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2 Sheets-Sheet 1

Fig. 2.

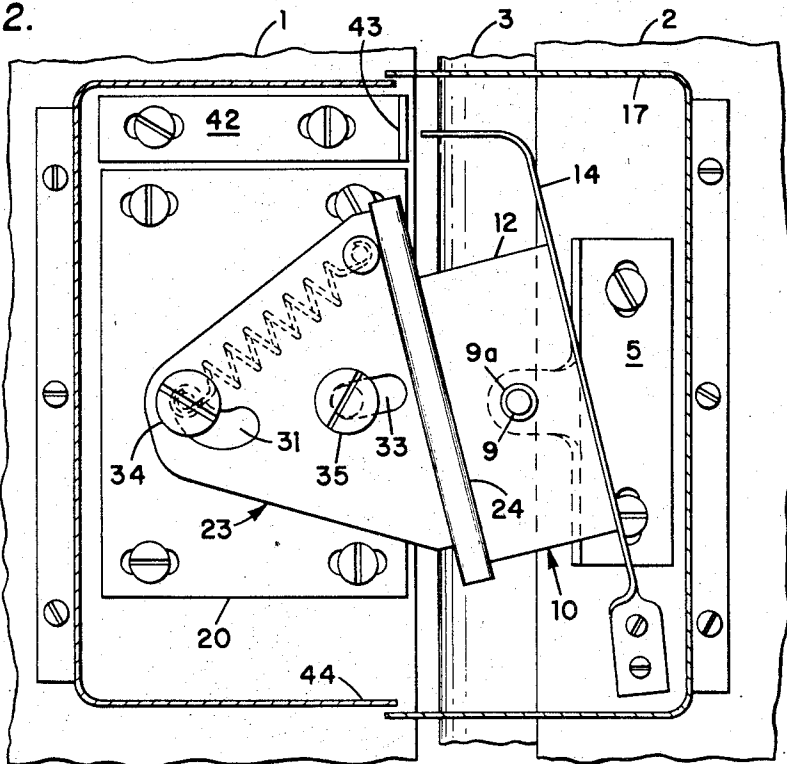
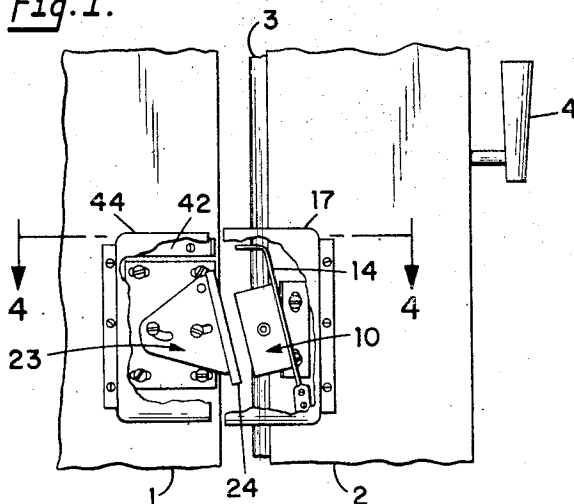


Fig. 1.



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MAGNETIC LATCH

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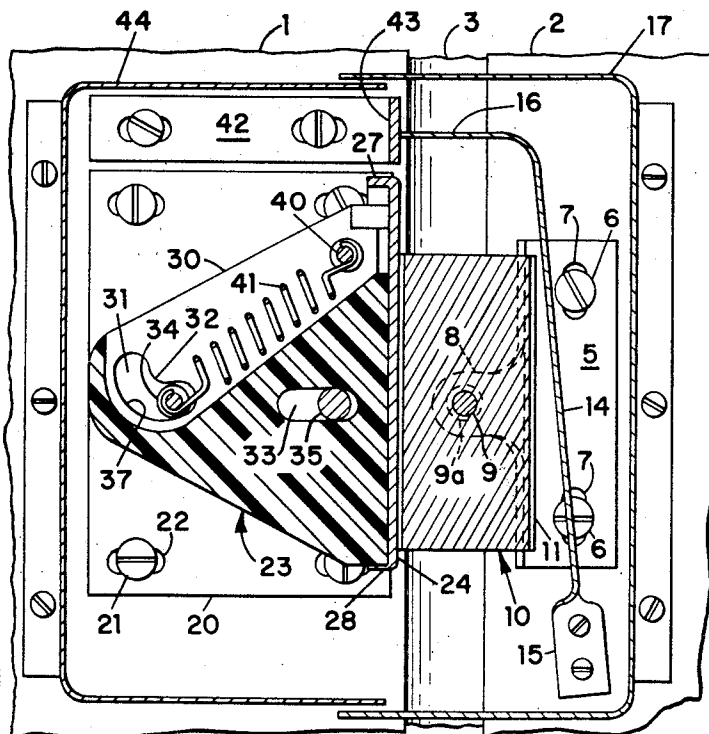


