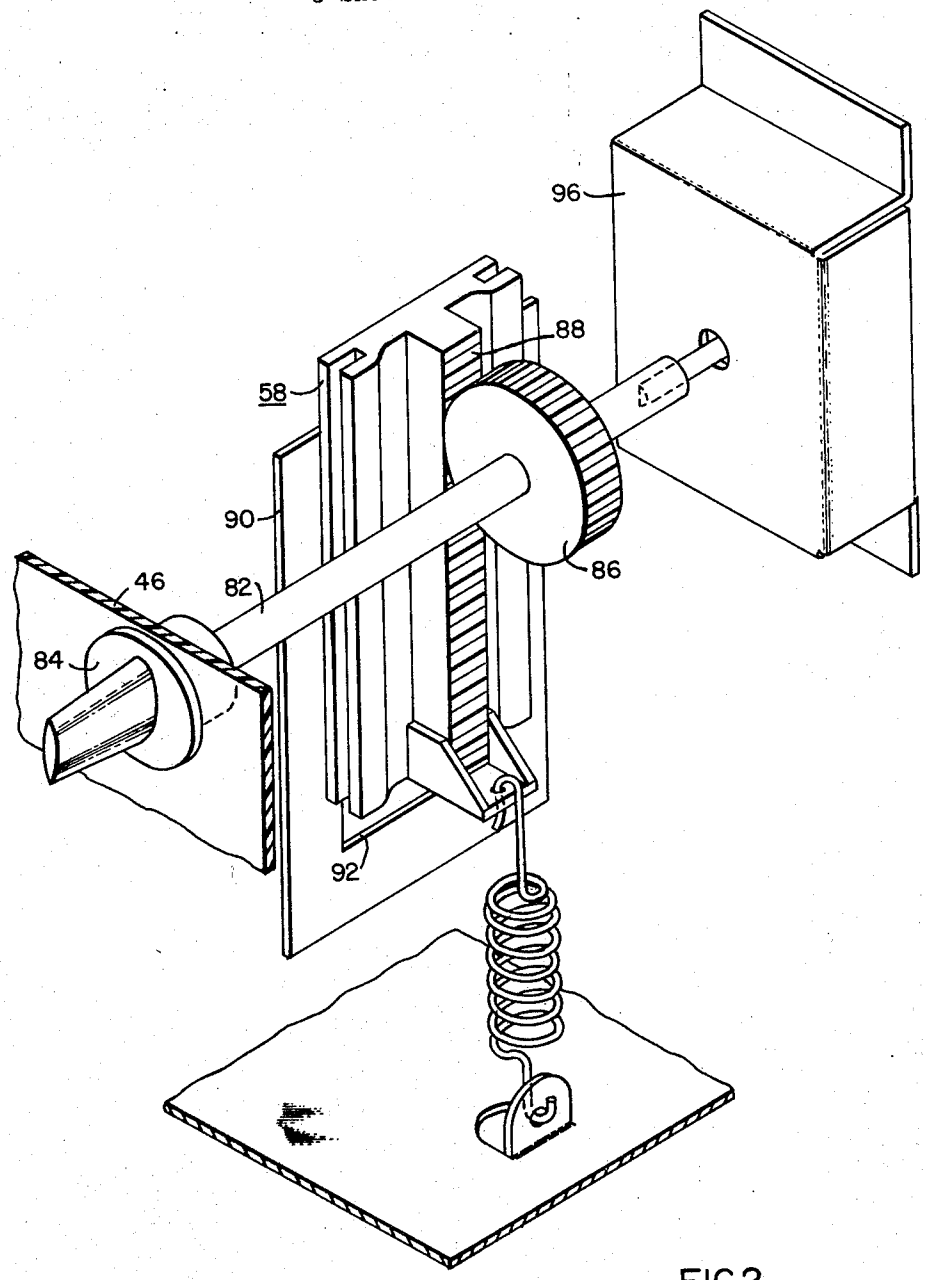


FIG.2

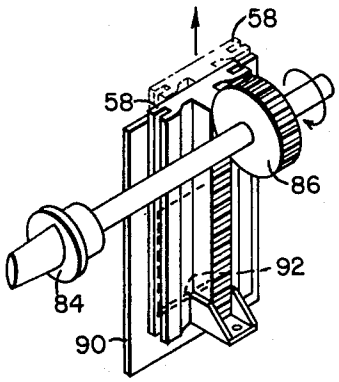


FIG.3

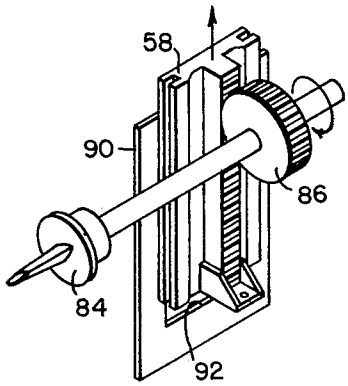


FIG.4

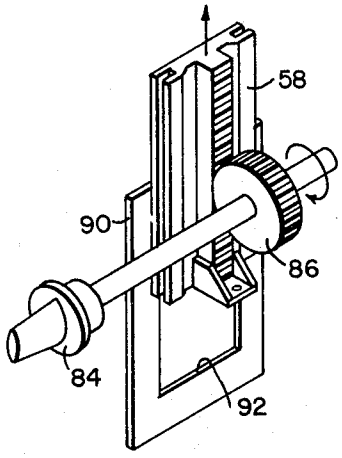


FIG.5

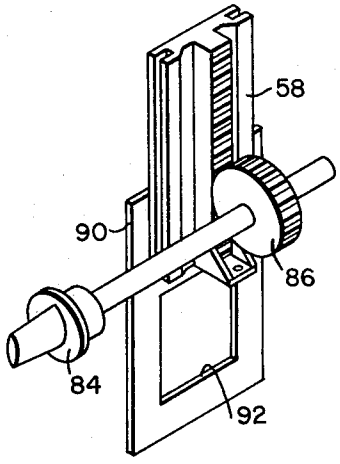


FIG.6

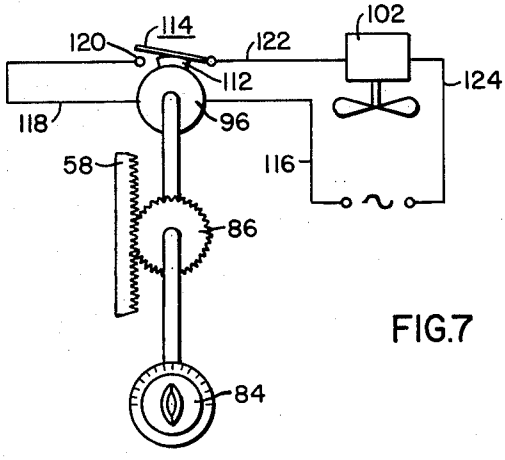


FIG.7

AIR CONTROL FOR FRESH FOOD COMPARTMENT QUICK CHILL OPERATION

RELATED CASES

U.S. Pat. application No. 22,499, filed Mar. 25, 1970, titled, "REFRIGERATOR-FREEZER WITH FAST CHILL ARRANGEMENT", now U.S. Pat. No. 3,659,429, and owned by a common assignee describes a refrigerator-freezer yielding a quick chill mode of operation.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to refrigerator/freezer damper arrangements and, more particularly, relates to an improved damper arrangement providing a quick chill function in the fresh food compartment of a refrigerator/freezer.

2. Description of the Prior Art

The quick chill arrangement as presently provided does not have its own damper. Thus the admission of air from the freezer side is dependent upon the position of the single primary damper which is dependent in its setting upon the temperature within the food compartment of the refrigerator. This primary damper opens and closes, based on a desired and set temperature for the food compartment as a whole. During a quick chill mode then, the quick chill operational cycle has little influence on the operation of the automatic damper so that the required quick chilling time of the food article can vary considerably depending on the existing position of the damper blade as called for by the temperature within the fresh food compartment.

If the damper is open at the start of quick chill, initial cooling will be faster due to added cold air being force circulated in the quick chill compartment by the auxiliary quick chill fan. But for items that are sensitive to freezing, this additional cold air can cause wilting and discoloration. On the other hand, if the damper is closed at the beginning of the quick chill cycle, the effectiveness of the chill cycle is reduced unless the automatic damper opens due to a temperature change within the fresh food compartment. Such a delay of damper opening reduces the effectiveness of cooling hot beverages, for example, resulting in longer cooling time to obtain a desired temperature.

