

Nov. 12, 1957

J. B. HORVAY

2,812,965

MAGNETIC LATCH

Filed Oct. 12, 1956

FIG. 1

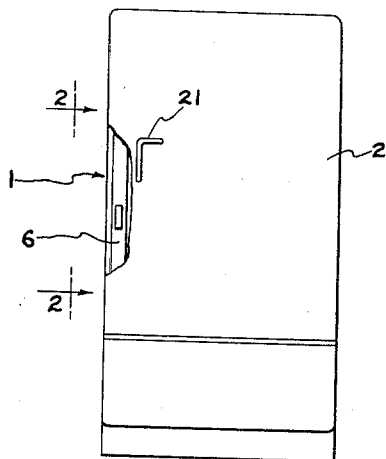


FIG. 2

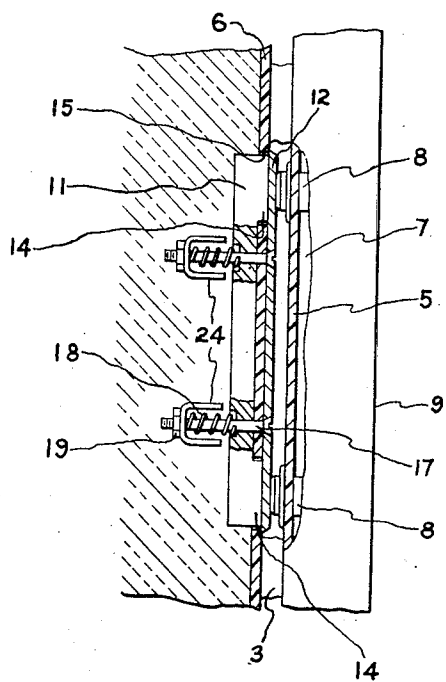
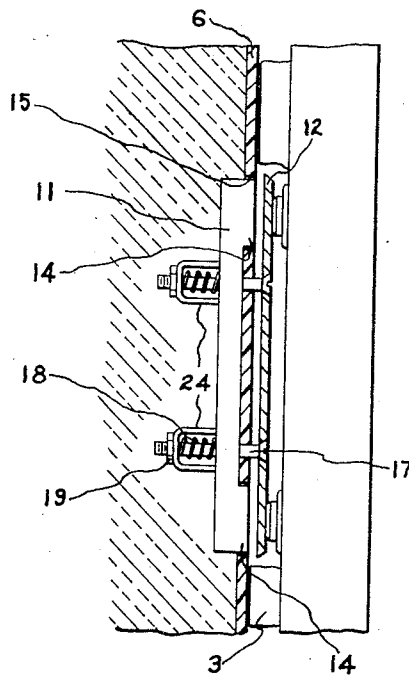


FIG. 3



INVENTOR.
JULIUS B. HORVAY

BY *Walter E. Fule*

HIS ATTORNEY

1

2,812,965

MAGNETIC LATCH

Julius B. Horvay, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Application October 12, 1956, Serial No. 615,534

4 Claims. (Cl. 292—251.5)

The present invention relates to a magnetic latch and is more particularly concerned with a magnetic latch for refrigerators and similar appliances.

In order to provide the proper sealing of refrigerator and freezer doors, particularly doors of a relatively large size and weight, it is necessary to employ strong or powerful latches. However, in the use of ordinary magnetic latches for this purpose, the opening force that must be applied to open such doors against the magnetic forces may be uncomfortably large from the user's standpoint.

Furthermore with ordinary magnetic latches, the force of attraction between the magnet and the keeper or armature decreases rapidly with the distance between the magnet and the armature or keeper.

It is therefore a primary object of the present invention to provide a magnetic latch having a high latching force or strength, which latch includes means for limiting the maximum force necessary to open the latched door.

Another object of the invention is to provide an improved magnetic latch including a keeper or armature assembly providing a high latching force when in contact with a cooperating permanent magnet and means to limit the total force necessary to overcome the magnetic attraction of the magnet for the armature assembly during opening of a door equipped with such latch.

Another object of the invention is to provide an improved magnetic latch including a keeper or armature assembly providing a high latching force when in contact with a cooperating permanent magnet and means to extend this latching force over a much longer distance than the corresponding latching force extends for ordinary magnetic latches.

A further and more specific object of the invention is to provide a low cost, effective permanent magnet latch including a keeper or armature assembly for limiting the unlatching force, the armature assembly being of a construction such that it can readily be mounted on a cabinet or door member.