Fig. 3.

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MAGNETIC LATCH

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This invention relates to latching devices for cabinets and the like, and in particular to a magnetic latch in which the closure of the door is maintained by the attraction between magnetic elements disposed respectively on the door jamb and on the door of the cabinet.

Latches of the magnetic type have certain advantages, among which are simplicity and ease of operation. When used in connection with a refrigerator cabinet or the like, a magnetic latch may have the further important advantage of permitting the door to be opened by a rather moderate push against the inside of the door, thus making it unlikely that a child could be trapped within a refrigerator cabinet and suffocate. As is well known, a refrigerator door ordinarily carries a soft and readily deformable gasket which provides a substantially air-tight seal when the door is closed, to minimize heat loss about the periphery of the door. Present forms of magnetic latches or magnet-provided door gaskets have a disadvantage in that if the door gasket were to take a permanent set which permits leakage between the gasket and the door jamb of the cabinet, the magnetic devices have been incapable of drawing the door more tightly closed, to "take up" on the door gasket to compensate for the set or other permanent deformation thereof.

It is an object of the present invention to provide a door latch of the magnetic type in which a spring effort applied to a magnetic armature acts to draw the door to a more tightly closed position, and thus provide continuous compensation for deficiencies or irregularities in the door gasket.

It is another object of the invention to provide a magnetic latch for refrigerator cabinets or the like in which a moderate push exerted against the inside of the door will at least cause the door to assume an ajar position in which the door gasket is separated from the door jamb by a space permitting sufficient entry of fresh air into the cabinet to sustain life in a person who may be trapped therein, and also providing for the passage of sound so that the shouts or cries of the trapped person would be clearly audible.

It is a further object of the invention to provide a magnetic latch which permits the door to be moved to a partially open position without disengagement of the magnetic elements, whereupon means automatically reduce the magnetic strength to permit easy separation of the magnet elements for further movement of the door to its fully open position.

It is a further object of the invention to provide a magnetic latch construction in which the magnetic elements are completely independent of the door gasket, thereby making it unnecessary to provide special gasket constructions and special methods of installation of the gasket.

It is a still further object of the invention to provide a door latch of the magnetic type which is simple in design and may be installed in or on a cabinet by unskilled labor.

In a presently preferred form of magnetic latch embodying the invention, I mount the magnetic element on

