June 21, 1966 H. W. KLINGAMAN 3,256,841

REFRIGERATOR SAFETY DEVICE

Filed March 30, 1964 2 Sheets-Sheet 1

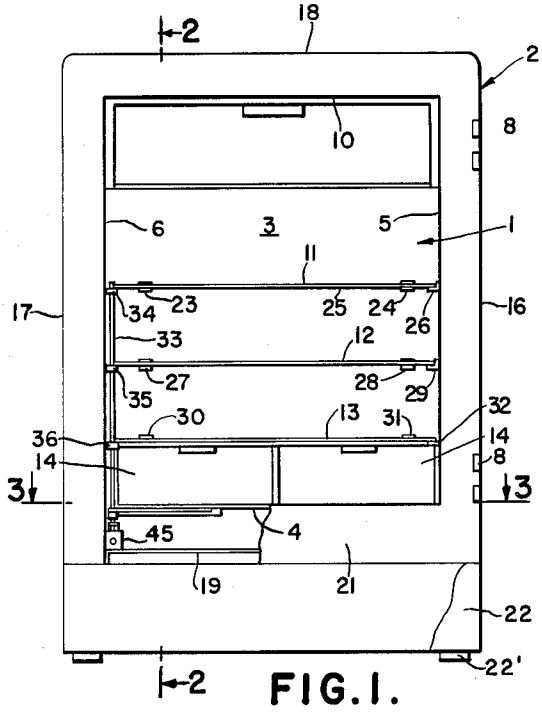


FIG. 1.

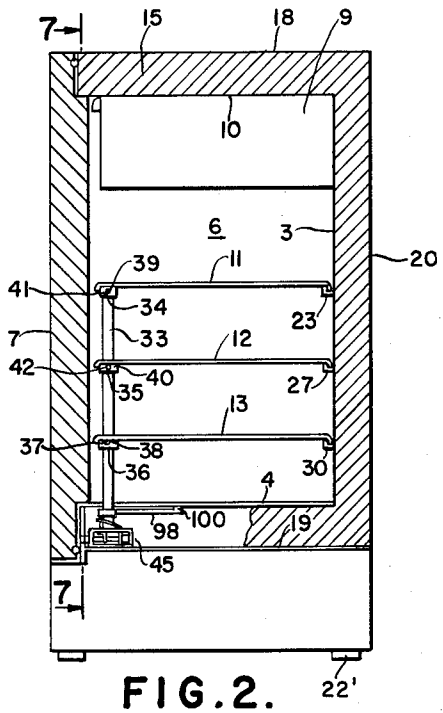


FIG. 2.

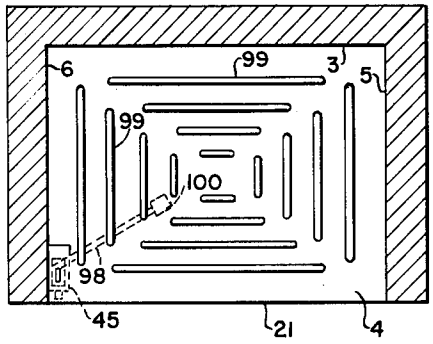


FIG. 3.

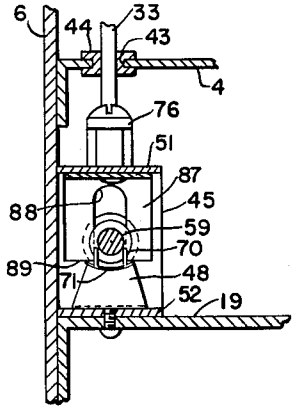


FIG. 6.

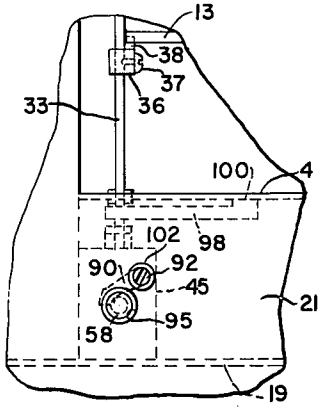


FIG. 7.