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

In carrying out the objects of the present invention, there is provided a magnetic latch including a magnet, preferably of the permanent type, and a cooperating armature or keeper assembly designed to materially reduce the force required to open the magnetic latch. The latch includes a magnet adapted to be mounted on either a door or a cabinet member with the poles thereof extending towards the other of these members on which is mounted the improved armature assembly of the present invention. The armature assembly comprises a fixed armature including portions disposed opposite the poles of the magnet and a movable armature overlying these portions of the fixed armature so that in normal operation of the latch the magnet poles are in actual contact

2

with the movable armature. The movable armature is of the saturating type, that is, is of such construction and material that it cannot accept the entire magnetic flux of the magnet. Spring means are employed for biasing the movable armature into engagement with the fixed armature so that when the latch is in its latching position the two armatures accept the entire magnetic flux from the magnet and together comprise a non-saturating armature structure or assembly. When the two armatures are in contact, the biasing force of the spring is substantially less than the force of attraction between the movable armature and the magnet. By this arrangement, while the entire armature assembly is available to provide a high latching force, the arrangement of the saturating movable armature and its biasing spring means decreases the maximum unlatching force by providing a two-step opening or unlatching operation; the first step being the breaking of the magnetic contact between the permanent magnet and the fixed armature with the permanent magnet retaining contact with the movable armature against the biasing action of the spring means and the second step, the breaking of the magnetic attraction between the movable armature and the magnet component whereupon the spring means returns the movable armature to its normal position in contact with the fixed armature. In a preferred embodiment of the invention, the spring means and the guide or supporting means for the movable armature comprise the principal elements required to hold or support the armature assembly on the supporting cabinet or door member.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is a general view of a refrigerator including a magnetic latch of the present invention;

Fig. 2 is a partial, sectional view along line 2—2 of Fig. 1 illustrating one embodiment of the present invention with the door in a closed position relative to the cabinet; and

Fig. 3 is a view similar to Fig. 2 showing the door in a partially open position.

Referring to the drawing, Fig. 1 illustrates a refrigerator including a cabinet 1, the access opening to which is closed by a door 2. The door is suitably mounted on the cabinet by means of hinges (not shown) and in the region of the access opening to the cabinet there is provided a gasket 3 (Fig. 2) which entirely encircles the access opening and seals the space between the cabinet and the door.

Both the cabinet and the door are double-walled structures or in other words comprise spaced wall portions or panels at least a portion of which are composed of a plastic material having good heat insulating properties, such materials also having good non-magnetic properties. In the embodiment shown, the inner panel or wall of the door indicated by the numeral 5 is composed of a sheet of plastic material as is also the breaker strip 6 which forms a heat barrier between the inner and outer walls of the cabinet 1. These panel components of the refrigerator cabinet and door provide suitable non-magnetic areas for the mounting of the magnetic latch.

The magnetic latch of the present invention which is designed to hold the door in its closed position and to compress the gasket into sealing relationship with the cabinet comprises magnet means secured either to the door or to the cabinet member of the refrigerator and an armature assembly secured to the other of these members. In the embodiment shown, the magnet means is secured to the door and comprises a permanent magnet 7 and pole pieces 8 mounted on the inner door panel 5 and disposed between this panel and the outer wall 9 of the door. The poles 8 extend through the inner door panel

5 opposite the breaker panel or strip 6 when the door is in a closed position. The magnet 7 is selected to have a sufficient magnetic attraction for an unsaturated keeper or armature structure to hold the door in a gasket sealing position, the minimum strength of the magnet depending on the force necessary to compress the gasket into sealing relationship with the cabinet base and the size or weight of the door itself. In other words at zero air gap conditions between an unsaturated armature and the permanent magnet component, the attractive force of the magnet for the unsaturated armature must be sufficient to provide the above-described conditions.

Magnetic latches of the strength sufficient to supply the forces necessary to compress the sealing gasket and hold a relatively heavy door in closed position relative to a cabinet member have a magnetic pull when the magnet element is in contact with the cooperating unsaturated armature so high that the application of an uncomfortably large force might be necessary to open the door during normal use of the refrigerator depending on the particular alignment between the cabinet and the door and the softness of the particular door gasket used. Furthermore, even if the opening force is not uncomfortably large at the time of the assembly of the cabinet, it might become so at some later date due to the change in alignment between the door and the cabinet or due to the change of compression of the door gasket due to aging and/or setting. The present invention provides a new and improved armature assembly of simple and compact design which solves this unlatching problem. More specifically there is provided as shown in Figs. 2 and 3 of the drawing an armature assembly comprising a fixed armature 11 and a movable armature 12. The movable armature 12 is normally held in direct contact with the fixed armature 11 when the door is in a closed position so that the two armatures cooperate to form an unsaturated armature or keeper structure. However, by providing for limited movement of the movable armature and by an arrangement in which this movable armature is the only armature component actually contacted by the magnet means when the door is in a closed position, the maximum pull which must be applied at any given instant to open the door is materially reduced.