Furthermore, the position of the damper is also dependent on the position that the customer has set on the control dial for dictating the temperature within the fresh food compartment. At the coldest position then, the quantity of cold air for quick chilling would be greater than at the cool position which, again, would be greater than that if the dial were set at the normal position. Efficiency of the prior art quick chill, therefore, is also variable, depending upon the automatic damper control position, as dictated by the original temperature set on the control dial.

Accordingly, it would be advantageous to provide a damper control system for a quick chill mode of operation which neither depended upon the setting of the temperature within the fresh food compartment, nor the temperature sensed by a thermostat which, in turn, controls an automatic damper opening. It would additionally be advantageous to provide a degree of chilling during a quick chill operation which accords more closely to that required for the particular items to be cooled.

SUMMARY OF THE INVENTION

The invention provides a pair of mechanically operated dampers which control the admission of air into a quick chill compartment in the fresh food side of a refrigerator. The primary damper controls the flow of cold air from the freezer side of the refrigerator for overall cooling of the fresh food compartment, with this air being circulated through the fresh food compartment by a circulating fan maintained in the freezer compartment. This primary damper is set by the user of the refrigerator to a desired temperature range of the fresh food compartment.

The second damper controls the admission of air from the freezer side during a quick chill operation in accordance with the setting of the manually operated quick chill knob or dial. Mechanism connects the dial to the damper and a timer motor so that the chill time and damper opening are generally controlled together to provide within limits, greater damper openings with longer time settings. Thus, those items having a high heat load, such as hot beverages and the like, not only have an increased time duration for quick chill but also have an increased amount of cooling air blown over them during the quick chill mode. A fan is disposed within the quick chill compartment to induce a flow of air through the opening controlled by the quick chill damper with this fan discharging its air to the quick chill compartment in a location so as to provide a back pressure against the flow of air through the opening controlled by the primary damper. Thus, during quick chill, the air flow within the fresh food compartment and quick chill compartment is dependent primarily upon the flow of air induced by the quick chill fan.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the invention reference may be had to the preferred embodiment, exemplary of the invention, shown in the accompanying drawings, in which:

FIG. 1 is a partial cross sectional plan view of a refrigerator incorporating the invention and showing the quick chill compartment and its operating components;

FIG. 2 is a perspective view of the quick chill damper, timer and dial arrangement;

FIGS. 3 through 6 are partially perspective views of the setting of the quick chill damper, dependent upon the length of time of desired quick chill operation; and

FIG. 7 is a schematic view of one circuit that could be utilized in the practice of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A refrigerator **10** (only partially shown) can be seen in FIG. 1 that includes a freezer compartment **12** and a quick chill compartment **14** disposed in and making up a portion of a fresh food compartment **16**. A fan **18**, disposed in the freezer compartment **12**, provides a flow of circulating cooling air within the freezer compartment and also normally circulates cooling air through a flow path **20** to the quick chill compartment **14** and thence to the remainder of fresh food compartment **16** so as to provide cooling to them. An ordinary open-work refrigerator shelf (not shown) divides the quick chill compartment **14** from the remainder of the fresh food compartment **16** and also supports those articles of food which are to undergo quick chilling.

Cooling air flow to quick chill compartment **14** and the remainder of fresh food compartment **16** through flow path **20** is modulated by means of a damper **22** that moves between open and closed position over flow path **20.** Flow path **20** is formed partially by a passageway **24** in a sidewall **26** dividing the frozen food compartment **12** from the fresh food compartment **16** and a passageway **28** formed by a pair of sidewalls **30** and **32** extending from the dividing wall **26** inwardly into the quick chill compartment **14.** A bottom **33** and a top wall (not shown) complete the configuration of a housing **35** for the passageway **28.**

Disposed within this passageway and bearingly received by the sidewalls **30** and **32** is an actuating shaft **36.** This shaft mounts a dial **38** for manual manipulation at its outward and forward extremity for rotation of the shaft **36.** A pinion **40** disposed on and fixed to rotate with the shaft **36** drives a rack **42** that is fixed and integral with the damper **22.** Thus, rotation of the pinion **40** as urged in its rotation by dial **38** moves the rack **42** upwardly or downwardly to thereby move the first damper **22** therewith to open and close the flow path **20.**

The dial **38** includes a thin flange portion **44** of enlarged diameter which spaces the same outwardly from a wall **46** which may be joined to the dividing side wall **26** and to a forwardly extending portion of wall **32** by a screw **48** or the like. The wall **46** may conveniently have indicia thereon to indicate settings for the damper **22.** Such settings may include "cold", "cool" or "normal" with the damper **22** fully open for "cold", closed slightly for "cool" and closed completely or almost completely for "normal."