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REFRIGERATOR SAFETY DEVICE

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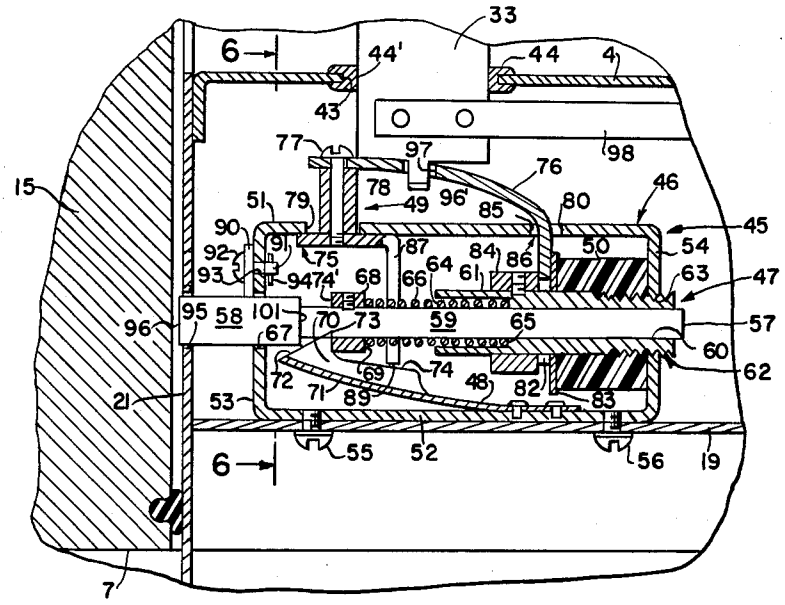


FIG. 4.

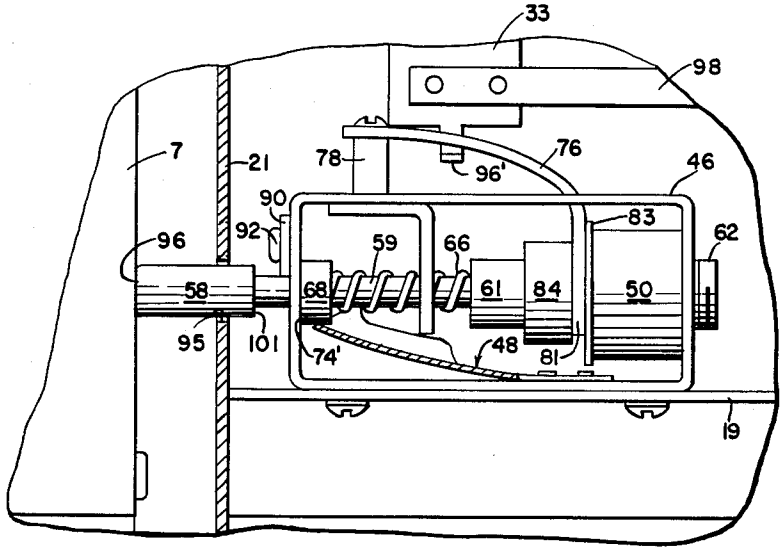


FIG. 5.

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REFRIGERATOR SAFETY DEVICE

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5 Claims. (Cl. 109—63.5)

This invention relates generally to safety devices to prevent suffocation of a child in an artight enclosure, and more particularly to a safety device which prevents suffocation of a child in a refrigerator of the type normally used in the home.

Each year children needlessly die because of suffocation when they are trapped in the cabinet portions of refrigerators and other enclosures which are substantially airtight when the door of the cabinet portion is closed. Such accidents frequently occur in refrigerators that have been abandoned by their owner, after the refrigerator has served its useful purpose. Just as frequently such accidents occur with refrigerators that are temporarily not being used, for example refrigerators in a vacant house or vacant apartment, or in refrigerators that are used for another purpose, for example, storage of various items after the refrigerator has become inoperative.