The armature structure as is more particularly shown in Figs. 2 and 3 of the drawing is mounted on the breaker strip or panel portions 6 forming part of the cabinet face and the fixed armature 11 is positioned behind this breaker strip 6 or in other words within the space between the inner and outer walls of the cabinet. The armature 11 for the most part is in contact with the inner surface of the breaker strip 6 and includes at the opposite ends thereof legs 14 extending through apertures 15 provided in the breaker strip 6. Preferably the forward ends of the legs 14 are flush with the front surface of the breaker strip 6. These forward surface portions of the legs 15 are also in line with the poles 8 of the magnet when the door is in its closed position.

Overlying the forward surface portions of the legs 14 and preferably also covering the apertures 15 is the movable armature 12. Thus, the movable armature 12 is interposed between the fixed armature 11 and the pole pieces 8. To provide for limited movement of the movable armature 12 relative to the fixed armature 11 in a direction perpendicular to the cabinet face or in other words in a direction in line with the movement of the pole pieces 8 when the door is opened, the movable armature 12 is supported on the cabinet face by fastening means in the form of bolts 17 extending through suitable apertures in the breaker strip 6 and the fixed keeper or armature 11. Preferably two of these bolts 17 are employed for proper alignment of the movable armature 12. For maintaining the movable armature in contact with the fixed armature under normal conditions there are provided spring means 18 carried by the bolts 17 rearwardly

of the fixed armature 11. These compression springs bear against the fixed armature 11 and against nuts 19 threaded onto the rear or tip of the bolts 17.

By this construction, it will be seen that when the door is opened or in other words moved from the position shown in Fig. 2 to the position shown in Fig. 3 the movable armature 12, subject to the biasing action of the springs 18 is free to move away from the fixed armature and travel along with and in contact with the poles 8. Hence the initial pull which need be applied to the handle 21 provided on the door 2 is limited to that necessary to break the attractive forces between the permanent magnet component and the fixed armature 11 plus any resistance offered by the springs 18. Since the principal function of the springs 18 is to return the movable armature 12 to its normal position in contact with the fixed armature 11, this biasing action of the springs can be made quite small. In any event by employing a saturating movable keeper 12, that is an armature component which cannot accept the full magnetic flux of the magnet assembly, the force initially required to open the door can be made materially less than that which would be required to release the permanent magnet component from an unsaturated keeper.

For example, by employing a movable armature 12 which is capable of accepting about 30% of the total magnetic flux of magnet 7, the pull on handle 21 required to initiate the door opening will be the force necessary to overcome the force resulting from the remaining 70% of the total flux passing through the fixed armature 11. This force will be about 1/2 of that required to release the same magnet from an unsaturated keeper structure due to the square relationship between flux density and magnetic pull.

After the attraction forces between the magnet component and fixed armature 11 are broken, or in other words, after the saturated movable armature 12 becomes separated from fixed armature 11, the latching force between the door and the case will stay approximately the same over a relatively long distance of door travel. This is due to the continuous magnetic attraction between the permanent magnet component and movable armature 12 and to the combined effect of diminishing forces of attraction between the permanent magnet component and fixed armature 11 and the increasing forces due to the change in compression of springs 18. This is in contrast to the action of ordinary magnetic latches where the latching force between the door and the case will drop very rapidly as soon as an air gap is introduced between the magnet member and the keeper; thus the improved magnetic latch of this invention has significantly different and for some applications, much more desirable pull characteristics than ordinary magnetic latches.

The continued movement of the door 2 towards an open position causes the stops 24 carried by the bolts 17 to come in contact with the fixed armature 11 thereby preventing further travel of the movable armature 12 relative to the fixed armature or to the cabinet 1. At this point, continued application of an opening force to the handle 21 causes the separation of the movable armature 12 from the magnet means mounted on the door 2 and this force again is less than that required to separate the same permanent magnet means from an unsaturated keeper. As soon as the movable armature 12 is released by the magnet means, the springs 18 return the movable armature 12 into contact with the exposed surface portions of the fixed armature 11 where it remains until the door is again opened.

