

Jan. 10, 1956

L. M. KURTZ
INSULATED CABINET

2,729,863

Filed Dec. 11, 1952

2 Sheets-Sheet 1

Fig. 1.

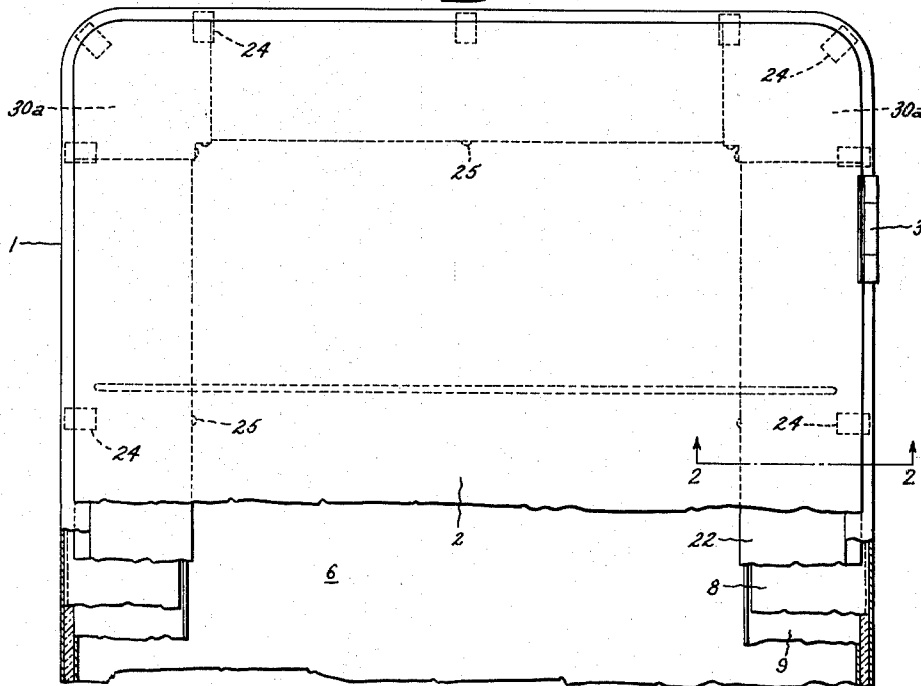


Fig. 2.

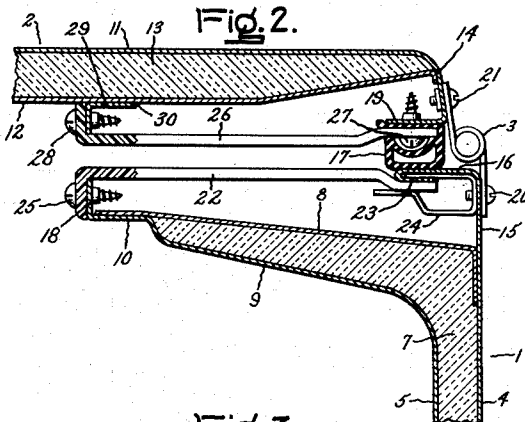


Fig. 3.

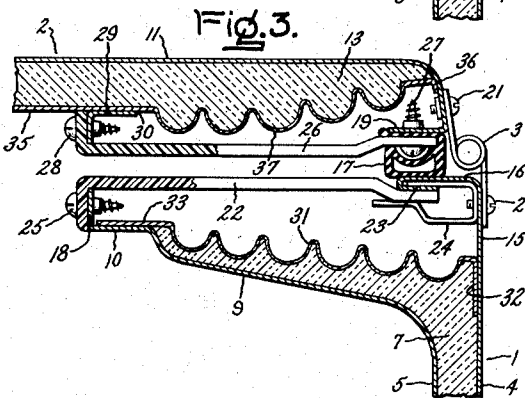


Fig. 4.