In order to insure that the damper **22** moves smoothly upwardly and downwardly in its closing and opening motion relative to the flow path **20,** each of the walls **32** and **30** include projections **50** and **52** which serve as a guiding means for the damper **22,** the same having offset portions **54, 54** intermediate their upper and lower ends so that each offset portion **54** and a major portion **56** extending above and below the offset portion on each side provide a guideway in which the projection **50** and **52** are inserted in a manner similar to the structure of a quick chill damper **58** (FIG. **2**). By the arrangement just described, then, flow of cooling air for the fresh food compartment **16** is provided through the flow path **20** from the freezer compartment **12,** with the quantity of air monitored by the easily movable damper **22** so that the fresh food compartment **16** may be kept at a temperature pursuant to the setting of the dial **38.**

The second or quick chill damper **58** is also situated within the quick chill compartment **14,** with this damper being disposed in a housing **60** formed by a pair of side walls **62, 64** and a bottom **65.** Since the housing **60** is open at its inner end to the quick chill compartment **14** the same provides a passageway **68** extending partially through the quick chill compartment **14** which, in conjunction with a passageway **70** formed in the dividing side wall **26,** forms a flow path **72** for the flow of air from the freezer compartment **12** to the quick chill compartment **14.** The damper **58,** of course, is placed in an obstructing or non-obstructing position relative to this flow path.

Quick chill damper **58** is guided in its upward and downward movement by means of a pair of offset portions **74, 74** formed intermediate its upper and lower ends so that a major portion **76** of the damper **58** extends above and below each offset portion and with the offset portions **74, 74** extending generally parallel to the major portions **76** on each side of the damper **58** so that a guideway is formed on each side of the damper **58.** The guideways have received therein a pair of tabs **80, 80** which are integral with and extend from the sidewalls **62, 64.** The quick chill damper **58** can thereby be conveniently guided in its upward and downward movement relative to the flow path **72.**

Extending through the front side wall **32** of housing **35** is a rotatable shaft **82** which controls the movement of the damper **58.** At its outer end the shaft **82** has fixed thereto a dial **84** (FIG. **2**) which provides a convenient means for grasping and rotating the shaft **82** by the user of the refrigerator **10.** Shaft **82** is disposed vertically above the shaft **36** for damper **22** so that there is no interference between the dials **84** and **38** and so that an indicia means (not shown) may also be provided on the front wall **46** of the quick chill compartment **14** so as to direct the user to the proper setting of the dial **84.** Such indicia may provide a time period extending from zero minutes to 90 minutes, for example, to thereby provide a varying chill time for food articles placed within quick chill compartment **14.**

Attached to and fixed intermediate the frontward and rearward terminations of the shaft **82** is a pinion gear **86,** with this gear thereby rotating with shaft **82** as dial **84** is manipulated by the user of the refrigerator. Pinion gear **86** meshes with a rack gear **88.** Disposed on an integral portion of the damper **58.** Thus, rotation of the pinion gear **86** provides movement of the damper **58** in an upward or downward direction to thereby provide a varying flow rate of cold air from freezer compartment **12** to quick chill compartment **14.** A template **90** may be mounted between the dividing wall **26** and housing **60** to provide an aperture **92** of a reduced size which may conveniently cooperate with the damper **58** during its monitoring of the air flow through flow path **72.**

Mounted on a rear wall **94** of quick chill compartment **14** is a quick chill timer motor **96** that operates for the set duration of the quick chill cycle by rotating the pinion gear **86** in the reverse direction from which it has been set to open the damper **58.** Rotation of the pinion gear **86,** as driven by the timer motor **96,** closes off the aperture **92** progressively until ten minutes time is reached on the dial **84.** Timer motor **96** may be removed from the main flow of air through flow path **72** within quick chill compartment **14** by a means of a housing **98** that extends therearound and is attached by any conventional means to the rear wall **94** of the quick chill compartment **14** and the dividing wall **26** of the refrigerator **10.**