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the cabinet door and the magnetic armature element on the cabinet itself, although this relationship could be reversed if desired, for there is no mechanical association of the magnetic latch with a knob or handle provided on the door. An important feature of the invention resides in the fact that both the magnetic element and the armature supporting means are mounted for limited movement relative to their respective cabinet components. For example, the permanent magnet element is permitted to rotate through a small arc, and the magnetic armature is carried on a movable device of non-magnetic material which is provided with spring means which will urge the armature carrier into a first position in which the armature is parallel to the door jamb and is continuously drawn toward the jamb, or into a second position in which the armature is angularly outwardly inclined therefrom. In the last-named position, the spring means has an over-center position which maintains the carrier in its inclined position. The parallel relationship of the armature and door jamb is representative of the closed door position, whereas the angular relationship is representative of the ajar and the fully open door position. When the door is closed, the permanent magnet on the door is firmly against the armature and the spring is imposing an effective closing bias against the door so as always to be drawing the door into a more tightly closed relationship. The magnetic attraction at this stage of operation, however, is stronger than the resistance of the spring, and when one exerts force on the door or on the door handle to open the door, the magnet will hold against the armature and will rotate the armature supporting means through the arc necessary to carry the spring through its overthrow point. Thus the rotation of the armature carrier to the position representing a partial opening of the door is accomplished without separation of the permanent magnet from the armature. This action is permitted by providing for displacement of the armature relative to the cabinet and the rotation of magnet relative to the door; and because the spring interposes little resistance to the partial-opening action, even a small child can move the door to the ajar position. In the circumstance of the application of the latch to a refrigerator, this partially open position would result in the separation of the door gasket from the door jamb to an extent permitting the entry of air as aforesaid. However, because of the strength of the magnetic attraction, it is desirable for easy completion of the door-opening movement that the magnetic strength be reduced. Accordingly, I provide means for short circuiting the magnetic poles as soon as the door attains the partially open or "ajar" position. The resultant reduction in magnetic attraction permits the door to be drawn to the fully open position almost without conscious effort. When the door is swung to a closed position, the magnet and the armature make complete contact while each are in their inclined positions and as the door continues to the fully closed condition, the pressure of the magnet against the armature rotates the armature carrier into the position representative of the closed-door condition. During the last stage of this operation, the short circuiting device is released from the magnetic poles so as to maintain the magnet at maximum strength.

Other features and advantages of the invention will be apparent from the following detailed description of a presently preferred embodiment thereof, read in connection with the accompanying drawings in which:

Fig. 1 is a fragmentary side elevation of a refrigerator cabinet and door showing a method of mounting the latch thereon; the door is open, and portions of the latch casing have been broken away to reveal underlying structure;

Fig. 2 is a side elevation of the latch showing the re-

spective elements in a position representative of the ajar position of the door;

Fig. 3 is a vertical sectional elevation looking in the direction of the arrows 3—3 of Fig. 4; and

Fig. 4 is a top plan view of the door latch with the cover portions thereof in section as represented by the arrows 4—4 of Fig. 1.

Although a latch embodying the invention is capable of use in normal fashion in which the respective parts are housed within the door and the door jamb of the cabinet, I have chosen to illustrate the invention as it would be when mounted externally of the cabinet. Similarly, I have chosen to illustrate the invention in its application to a refrigerator cabinet in view of the fact that the feature of the latch providing for easy opening of the door to an ajar position is particularly useful as a safety device in refrigerators. Accordingly, the refrigerator cabinet, fragmentarily shown in Fig. 1, comprises the usual cabinet portion 1 and door 2 conventionally hinged for rotation of the door about a vertical axis. In order to perfect the sealing of the door when it is in closed position, the usual gasket 3 is provided; said gasket may be in all respects conventional and applied to the door about the periphery thereof in any conventional fashion. When the door is fully closed, the gasket 3 is under compression, as suggested in Fig. 4, in which the broken line portion 3a typifies the normal projection of the gasket 3 when the door is in an open or an ajar position. The handle 4 is merely representative of any handle or other device for convenience in opening the door. It is to be understood that unlike conventional refrigerator latches, the handle 4 does not cooperate in any way with the magnetic latch embodying the present invention.

The latch embodies two cooperating structures, respectively mounted on the door and on the cabinet. Referring now to Figs. 3 and 4, the latch structure carried by the door comprises a rigid bracket 5 which may advantageously be of non-magnetic material, such as brass, fixed to the side wall of the door by means which preferably allow for at least vertical adjustment; typically, such mounting means may comprise machine screws 6 which pass through slots 7 in the base of the bracket 5. As best shown in Fig. 4, a tongue 8 of the bracket provides a base on which is pivotally mounted a permanent magnet element 10. The pivot may comprise a rivet 9 passing through a slightly oversized hole in the magnet element and preferably employing suitable bearing washers 9a so as to give the magnet element reasonable freedom to rotate in a vertical plane. The magnet element is preferably of the powerful and long lived type made of aluminum, nickel, and cobalt alloy, known in the trade as "Alnico"; and the magnet includes pole pieces 11 and 12 which may have the same rectangular shape as the body of the magnet element but are preferably slightly larger in width. The door-mounted structure further includes a magnetic short circuiting device comprising a strip 14 of spring steel fastened securely to the outside wall of the door by a broad base 15 and extending in an angular direction toward the edge of the door, as viewed in Fig. 3. The shorting device 14 is inherently biased into engagement with the magnet pole pieces. It terminates in an extension 16 which projects forwardly of the door and the gasket 3 when the door is in an open position. As later explained, when the door is closed, the shorting device 14 is separated from the magnet as the extension 16 comes to a home position. Said device covers the respective pole pieces 11 and 12 with a wide area of contact therewith when the door is in the ajar or the open position. Finally, the door-mounted structure preferably includes a stamped metal cover 17 which, as shown in Figs. 1 and 2, extends substantially forwardly of the door and gasket.

