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MAGNETIC CLOSURE DEVICE

3,400,964

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2 Sheets-Sheet 1

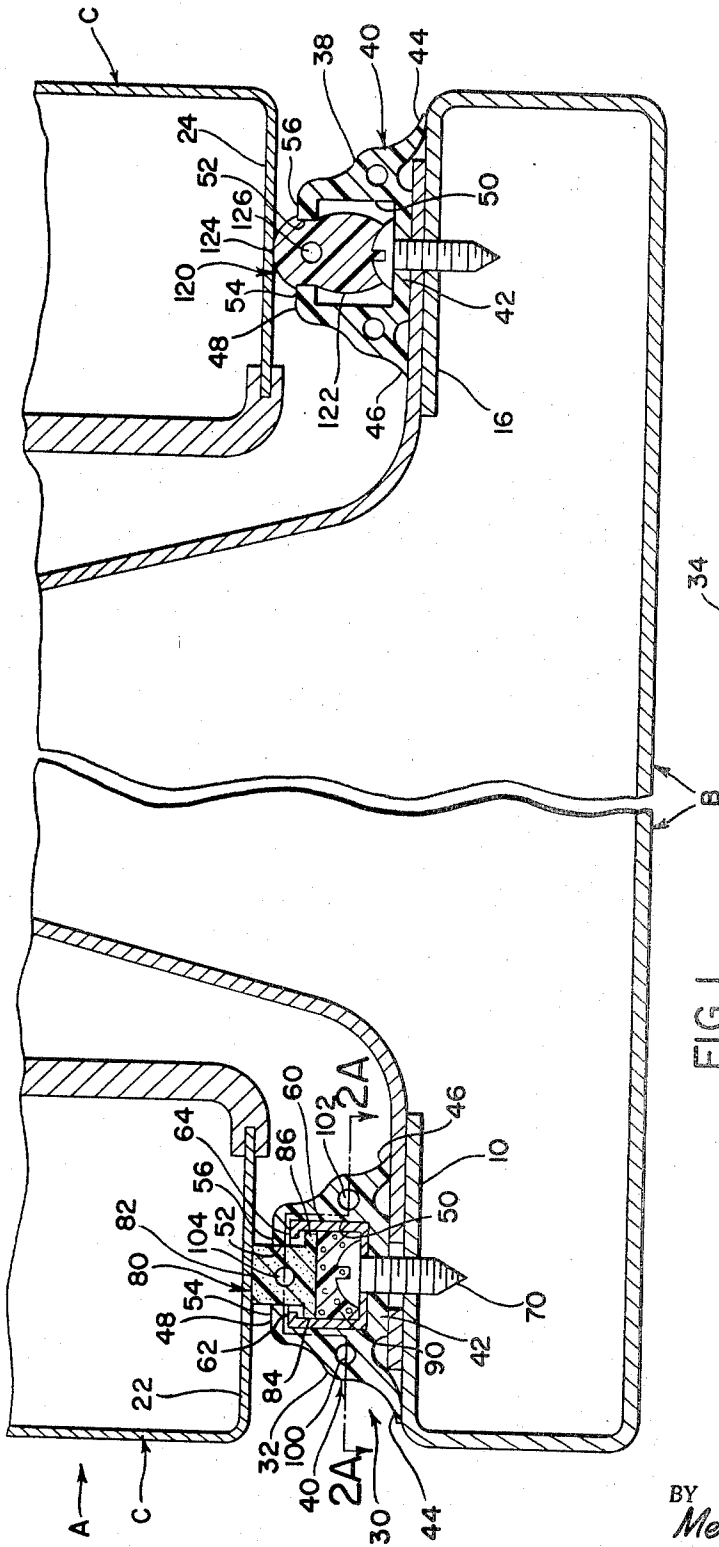


FIG. 1

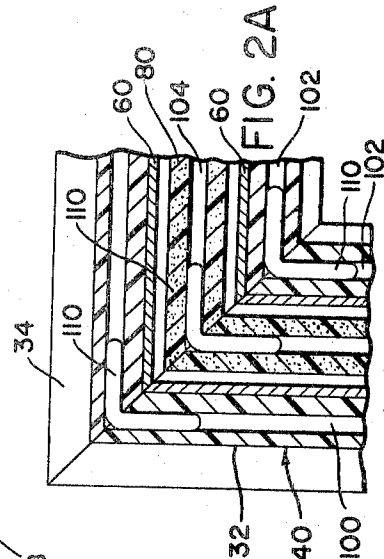


FIG. 2A

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2 Sheets-Sheet 2