The action of the latch during closing of the door will depend upon a number of factors including the speed at which the door is being closed, the rate of compression of the gasket, the biasing force of the spring, and the forces of attraction between the movable armature and the magnet. Under some conditions, as when the door is closed slowly against a relatively stiff gasket and the

spring has a relatively low biasing force, the movable armature 12 moves away from fixed armature 11 and makes contact with the permanent magnet component in the instant when the forces of attraction between the magnet component and the movable armature 12 overcome the combined forces of springs 18 and the friction and inertia in the keeper assembly. Under the reverse conditions, the movable armature 12 might not move away from fixed armature 11 at all during the closing of the door. Obviously, for certain applications, it might be desirable to select the components in such a manner that the movable armature will move away from the fixed armature when there is still considerable distance between the door and the case.

In addition to providing means for limiting the maximum pull necessary to open the door against the magnetic attractive forces of the latch assembly, the armature structure of the present invention also possesses a number of advantages from the assembly standpoint. Except for the legs 14 of the fixed armature 11 which extend through the apertures 15 and provide some degree of vertical support for the armature assembly, it will be noted that the entire armature assembly is supported or mounted on and fastened to the breaker strip 6 by means of the same elements which provide for limited movement and return of the movable armature 12. In the mounting of the armature assembly on this breaker strip 6, only a few simple operational steps are required. First, the fixed armature 11 is positioned within the aperture 15 after which the movable armature with the bolts 17 carried thereby is placed on the front of the breaker strip 6 and the bolt threaded through the holes provided therefore in the breaker strip 6 and the fixed armature 11. The springs 18 are then threaded onto the bolts 17 followed by the stops 24 and the nuts 19. The nuts 19 are threaded onto the bolt a distance sufficient to compress slightly the springs 18 as only a slight pressure is required to hold the armature assembly in operative position on the breaker strip 6 and to return the movable armature from the advanced position shown in Fig. 3 to its normal position shown in Fig. 2. The resultant structure, particularly when the movable armature 12 also completely covers the apertures 15, presents a neat and attractive appearance.

While a specific embodiment of the present invention has been shown and described, it is to be understood that the invention is not limited thereto but it is intended by the appended claims to cover all such modifications and changes as fall within the true spirit and scope of the invention.

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

1. A magnetic latch for holding a door member in closing relation relative to a cabinet member comprising a permanent magnet adapted to be mounted on one of said members with the poles thereof extending towards the other of said members, an armature assembly adapted to be mounted on the other of said members and com-

prising a fixed armature having portions thereof disposed opposite said poles, a saturating movable armature overlying said portions of said fixed armature and spring means normally biasing said movable armature in engagement with said fixed armature, said armatures together forming a non-saturating keeper structure.

2. The latch of claim 1 in which the movable armature can accept about one-third the total magnetic flux of said magnet.

3. A magnetic latch for holding a door member in closing relation relative to a cabinet member comprising a permanent magnet adapted to be mounted on one of said members with the poles thereof extending towards the other of said members, an armature assembly adapted to be mounted on the other of said members and comprising a fixed armature having portions thereof disposed opposite said poles, a saturating movable armature overlying said portions of said fixed armature and contacted by said poles when the door is closed, and spring means normally biasing said movable armature in engagement with said fixed armature, said armatures together forming a non-saturating keeper structure, the biasing force of said spring means being less than the force of attraction between said saturating movable armature and said magnet when said armatures are in engagement with one another, and stop means for limiting movement of said movable armature away from said fixed armature.

4. A magnetic latch for holding a door member in closing relation relative to a cabinet member comprising a permanent magnet adapted to be mounted on one of said members with the poles thereof extending towards the other of said members, an armature assembly adapted to be mounted on the other of said members and comprising a fixed armature having portions thereof disposed opposite said poles, a saturating movable armature overlying said portions of said fixed armature and contacted by said poles when the door member is closed, means supporting said movable armature in operative position relative to said fixed armature, said supporting means engaging said movable armature and including a portion disposed on the opposite side of said fixed armature from said movable armature, spring means engaging said portion of said supporting means and said fixed armature for normally biasing said movable armature in engagement with said fixed armature, said armatures together forming a non-saturating keeper structure, the biasing force of said spring means with the door in the closed position being less than the force of attraction between said saturating movable armature and said magnet.

References Cited in the file of this patent

UNITED STATES PATENTS

2,252,144 Taylor et al. Aug. 12, 1941

FOREIGN PATENTS

730,956 Great Britain June 1, 1955