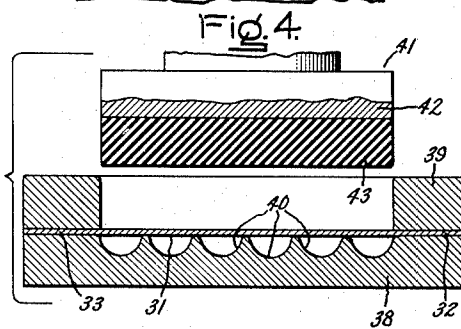
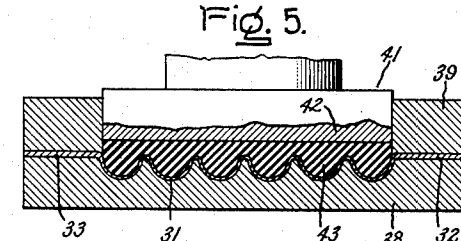


Fig. 5.



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Fig. 6.

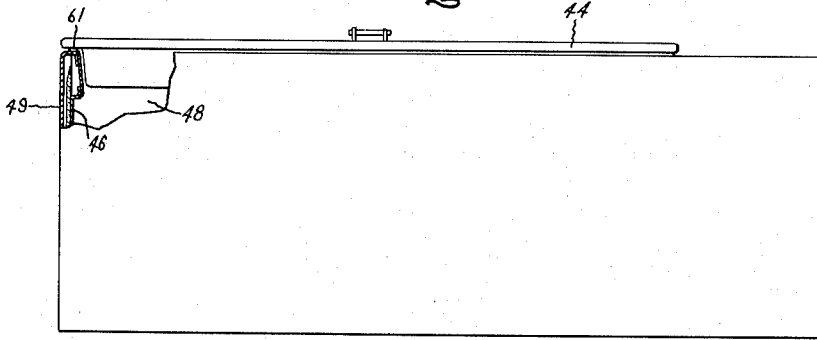
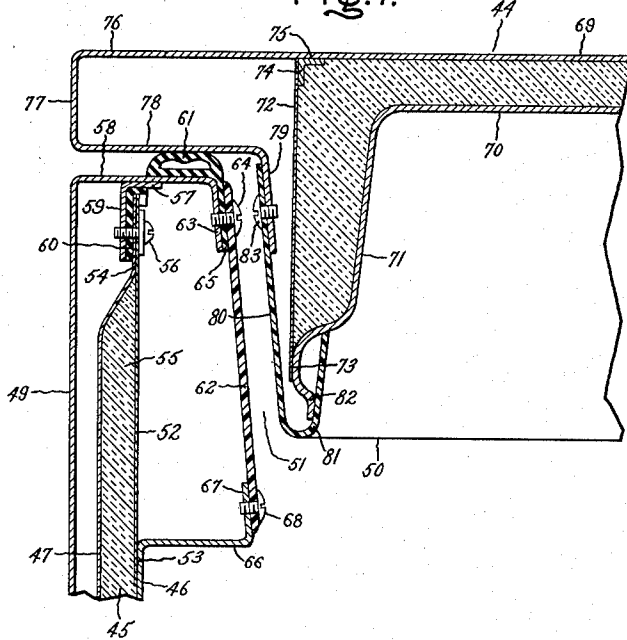


Fig. 7.



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2,729,863

INSULATED CABINET

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Application December 11, 1952, Serial No. 325,298

1 Claim. (Cl. 20—35)

My invention relates to cabinets, and more particularly to insulated cabinets for use with refrigerators, freezers and the like.

It has been found that vacuum insulation, for example, of the type described and claimed in the copending application of Herbert M. Strong and Francis P. Bundy, Serial No. 236,788, filed July 14, 1951, and assigned to the General Electric Company, the assignee of the present invention, offers substantial advantages for use in refrigerators, freezers and the like. My invention is an improvement over the invention of the Strong and Bundy application, and, therefore, I do not claim as my invention anything shown or described in said Strong and Bundy application, which is to be regarded as prior art with respect to the present application. Because of the greatly improved thermal insulating properties of the insulation of the Strong and Bundy application, a much smaller thickness of such insulation may be employed with the resultant large increase in food storage space for the same outside dimensions of the cabinet. However, these advantages are not achieved without some attendant problems.