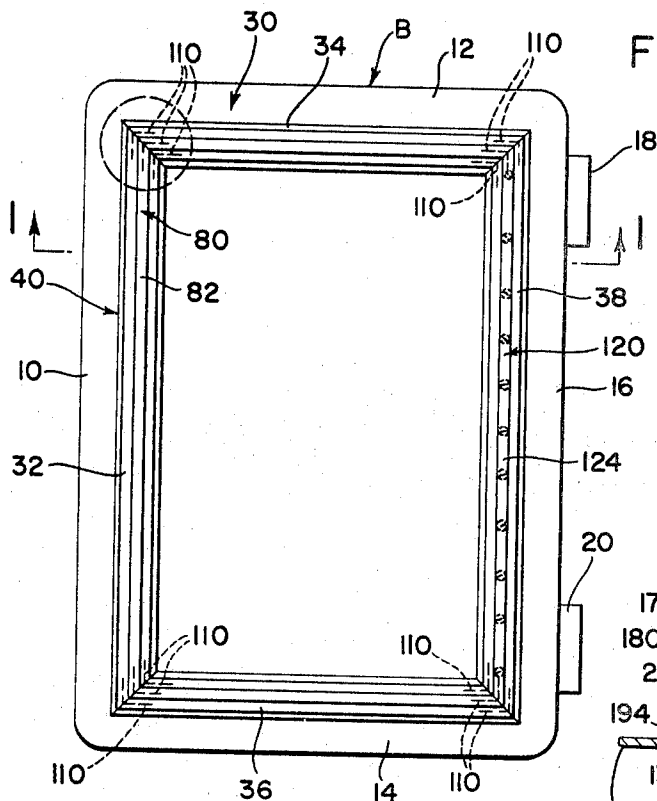


FIG. 2

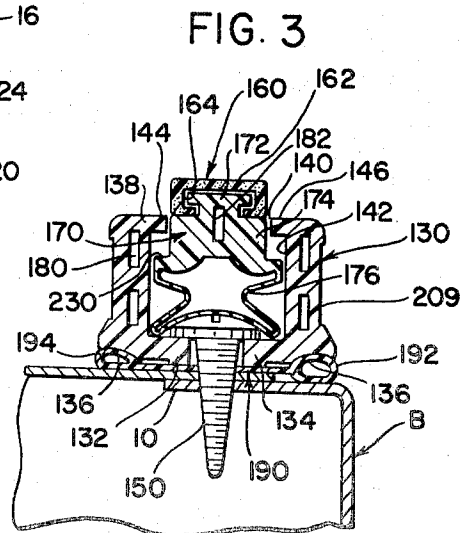


FIG. 3

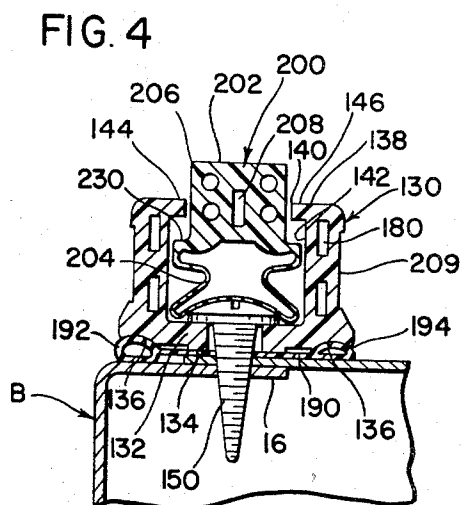


FIG. 4

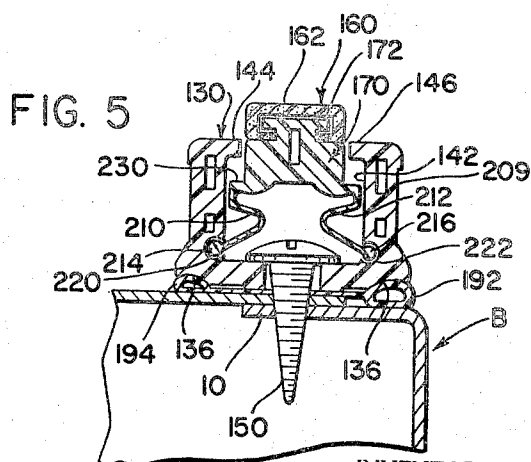


FIG. 5

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MAGNETIC CLOSURE DEVICE

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10 Claims. (Cl. 292—251.5)

