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SEALING ARRANGEMENT

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6 Claims. (Cl. 20-69)

This application relates to sealing means and more particularly relates to improved sealing means adapted to seal an access opening in a cabinet such as a refrigerator.

It is frequent practice to provide refrigerators with an access door to a cooled interior compartment which carries a gasket having one or more magnets secured therein for making an airtight connection to a metal flange on the refrigerator cabinet. Such gaskets usually have a first edge portion which is securely sealed to a portion of the refrigerator door. A magnet is disposed adjacent a second edge portion of the gasket which makes sealing engagement with a metal surface on the access opening provided in the cabinet. An extensible web portion connects the two described edges and imparts flexibility to the gasket. The flexible web portion enables the gasket to adapt itself to different manufacturing tolerances in the width of the spacing between the access door and the access opening. The refrigerator door is usually hinged adjacent one edge and the door is opened by exerting sufficient pressure on a simple handle to overcome the force of the attraction between the magnet carried by the gasket and the metal portion of the cabinet to which it is attracted.

The prior art sealing means described provides an airtight seal between the refrigerator door and cabinet and effectively prevents the entrance of warm ambient air into the interior cooled compartment of the refrigerator. However, users often complain that an excessively high pull is required to open the refrigerator door. This difficulty arises principally because of a pressure difference which often occurs between the interior compartment of the refrigerator and the ambient air, which may exert a substantial force tending to maintain the door closed. It is apparent that this force must be overcome, in addition to the relatively nominal magnetic pull exerted by the magnet, in order to open the door.

The described pressure difference across the refrigerator door arises principally for two reasons. First, as warm air within the refrigerator cabinet is cooled, the pressure in the interior of the cabinet is reduced below that of ambient air pressure exerted on the outside of the door, resulting in a high force which must be overcome to open the door. Second, as the user begins to open the door the extensible web portion of the gasket extends in length, thereby resulting in a slight increase in volume of the interior of the cabinet. The increase in volume in the cabinet reduces the pressure of the air inside the refrigerator, which in turn gives rise to another pressure difference across the door, which must also be overcome in order to open the door. It has been found that the magnitude of the latter force, alone, may be great enough to require a pull in excess of 40 pounds in order to open the door of a typical household freezer and that the cumulative effect of the two forces may be many times greater than this.

Not only is the pull required to open a conventional

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magnetically secured refrigerator door inconvenient to the user, but it is also obvious that it presents a hazard to small children who might become accidentally trapped in the interior of an abandoned refrigerator. Consequently, it is highly desirable to minimize the force necessary to open the refrigerator door while at the same time to provide adequate sealing against the entrance of ambient air into the cabinet.

Accordingly it is the principal object of this invention to provide an improved sealing arrangement for an access door.

It is a further object of this invention to provide an improved sealing arrangement for access door which enables equalization of pressure differences occurring across the door so as to reduce the pull required to open it to an acceptable force.

These and other objects of this invention are achieved in the illustrated preferred embodiments thereof by providing means in association with a sealing gasket to limit the extension of the gasket in a localized area thereof so as to provide a location for equalization of pressure differences existing across the access door. More specifically, a relatively narrow inextensible tape is secured between the sealing edges of a gasket for a refrigerated enclosure so that extension of the gasket is restricted at a limited location thereon. In accordance with a further embodiment of this invention the degree of restriction of the extension of the gasket may be made adjustable by securing an end of the tape under suitable fastening means such as a sheet metal screw.

These and other objects of this invention will become more apparent by reference to the following specification and attached drawing wherein:

FIGURE 1 is a cross sectional view through a portion of a refrigerated cabinet and door having sealing means in accordance with applicants' invention;

FIGURE 2 is a side view showing applicants' improved sealing means between a partially opened refrigerator door and a refrigerated cabinet;

FIGURE 3 is a cross sectional view showing a slightly modified embodiment; and

FIGURE 4 is a cross sectional view showing a further modified embodiment of applicants' invention.

Referring particularly to FIGURE 1 there is shown a refrigerated cabinet box section, designated generally 10, having an inner flange 11 and an outer, steel or other magnetic metal flange 12 which forms an exterior wall of a refrigerator, freezer, or other cabinet. Cabinet 10 is provided with an access opening 13 defined by a portion of outer flange 12. Suitable insulation may be provided between the inner and outer flanges, if desired.