Disposed rightwardly of quick chill timer housing **58** (FIG. **1**) is a fan motor housing **100** in which is disposed a fan motor **102** that rotates a fan blade **104** located outwardly of the fan housing **100** by a fan shaft **106.** A fan shroud **108** is attached to front sidewall **30** by means of self-threading screws **110** although it could be an integrally molded assemblage or the like, and extends in an annular manner around the fan blade **104** so as to provide a guide means for the air being moved by this fan blade. The opposite side of the fan shroud **108** is attached to a wall extension **110** extending forwardly from the rear wall of the quick chill compartment **14.**

Operation of fan blade **104** includes a flow of air so that air moves through the flow path **72** and is discharged by the fan blade **104** forwardly thereof into the remainder of the quick chill compartment **14**. Such a discharge of air (at this time with the damper **58** at least partially open) provides a pressure buildup of air adjacent the damper **22** so that there is a tendency for the air passing through the air flow path **20** to be stagnated at this point so that substantially all the air circulated within quick chill compartment **14** is air which has been imparted to this compartment through the flow path **72**. Thus, operation of the quick chill compartment **14**, during a quick chill mode with the damper **58** at least partially open, is substantially independent of the flow of air through the air passageway **20**.

In the event that a short quick chill time period is required or desired and the dial **84** is rotated to ten minutes time duration or less, items such as lettuce and salads may be quick chilled without browning. The damper **58** for such a time period is closed because the damper has not moved sufficiently far to provide an air flow through flow path **72**. The fan blade **104** would still rotate but would tend to draw air from the food compartment **16** and the quick chill compartment **14** to provide a flow of circulating air through the fan shroud **108** and quick chill compartment **14**. Again a pressure head is provided on the inner side of the damper **22** so that no flow of air would tend to move through the flow passage **20** to the quick chill compartment. Thus, a substantial independence from the normal cooling air flow through damper **22** is achieved during a quick chill cycle when the damper **58** is entirely closed. Of course, when the damper **58** is in the final ten minute time period of any time period set by the dial **84**, circulation of air within the fresh food compartment, with no discharge from flow passageways **20** and **72**, would be the only air available for the quick chill mode.

Turning now to FIG. **7** wherein a schematic diagram of the instant invention is provided, it can be seen that the timer motor **96** includes a cam or cam surface **112** which rotates into engagement with a switch **114** to cause the same to open (illustrated position), interrupting operation of the fan motor **102** and the timing motor **96**. The manner by which this is accomplished will now be detailed. A lead **116** extends from one side of an alternating current power supply to the timing motor **96**. The opposite side of the timing motor is connected to a lead **118** that extends to a contact **120** of the switch **114**. The opposite side of the switch **114** is connected to a lead **122** extending to fan motor **102**, with the opposite side of this fan motor connected to a lead **124** that extends back to the other side of the alternating current power supply. The dial **84**, pinion gear **86**, and the timer motor **96** are, of course, all connected mechanically so that movement of one calls for movement of the others. The timer **96** may also take the form of the common, wind-up mechanical timer which controls a switch **114**.

Assuming now, for example, that a time of set duration is dialed for the quick chill mode of operation by means of dial **84**. This rotation of dial **84** causes a consequent rotation of pinion gear **86** and a partial or full opening of damper **58**. At the same time, timer motor **96** has been rotated so as to place cam surface **112** in a disengaged position relative to the switch **114** so that the contact **120** is closed energizing the timer motor **96** and fan motor **102**. Timer motor **96** operates to slowly turn the cam **112** and pinion gear **86** to close the damper **58**. After the elapse of the timer set by dial **84**, the cam surface **112** again engages the switch **114** moving the same out of contact with its contact **120** and terminating the operation of the timer motor **96** and fan motor **102**.

As set up previously, the maximum time period which could be set with dial **84** was chosen as **90** minutes. If the dial is rotated to such a position, the damper **58** is in its fully open position relative to the aperture **92**, with this damper slowly closing until it reaches its closed position with ten minutes left of the time period set. Thus, the damper **58** slowly limits, to a greater and greater extent, the amount of air provided for the quick chill mode as the time period set decreases toward zero.