For example, in conventional refrigerators and freezers with a wall thickness of three inches to four inches there is a substantial space conveniently available for a breaker strip of sufficient width to insure the desired temperature gradient between the inner and outer wall and to minimize sweating of the outer wall. Similarly, with such wall thicknesses there is ample space available to provide a face surrounding the access opening which is of sufficient width for sealing engagement by a gasket mounted on the door, or, alternatively, of sufficient width for the mounting of a gasket thereon. On the other hand, the efficient vacuum insulation may require an insulated structure of a thickness of only approximately $\frac{1}{2}$ in. This makes difficult the provision of a breaker strip of sufficient width to insure the necessary temperature gradient thereacross. This problem is further aggravated by the fact that, where one or both walls of the sealed evacuated envelope are employed as walls of the refrigerator or freezer cabinet itself, the breaker strip must be made of a material capable of perfect sealing engagement with the walls of the envelope. In addition, with an actual wall thickness of the order of $\frac{1}{2}$ in., it is exceedingly difficult to provide an adequate surface for either mounting the sealing gasket of the cabinet or for sealing engagement by a gasket.

Another problem raised by the use of vacuum insulation is that relating to the mounting of various accessories necessary for a complete refrigerator or freezer. For example, it is necessary to provide hinges for swinging movement of the door or lid of the cabinet, and it is further necessary to provide a suitably mounted latch and strike for pressing the lid or door into sealing engagement. In conventional refrigerators the mounting of these elements presents no problem since they may be easily mounted by fastening devices extending through the walls of the cabinet or door. However, where these walls form a sealed envelope and where it is necessary to main-

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tain a very low pressure within the envelope over a prolonged period of time, it is undesirable and relatively impractical to mount hinges, latches, etc., by devices penetrating the walls of the sealed envelope. In accordance with my invention, the above difficulties are overcome and a satisfactorily insulated cabinet employing vacuum insulation is provided.

It is an object of my invention to provide an improved insulated cabinet.

It is another object of my invention to provide an improved cabinet construction especially suited for vacuum insulated cabinets.

It is a further object of my invention to provide an insulated cabinet including an improved arrangement for minimizing edge losses between the inner and outer walls thereof.

It is still another object of my invention to provide an insulated cabinet including an improved breaker strip construction.

It is still a further object of my invention to provide a vacuum insulated cabinet including an improved arrangement for mounting hinges and other accessories thereon.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention one of the walls of a sealed evacuated envelope is flanged inwardly generally normal to the remainder of the wall and in a direction extending away from the other wall. A breaker strip composed of a metal of low thermal conductivity is welded to the walls at the flange portion to seal the envelope. The walls include portions extending beyond the breaker strip and a trim strip is secured to these extensions for concealing the breaker strip and providing a finished appearance. Latches, hinges, and the like are mounted on these extensions so that fastening devices extending through the walls for mounting such elements do not affect the sealed envelope.

For a better understanding of my invention, reference may be had to the accompanying drawings in which

Fig. 1 is an elevation view, partly broken away, of a portion of a refrigerator cabinet illustrating an embodiment of my invention.

Fig. 2 is a sectional plan view taken along the line 2—2 in Fig. 1 looking in the direction of the arrows.

Fig. 3 is a view similar to Fig. 2 illustrating a modified form of my invention.

Fig. 4 is a view of one form of apparatus for making the breaker strip shown in Fig. 3.

Fig. 5 is a view similar to Fig. 4 showing the parts in a different position.

Fig. 6 is an elevation view, partly broken away, of an insulated cabinet showing a modified form of my invention.

Fig. 7 is an enlarged sectional view of a portion of the cabinet shown in Fig. 6.

Referring to Figs. 1 and 2, there is shown an insulated cabinet 1 having a door 2 hingedly mounted thereon by means of hinges, one of which is shown at 3. The cabinet 1 includes a metal outer wall 4 and a metal inner wall or liner 5. The inner wall 5 defines a food storage compartment 6 including a plurality of shelves, one of which is shown at 6a. The space between the inner and outer walls is filled with a suitable heat-insulating filler material 7, which may be of the type described and claimed in the aforementioned Strong and Bundy application.

The space between the walls 4 and 5 is evacuated to provide an insulating structure of very low thermal

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conductivity. Because of the excellent thermal insulating properties of such structures, as described in the aforementioned Strong and Bundy application, a cabinet approximately $\frac{1}{2}$ inch in thickness of wall construction provides insulation comparable to that of conventional refrigerators where 3 to 4 inches of insulation are employed. In order to seal the evacuated envelope provided by the walls 4 and 5 a breaker strip or frame 8 is provided at the forward portion of the cabinet 1. This breaker strip is preferably made of a metal of low thermal conductivity in order to effect the perfect sealing engagement with the outer and inner walls required by vacuum insulation; for example, stainless steel has suitable characteristics for this purpose.