An access door section designated generally 15 is provided to cover access opening 13. Door 15 is suitably hinged to cabinet 10 by hinges (not shown) provided along one edge of the door as is customary in refrigerators. Door 15 is provided with an outer flange 16 forming an exterior wall of the door and an inner flange 17 forming an interior wall thereof. A suitable rigid handle 18 shown in FIGURE 2 is secured to exterior flange 16 opposite the hinged portion of the door to enable it to be opened.

A gasket assembly, designated generally 20, is disposed between access door 15 and cabinet 10. It will be understood that gasket 20 preferably extends about substantially the entire periphery of access opening 13 and access door

15 to provide an airtight seal preventing the entrance of ambient air into the interior of the refrigerator cabinet.

Gasket 20 is provided with a first edge portion 21 which is fixedly secured in sealing engagement with access door 15 by a retaining strip 22 and suitable fastening means such as a sheet metal screw 23. As shown in FIGURE 1 the described retaining means may also be employed to secure inner flange 17 to outer flange 16 of the access door section.

Gasket 20 is further provided with a second edge portion 26 adapted to make sealing engagement along its periphery with access opening 13. Magnetic means 27 is provided in the interior of gasket 20 adjacent second edge portion 26 in order to provide an attractive force in cooperation with metal outer flange 12 to retaining the second edge portion in removable sealing engagement with access opening 13.

It will be understood that magnetic means 27 conventionally comprises one or more magnets or a flexible magnetized strip disposed in a tubular section of gasket 20 cooperating with magnetic means located on cabinet section 10, such as steel flange 12. However, magnetic means 27 may comprise a strip of soft iron or other powdered or solid magnetic material which is attracted by other magnetic means such as magnets located on cabinet section 10, if desired. Alternately gasket 20 may be fixedly secured to cabinet section 10, if desired, so that magnetic means 27 will cooperate with suitable magnetic means on door section 15.

Gasket 20 is also provided with an extensible web, belows-like portion 25 extending between first edge portion 21 and second edge portion 26, so as to permit variation in the distance between the edge portions of the gasket. Extensible web portion 25 enables gasket portion 20 to compensate for various clearances between access opening 13 and access door 15 which may be encountered as a result of normal manufacturing tolerances. The extensible web portion permits the gasket to pull into sealing engagement as door 15 is closed to cover access opening 13. The extensible web portion 25 also permits gasket 20 to accommodate the differences in the clearance space existing between the access door and the cabinet due to the portion of the door adjacent the hinges approaching sealing engagement with the cabinet sooner than the remote portion of the door, upon closing thereof. The extensible web need not necessarily be linearly expansible, as shown, but is "extensible" in the sense that it permits relative movement between the edge portions of the gasket which can cause an expansion of volume in the cabinet section upon opening of the door.

It is also desirable to provide a lip portion 28 to cover retaining strip 22 and screw 23 thereby presenting a neat and finished appearance to the access door. Gasket 20 is desirably made of a relatively flexible impervious material such as rubber, synthetic rubber, or a plastic. It will be understood that many variations of gasket shape may be employed in practice. Therefore, the terms "edge" and "extensible web" are intended to broadly cover equivalent portions of these other gaskets. For example, the "extensible web" may comprise merely a flexible hinge portion of the gasket that functions to provide movement between the sealing "edges" tending to expand the volume of the cabinet upon opening the door. The sealing edges may merely comprise the edges of the web and need not be otherwise separately distinguishable from the web portion.

In accordance with this invention a relatively narrow inextensible flexible tap 30 is secured between first edge portion 21 and second edge portion 26 of gasket 20 to limit the extension of web portion 25 at the location of the tape. Tape 30 preferably comprises a plastic tape having a pressure sensitive adhesive backing to enable it to be secured between the first and second edge portions of the gasket.

As shown in FIGURE 1, tape 30 may be adhesively se-

cured under the lower horizontal edge of lip portion 28, extend back around the lip and over the upper portion of the lip, around second edge portion 26 and secured to the lower horizontal portion of first edge portion 21. Screw 23 and retaining strip 22 may serve to help retain tape 30 with respect to the gasket. If desired, screw 23 may also extend through the tape, although if the tape is suitably adhesively secured to the gasket this construction is unnecessary. Any suitable securing means may be used to retain the tape in its desired position and it is not necessary that the tape be of the pressure sensitive type. For example, an epoxy glue may be used to cement the tape to the desired portion of the gasket.

