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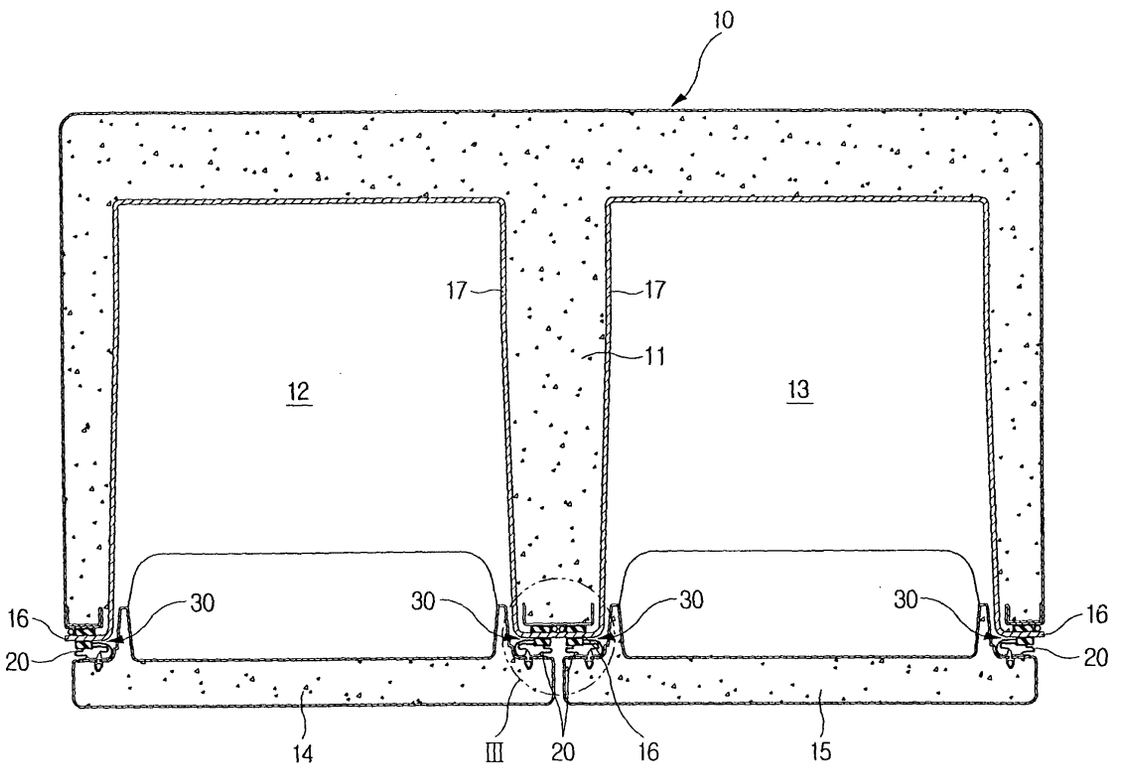
(54) A refrigerator having storage chambers

(57) A refrigerator including a door (14,15), a gasket (20), first and second magnets (31,32), and at least one shield member (33). The door (14,15) is attached to a body (10) which selectively opens and closes a storage chamber. The gasket (20) is arranged along an inside surface of the door (14,15) to maintain airtightness of the storage chamber. The first magnet (31) is contained in the gasket (20). The second magnet (32) is embedded inside a front (16) of the body (10) to face the first magnet (31). The shield member (33) blocks surfaces of one of the first and second magnets (31,32) not facing a remaining magnet (32,31).

FIG. 2



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Description

[0001] The present invention relates generally to refrigerators, and more particularly, though not exclusively, to a refrigerator in which the structure of magnets, which are disposed in both a door and a body to maintain airtightness of a storage chamber, respectively, is improved.

[0002] Generally, a refrigerator is an apparatus that provides cold air generated in an evaporator to a storage chamber to maintain various foods in a fresh condition. The storage chamber is selectively opened and closed by a door, and an airtight device is generally provided between a refrigerator body and the door to maintain airtightness of the storage chamber when the door is closed.

[0003] An airtight device may be exemplified by a gasket that is arranged along a circumferential edge of the inside surface of the door containing a magnet. The gasket causes the storage chamber to be airtight as the magnet contained in the gasket adheres to the front of the steel refrigerator body when the door is closed. Where a body of a refrigerator is made of a non-magnetic substance, such as synthetic resin, like a refrigerator disclosed in Korean Unexamined Pat. Pub. No. 2001-0113245, a magnetic substance, such as a steel plate, or magnet is embedded inside a front of the refrigerator body to allow the magnet contained in the gasket arranged on the door to adhere to the refrigerator body.