The latch structure carried by the cabinet adjacent the door jamb portion thereof includes a bracket 20 which

is preferably of non-magnetic material, mounted on the cabinet wall by means providing for lateral adjustment such as the machine screws 21 and the elongated openings 22. The bracket 20 carries a non-magnetic carrier 23 on which a magnetic armature 24 is slidably mounted. For example, the carrier 23 may be made of nylon. As best shown in Fig. 4, the armature 24 is of channel shape having re-entrant flanges 25 which are in a slidable keying relation with a flange-like member 26 of the carrier 23. Upper and lower stops 27 and 28, respectively, are formed in the armature 24 to permit a vertical sliding movement of the armature on the carrier within moderate limits, as shown by comparison of Figs. 2 and 3.

Preferably, the nylon armature carrier 23 has a pocket 30 at the base of which is an arcuate slot 31 having a very clearly defined lobe 32 intermediate the ends thereof. The carrier is further formed with an elongate slot 33. The armature carrier 23 is mounted for displacement on the bracket by means of the machine screws 34 and 35 which respectively pass through the slots 31 and 33 and are suitably secured within the side wall of the cabinet 1 as by the nuts 34a and 35a. The large flat heads of the screws 34 and 35 provide ample exterior bearing surfaces and in order similarly to provide bearing portions between the carrier 23 and the bracket 20, I prefer to employ metal washers 36, as illustrated.

It will be observed that although it cannot be said that the armature carrier 23 is truly pivotally mounted on the cabinet 1, it is nevertheless disposed on said cabinet in a manner providing for the rotation of the armature carrier in a vertical plane. This rotational movement in one direction is accomplished by drawing the armature carrier directly outwardly from the cabinet so that as the carrier moves to the right of Fig. 3, the action of the sloping bottom wall portion 37 of the arcuate slot 31 enforces a rotation of the carrier by reason of the engagement therewith of the screw 34. In its fully outwardly drawn position, the carrier will occupy the relationship to the front wall of the cabinet which is shown in Fig. 2. This outward movement of the carrier is made relatively smooth and effortless by making the respective slots 31 and 33 somewhat oversize with respect to the machine screws passing therethrough and by having the center line of the respective screws 34 and 35 coincident with the center of the rivet 9 about which the magnet element 10 may pivot.

A pin 40 passing through the pocket 30 of the carrier 23 near the upper end thereof serves as an anchor for a coil spring 41 which is secured about the machine screw 34, as indicated in Figs. 3 and 4. The particular relation of the block 23 to the screws 34 and 35 gives a toggle-like action to the spring 41; and in view of the fact that the spring cannot rotate the block 23 clockwise about the screw 34, as viewed in Fig. 3, the tension of the spring is exerted in drawing the block 23 in a leftward direction. This leftward movement is ordinarily resisted by the gasket 3; but it will be obvious that if the gasket were deformed so as no longer to have its full depth of body, the spring 40 would tend to draw the door 2 toward the door jamb portion of the cabinet to insure a tight closure of the door. The slots 31 and 33 are, therefore, made sufficiently long to provide for the expected amount of "take-up."

A stop 42 is fastened to the cabinet above the bracket 20 and arranged for longitudinal adjustment, as shown. The member 42 may advantageously be of simple angle form so as to present a wall extension 43 directly in front of the portion 16 of the short circuiting strip 14. The member 42 is adjusted relative to the end wall of the cabinet so that as the door 2 approaches its closed position—for example, when the free end of the gasket 3 is about one-quarter of an inch away from engagement with the door jamb—the end 16 of the short circuiting member strikes the wall portion 43 of bracket 42 and the strip 14 will be urged out of engagement with the

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magnet pole pieces, whereby the strip 14 will occupy the position shown in Fig. 3. The cabinet-mounted latch structure is provided with a cover portion 44 which interfits with the cover 17 when the door is in its closed position.