In order that a sufficiently high temperature gradient be provided between the inner and outer walls at the edge portions connected by the breaker strip, the inner wall 5 is flanged inwardly, as indicated at 9, generally normal to the main body of the wall 5, and this flange portion 9 extends in a direction away from the outer wall 4. In this manner the end 10 of the inwardly extending flange portion 9 is spaced a substantial distance from the outer wall 4 in contrast to the relatively close spacing of the walls 4 and 5 throughout the major portion of their area. As can be seen from Fig. 1, the aforementioned flange portion 9 together with the breaker strip or frame 8 forms a picture-frame construction around the access opening of the food storage compartment 6. By this construction the breaker strip 8 is of substantial width and, with the material employed therefore, effects a sufficient temperature gradient to insure that heat leakage from the outer wall to the food storage compartment is minimized and that the temperature of the outer wall in the region of the breaker strip is sufficient to minimize condensation of moisture or sweating.

In the form of invention shown in Fig. 2, the door 2 includes an outer wall 11 which may be of any conventional material, such as low carbon steel, and an inner wall 12 which is made of a metal of low thermal conductivity, such as stainless steel. As in the construction of the cabinet, the space between the inner and outer walls of the door is filled with a suitable filler material 13, preferably in accordance with the aforementioned Strong and Bundy application. The walls 11 and 12 are sealed adjacent their edges in any suitable manner, as by welding as indicated at 14, and the space between the walls is evacuated. While, in the form illustrated, the entire inner wall of the door has been formed from a single sheet of stainless steel, it will be apparent that a separate breaker strip or frame of stainless steel, similar to the strip 8 of the cabinet, could be employed, the remaining or central portion of the inner wall being formed, for example, of low carbon steel the same as the outer wall 11. The breaker strip in that case would be welded or otherwise sealed to the inner and outer walls of the door just as the breaker strip 8 is welded to the inner and outer walls of the cabinet.

As mentioned previously, the cabinet 1 and the door 2 are connected by hinges 3. Since the cabinet and the door are sealed and evacuated and since it is imperative that a very low pressure be maintained over a long period of time if the excellent properties of the vacuum insulation are to be retained, it is desirable to avoid having any mounting devices penetrate the walls of the sealed envelopes of the cabinet and the door. In order to eliminate the problem of any hinge mounting devices penetrating the sealed envelopes, the outer and inner walls of the cabinet are arranged to include sections extending beyond the breaker strip 8, that is, beyond the end of the sealed envelope provided by the major portion of the walls 4 and 5 and the breaker strip 8. Thus, the outer wall 4 includes an extending section or extension 15 which extends beyond one edge of the breaker strip 8. This extension 15 further includes an inwardly extending flange portion 16 for engagement by a sealing gasket

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17. As mentioned previously, the thickness of the walls in vacuum-insulated cabinets is too small to provide a sealing surface of satisfactory width for the gasket. The inwardly extending flange 16 of the extension 15 provides a wider surface satisfactory for sealing engagement by the gasket. Similarly, the outer wall 11 of the door includes an extending section or extension 19 projecting beyond the welded area 14 where the outer and inner walls 11 and 12 are welded or otherwise sealed together. The hinge 3 may then be mounted on the cabinet and the door in any suitable manner, for example, by screws 20 and 21. The screw 20 projects through the extension 15 of the outer wall 4 of the cabinet beyond the breaker strip 8 and, of course, outside the surface of the sealed envelope. Accordingly, the penetration of the wall 4 by the screw 20 to mount the hinge 3 in no way affects the envelope or the vacuum maintained therein. Similarly, screw 21 penetrates the extension 19 of the wall 11 of the door beyond the weld area 14 and therefore beyond the confines of the sealed envelope of the door. It therefore also has no effect on the envelope or the vacuum maintained therein.

While not shown in the drawing, it will be realized that similar extensions of the walls of the door and cabinet can be employed to provide mounting surfaces for the latch and the strike conventionally employed for holding the door closed and for compressing the gasket into sealing engagement with the corresponding face of the cabinet.