As will be seen from FIGURE 2, tape 30 is relatively narrow with respect to the length of gasket 20 and in practice it has been found that a tape having about a two inch width is satisfactory. It will be appreciated that tape 30 may alternatively comprise a string-like cord or other restraining means suitably fastened to limit extension of web portion 25. The term "tape" is intended to be interpreted broadly to cover such string-like members as well as woven fabric, plastic, metal, and roving materials.

In operation access to the interior of cabinet 10 is obtained by gripping handle 18 and pulling hinged door 15 away from cabinet 10. As door 15 is moved away from the cabinet, web portion 25 of gasket 20 tends to extend so that the gasket remains sealed against the access opening in the cabinet. However, at the region of the location of tape 30, extension of web portion 25 is prevented beyond a predetermined extent and therefore, an opening develops between tape 30 and access opening 13 as shown in FIGURE 2. This opening permits any pressure difference existing across the face of door 15 to equalize so that the air pressure on the interior of cabinet 10 is the same as that existing on the exterior of access door 15. Consequently, the user is not required to overcome a force due to a difference in pressure across access door 15 to open the door, and the door is enabled to be easily opened by merely overcoming the relative negligible force of attraction between magnet 27 and flange 12. In addition, the space between tape 30 and cabinet 12 provides a location of the initiation of peeling separation between gasket 20 and outer flange 12 which further reduces the pull necessary to separate the gasket from the cabinet.

Referring now to FIGURE 3 there is shown a slight modification of applicants' invention wherein tape 31 is secured to the sides of gasket 20 rather than wrapped around horizontal surfaces as shown in the preceding figure. While suitable pressure sensitive adhesive tapes may be employed in the embodiment shown in this figure, it is preferred to use a cord or string-like tape which is adhesively secured to gasket 20 by means of an epoxy resin, for the reason that more secure adhesion is required between the gasket and tape than necessary in the preceding embodiment. It is not believed necessary to describe this figure in greater detail, like reference characters having been used as shown in the preceding embodiment. If desired tape 31 may be secured along only one side of gasket 20 between the edge portions thereof.

In FIGURE 4 a still further modification of applicants' invention is shown. Like reference characters are used to indicate parts similar to those shown in the preceding embodiments. In this embodiment of the invention, a tape 32 which may be similar to tapes 30 and 31 is disposed about gasket 20 but has free end portions which are adjustably retained by securing means 22, 23 so that the degree of restraint imposed on extensible web portion 25 may be varied to suit the requirements of a particular installation. In this embodiment it is not necessary to secure tape 32 to the gasket. A part of lip portion 28 is cut away at 29 to permit the end of the tape to be secured under retaining strip 22. The other end of tape 32 is secured under first edge portion 21 by being com-

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pressed when screw 23 is tightened. It will be apparent that the tightening of screw 23 securely retains tape 32 to limit movement of second edge portion 26 away from first edge portion 21 to any desired extent. Screw 23 may, if desired, extend through tape 32, but this is not essential. When installing tape 32 the workmen need merely determine the degree of restraint which is desired and suitably adjust the length of tape 32 by fastening the ends in any desired position under the fastening means.

Many modifications of applicants' invention will occur to those skilled in the art. Other restraining means than illustrated herein may be employed to limit the extension of the web portion of the gasket, for example the gasket may be integrally formed with a tape or other reduced extensibility portion, such as a thickened or stiffened region on the web, at one or more locations along its length to achieve the desired result. It is only necessary that some type of restraining means be provided so that there is a suitable location on the gasket where its extensibility, that is, relative movement between the sealing edges, is reduced to provide a point at which the equalization of pressures between the interior and exterior of the cabinet can take place upon initially pulling the door handle.

The restraining tape may be made integral with the gasket or may be secured by other suitable means than those described, such as by a mechanical bond or fastener or any suitable thermosetting plastic binder. The tape also may comprise a thin metal wire or band if desired.