The trapping of children in such cabinets frequently occurs while the children are at play. Sometimes the game is hide and seek, and a child climbs into the refrigerator and pulls the door closed upon itself. In other instances one child may inadvertently close the door while another child is in the refrigerator, and the child who closes the door then finds that he cannot exert sufficient force to open the refrigerator, when the door has a magnetic latch, or cannot reach the handle of the door, when the door has a spring type latch.

To prevent the escape of cool air from a refrigerator by convection refrigerators are necessarily constructed to form an airtight cabinet enclosure when the door of the refrigerator is closed. Hence, when a child climbs into the refrigerator and the door is closed, it frequently takes but a few minutes to exhaust the air supply in the refrigerator and the child suffocates. Since small children between the ages of one and a half and 4 or 5 years of age frequently do not have the strength to open a magnetically latched refrigerator door, and cannot open a spring latched door from the inside, the end result, as shown by statistics, is a relatively high accidental death rate due to suffocation in airtight cabinet portions of such devices. Hence, there is a definite need for a fully automatic safety device which positively prevents trapping or otherwise locking of children in airtight enclosures of the cabinet portions of such devices as refrigerators.

Applicant has devised such a safety device which automatically prevents suffocation of children in refrigerators. In its preferred embodiment which will subsequently be described in detail, a closure operating member is actuable to a condition in which the door of the cabinet is either opened automatically in response to the presence of a child in the cabinet, or is prevented from closing at all if a child is in the cabinet, depending on the weight of the child and the extent of his activity within the cabinet. The door operating member is actuated in response to the weight of the child on a supporting portion of the interior of the cabinet on which the weight of the child must necessarily rest when in the cabinet. In the preferred embodiment, a force transmitting member is connected between, the supporting surface on which the weight of the child would necessarily rest, and the closure operating member, to actuate the door operating member to either prevent closing of the cabinet door if the weight of the child is sufficient to actuate the operating member when the child merely climbs into the refrigerator, or to actuate the door operating member after the cabinet door is closed in response to the increased weight applied to the support due to motion of the child within the cabinet in an attempt to escape.

It is believed that one reason that manufacturers of refrigerators, and other devices which have airtight cabinets have not attempted to incorporate such safety devices in refrigerators during manufacture is because of the high cost of a safety device which would operate effectively and in a fail-safe manner. Applicant's safety device operates in this fail-safe manner, is extremely easy to incorporate in both existing refrigerators, and in refrigerators during manufacture, and is extremely economical, costing only a very nominal additional amount to place the safety device in the refrigerator.

In view of the foregoing, a first and most important object of the present invention is to provide a safety device for airtight cabinets which positively prevents suffocation of a child trapped in the cabinet.

A further object is to provide a safety device to prevent entrapment of a child in an airtight cabinet, which requires manual resetting in a manner which cannot be accomplished by a child so that the door of the cabinet is positively prevented from being closed by children at play once the device is actuated.

Another and still further object of the present invention is to provide the safety device in combination with the supporting members within an airtight cabinet, and a device connected between the supporting members and a closure operating member to actuate the operating member in response to the weight of the child on any of the supporting members in the cabinet.

A still further object of this invention is to provide a safety device, the proper operation of which cannot be accidentally defeated.

Another and further object of this invention is to provide a safety device with the features set forth above which is economical to manufacture, easy to adapt to existing refrigerators, and relatively simple to incorporate in newly manufactured refrigerators.

The following specification, of which the accompanying drawings form a part, explains the manner in which the foregoing objects are attained in accordance with this invention. In the drawings:

FIG. 1 is a front elevational view of the safety device of this invention incorporated in a conventional type refrigerator with portions of the refrigerator cut away, and the door removed for clarity;

FIG. 2 is a view in section looking along lines 2—2 of FIG. 1;

FIG. 3 is a top view in section looking along lines 3—3 of FIG. 1, and showing the bottom wall structure of the refrigerator cabinet;

FIG. 4 is an enlarged sectional view in side elevation of the door operating mechanism in its cocked position and showing also the associated portions of the refrigerator;

FIG. 5 is a view similar to FIG. 4 and showing the door operating mechanism in a released position;

FIG. 6 is a sectional view on a smaller scale taken along lines 6—6 of FIG. 4 showing the door operating mechanism and the associated parts of the refrigerator;

FIG. 7 is an enlarged partial view looking along line 7—7 of FIG. 2 showing the details of the reset arrangement for the door operating mechanism as well as the support and bottom wall operated member.