[0004] However, in the refrigerator having a front made of resin, the magnetic substance or magnet is embedded in the front of the refrigerator body, but the front of the refrigerator body made of resin is interposed between the magnet contained in the gasket and the magnetic substance or magnet embedded in the refrigerator body. Thus, an attractive force between the magnet and the magnetic substance or magnet is weak. Therefore, it is difficult to maintain the airtightness of the storage chamber. There is a scheme in which the width of the magnet contained in the gasket or the magnetic substance or magnet embedded inside the front of the refrigerator body is widened to overcome the problem of the weak attractive force. However, this scheme causes difficulty in the manufacture of the refrigerator and incurs excessive manufacturing costs.

[0005] Furthermore, when a magnet is embedded inside the front of the refrigerator body, the magnet must be embedded at a correct position corresponding to that of the magnet contained in the gasket. When a foam insulating material is injected into the refrigerator body during the manufacture of the refrigerator, the magnet may be pushed by the pressure of the foam insulating material and removed from an initial correct position. Some amount of repulsive force may be generated between the magnet embedded inside the front of the refrigerator body and the magnet contained in the gasket, so poor airtightness of the storage chamber may result.

[0006] Accordingly, it is an aim of preferred embodiments of the present invention to provide a refrigerator having an increased attractive force between a door-side magnet and a body-side magnet without increasing the sizes of the two magnets. A further aim of preferred embodiments of this invention to provide an attractive force even though the two magnets are offset from each other, thus preventing poor airtightness of the storage chamber.

[0007] According to the present invention in a first aspect there is provided a refrigerator, comprising a door attached to a body and which selectively opens and closes a storage chamber, a gasket along an inside surface of the door which maintains airtightness of the storage chamber, a first magnet in the gasket, a second magnet inside a front of the body facing the first magnet, and at least one shield member blocking surfaces of at least one of the first and second magnets not facing a remaining magnet.

[0008] In an embodiment of the invention, the shield member may be a metallic plate surrounding the remaining surfaces of the one magnet not facing the remaining magnet.

[0009] In an embodiment of the invention, the shield member blocks surfaces of the second magnet.

[0010] In an embodiment of the invention, the shield member blocks the north pole of the one magnet.

[0011] In an embodiment of the invention, the front of the body may be a non-magnetic substance.

[0012] According to the present invention in a second aspect, there is provided A refrigerator having an improved magnetic seal between a refrigerator door and a refrigerator body, comprising: the body; the door, having a gasket along an inside surface, which moves between an open and a closed position relative to the body; first and second magnets, within the gasket and a front of the body, respectively, which are attractive when the door is closed; and at least one shield member blocking surfaces of at least one of the first and second magnets not facing the other magnet.

[0013] According to the present invention in a third aspect, there is provided A refrigerator having an improved magnetic seal between a refrigerator door and a refrigerator body, comprising: a body; a door, having a gasket along an inside surface, and which moves between an open and a closed position relative to the body; first and second magnets, within the gasket and a front of the body, which are attractive when the door is closed; and at least one shield member, wherein the shield member blocks lines of magnetic force extending from at least one magnet which are substantially repulsive to the other magnet.

[0014] According to the present invention in a fourth aspect, there is provided A refrigerator having a storage chamber with improved airtightness, comprising: a refrigerator body, including the storage chamber, coupled to a cooling system; a door to move between open and closed positions relative to the storage chamber, re-

spectively; first and second magnets in the body and the door, respectively, providing an airtight seal between the body and the door; and at least one shield member blocking surfaces of at least one of the first and second magnets which are not facing the other magnet.

[0015] According to the present invention in a fifth aspect, there is provided A refrigerator having a storage chamber with improved airtightness, comprising: a refrigerator body, including the storage chamber, coupled to a cooling system; a door able to occupy an open and a closed position relative to the storage chamber; first and second magnets in the body and the door, respectively, providing an airtight seal between the body and the door; and at least one shield member, wherein the shield member blocks lines of magnetic force extending from at least one magnet which are repulsive to the other magnet.

[0016] Further features of the present invention are set out in the appended claims.