ABSTRACT OF THE DISCLOSURE

There is provided a magnetic closure device for a door comprising an elongated carrier having a mounting base secured to the door at one side and an outwardly facing portion opposite the mounting base. The carrier includes a longitudinal cavity and a longitudinally extending slot in the facing portion and communicated with the cavity. This slot defines spaced ribs which hold an elongated flexible permanent magnet secured to a mounting element within the cavity and adapted to bias the magnet outwardly for contact with a door frame to hold the door closed and to seal the periphery of the door.

The present invention pertains to a closure device of the type generally used on the door of a metal cabinet and more particularly to a magnetic closure device for such use.

This invention is particularly applicable to a magnetic closure device used on the door of a refrigerator, and it will be described with particular reference thereto; however, the invention has much broader applications and may be used as a closure device for various articles.

It has become common practice to provide a refrigerator door with a magnetic closure including a hollow non-magnetic, plastic gasket extending around the periphery of the refrigerator door and an elongated, flexible permanent magnet strip inserted within the gasket. The flexible magnetic strip creates a holding force between the door mounted gasket and the frame of the refrigerator. In manufacturing this magnetic closure, the gasket with the magnet inserted is first formed into a rectangular unit with the corners of the unit being secured together by an appropriate plastic adhesive substance. This rectangular unit is then fastened onto the refrigerator door. In order to accomplish this fastening operation, the plastic gasket includes a lower flap or lip through which appropriate fasteners, such as screws, extend. These fasteners hold the rectangular unit onto the door.

This particular magnetic closure, although widely used in the refrigerator art, has certain inherent disadvantages. The corners of the rectangular unit, after they are secured together, are no longer freely deformable because the adhesive substance increases the rigidity of the gasket in the corner areas. Also, the formation of an angle at the corners inherently increases the rigidity of these corners. When securing the closure onto the refrigerator door by passing fasteners through the lower flap on the gasket, the gasket must be tilted away from the door. This operation can be performed along a major portion of the rectangular unit; however, in the corner areas, this tilting action is prohibited by the rigidity of the corners. Consequently, fasteners must be spaced a distance of 5-7 cm. from the corner areas of the gasket unit. This results in an imperfect seal at the corners of the rectangular closure unit.

In addition, because the closure must be formed into a rectangular unit before it is secured onto the door, it was necessary to handle these prior magnetic closures by using a special cardboard container. These containers included a central frame around which the individual closure units were placed. This was expensive and re-

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quired a substantial amount of space for transporting the rectangular gasket unit. This increased the overall cost of the prior magnetic closure.

These and other disadvantages of prior devices have been overcome by the present invention which is directed toward a magnetic closure device having an improved holding force and which need not be joined into a rectangular unit before it is attached onto the refrigerator door.

In accordance with the present invention there is provided a magnetic closure device comprising an elongated carrier having a mounting base at one side and an outwardly facing portion opposite the mounting base, and the carrier includes a longitudinally extending cavity and a longitudinally extending slot in the facing portion and communicated with the cavity. This slot has a predetermined width and defines inwardly extending, opposed support ribs. An elongated flexible permanent magnet member is provided coextensive with the slot and the cavity, and an elongated mounting element is secured to the magnet member. The above-mentioned mounting element is received within the cavity of the carrier and has a transverse dimension substantially greater than the width of the slot so that the mounting element may reciprocate vertically within the cavity of the carrier and below the opposed support ribs.

In this manner, there is provided a contoured carrier having an internal cavity extending in a longitudinal direction and opening toward the side opposite the side which is fastened onto the refrigerator door. The opened side of the carrier is provided with support ribs so that a flexible permanent magnet structure may be provided within the cavity in a manner to reciprocate in a direction normal to the refrigerator door surface. The ribs prevent the magnet structure from being forced outwardly from the inner carrier cavity.