Turning now to the drawings in detail and particularly to FIGS. 1 and 2 it is seen that the safety device of this invention is incorporated in an airtight cabinet **1** of a refrigerator **2**. Cabinet **1** has a rear wall **3**, a bottom wall **4**, side walls **5** and **6** and a horizontally swingable door **7** supported on hinges **8** at the right hand side of refrigerator **2**, as seen in FIG. 1.

Within cabinet **1** is the usual freezing compartment **9** adjacent top wall **10** of the cabinet, several horizontal shelves **11–13** which provide support for articles placed in the refrigerator, and drawers **14** conventionally used for vegetables and the like located between shelf **13** and bottom wall **4**. Refrigerator **1** also has an outer wall structure which forms a box shaped enclosure for cabinet **1**, the wall portions of the outer wall structure being spaced from and parallel with the walls of the cabinet, to provide space for insulation **15** to thermally insulate cabinet **1** against heat loss. The outer wall structure includes outer side walls **16**, and **17**, outer top wall **18**, outer bottom wall **19**, and outer rear wall **20**. Extending between the inner and outer wall structures is a wall portion **21** which closes the space between the inner and outer walls at the front of the refrigerator.

Below outer bottom wall **19** is a compartment **22** defined by wall portions of the refrigerator at the bottom thereof. The bottom of the refrigerator is provided with short legs **22'** for supporting refrigerator **2** on a surface, for example a kitchen floor. Compartment **22** commonly houses the various portions of the refrigeration unit including motor, compressor, etc. (not shown) of the refrigerator.

The rear edge of shelf **11** is supported by a pair of support elements **23** and **24** secured to the rear wall **3** of cabinet **1** in horizontally aligned relation. Support elements **23** and **24** each have an enlarged head spaced from rear wall **3** to provide an upwardly projecting tab which hooks under a downwardly depending peripheral skirt **25** of shelf **11**, this interhooked arrangement preventing slipping of shelf **11** in a fore and aft direction during normal use of the refrigerator.

The right hand side of the shelf **11** is similarly supported by a support element **26** secured to side wall **5** at a location offset toward the front of the refrigerator, support element **26** having an enlarged head which hooks under that portion of skirt **25** at the right hand side of the shelf, as viewed in FIGURE 1. This arrangement prevents lateral sliding of shelf **11**.

Shelves **12** and **13** are similarly mounted, shelf **12** being supported by support elements **27–29** and shelf **13** being supported by support elements **30–32**.

A portion of the safety device of this invention is arranged to support the left hand side of shelves **11–13** of cabinet **1** as viewed in FIGURE 1. The support there includes a rectangular bar **33** of sufficient length to extend at least to the level of shelf **11** as well as through bottom wall **4** of cabinet **1**. The bar **33** is relatively thin so it fits between side wall **6**, and the left hand edges of shelves **11–13**. Adjustably secured to bar **33** are support elements **34–36** which support the left hand edge of shelves **11** through **13**. As best seen in FIGURE 7 which shows support element **36**, each support element partially encircles bar **33** and is provided with a threaded fastener in the form of a bolt **37** threaded into support element **36** for securing the support element against movement along the bar at any desired position. Extending upwardly from support element **36** is a finger **38** which engages under the peripheral

skirt of shelf **13** to support the left hand side of the shelf and to further secure the shelf against lateral movement in the cabinet **1**. It is to be understood that support elements **34** and **35** are each identical to support element **36** and have support fingers **39** and **40** which extend under the respective peripheral skirts of shelves **11** and **12** and bolts **41** and **42** to secure elements **34** and **35** to bar **33**.

