May 14, 1968 R. S. TOWNSEND 3,382,618

CLOSURE SEALING MEANS FOR REFRIGERATOR CABINET

Filed Sept. 20, 1965 2 Sheets-Sheet 1

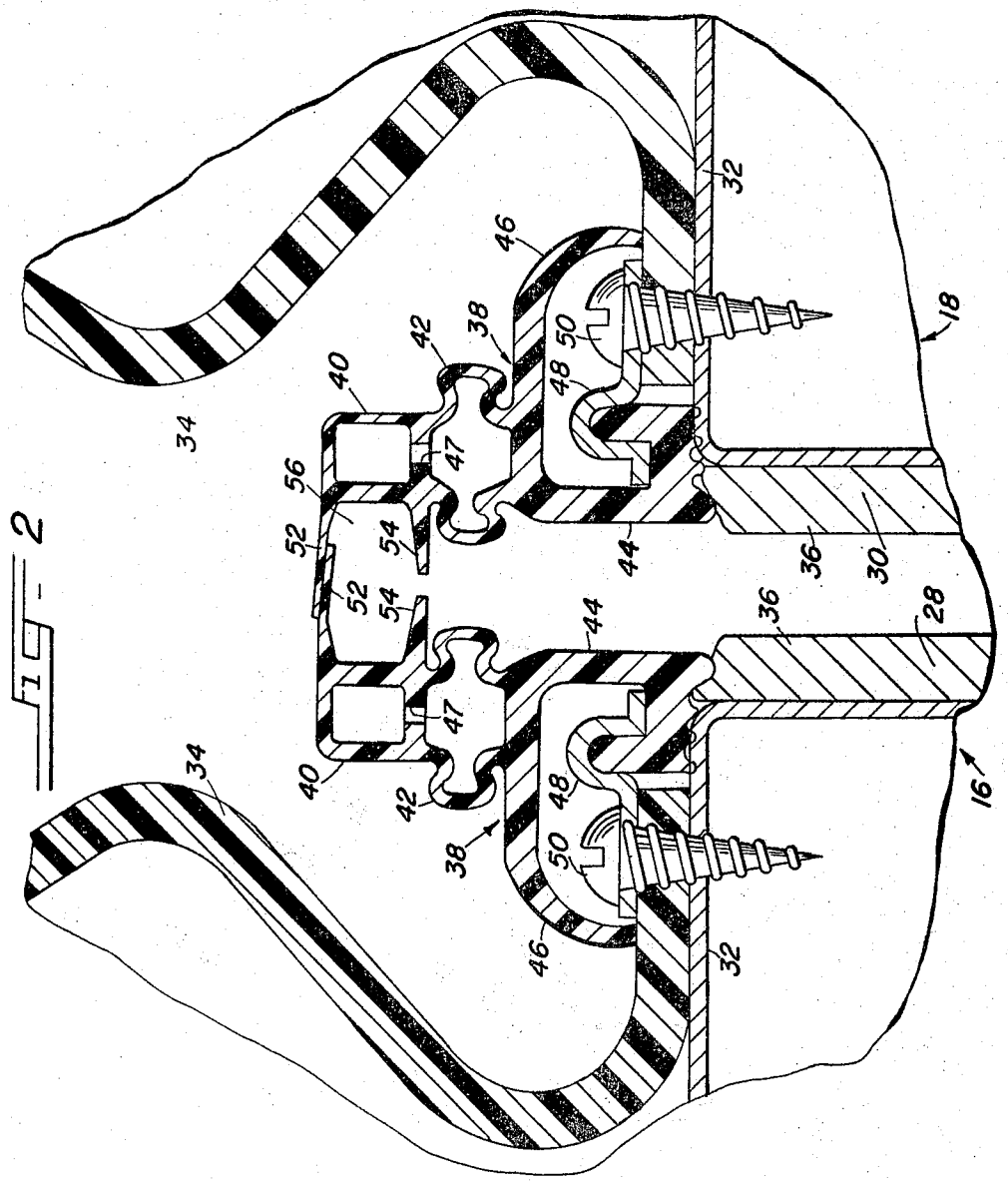


FIG. 2