It has been suggested to provide the flexible permanent magnet strip with a lower cavity or recess extending along the length of the strip. This flexible permanent magnet strip can be secured onto an elastic sealing strip by providing an outwardly extending rib on the sealing strip. This rib is forced into the cavity of the magnet strip. In this manner the closure has an exposed magnet and a lower sealing strip. This particular design facilitated the corner connection of the flexible permanent magnet strips. An angled bracket was inserted into the lower recesses of the flexible permanent magnet strips at the ends adjacent the corner. The bracket extending between the magnet strips locked the corner joint of the permanent magnet strip; however, the elastic gasket or carrier, which supported the flexible permanent magnet, still had to be joined by an adhesive at the corners. This disadvantage of the mentioned prior permanent magnet closure is overcome by a further aspect of the present invention.

In accordance with this aspect of the present invention, the carrier of the closure device is provided with one or more internal apertures. When two mitered ends of adjacent carriers are placed together an L-shaped support bracket may be driven into the apertures of the carriers. This locks the carriers together as a unit. A similar structure is utilized for locking the permanent magnet strips at the mitered joints or corners. Because of this structure, the carrier and flexible permanent magnet strip may be shipped to the assembly area in an unassembled condition. At the assembly area, the carrier opposite the hinge edge of the refrigerator door is secured onto the door by screws extending through the bottom of the carrier. Thereafter, the flexible permanent magnet strip is inserted longitudinally into the carrier, and the corner support brackets are forced into apertures at both the upper and lower mitered ends of the carrier and flexible magnet strip.

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The upper and lower carriers are then mitered and brought into engagement with the previously assembled carrier. The corner support brackets extending from the apertures of the assembled carrier penetrate or extend into the apertures of the upper and lower carriers. This locks the carrier corners together. Then the upper and lower carriers can be screwed to the refrigerator door, with the fasteners being immediately adjacent the mitered corners. Thereafter the flexible permanent magnet strips with mitered ends can be slipped into the upper and lower carriers. As the magnet strips approach the corner areas, the corner brackets extending from apertures of the assembled permanent magnet strip extend into the apertures of the upper and lower permanent magnet strip. This locks the mitered corners of the permanent magnet strip together.

After the three sides of the magnet closure have been assembled, a carrier is assembled onto the hinge side of the refrigerator door. A flexible sealing strip, which is non-magnetic, is then pressed downwardly into the internal cavity of the hinge side carrier to complete the closure structure. It is appreciated that this assembly process, which is possible because of the structure of the present invention, greatly facilitates the assembly operation for the magnetic closure of a refrigerator door, or a magnetic closure for a similar article.

It is within the contemplation of the present invention to also provide the internal cavity of the carrier with a reinforcing, channel-shaped metal member. In addition, a biasing structure is provided beneath the permanent magnet strip to bias the strip in a direction outward of the door.

By providing the flexible permanent magnet without a layer of plastic over the attaching surface, the permanent magnet can directly contact the frame of the refrigerator. This provides a more efficient utilization of the flexible permanent magnet material, and if desired, the amount of magnetic material within the flexible permanent magnet member may be reduced.

It is also within the contemplation of the present invention to provide the flexible permanent magnet as a composite unit with the lower portion of the magnet being a plastic member actually received within the inner cavity of the carrier. This effects an even greater saving of magnetic material, and the plastic member at the lower portion of the flexible permanent magnet strip may be provided as biasing structure for urging the flexible permanent magnet member outwardly toward the refrigerator frame.

The primary object of the present invention is the provision of a magnetic closure device for a metal cabinet, such as a refrigerator cabinet, which device results in a more magnetically efficient, easier shipped, and easier assembled magnetic closure.

Another object of the present invention is the provision of a magnetic closure device for a metal cabinet, such as a refrigerator cabinet, which device allows a more efficient joint at the corners of the closure.

Yet another object of the present invention is the provision of a magnetic closure device for a metal cabinet, such as a refrigerator cabinet, which device includes a flexible permanent magnet that directly contacts the cabinet frame.

Another object of the present invention is the provision of a magnetic closure device for a metal cabinet, which device allows a tighter joint at the mitered corners of the closure.

Still a further object of the present invention is the provision of a magnetic closure device for a metal cabinet, such as a refrigerator cabinet, which device includes a carrier with an internal cavity opened toward the cabinet frame and a flexible permanent magnet member held within the cavity for movement toward and away from the frame.