As best seen in FIGS. 4 and 6 bar **33** extends through an opening **43** in bottom wall **4**. Opening **43** is provided with a seal in the form of a resilient grommet **44** of rubber or other resilient plastic material. A rectangular opening **44'** in grommet **44** is so dimensioned as to lightly engage the surfaces of bar **33** that pass through the grommet to provide a seal that permits sliding motion of the bar relative to the grommet. This seal provided by the grommet prevents the flow of air around bar **33** from cabinet **1** to the insulation space between the inner and outer wall portions of the refrigerator.

Referring now to FIGS. 4 and 7 it is seen that a door operating device **45** is disposed on outer bottom wall **19** at a location immediately beneath bar **33**. Door operating mechanism **45** includes a frame **46**, a plunger assembly **47** carried by the frame, a latch **48** for latching the plunger assembly and a latch operating mechanism **49** including a resilient bushing **50**.

Frame **46** is formed from a length of strap iron that is bent to form, as viewed in side elevation, a rectangular shell having a straight flat upper member **51** in spaced parallel relation to a lower member **52** these members being joined by side legs **53** and **54** extending between the ends of members **51** and **52**. Lower member **52** is drilled and tapped to receive screws **55** and **56** which extend through suitable holes in outer bottom wall **19** to secure the door operating mechanism to the wall.

Plunger assembly **47** includes a plunger **57** having an enlarged cylindrical head **58** integral with a smaller diameter shaft portion **59**. Shaft **59** is disposed for sliding movement in bore **60** of a bushing **61**. Bushing **61** has external threads **62** which permit threading the bushing into an internally threaded opening **63** in leg **54** to secure the bushing to the frame. When bushing **61** is threaded into opening **63** the axis of the bushing lies parallel with upper and lower frame members **51** and **52** and is spaced approximately midway between the members. The end of bore **60** remote from leg **54** is counter-bored as at **64** to provide a transverse annular shoulder **65** that forms a seat for one end of helically wound compression spring **66**. With shaft **59** disposed in bore **60**, head **58** of the plunger extends through a circular opening **67** in leg **53** of the frame, the axis of opening **67** being coincident with the axis of plunger **57**. Fixed to shaft **59** between head **58** and bushing **61** is a collar **68** that presents a transverse annular shoulder **69** which faces toward bushing **61**. Spring **66** is selected to have an appropriate diameter to slip over shaft **59** and fit into counter-bore **64** so that the ends of the spring seat on shoulders **65** and **69**.

Latch **48** is formed from sheet metal which is spring material and has one end fastened with rivets to lower member **52** of the frame. The free end of latch member **48** is generally U-shaped as viewed in front elevation, having spaced apart legs **70** projecting toward plunger **57** from base portion **71** of the latch member. As viewed in side elevation (FIG. 4), the front end of legs **70** are generally triangular, having downwardly sloped forwardly facing edges **72** which terminate at edges **73** disposed in a plane perpendicular to plunger **57**, edges **73** facing toward leg **54** of the frame. Merging with edges **73** are edges **74** of legs **70**, edges **74** facing generally upwardly and inclined only slightly relative to the axis of plunger **57**. The spring properties of latch member **48** are such that the free end of the latch member is normally biased toward the plunger so edges **73** engage a transverse annular face **74'** of collar **68**, when the plunger is latched as shown in FIG. 4.

Latch operating assembly **49** includes a latch operating element **75** secured to latch operating lever **76** with screw **77** and bushing **78** which extend through opening **79** in upper member **51** of the frame. Lever **76** curves toward frame **46** from the head of the screw **77**, is bent where it passes through an opening **80** of upper member **51** and terminates at an enlarged end **81** having a U-shaped slot **82** therein the legs of which straddle bushing **61**. Between rubber bushing **50** and end **81** is a washer **83**, loosely disposed on bushing **61**, which engages the surface of end **81** that faces toward leg **54**. Affixed to bushing **61** on the other side of end **81** of the lever is a collar **84** adjustably secured to bushing **61** with a set screw. Collar **84** is secured to bushing **61** at such a location that bushing **50** is under slight axial compression.