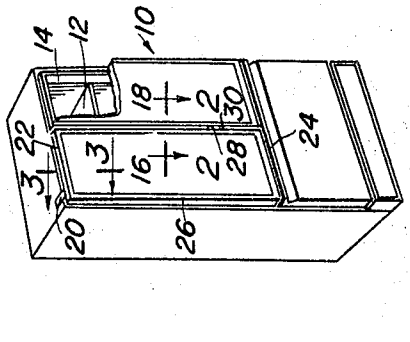


FIG. 1

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FIG. 3

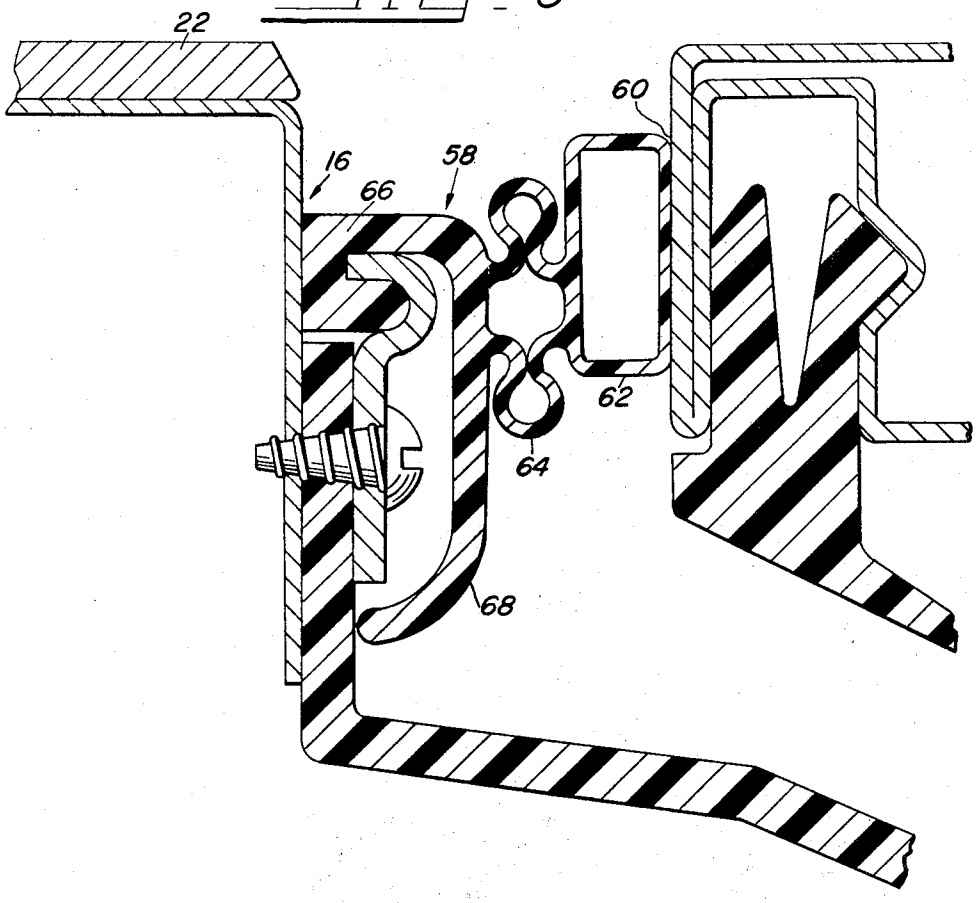
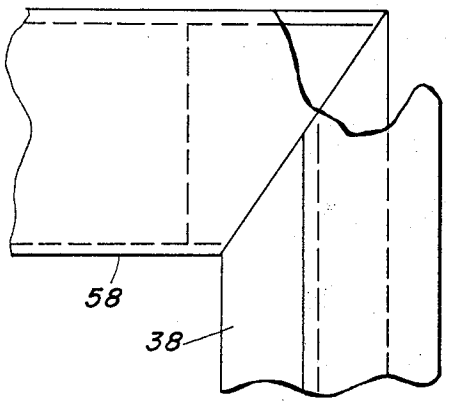