These and other objects and advantages will become apparent from the following description used to illustrate

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the preferred embodiments of the invention as read in connection with the accompanying drawing in which:

FIGURE 1 is an enlarged cross-sectional view taken generally along line 1—1 of FIGURE 2;

FIGURE 2 is a side plan view of the refrigerator door having a magnetic closure as illustrated in FIGURE 1;

FIGURE 2A is a cross-sectional view taken generally along line 2A—2A of FIGURE 1 and in the corner area indicated by the circle in FIGURE 2;

FIGURE 3 is an enlarged cross-sectional view of a modification of the preferred embodiment of the present invention;

FIGURE 4 is an enlarged cross-sectional view of the hinge side structure used with the embodiment shown in FIGURE 3; and,

FIGURE 5 is an enlarged cross-sectional view showing a further modification of the present invention.

Referring now to the drawing wherein the showings are for the purpose of illustrating preferred embodiments of the invention only and not for the purpose of limiting same, FIGURES 1 and 2 partially show a refrigerator A having a door B with mounting edges 10, 12, 14, and 16, and a cabinet frame C with ferro-magnetic mounting walls 22, 24. In accordance with the present invention, there is provided a magnetic closure device 30 which, when assembled, includes an outer edge portion 32, top and bottom edge portions 34, 36 and hinge side edge portion 38, as shown in FIGURE 2. Essentially, portions 32, 34, and 36 are identical; therefore, only the outer edge portion 32 of the closure will be described in detail. This description will apply equally to the other edge portions of the magnetic closure device.

Referring now more specifically to the outer edge portion 32, best shown in FIGURE 1, there is provided an elongated carrier 40 preferably formed from a plastic material which has a sufficient amount of rigidity to perform the function to be described later. The elongated carrier 40 includes a lower mounting base 42 having integral sealing lips 44, 46 which directly contact mounting edge 10 of door B to form a seal adjacent the mounting base. The carrier is also provided with an upper portion 48, an inner longitudinally extending cavity 50 and a slot 52 in the upper portion 48 and communicated with the cavity 50. This slot forms inwardly extending, opposed support lips 54, 56.

To increase the rigidity of the cavity 50, there is provided, in accordance with the illustrated embodiment of the invention, a metal channel member 60. The channel member 60 includes inwardly extending support flanges 62, 64 which directly underlie the support lips 54, 56, for a purpose to be hereinafter described. The carrier 40 is secured onto the mounting edge 10 by a plurality of axially spaced fasteners 70, taking the form of metal screws extending through the mounting base 42 into the mounting edge 10. Of course, various other arrangements could be provided for fastening the carrier 40 onto the mounting edge of door B.

A longitudinally extending flexible permanent magnet 80 is utilized as the latching element of the closure edge portion 32. Flexible permanent magnets have now become extensively used in refrigerator gaskets. They are formed by extruding a mixture of a flexible binder matrix and finely divided permanently magnetizable particles. These particles are usually barium ferrite; however, other magnetic particles such as lead or strontium ferrite have been suggested. In addition, finely divided manganese bismuthide has also been suggested for use as the permanently magnetizable particles. The flexible permanent magnet member 80 may be extruded into various cross-sectional shapes. In accordance with the illustrated embodiment of the present invention as shown in FIGURES 1 and 2, the permanent magnet member 80 includes an outwardly extending attaching surface 82 provided with appropriate opposite polarity magnetic poles, not shown. The lower side of the permanent mag-

net member includes mounting elements taking the form of outwardly extending shoulders **84, 86**. These shoulders coact with the support flanges **62, 64** and support lips **54, 56** to allow reciprocation of the flexible permanent magnet in a direction perpendicular to the attaching surface **82**. A resilient member **90**, which may be formed from sponge material, a flexible tubular member, or similar resilient elements, is positioned below the shoulders **84, 86**. In this manner, a flexible permanent magnet **80** is forced upwardly from the carrier **40** so that it conforms to the various surface irregularities of ferro-magnetic wall **22**.

Referring now to FIGURES 1, 2 and 2A, the carrier **40** is provided with longitudinally extending apertures **100, 102**, and the magnetic member **80** is provided with a longitudinally extending aperture **104**. These apertures are utilized for joining the mitered corners of the carriers and the permanent magnet members. Lock or support brackets **110**, which are generally right angle wire members, are adapted to extend from the apertures of the carrier and magnet member on one edge of the door to corresponding apertures in the carrier and magnet member on an adjacent edge of the door. The use of these lock or support brackets in the assembly of the magnetic closure device **30** will be described later.