With the door in closed position, the magnet pole pieces 11 and 12 are in full engagement with the armature 24 which, as shown in Fig. 3, is then in a vertical position. The shorting member 14 has been separated from the pole pieces and, therefore, the full magnetic effect of the magnet element 10 is applied against the armature, whereupon the door is held securely closed. Drawing outwardly on the handle 4 enforces a rightward movement of the armature carrier 23, as viewed in Fig. 3, until the lobe 32 passes over the screw 34 and the screw 34 comes to rest in the left-hand end of the slot 31. The resulting enforced counterclockwise rotation of the carrier 23 establishes the carrier in the Fig. 2 position. The spring 41 operates in toggle fashion to maintain the carrier 23 in such position. It will be understood that the strength of the magnet element 10 is such that until it is short-circuited by the element 14, it is sufficient to overcome the tension of the spring. In view of the fact that the magnet element 10 is pivotally mounted and since the armature 24 is slidably mounted on the carrier 23, the magnet element and the armature maintain their engagement even though the carrier 23 is in its angularly displaced position. This relationship prevails until the door reaches an ajar position, which may arbitrarily be represented by the separation of the gasket 3 from the cabinet by about one-quarter of an inch. At this position, the short circuiting member 14 becomes free to engage fully with the pole pieces of the magnet, whereupon the strength of the magnet as measured with respect to its engagement with armature 24 is greatly lessened and it is possible easily to draw the door to full open position. The initial opening movement of the door to the ajar position providing the one-quarter inch air space between the gasket and the cabinet is quite easy because of the relative mobility of the latch elements, and because the spring 41 need be extended only to the amount necessary to permit the screw 34 to pass over the lobe 32. Even a child trapped within the cabinet could accomplish at least this degree of door opening.

In the fully separated position the respective latch sub-assemblies remain in the angular relationship shown in Fig. 1. The short circuiting member 14 maintains the magnet element 10 in its inclined position and the spring 41 maintains the carrier 23 in its position in which the armature 24 is parallel to the pole pieces of the magnet. When the door is swung to closed position, the magnet pole pieces and armature re-engage and the continued movement of the door will effect a rotation of the armature carrier and the magnet element into the Fig. 3 position. As the magnet element engages the armature 24, it reduces the magnetic strength relative to the short circuiting member 14, whereupon when the end 16 thereof engages the flange 43 of the bracket 42, the short circuiting element is conditioned for complete separation from the magnet as the door closes.

It will thus be seen that the magnetic latch embodying the invention provides for the use of a powerful permanent magnet in an association with a magnetic armature whereby the door is securely maintained in a closed position, but nevertheless permits the door easily to be moved to an ajar position without the necessity of breaking the magnetic engagement of the respective latch elements. The latch further provides for an automatic reduction of the attraction between the magnet element and the armature as the door is moved from its closed position through the ajar position, whereby the separation of the magnetic elements may be accomplished without conscious effort.

The illustration of the invention on a cabinet having a conventional hinged door is not intended as a limita-

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tion, for it is obvious that the latch is equally applicable to cabinets having sliding doors and the like.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the scope of the invention.

I claim:

1. A cabinet latch of the magnetic type, comprising in combination, a door-mounted structure including a permanent magnet element arranged for pivotal movement relative to said door and having pole pieces in mutually spaced parallel relation, a short circuiting member fixed to said door in alignment with said pole pieces, said short-circuiting member being arranged to bridge said pole pieces over a large area thereof when the door is in any position between a fully-opened position and an ajar position; a cabinet-mounted structure including an armature, means for mounting said armature on said cabinet for limited displacement outwardly of said cabinet, said armature-mounting means permitting engagement of said armature by said magnet pole pieces in all positions of said door between said ajar position and a fully closed position; and means for disengaging said short circuiting member from said magnet pole pieces when the door is moved from said ajar position to a closed position, whereby the magnetic engagement between said magnetic element and said armature is at maximum strength when the door is in closed position, but the door may be moved from closed position to the ajar position by reason of the displacement of said armature following which the lessened magnetic strength resulting from the bridging of the magnet pole pieces by short circuiting member permits the ready separation of the magnet element from the armature as the door continues in movement from the ajar to the full open position.