FIG. 4



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CLOSURE SEALING MEANS FOR REFRIGERATOR CABINET

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1 Claim. (Cl. 49—483)

ABSTRACT OF THE DISCLOSURE

A condensate preventive for refrigerators provided by a pair of flexible gaskets respectively connected to side-by-side refrigerator doors swingable toward each other, each gasket being substantially U-shaped in cross section with its legs extending toward the legs of the other gasket, one pair of corresponding legs overlapping in sealing relation and the other pair of legs extending toward each other and defining, with the first pair, a partial dead air space in the refrigerated space between the doors.

This invention relates to an improved sealing means for use in connection with a freezer or refrigerator cabinet wherein a pair of side-by-side closure members are used to close the single access opening to the cabinet.

In order to seal the space between the closure members at the center of the access opening a center post or mullion has generally been used. The inner opposed edges on the closure members then form a sealing engagement with the face of the mullion just as the other edges of the closure members form a sealing engagement with the face of the cabinet frame. Usually an appropriate gasket sealing means is provided between the frame and the closure member. However, when it is desirable to construct the refrigerator cabinet without a mullion to provide an unobstructed access opening the sealing of the space between the opposed edges of the closure members must be accomplished in a different manner. Sealing means have been provided on the opposed edges of the closure members which cooperate with each other to provide the seal. These sealing means have suffered from a variety of difficulties, not the least of which is an undesirable leakage of warm air through the gasket material.

With only the gasket providing a barrier between the cold air inside the refrigerator and the warm air outside the refrigerator, the air on the outside, but immediately adjacent the gasket seal, has a tendency to become relatively cool. This cooling of the air occurs because the warm air has a tendency to move toward a colder zone. The moisture in this cool air tends to condense on the surface of the gasket seal and perhaps even on the door edge itself, and eventually this turns to frost. As a result the doors may stick and become hard to open.

The rate of heat transfer through a gasket material is dependent on the thermal conductivity of the material. When the gasket is made of a material of high thermal conductivity the rate of heat transfer therethrough from the outside to the inside of the refrigerator will be greater than if a gasket material of relatively lower thermal conductivity is used. Thus sweating and frosting will occur earlier with a material of relatively higher thermal conductivity because of heat linkage through the material

from immediately outside the gasket material to the inside of the refrigerator.

This problem in some instances has been attacked by making an attempt to heat the air in the vicinity of the gasket and door edge. To accomplish this, electrical heating elements have been used in some structures. These have been inserted in the gasket or within the refrigerator door adjacent the door edge. This, of course, necessitates extra initial expense, to say nothing of the expenses of subsequent repairs should the heater become defective necessitating replacement of both heater and gasket.

I have devised a novel gasket means which is effective to reduce heat leakage to the inside of the refrigerator and as a consequence prevents the air in the vicinity of the outside of the gasket means from cooling to a point where excesive condensation occurs on the gasket and door edge. I do this without the provision of any extra elements to be attached to or associated with the gasket.

As mentioned above, the higher the thermal conductivity of a gasket material the more heat leakage will result. The Coefficient of Thermal Conductivity (referred to as a K-factor) of various types of rubber or universally used plastic material, for example, used for refrigerator gaskets ranges from 6.0–7.0 B.t.u.-in./hr. ft.^{2} degree F. By comparison, the thermal conductivity of dead air is 0.168.

My novel gasket means utilizes this low K-factor for air by providing a structure which includes an air cell or air pocket which when the doors or closure members of the refrigerator are closed is effective as an insulator to substantially reduce the passage of warm air through the gasket into the refrigerator. While my invention is described herein in conjunction with a mullionless multiple door refrigerator cabinet and is particularly useful in the structure I will describe, the broader aspect of my invention contemplates that a partial dead air space may be incorporated in other gasket structures.

Accordingly, a principal object of this invention is to provide an improved gasket means for use in conjunction with a refrigerator cabinet which will be less susceptible to the formation of condensate thereon and will be further effective to reduce the formation of condensate on the adjacent closure members.