The edge of opening **80** that extends under the bend in lever **76** is slightly rounded to provide a bearing surface **85** on which the face of the lever at **86** pivots when force is applied to the lever by bar **33**.

Latch operating element **75** is L-shaped as viewed in side elevation, (FIG. 4) having a vertical leg **87** and a horizontal leg. Vertical leg **87** has a U-shaped slot **88** the sides of which extend on opposite sides of the shaft **59** to straddle the shaft. Flat horizontal bottom edges **89** of leg **87** are disposed to engage edges **74** of latch member **48** when latch operating element **75** is moved downwardly by a force from bar **33**.

A lock member in the form of a hook **90** is mounted for pivotal movement in a plane perpendicular to the axis plunger **57**. Hook **90** is fixed to a pin **91** having a head **92** with a slot to receive a screwdriver. The pin extends through an opening **93** in leg **52**, the axis of opening **93** being offset to one side of and above the axis of plunger **57** so the inner curved portion of the hook normally rests by gravity against the cylindrical surface of head **58** of the plunger when the plunger is cocked. Axial movement of the pin out of opening **93** is prevented by a spring clip **94** secured to the end of the pin opposite the head.

As shown in FIGS. 4 and 6 door operating mechanism **45** is mounted on outer bottom wall **19** with the axis of plunger **57** perpendicular to the plane of wall **21**. With plunger **57** in its latched position as shown in FIG. 4 head **58** of the plunger extends through opening **95** so that flat end **96** is approximately flush with the outer surface of wall **21**. As viewed in front elevation (FIG. 6) the axes of plunger **57** and bar **33** are seen to intersect, at a right angle.

Bar **33** is connected to lever **76** by inserting a narrow tongue **96'** formed at the end of the bar, through an opening **97** of the lever and then bending the end of the tongue to prevent removal of the bar by the user of the refrigerator. Secured to bar **33** at a location between grommet **44** and lever **76** is an operating element extension **98** that extends diagonally immediately beneath bottom wall **4** and is normally slightly spaced therefrom. Bottom wall **4** is made of thin sheet metal provided with upwardly projecting bead like indentations **99** formed therein, the indentations being in a generally rectangular array to increase the flexibility of the bottom and thus provide for an over center snap action similar to that of the dished portion of an oil can.

Operating element extension **98** extends about two-thirds the distance to the geometric center of bottom wall **4**, and terminates at a flat end **100**. The bottom wall normally is bowed slightly upwardly so that the wall is spaced slightly from end **100** of the operating member extension. When a predetermined amount of weight is applied directly to bottom wall **4** the bottom wall collapses and snaps over to a downwardly bowed position thereby engaging and applying pressure to operating element **98** by engaging flat end **100**. Such press is transmitted to bar **33** to actuate latch **48** of the door operating mechanism.

The plunger of door operating mechanism **45** is released by applying sufficient force to bar **33** to move edges **89** of latch operating element **75** into engagement with edges **74** of latch **48** and push the latch downwardly until edge **73** is moved a distance sufficient to release collar **68**. The plunger then snaps forwardly under the action of spring **66** to the position shown in FIG. 5 the forward motion of the plunger being limited by engagement of face **74'** of the collar with the inner surface of leg **53**. In this position end **95** of head **58** of the plunger extends a sufficient distance beyond wall **21** to engage the inner surface of door **7** to open same, and if already open, to function as a stop to prevent closing the door. As soon as plunger **57** is operated to its extended position hook **90** moves downwardly by gravity to engage shaft **59** and thus provide a lock behind transverse annular surface **101** at the connection between head **58** and shaft **59**. In this position hook **90** positively prevents resetting the plunger to its latched position by slamming the door, or by otherwise pushing inwardly on the plunger. To reset the plunger it is first necessary to insert a screwdriver through opening **102** (FIG. 7) in wall **21** to engage the slot in the head **92** of pin **91** and rotate the pin slightly in a clockwise direction to lift the hook beyond the periphery of head **58**, whereupon the plunger can be pushed axially inwardly until shoulder **69** of collar **68** is behind the plane of edges **73** of latch **48** to permit the latch to snap toward shaft **59** to latch the plunger in its cocked position. Opening **102** is preferably made very small, for example $\frac{3}{16}$ of an inch, and the head of the pin **91** is spaced from wall **21**, as shown in FIG. 4 to prevent children from operating hook **90** merely by inserting a finger through opening **97**, and then resetting the plunger. To provide for additional safety, opening **102** is normally closed with a plug of the snap-in type (not shown) that requires a screwdriver for removal.