As shown at the right in FIGURE 1, the hinge edge of the door **B** is provided with a non-magnetic sealing arrangement including a carrier **40** having the same features as the carrier **40** on the other edges of the door. However, there is no permanent magnet at the hinge side of the door. In its place, there is provided an elongated plastic seal **120** having a downwardly extending body **122** and an upper sealing ridge **124**. As will be explained later, the plastic seal, which may be formed from sponge material, or other resilient material, is pressed downwardly into the carrier **40**. To effect a joint at the mitered edge of the sealing device adjacent the hinge side of the door, the plastic seal **120** is provided with a longitudinally extending aperture **126**. This aperture receives one of the lock or support brackets **110** to hold the seal **120** in place adjacent the upper and lower corner of hinge portion **38** of magnetic closure device **30**.

By constructing the present invention in accordance with the above description, the carrier **40** and flexible permanent magnet **80** may be transported separately to the place of assembly. This can be done before or after the corners have been mitered. This substantially reduces the cost of transporting the magnetic closure device **30**. In addition, this construction of the magnetic closure device facilitates the actual assembly operation. First, the outer edge portion **32** of magnetic closure device **30** is secured onto edge **10** of door **B** by the fasteners **70**. The flexible permanent magnet **80** with the resilient member **90** is forced transversely through the cavity **50**. The ends of the carrier and permanent magnet strip have been mitered as shown in FIGURE 2A. Thereafter, the angularly bent lock or support brackets **110** are forced into the apertures **100, 102** and **104** at the upper and lower ends of portion **32**. This provides a plurality of transversely extending legs into which the carriers **40** of portions **34, 36** are forced. Thereafter, the upper and lower carriers are fastened onto the door edges **12, 14**, respectively, by fastener **70**. A mitered flexible permanent magnet with the resilient material **90** is then forced longitudinally toward the edge **10**. As the magnet strip abuts the previously positioned magnet strip, one leg of the brackets **110** is forced into the aperture **104**. This secures the corner joint at edge **10**.

The carrier **40** of portion **38** is then secured along edge **16**, as shown in FIGURE 2. Since brackets **110** are used at the corners, the carrier along edge **16** should be forced in place before insertion of the flexible permanent magnet into the carriers along edges **12, 14**. Thereafter, the seal **120** is forced transversely into the cavity **50** with brackets **110** being inserted into the ends of the flexible

permanent magnets at both the upper and lower portions of the door. These brackets are received within aperture **126** of the seal **120**. This completes the assembly operation.

It is appreciated that this procedure is substantially less expensive than prior assembly procedures wherein the complete magnetic closure was assembled into a rectangular frame. This frame was transported to the actual assembly operation. In addition, the four corners of the magnetic closure device **30** are rigidly secured to the door **B**. This was heretofore impossible with known magnetic closure devices.

Referring now to FIGURES 3 and 4, a modification of the present invention is illustrated. This embodiment of the invention allows use of a lesser amount of permanent magnet material. Essentially, this embodiment of the invention includes a carrier **130** having a lower mounting base **132** with a centrally disposed mounting boss **134**. Along the under edge of the carrier there is provided transversely spaced depressions **136**, the purpose of which will be described later. The carrier includes an upper portion **138** having a slot **140** communicated with an inner, longitudinally extending cavity **142**. The cavity and slot form opposed support lips **144, 146**, which function similarly to the support lips **54, 56** of the previously described embodiment. Fasteners **150** are used to secure the carriers **130** around the periphery of a refrigerator door.

A flexible permanent magnet member **160** having the same composition as magnet member **80** is provided with an upper magnetic attaching surface **162** having spaced opposite polarity poles, not shown, and a lower T-slot **164**. A mounting element **170** extends through the slot **140** and includes an outwardly projecting T-rib or protuberance **172**. The flexible permanent magnet member **160** is slipped longitudinally over the rib **172** so that the permanent magnet member is held onto the mounting element **170**. This element also includes a lower body **174** which terminates in a tubular resilient biasing means **176**. The operation of this particular composite permanent magnet structure is readily apparent from the drawing. Apertures **180** of carrier **130** and aperture **182** of mounting element **170** are adapted to receive support brackets **110** during the assembly of this particular embodiment of the invention.

The mounting boss **134** prevents the fastener **150** from spreading the lips **144, 146** during assembly. A sealing strip **190** is provided under the boss **134** and includes transversely spaced, longitudinally extending beads **192, 194**. These beads form a seal between the depressions **136** and the mounting edge of the door **B**.