In order to conceal the various welds and to provide a pleasing finished appearance at the front of the cabinet, a trim strip 22, which may be of conventional plastic material, is employed. One end of the trim strip 22 is received within recesses provided by a return bent portion 23 of the extension 15 and a plurality of clips 24. The clips 24 have one leg thereof received within the return bent portion 23. The other edge of the trim strip is secured to the extension 18 of the inner wall 5 by any suitable fastening device, such as screws 25, passing through the breaker strip and the extension 18. As in the case of the screws employed for mounting the hinges 3, the screws 25 penetrate the inner wall 5 beyond the breaker strip 8 and beyond the sealed envelope, so that they likewise have no effect on the sealed envelope of the cabinet or the vacuum to be maintained therein. A trim strip 26 is similarly provided for imparting a finished appearance to the marginal edge of the door. One edge of the trim strip 26 is connected by screws, one of which is shown at 27, to the extension 19 of the outer wall 11. The provision of the extension 19 beyond the edge 14 of the sealed envelope of the door permits the use of fasteners, such as the screws 27, which penetrate the outer wall 11 without any danger of affecting the vacuum maintained within the sealed envelope of the door. In addition the screws 27 are employed for mounting the gasket 17, thereby providing a mounting arrangement for the gasket without effect on the vacuum maintained within the sealed envelope. The other edge of the trim strip 26 is mounted by screws, one of which is shown at 28, to a bracket or strip 29 which is welded at 30 to the inner wall 12 of the door.

In the form illustrated in Fig. 1, separate trim strips 22 are provided along the sides, top and bottom of the cabinet. In order to provide a finished appearance at the corners, a separate corner piece 30a is provided at each of the corners, and each corner piece is arranged to overlap the ends of corresponding vertical and horizontal trim strips. Alternatively, a single trim strip molded as a one-piece frame could be employed in lieu of the horizontal and vertical trim strips and corner pieces. In order to reduce air circulation, and hence heat transfer by convection in the space between the breaker strip and the trim strips, a suitable heat-insulating material, such as glass fiber, may be disposed between the breaker strip 8 and the trim strip 22 and, similarly, between the inner wall 12 of the door and the trim strip 26.

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In Fig. 3, there is shown a modified form of my invention which differs from that just described in the nature of the breaker strip employed for the cabinet and in the nature of the marginal edge of the inner wall of the door. The same numerals have been employed to designate corresponding parts in Figs. 2 and 3. In order to minimize the heat transfer between the inner and outer walls of the sealed envelope at the edges thereof, that is, through the breaker strip, it is desirable that this breaker strip be made as thin as possible, thereby increasing its resistance to heat flow therethrough. On the other hand, it is essential to the maintenance of a vacuum within the sealed envelope that a perfect weld be secured between the breaker strip and the inner and outer walls. If the breaker strip is made too thin, there is danger that defective welds may be secured, a minimum thickness of metal being necessary to insure a perfect weld throughout the length of the weld area, particularly under mass production manufacturing conditions. In accordance with the form of invention shown in Fig. 3, a minimum heat conductivity through the breaker strip is secured while still maintaining the conditions desirable for insuring a perfect weld. Thus, the breaker strip 31 is provided with longitudinal edge portions 32 and 33 which are of sufficient thickness to provide the necessary material for satisfactory welding. By way of example, these edge portions may be at least .018 inch thick, this being considered a minimum thickness for insuring a perfect weld throughout, under manufacturing conditions. The portion of the breaker strip intermediate these edges 32 and 33 is corrugated to provide a substantially longer heat flow path than is possible with the straight or flat breaker strip 8 employed in the form of invention illustrated in Fig. 2. In addition to the increased resistance to heat flow provided by longer heat flow path through the corrugations the thickness of the breaker strip in the central region between the edges 32 and 33 is substantially reduced over that existing at these edges. Thus, the resistance to heat flow is increased both by increasing the length of path through which the heat must flow and also by substantially reducing the cross-sectional area of the material through which the heat must flow.

Similarly, the marginal portion of the inner wall 35 of the door inwardly from the edge 36 thereof is corrugated, as indicated at 37. As in the case of the breaker strip 31 it provides an edge 36 which is of sufficient thickness to provide satisfactory welding and a corrugated portion 37 of substantially reduced thickness. As was mentioned in connection with Fig. 2, it will be apparent that the portion 37 could be formed, like the breaker strip 31, as a breaker strip separate from the central portion of the inner wall 35 of the door, having edges of sufficient thickness for welding to the outer and inner walls of the door and an intermediate central region of corrugated construction and of reduced thickness.