As is apparent from the previous descriptions with regard to FIG. 2, bar **33** supports one side of shelves **11** through **13** via the engagement of support elements **34** through **36** with the sides of the shelves. When a weight above a predetermined amount is placed on any of the shelves lever **76** is operated to move latch member **48** away from plunger **57** and the plunger snaps forward to its extended position. The door operating mechanism can be pre-set to operate at different predetermined loads. End **81** of operating lever **76** partially deforms bushing **50** when a force is applied to the lever by bar **33**. This effect is caused by the pivotal motion of the lever on bearing surface **85** of the frame. Hence, it is apparent that the force acting on lever **76** that is required to release the latch is determined by the resiliency and degree of preloading of bushing **50**. Therefore, to adjust the door operating mechanism to operate under the action of different loads applied to lever **76** by bar **33** it is merely necessary to select a bushing **50** having the desired characteristics of resiliency and to select a washer **82** of such thickness that the preloading of the bushing is that which is required to operate the latch member when a predetermined load is applied to bar **33**.

If for some reason the owner of the refrigerator removes the shelves **11** through **13** and drawers **14** the device still operates to prevent trapping of the child in the cabinet portion of the refrigerator. Such operation of door operating mechanism **45** is effected by flexible bottom wall **4** cooperating with extension **98**. Thus, a weight applied to bottom wall **4** causes the bottom wall to collapse and bow downwardly thereby exerting a force on an extension **98** sufficient to move bar **33** downwardly to operate latch **48** as previously described. After the weight is removed from wall **4** the wall is pushed back to its upwardly bowed position by the forces from bushing **50**. If necessary the wall can be reset by pulling up on bar **33** to snap the wall back when flat end **100** engages the walls.

It is to be noted that in its extended position the end **96** of plunger **58** is at a sufficient distance from the plane of wall **21** to prevent closing the refrigerator door. In refrigerators having a door with a magnetic latch plunger

57 can be operated to its extended position either before or after a child climbs into the refrigerator without endangering the life of the child. When a magnetic latch is provided on the refrigerator a bushing 50 is selected to permit release of the plunger in response to a weight slightly greater than the predetermined weight of a child. Under these circumstances the door could be closed for a short while but would be operated by the dynamic weight of the child moving about the refrigerator in an attempt to escape. When the refrigerator door has a mechanical latch the door operating mechanism is preset to release the plunger 57 as soon as a child's weight is applied to any of the shelves.

It has been determined that the average two year old child weighs 25 pounds. Therefore, a bushing 50 is selected which will permit lever 76 to operate the door operating mechanism whenever the weight on the shelf system exceeds 25 pounds. It is to be noted that shelves 11–13 are somewhat flexible so that a child's weight causes the shelf to deform a sufficient amount to move bar 33 to operate the door operating mechanism.

For example, assume that a child climbs onto shelf 11. Shelf 11 will deform slightly so that a portion of the additional weight is applied to bar 33 at support element 34. This weight depresses bar 33 and hence, transmits the load to lever 76, causing the lever to pivot on bearing surface 85. As the lever pivots, its motion is resisted by bushing 50, and hence, if the weight on the shelf were less than the predetermined weight of a child e.g. 25 pounds, the plunger would not be operated. However, since the weight applied to the shelf is 25 pounds the lever pivots a distance sufficient to press edges 89 of latch operating element 75 against latch 48 to operate the plunger. When the plunger operates to its extended position door 7 cannot be closed because of the restraining action of the plunger, and the operation of the lock in the form of hook 90.