2. A cabinet latch of the magnetic type, comprising in combination, a door-mounted structure including a permanent magnet element arranged for pivotal movement relative to said door and having pole pieces in mutually spaced parallel relation, a short circuiting member of resilient magnetic material fixed to said door in alignment with said pole pieces, said short-circuiting member being inherently biased to bridge said pole pieces over a large area thereof when the door is in any position between an ajar position and a fully-open position; a cabinet-mounted structure including an armature, means for mounting said armature on said cabinet for limited displacement outwardly of said cabinet, said armature-mounting means permitting engagement of said armature by said magnet pole pieces in all positions of said door between said ajar position and a fully closed position, and means for disengaging said short circuiting member from said magnet pole pieces when the door is moved from said ajar position to a closed position, whereby the magnetic engagement between said magnetic element and said armature is at maximum when the door is in closed position, but the door may be moved from closed position to the ajar position by reason of the displacement of said armature following which the lessened magnetic strength resulting from the bridging of the magnet pole pieces by the short circuiting member permits the ready separation of the magnet element from the armature as the door continues in movement from the ajar to the full open position; and spring means disposed between said cabinet and said armature-mounting means and arranged to draw said armature-mounting means inwardly with respect to said door when said door is in closed position, thereby exerting a continuous closing effort on said door.

3. A cabinet latch of the magnetic type, comprising in combination, a door-mounted structure including a permanent magnet element arranged for movement relative to said door and having mutually spaced pole pieces, a short circuiting member of magnetic material disposed

on said door adjacent said pole pieces, means for causing said short-circuiting member to engage said pole pieces over a large area thereof when the door is in any position between an ajar position and a fully-open position; a cabinet-mounted structure including an armature, means for mounting said armature on said cabinet for displacement outwardly of said cabinet to the extent corresponding with the ajar position of the door, said armature-mounting means permitting engagement of said armature by said magnet pole pieces in all positions of said door between said ajar position and a fully closed position; a striker on said cabinet for engaging said short circuiting member to move the same away from said magnet pole pieces when the door is moved from said ajar position to a closed position, whereby the magnetic effort exerted between said magnetic element and said armature is at maximum when the door is in closed position, but the door may be moved from closed position to the ajar position by reason of the displacement of said armature following which the lessened magnetic strength resulting from the engagement of the short circuiting member with the magnet pole pieces permits the ready disengagement of the magnet element from the armature to allow the door to be drawn to full open position; and spring means effective at all relationships of the respective latch structures intermediate the ajar position and the closed-door position to urge the door continuously in a closing direction.

4. A cabinet latch of the magnetic type, comprising in combination, a door-mounted structure including a permanent magnet element having mutually spaced pole pieces, means for supporting said magnet element for limited rotation relative to said door, a magnetic member for bridging said pole pieces, means for mounting said magnetic member on said door, means for biasing said member into engagement with said pole pieces over a substantial area thereof; a cabinet-mounted structure including an armature member and means for supporting said armature member for limited rotation in the plane of rotation of said magnet element, said armature member being in the path of movement of said permanent magnet element as the cabinet door is swung to closed position and being engaged by the said pole pieces as the door reaches an ajar position; and means for moving said magnetic bridging member out of engagement with said pole pieces during the final movement of said door from its ajar position to its closed position, whereby the magnetic effort is at maximum when the door is in its closed position but is substantially reduced by the engagement of the pole pieces by the magnetic member as the door passes the ajar position in its opening movement, to thereby facilitate separation of the magnet element from the armature.