Referring now to FIGURE 4, the structure utilized along the hinge side of the door is illustrated. A non-magnetic sealing element **200** having a sealing surface **202** and a lower tubular resilient biasing means **204** is provided within carrier cavity **142**. The cavities or voids **206** within the sealing element **200** impart an increased resiliency and sealing capacity to this plastic member. Aperture **208** of the sealing element is used at the corner of the closure device to receive a bracket **110**, as previously discussed. The corner support apertures shown in FIGURES 3 and 4 are rectangular in cross-section, in this manner a larger area corner bracket is usable. This provides improved corner support for the magnetic closure device.

A still further embodiment of the invention is illustrated in FIGURE 5. This embodiment is somewhat similar to the embodiment shown in FIGURE 3; however, the biasing means at the lower end of mounting element **170** includes spaced accordion walls **210, 212** which terminate in beads **214, 216**. These beads are adapted to be received by longitudinal movement within recesses **220, 222** along the lower edge of cavity **142**. In this manner, the composite magnetic structure is actually secured to the inner portion of the carrier **130**. In the

embodiments shown in FIGURES 3-5, the member within the cavity 142 each include spaced shoulders 230 which coact with the inwardly facing lips 144, 146 to prevent removal of the member in a transverse direction during use of the magnetic closure device. Also, the carrier 130 is provided with longitudinally extending recesses 209. These recesses are adapted to receive colored tapes which are adhered to the carrier for purposes of imparting a more pleasing outer appearance.

The present invention has been described in connection with certain structural embodiments; however, it is appreciated that various changes may be made in these embodiments without departing from the intended spirit and scope of the present invention as defined in the appended claims.

Having thus defined my invention, I claim:

1. A magnetic closure device comprising an elongated carrier having a mounting base at one side and an outwardly facing portion opposite said mounting base, said carrier including a longitudinally extending slot in said facing portion and communicated with said cavity, said slot having a preselected width and defining inwardly extending, opposed support ribs, an elongated flexible permanent magnet member coextensive with said slot and said cavity, an elongated mounting element secured to said magnet member, said element being received in said cavity and having an upper rigid surface with a transverse dimension substantially greater than the width of said slot whereby said mounting element may reciprocate vertically in said cavity and below said ribs, and an elongated resilient member coextensive with said mounting element and in said cavity, said resilient member being below said mounting element whereby said resilient member continuously biases said mounting element toward said ribs.

2. A magnetic closure device as defined in claim 1 wherein said elongated resilient member is a hollow plastic member.

3. A magnetic closure device as defined in claim 2 wherein said resilient hollow plastic member is formed integrally with said mounting element.

4. A magnetic closure device as defined in claim 2 wherein said hollow member has two longitudinally extending beads located at opposite sides of said cavity and said cavity includes longitudinal recesses for fixedly holding said beads.

5. A magnetic closure device as defined in claim 1 wherein said mounting element is formed integrally with

said flexible magnet member and includes two outwardly extending flanges within said cavity.

6. A magnetic closure device as defined in claim 1 wherein said mounting element comprises an elongated plastic element having opposed shoulders underlying said support ribs and mechanical means for attaching said plastic element to said flexible magnet member.

7. A magnet closure device as defined in claim 1 wherein said mounting base includes integral sealing lips extending along each side thereof.

8. A magnetic closure device comprising an elongated carrier having a mounting base at one side and an outwardly facing portion opposite said mounting base, said carrier including a longitudinally extending cavity and a longitudinally extending slot in said facing portion and communicated with said cavity, said slot having a preselected width and defining inwardly extending, opposed support ribs, an elongated flexible permanent magnet member coextensive with said slot and said cavity, an elongated mounting element secured to said magnet member, said element being received in said cavity and having an upper rigid surface with a transverse dimension substantially greater than the width of said slot whereby said mounting element may reciprocate vertically in said cavity and below said ribs, and a sealing strip between said base and said closure, said sealing strip including at least one resilient bead extending between said carrier and said closure element, said bead being adjacent one transverse edge of said base.

9. A magnetic closure device as defined in claim 8 wherein said bead is a hollow plastic element.

10. A magnetic closure device as defined in claim 8 wherein said sealing strip includes two resilient beads extending between said base and said closure element, said beads being adjacent opposite transverse edges of said base.

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