In Figs. 4 and 5 there is illustrated diagrammatically one arrangement for making the breaker strip 31. As there shown, the breaker strip 31 is firmly gripped at its longitudinal edges 32 and 33 between a lower die 38 and an upper clamping member 39. The die 38 and the clamping member 39 may be held in firmly gripping engagement with the breaker strip 31 in any conventional manner well known in the art for gripping the edges of sheet metal structures. The lower die is formed to include a plurality of depressions or corrugations 40 into which the breaker strip 31 is adapted to be forced in forming it into the ultimate corrugated shape. In order to effect movement of the breaker strip into the depressions 40 and the lower die 38, an upper die 41 is provided. This upper die includes a steel backing member 42 and a face 43 formed of some deformable material such as rubber.

After the breaker strip 31 has been assembled and clamped in the position shown in Fig. 4, a downward force is exerted against the upper die 41 moving it to the position shown in Fig. 5. During this downward movement the die 41 forces the breaker strip 31 into

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conformity with the depressions 40 of the lower die 38, thereby forming the central portion of the breaker strip intermediate the edges 32 and 33 into the corrugated form shown. The deformable face 43 of the upper die assumes the shape of the corresponding face of the lower die, as shown in Fig. 5, to urge the breaker strip effectively into the depressions 40 of the lower die. In pressing the breaker strip into these depressions, it can be seen that the material of the breaker strip is necessarily drawn or lengthened to provide a thinner cross section in this intermediate area and, as mentioned previously, providing a greater length and, hence, greater flow path between the edges 32 and 33.

Another modified form of my invention is shown in Figs. 6 and 7. For convenience in positioning on the drawing, the freezer illustrated in Fig. 6 has been shown as of the chest type with a top opening lid 44. However, it will be realized that this figure equally well illustrates an upright type freezer merely by shifting the position so that the righthand edge becomes the bottom of the cabinet. In the form of invention shown in Figs. 6 and 7 a sealed envelope 45 is provided, including two walls 46 and 47. The inner wall 46 forms the liner defining the storage compartment 48 of the freezer. The cabinet includes a separate outer wall 49 and the envelope 45 is adapted to be received within the outer wall 49 from the bottom of the freezer. After assembling the envelope within the outer wall of the cabinet, a separate sheet forming the bottom of the cabinet is secured in any suitable manner to the outer wall 49 to complete the cabinet.

In the form shown in Figs. 6 and 7 the pictureframe construction previously described is not employed and the portion of the cabinet framing the access opening projects inwardly a much shorter distance than in the form previously described. In the form shown in Fig. 7 the door 44 differs from that previously described and includes an inwardly projecting portion 50 providing a long, narrow gap 51 between the door and the cabinet to minimize heat leakage.

The walls 46 and 47 are connected by a breaker strip 52, which, as in the forms previously described, may be of a metal of low thermal conductivity such as stainless steel. It may further be corrugated as in the form shown in Fig. 3. The breaker strip 52 is welded to the inner wall 46 at 53 and to the wall 47 at 54. As in the form previously described, a heat-insulating filler material 55 is provided within the envelope 45. The structure thus far described is mounted on the forward edge of the outer wall 49 by suitable fastening means such as screws, one of which is shown at 56, extending through the breaker strip and the wall 47 beyond the weld area 54. Hence, the screws 56 penetrating the breaker strip and the wall 47 have no effect on the vacuum maintained within the envelope 45. In order to effect mounting by the screws 56 a bracket 57 is welded or otherwise secured to an inwardly extending flange 58 of the outer wall 49. The screws 56 are adapted to engage a downwardly extending leg 59 of the bracket 57. A sealing gasket 60, which may be of rubber or similar compressible material, is included adjacent the bracket 57.