5. A cabinet latch of the magnetic type, comprising in combination, a door-mounted structure including a permanent magnet element having mutually spaced pole pieces, means for supporting said magnet element for rotation relative to said door, a magnetic member for bridging said pole pieces, means for mounting said magnetic member on said door for biasing said member into engagement with said pole pieces over a substantial area thereof; a cabinet-mounted structure including an armature and non-magnetic means for supporting said armature on said cabinet for rotative movement between a first position representative of a closed-door condition and a second position representative of an open-door condition, spring means for drawing said armature member supporting means toward said first position, said armature being in the path of movement of said permanent magnet element as the cabinet door is swung to closed position and being engaged by the said pole pieces as the door approaches the closed condition, and means for moving said magnetic bridging member out of engagement with said pole pieces during the final movement of said door to its closed condition, whereby the magnetic effort is at maximum when the door is in its closed condition but is substantially reduced by the engagement of

the pole pieces by the magnetic member as the door is moved between its closed condition and an open condition, to thereby facilitate separation of the magnet from the armature.

6. A safety latch for refrigerator cabinets and the like having a door provided with a relatively soft gasket which provides an air seal about the door jamb of the cabinet when the door is in closed position, comprising, in combination, a permanent magnet having pole-pieces in mutually spaced parallel relation, means for pivotally mounting said magnet on said door, a magnetic armature, a non-magnetic carrier for said armature, means for mounting said carrier for movement between a position representative of a fully closed condition of said door and a position in which the armature is disposed forwardly of said door jamb for engagement by said magnet pole pieces when the door attains a partially closed position characterised by a free space between said gasket and said door jamb sufficient to admit air into said cabinet in quantities to support life, said armature being slidably mounted on said carrier for accommodating the relative displacement of said carrier and said magnet as the door moves from said position to the fully closed position, a magnetic short-circuiting element mounted on said door, said short-circuiting element being self-biased for engagement with the magnet pole pieces over a substantial area thereof when the door is in its said partially open position or any more-open position, means engaging with said short-circuiting element when the door is in closed position to maintain said element out of engagement with said pole pieces, whereby the magnetic attraction between the magnet and the armature is then at maximum strength, and spring means effective when the door is in closed position to urge said armature carrier in a direction maintaining said gasket under continuous compression, the effective strength of said spring means being then less than the strength of magnetic attraction between said magnet and said armature, whereby said door may be moved from the closed position to said partially-open position without separation of said magnet from said armature but the lessened strength of magnetic attraction then resulting from the short-circuiting of said pole pieces will thereafter readily permit such separation.

7. A safety latch according to claim 6, in which the armature carrier has a detent position for releasably maintaining the carrier in its said position in which the armature is disposed forwardly of the door jamb.

8. A safety latch according to claim 6, in which the armature carrier is mounted for rotation relative to said cabinet and as the door is moved from closed to open position the said carrier rotates to dispose the armature in an angular relation to said door jamb, said carrier having detent means maintaining that angular relation as the magnet separates from said armature, and the engagement of said magnetic pole pieces by said magnet short-circuiting element maintains the magnet pole pieces in parallel relation to said armature.

9. A safety latch according to claim 6, in which the respective mounting means for said magnet and said armature carrier permit vertical and horizontal adjustment of the elements relative to each other.

10. A safety latch according to claim 6, in which the short-circuiting element engaging means comprises a bracket mounted on said cabinet and against which bracket a projecting member of said short-circuiting element strikes as the door nears its closed position.

11. A safety latch for a refrigerator cabinet, comprising a first magnetic latching element, means for mounting the same on a door of the cabinet, a second magnetic latching element, means for mounting the same on a wall of the cabinet, the respective mounting means providing for establishment of full face-to-face magnetic engagement of the respective elements at maximum magnetic attraction at all times between a fully closed position of

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said door and a predetermined partially open position sufficient to admit external air into said cabinet to maintain human life therein, said mounting means providing for the opening of said door by a push from the inside thereof without manual operation of any of said latching elements, a magnetic flux-density control member mounted on said cabinet structure for movement relative to one of said magnetic latching elements, means for biasing said control member to engage with said one magnetic latching element to substantially reduce the magnetic attraction between the respective magnetic latching ele-

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ments, and means effective as said door traverses said predetermined partially open position during movement in a closing direction to mechanically disengage said flux control member from said magnetic latching element to restore the maximum magnetic holding power thereof.

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