It will also be apparent that applicants' invention particularly as illustrated herein, may be applied to existing cabinets of the type described to reduce the pull required to open their access doors.

Furthermore, this invention is not limited to its use with respect to refrigerators and freezers but has application generally to facilitating the opening of access doors which are sealed by either magnetic or other types of gaskets.

Accordingly, other modifications and embodiments of this invention within the scope of the following claims will become apparent to those skilled in the art.

We claim:

1. A gasket for an enclosure member having a removable access cover member comprising:

a first edge portion adapted to be secured to one of said members;

a second edge portion adapted to make sealing engagement with the other of said members, extensible means between said first and second edge portions;

magnetic means associated with said gasket for retaining said second edge portion in sealing engagement with said other member;

restraining means adapted to limit extension of said extensible means, to thereby facilitate opening of said access cover by providing a location for relief of pressure difference which may exist across said access cover and for promotion of a peeling separation between said magnetic means and said other of said members, said restraining means being disposed along an exterior surface of said gasket and comprising a relatively inelastic, flexible, narrow tape extending at least partially across said gasket between said first edge portion and said second edge portion of said gasket, said tape having a relatively small width with respect to the length of said gasket.

2. A gasket as defined in claim 1 wherein said restraining means includes an end portion which is adapted to be adjustably secured by a retaining means adapted to secure said gasket to an enclosure so as to permit adjustment of the length of said tape to provide a desired extent of restraint.

3. A refrigerated enclosure including:

means defining a cabinet section having an access opening;

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means defining a cabinet access door section; and gasket means disposed between said access opening and said access door for sealing therebetween, said gasket means comprising:

a first edge portion secured to one of said cabinet sections in sealing engagement therewith;

a second edge portion adapted to sealingly engage the other of said cabinet sections;

magnetic means associated with said gasket means for removably retaining said second edge portion in sealing engagement with said other cabinet section;

a relatively impervious, extensible web portion extending between said first and second edge portions for providing a seal between said cabinet member; and

relatively inextensible restraining means cooperating with at least a portion of said gasket means to limit extension of said web portion to a predetermined extent so that opening of said access door is facilitated by relieving any pressure difference existing between the interior of said cabinet and the ambient atmosphere and by providing a location for initiation of separation between said second edge portion of said gasket means and said other section, said restraining means being disposed along an exterior surface of said gasket means and comprising a relatively inelastic, flexible, narrow tape extending at least partially across said gasket means between said first edge portion and said second edge portion of said gasket means, said tape having a relatively small width with respect to the length of said gasket means and with respect to the length of the side of said access opening adjacent which it is disposed.

4. A refrigerated enclosure according to claim 3 wherein said restraining means for said gasket includes an end portion which is adapted to be adjustably secured by the means securing said first edge portion to said cabinet section, so as to permit adjustment of the length of said tape to provide a desired extent of restraint for said gasket.

5. A refrigerated enclosure as defined in claim 3 wherein said restraining means for said gasket is adhesively secured to at least a portion of the exterior surface of said gasket.

6. A refrigerated cabinet having:

means defining a cabinet enclosure section having an access opening;

means defining a cabinet access door section arranged to substantially close said access opening;

means defining a gasket secured to one of said sections and adapted to be disposed between said access door section and said cabinet section to sealingly engage said sections, said gasket comprising:

a first edge portion adapted to cooperate with fastening means to secure said first edge portion to one of said cabinet sections;

a second edge portion adapted to make sealing engagement with the other of said cabinet section;

magnetic means secured to said gasket adjacent said second edge portion to hold said second edge portion in sealing engagement with said other cabinet section;

a relatively impervious, extensible, web portion extending between said first and second edge portions of said gasket to provide an air seal between said cabinet members when said second edge portion is in sealing engagement with said other cabinet section;

and a relatively narrow, flexible inelastic tape extending at least partially across said gasket be-

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tween said first and second edge portions of said
 gasket to limit extension of said web portion,
 said tape having at least one portion thereof
 adapted to be engaged by said fastening means
 in a plurality of positions so as to accommodate
 selection of a desired maximum extension of
 said web portion for a particular installation
 thereby providing a location for the relief of
 pressure differences across said access door and
 for the initiation of peeling separation of said

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gasket from said other cabinet section upon
 opening of said access door.

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