In view of the foregoing description it is apparent that applicant has devised a novel arrangement for positively preventing the entrapment of a child in the cabinet portion of an airtight enclosure. While a preferred embodiment has been illustrated and described it is to be understood that numerous changes could be made in both the force transmitting arrangement and the door operating and stop arrangement without departing from the scope of this invention as defined in the appended claims.

What is claimed is:

1. In a safety arrangement to prevent trapping of a child in the cabinet portion of a refrigerator having a door the combination comprising:
- a plurality of horizontal shelves in said cabinet portion;
- a force transmitting device connected to each of said plurality of shelves and forming at least a portion of the supporting structure for said shelves;
- a door operating mechanism comprising:
  - a stop member movable between a first position and a second position,
  - resilient means for moving said stop member from said first position to said second position, and
  - latch means to normally maintain said stop member in said first position
- said stop member being effective to prevent closing and latching of the door of said refrigerator whenever said stop member is in said second position; and
- said force transmitting device being connected to operate said latch means whenever the dynamic weight of a child on said shelves exceeds a predetermined amount,
- whereby, said stop member is moved to said second position to prevent closing and latching of said door whenever a child is in said cabinet portion.

2. A safety arrangement in accordance with claim 1 in which:
- said cabinet portion has a flexible horizontal bottom wall, and
- said force transmitting device includes a member extending adjacent said bottom wall,
- said bottom wall being sufficiently flexible to engage said member to operate said latch means whenever a predetermined weight is on said bottom wall.

3. A safety arrangement in accordance with claim 1 in which:
- said force transmitting device is a generally vertical rigid bar.

4. In a safety arrangement to prevent trapping of a child in a chamber in a refrigerator having an opening sufficiently large to permit a child to enter said chamber, and a closure movable to substantially seal said opening, the combination comprising:
- a support in said chamber for normally supporting articles thereon;
- a restraining device operable to
  - a first condition in which said restraining device permits normal opening and closing of said chamber, with said closure, and
  - a second condition in which said restraining device prevents closing of said chamber with said closure;
- means connected between said support and said restraining device to actuate said restraining device to said second condition in response to the dynamic weight of a child on said support;
- said restraining device including a stop member movable into the path of travel of said closure to prevent closing said opening whenever said restraining device is operated to said second condition;
- lock means operative to positively prevent movement of said stop member out of the path of travel of said closure when said restraining device is operated to said second condition; and
- release means to release said lock means to permit manually resetting said restraining device to its first condition from said second condition, said release means being substantially concealed relative to the refrigerator and including a concealed tool engageable portion adapted to be manipulated by a household tool to release said lock means;
- whereby said restraining device can be reset by an adult with a household tool, but cannot usually be reset by a child unaware of the existence or location of said release means.

5. In a safety arrangement to prevent trapping of a child in the chamber of a refrigerator having an opening sufficiently large to permit a child to enter said chamber, and a closure movable to substantially seal said opening, the combination comprising:
- a support in said chamber for normally supporting articles thereon;
- a restraining device operable to
  - a first condition in which said restraining device permits opening and closing of said chamber, with said closure, and
  - a second condition in which said restraining device prevents closing of said chamber with said closure;
- means connected between said support and said restraining device to actuate said restraining device to said second condition in response to the dynamic weight of a child on said support;
- said restraining device comprising
  - a frame secured to a portion of the refrigerator,
  - a plunger movable to a first position in which said first condition is satisfied, and a second position in which said second condition is satisfied,
  - spring urged latch means to normally maintain said plunger in said first position,
  - first spring means to urge said plunger from said first position to said second position;
  - latch operating means to unlatch said latch means, said latch operating means being directly con-

nected to said means connected between said support and said restraining device,

second spring means to resist actuation of said latch operating means,

lock means to normally prevent movement of said plunger from said second position to said first position, and

release means to release said lock means, said release means being concealed relative to said refrigerator;

whereby the plunger of said restraining device is moved from said first position to said second position by said spring means when a child is in said refrigerator, and said plunger is prevented from being returned to its first position by said lock means until said lock release means is operated to permit resetting said plunger to its first position.

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