FIGS. **3** to **6** illustrate, generally the relationship of the damper **58** to the pinion gear **86** as the time set by the dial **84** is varied. FIG. **3** shows, in full lines, the position of the damper **58** in its closed position at a zero time setting on the dial **84**. FIG. **4** illustrates the position of the damper **58** when the dial **84** has been set at **15** minutes. FIG. **5** illustrates the position of the damper **58** when the dial **84** has been positioned to set up a **45** minute time period for the quick chill mode, and FIG. **6** is an illustration of the damper and aperture when a time period of **90** minutes has been set for the quick chill cycle. It should be specifically noted that, because of the relative size and location of the damper **58** and aperture **92**, the damper **58** is fully open in both FIGS. **5** and **6** so that the quick chill operates with maximum air between the time of 90 minutes and the time of 45 minutes. It should also be again noted that the damper **58** remains closed for zero minutes up to 10 minutes of remaining time and the same would assume the position shown in broken lines in FIG. **3** for this 10 minute or lesser time setting.

It should be obvious that varying times could be provided for the setting of the damper **58** so that it would be disposed in slightly different positions than those shown in FIGS. **3–6**, depending upon the time duration of damper operation desired. However, FIGS. **3–6** are considered to provide a general damper and dial arrangement that has been utilized to provide a very effective but manually variable quick chill cycle.

It should be recognized by one skilled in the art that an air control arrangement for a quick chill cycle of operation of a refrigerator has been described, that satisfied all the advantages set out in the beginning portion of the description. It should, further, be obvious to one skilled in the art that many modifications can be made to the embodiment described as exemplary which would still fall within the spirit and purview of the description offered.

I claim as my invention:

1. In a control arrangement for a refrigerating device including a freezer space and a refrigerator space and having a quick chill space in the refrigerator space, including;

a fan means in said quick chill space for circulating air thereabout;

a timer means for controlling said fan means;

manually operative means for setting said timer means;

an air passageway between said freezer space and said quick chill space;

a damper for said air passageway;

said manually operative means for setting said timer means being operative to position said damper simultaneously.

2. In the control arrangement of claim 1 wherein;

a. said damper is moved, generally and within limits, to assume a less and less interfering position to the flow of cooling air from said freezer space to said quick chill space as said timer means is manually set for a longer and longer time period of quick chill operation.

3. In the control arrangement of claim 1 wherein;

a. said manually operative means includes a manually manipulated knob and gear means mounted on a common shaft.

4. In the control arrangement of claim 1 wherein;

a. said timer means may be set for any one of a number of time periods;

b. said damper is arranged to remain in a closed position for those time periods not exceeding a selected time period.

5. In a control and air circulation arrangement for a refrigerating device including a freezer space and a refrigerator space and having a quick chill compartment in the refrigerator space, including;

a. first and second air passageways for the supply of cooling air from said freezer space to said quick chill compartment,

b. first and second damper means for said first and second air passageways, respectively,

c. a first fan means in said freezer space for moving air through said first air passageway,

d. a second fan means in said quick chill compartment for circulating air in said compartment and drawing air through said second air passageway when said second passageway is open,

e. said second fan means when operating creating an air flow condition at said first passageway opposing the admission of air flow through said first air passageway to said quick chill compartment.

6. In the control and air circulation arrangement of claim 5 wherein;

a. said second fan means when operating creating said air flow condition irrespective of the position of said second damper.

7. In the control and air circulation arrangement of claim 5 wherein;

a. said first damper means controls a flow of cooling air through said first air passageway to modulate the temperature of a fresh food compartment of said refrigerator,

b. timer means is provided for controlling periods of operation of said second fan means,

c. said second damper means is positionable in accordance with setting of said timer means.

8. In a refrigerator-freezer of the character having a fast chill compartment in the refrigerator side with a timer controlled fan for circulating air in said chill compartment, an air flow and control arrangement comprising:

means defining an opening through which air is adapted to be admitted from the freezer side to said chill compartment;

damper means for said opening;

manually operated means for setting said timer for any of a number of periods of fan operation and concurrently establishing a setting of said damper means.

* * * * *