Another object is to devise improved means for insulating the space between the edges of adjacent closure members of a refrigerator utilizing only an improved gasket means.

A further object is to provide an improved gasket means for use in conjunction with the closure members of a refrigerator cabinet which utilizes the high insulating properties of air to prevent formation of condensate and frosting on the gasket and associated parts of the refrigerator.

Another object is to provide an improved sealing means between closure members which does not require any auxiliary means such as a heater element to assist in preventing formation of condensate on the sealing means and adjacent edges of the closure members.

The above and other objects and advantages of the invention will be more readily apparent when read in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of a refrigerator unit partially in section incorporating the subject matter of the invention;

FIGURE 2 is a plan view in section taken along line 2—2 of FIGURE 1 showing mating edges of the closure members with attached sealing gaskets;

FIGURE 3 is a view in section of the top edge of the refrigerator taken along line 3—3 of FIGURE 1; and

FIGURE 4 is an enlarged view showing the mitred corner of a gasket on the inner edge of the door and the top edge of the door.

The invention is directed to means for preventing condensate formation in refrigerators by differential exterior and interior temperature variances and is particularly characterized by a pair of flexible gaskets respectively connected to side-by-side refrigerator doors swingable toward each other, each gasket being substantially U-shaped in cross-secion with its legs extending toward the legs of the other gasket, one pair of corresponding legs overlapping in sealing relation and the other pair of legs extending toward each other and defining, with the first pair, a partial dead air space in the refrigerated space between the doors.

Referring now to the drawings, **70** indicates generally a refrigerator cabinet having a storage compartment **12** with a single access opening **14**. The access opening is closed by a pair of closure members or doors **16** and **18** pivotally mounted at the outer edges of the cabinet **10** by suitable means such as hinges **20**. The refrigerator shown in FIGURE 1 is of the mullionless type, that is, one in which there is no center post against which the inner edges of the doors may seal, the seal being provided by appropriate means associated with the doors themselves. The doors **16** and **18** have a top edge **22**, a bottom edge **24** and an outer edge **26** which are adapted to overlie the frame of the refrigerator cabinet bordering the access opening **14**. Inner edges **28** and **30** of doors **16** and **18** respectively are brought together in a sealing engagement to be described.

Each of the doors **16** and **18** may be of a standard construction comprising an outer door cover **32** and an inner door panel **34** which may be made of a plastic material. The door may or may not have trim strips **36** formed on the edges thereof. The portions of the doors shown in FIGURE 2 are in their closed position. Either door can be selectively opened or closed.

A gasket **38** made of a conventional rubber gasket material or a conventional vinyl plastic gasket material is attached to each of the doors **16** and **18** to provide a seal for the space between the inner door edges **28** and **30**. It will be observed that the gaskets on each of the doors are of identical cross-section but are in reversed position with respect to each other to form the seal. The gasket **38** comprises a tubular section **40**, a bellows section **42**, a base section **44**, and a projection lip **46** which overlies a fastening means in the assembled relationship. A vent hole **47** communicates between the tubular section **40** and the bellows **42**. The fastening means comprises a clamp member or retainer **48** and a plurality of screws **50**, the clamp member **48** overlying a part of the base section **44**, and the screws **50** then being used to secure the clamp member to panel portions **32** and **34**.

The tubular section **40** of the gasket **38** has formed thereon a pair of projecting lip portions **52** and **54** which extend into the space between the two doors **16** and **18** to define a substantially U-shaped cross-section. The corresponding projecting lip portions **52** on each of the doors are relatively thin and flexible and overlap each other in sealing relationship when the doors **16** and **18** are closed as shown in FIGURE 2.

The projecting lip portions **54** also extend into the space between the two doors **16** and **18**. The corresponding portions **54** on the doors **16** and **18**, however, do not overlap although they are of such a length that they practically abut each other. The portions **52** and **54** are spaced from each other to define an air insulating cavity **56** in the nature of a partial dead air cell when the doors are closed. Thus an insulating wall of air plus the seal provided by the overlapping projections **52** prevent the transfer of heat from the outside to the inside of the refrigerator. The partial dead air cell is exposed to the warm outside temperature, i.e., outside of the cabinet and the overlapping projections **52** are exposed to cold air inside the cabinet.