Since, as mentioned previously, vacuum insulated walls are quite thin, sufficient insulation being provided by a wall of, say, 1/2 inch thickness, the flanged portion 58 extends inwardly beyond the bracket 57 and beyond the plane of the liner formed by the major portion of the inner wall 46. This provides an extending section or extension of sufficient width to provide a face for the gasket 61 employed for sealing the food storage compartment 48. In order to conceal the screws and welded surfaces and to provide a finished appearance at the front edge of the cabinet, a trim strip 62 is employed. The extension 58 also serves for mounting one edge of the trim strip 62. For this purpose the extension 58 includes a depending flange 63 and the upper edge of the

trim strip 62 is secured to the depending flange 63 by any suitable fastening devices, for example, screws, one of which is shown at 64. The screws 64 are, as shown, also effective for mounting the gasket 61 in position, clamping a tail 65 at the gasket between the trim strip 62 and the depending flange 63. In order to provide a mount for the lower edge of the breaker strip 62, the inner wall 46 is flanged inwardly as indicated at 66 and then upwardly as indicated at 67. The lower edge of the trim strip 62 is secured to the upwardly extending flange 67 in any suitable manner, as by screws, one of which is shown at 68.

As in the form previously described, these extensions 58 and 66 of the walls which project beyond the sealed envelope provide for mounting the trim strip by screws or other simple fastening devices which penetrate these extensions without having any effect on the sealed envelope itself.

The door or lid 44 includes an outer wall 69 and an inner wall 70. The inner wall 70 includes a downwardly extending marginal flanged portion 71 which corresponds generally to the inwardly extending marginal flange 9 in the cabinet construction shown in Fig. 2. The walls 69 and 70 are joined by breaker strip 72 for sealing the envelope formed by the walls 69 and 70. As in the forms previously described, this breaker strip is preferably formed of a metal of low heat conductivity such as stainless steel. It may further be corrugated as in the form shown in Fig. 3. In the form illustrated in Fig. 7 one edge of the breaker strip is welded directly to the flange 71, inner wall 70, as indicated at 73, and the other edge is welded to a bracket 74 which in turn is welded to the outer wall 69 as indicated at 75. It will be apparent, however, that the breaker strip 72 could be formed with a flanged portion, similar to the breaker strip 8 in Fig. 2, which could be welded directly to the outer wall 69, thereby permitting the omission of the bracket 74. In order to provide a supporting surface for hinges, latches, etc., the outer wall 69 includes an extending portion or extension 76 which extends beyond the weld region 75 and beyond the sealed envelope bounded by the breaker strip 72. This extension 76 includes a downwardly extending edge 77 and inwardly extending section 78 for engagement by the gasket 62 and a second downwardly extending section 79. The relatively wide face 78 provides adequate surface for engagement by the sealing gasket 61. In order to provide a finished appearance for the door a trim strip 80 is employed. The lower edge 81 of this trim strip is formed of generally U-shaped cross-section so as to overlap the end 82 of the inwardly extending flange 71 of the inner wall 70 and the weld area at 73 where the breaker strip 72 is joined to this flange 71. The mounting of the trim strip 80 is completed by any

suitable fastening devices, for example, by screws, one of which is shown at 83, which penetrate the trim strip 80 and the downwardly extending section or flange 79 of the outer wall 69. By the construction shown, the breaker strip is effectively mounted by screws or other simple fastening devices which actually penetrate the outer wall without having any effect on the sealed envelope forming the major portion of the door. Although not shown in this figure, it will be apparent that the extension 76 of the outer wall 69 of the door and the outer wall 49 of the cabinet provide portions extending beyond the sealed envelope in each case for the mounting of hinges, latches, strikes, etc. without any danger that the fastening devices used for mounting such elements will penetrate the vacuum-insulated sealed envelopes.

While I have shown and described specific embodiments of my invention, I do not desire that my invention be limited to the particular constructions shown and described, and I intend by the appended claim to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

An insulating structure including a sealed evacuated envelope comprising a first wall, a second wall, said second wall including a flange portion extending generally normal to the body of said second wall in a direction away from said first wall, a breaker strip of a material of low thermal conductivity disposed in a direction generally normal to said walls and sealingly engaging said walls to complete said sealed envelope, said first wall including a section extending beyond said breaker strip, a trim strip having one edge secured to said extending section of said first wall and disposed generally parallel to said breaker strip, the other edge of said trim strip being formed in U-shaped cross section, the end of said flange portion of said second wall being received within said U-shaped cross section of said breaker strip, and a fastener penetrating said extending section of said first wall for mounting said trim strip.

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