Because the coefficient of thermal conductivity of dead air is so low, namely about 0.168, the dead air in the space **56** serves as an effective insulator and substantially reduces the transfer of heat from the vicinity of the door edges to the interior of the refrigerator unit. This results in less condensation forming on the gasket and surrounding area. While condensate will form, frost will not occur as the temperature will be above the freezing point of water in this area. A further important advantage is the reduction of heat leakage of the refrigerated compartment. In contrast to having only the overlapping lip portions of a rubber or plastic gasket, the coefficient of thermal conductivity of which falls in the range of 6.0–7.0, I have provided a comparatively high adjoining insulating medium in the nature of trapped air the K-factor of which is about 0.168. This I have done by structuring the gasket itself so that cooperating gaskets will define an air pocket when the doors are closed.

The use of such an air pocket or dead air cell is particularly adapted to construction on a gasket material where part of the sealing function is to be accomplished by overlapping projections on cooperating gaskets such as projecting lips **52**. And it represents a substantial improvement thereto when it is recognized that a wall of dead air having a very low K-factor gives substantial insulation support to the sealing effect provided by the projecting overlapping lips **52** made of a gasket material having a K-factor in the range of 6.0–7.0.

Referring now to FIGURE 3 there is shown the top of door **16**, its associated gasket **58** and a face portion **60** of the refrigerator cabinet **10** against which the gasket **58** seals. The gasket **58** comprises a tubular portion **62**, a bellows portion **64**, a base section **66** and a projection lip **68** which overlies a fastening means in the same manner as described in connection with gasket **38**. The tubular portion **62** may have a magnetic material disposed therein to assist in sealing against the frame face **60**. This type of gasket **58** may be used on the top, bottom and outer pivoting edges of the doors **16** and **18**.

FIGURE 4 illustrates generally how the gaskets **38** and **58** are mitred and sealed at the uper and lower corners of the inner edges of doors **16** and **18**.

Thus it is apparent that I have provided a gasket means which is effective to reduce the transfer of heat from a warm area to cold area by utilizing the advantages provided by the low thermal conductivity of air. By providing this type of a barrier to the transfer of heat, I eliminate the necessity for an extra heating element which, if installed within the gasket itself can present serious maintenance problems. In addition, it will be observed that the gasket can be a simple extruded member which in and of itself embodies the features necessary to prevent the heat transfer and consequent moisture formation and frosting.

While a preferred embodiment of the invention has been specifically disclosed, it is understood that the invention is not limited thereto as variations will be readily apparent to those skilled in the art and the invention is to be given its fullest possible interpretation within the terms of the following claim.

I claim:

1. In combination:

a refrigerator cabinet having an access opening to the interior thereof;

a plurality of closure members in side by side relationship for normally closing said opening, said closure members having opposed spaced edges extending across said opening;

means for sealing the space between said opposed edges comprising opposed flexible sealing strips extending

along the opposed edges of said closure members, each of said strips being secured to the opposed edges of said closure members;

each of said sealing strips comprising a first projection means extending into the space between said opposed edges in overlapping relationship with the corresponding portion of the other of said strips, and

a second projection spaced from said first projection and extending into the space between said opposed edges in a spaced but contiguous relationship with the corresponding portion of the other of said strips,

said first and second projections on said opposed sealing strips together defining a partial dead air space to thereby more effectively control leakage of warm air past said sealing strips.

References Cited

UNITED STATES PATENTS

1,918,911	7/1933	Hull	49—483 X
2,767,040	10/1956	Kesling	49—483 X
2,811,406	10/1957	Moore et al.	49—483 X
3,004,309	10/1961	Korodi	49—483 X
3,070,852	1/1963	Hilliker	49—483 X
3,161,925	12/1964	Bertolini	49—483 X
3,216,776	11/1965	Carbary	49—483 X
3,229,332	1/1966	Koller	49—483 X

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