[0017] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiments, by way of example only, taken in conjunction with the accompanying drawings of which:

Figure 1 is a perspective view showing an appearance of a refrigerator, according to the present invention;

Figure 2 is a cross section of the refrigerator of Figure 1;

Figure 3 is a detailed view of a portion of Figure 2;

Figure 4 is a sectional view of an airtight device of the refrigerator according to one embodiment of the present invention, showing an arrangement of magnets;

Figure 5 is a view showing lines of magnetic force formed around a second magnet of the refrigerator of the present invention;

Figure 6 is a view showing lines of magnetic force formed around a general magnet;

Figure 7 is a sectional view of an airtight device of the refrigerator with the second magnet offset from an appropriate position;

Figure 8 is a sectional view of an airtight device of the refrigerator according to another embodiment of the present invention with a shield member attached to a first magnet; and

Figure 9 is a sectional view of an airtight device of the refrigerator according to another embodiment of the present invention with shield members attached to the first and second magnets.

[0018] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0019] As illustrated in Figures 1 and 2, a refrigerator of an embodiment of the present invention is constructed so that a storage chamber defined inside a body 10 of the refrigerator is divided by a central partition 11 into a freezer compartment 12 on the left and a refrigerator compartment 13 on the right. Further, a freezer compartment door 14 and a refrigerator compartment door 15 are situated in front of the freezer compartment 12 and in front of the refrigerator compartment 13, respectively. Both the freezer compartment door 14 and the refrigerator compartment door may occupy open 1 and closed 2 positions.

[0020] Gaskets 20 are arranged along circumferential edges of inside surfaces of the doors 14 and 15, which are used to selectively open and close the freezer compartment 12 and the refrigerator compartment 13, respectively, to maintain airtightness of the freezer compartment 12 and the refrigerator compartment 13.

[0021] A front 16 of the body 10 that comes into contact with the gaskets 20 is integrated with two inner casings 17 into a single body through a resin forming process. This construction of the front 16 of the body 10 provides the front 16 of the body 10 with a pleasant appearance and reduces manufacturing costs by allowing the two inner casings 17 of the freezer compartment 12 and the refrigerator compartment 13 to be integrally fabricated.

[0022] An airtight device 30 provided on the gaskets 20 and the front 16 of the body 10, as illustrated in Figures 3 and 4, includes first magnets 31 contained in the gaskets 20 and second magnets 32 embedded inside the front 16 of the body 10 to face the first magnets 31, respectively. The first magnets 31 are arranged to face the second magnets 32, with opposite poles thereof facing each other. This creates an attractive force between the first and second magnets 31 and 32 (see Figure 4). The construction takes into account the fact that the front 16 of the body 10 is made of resin that is a non-magnetic substance. In this case, the airtightness of the freezer compartment 12 and the refrigerator compartment 13 is maintained by an attractive force between the first magnet 31 contained in the gaskets 20 and the magnets 32 embedded in the front 16 of the body 10.

[0023] A shield member 33 is attached to each of the second magnets 32 embedded in the front 16 of the body 10 so that side surfaces and a rear surface of the second magnet 32 are covered to enhance the attractive force between the first and second magnets 31 and 32. A front surface of the second magnet 32 facing each of

the first magnets 31 is uncovered. The shield member 33 is formed of a metallic plate made of a magnetic substance, and is positioned in tight contact with inside surfaces of the second magnet 32 to surround the three surfaces of the second magnet 32. This construction, as depicted in Figure 5, causes lines of magnetic force extending from a north pole to a south pole of the second magnet 32 to be blocked by the shield member 33 and be prevented from leaking through the inside surfaces of the magnet 32 . Therefore, the flux density of the lines of magnetic force is increased in an area between the first and second magnets 31 and 32, thus increasing the attractive force between the first and second magnets 31 and 32.

[0024] The effect obtained by the shield member 33 can be easily appreciated by comparing lines of magnetic force around a magnet without the shield member 33 shown in Figure 6 with lines of magnetic force around the second magnet 32 with the shield member 33 shown in Figure 5. As shown in Figure 6, in the case of the magnet without the shield member 33, the lines of magnetic force extending from a north pole to a south pole of the magnet are distributed around the magnet. Thus, the effective distance L of the magnetic force contributing to actual attractive force between the first and second magnets 31 and 32 is short.

[0025] In contrast, as shown in Figure 5, in the case of the second magnet 32 with the shield member 33, the lines of magnetic force extending from a north pole to a south pole of the second magnet 32 are blocked by the shield member 33 and, therefore, most lines of the magnetic force are directed through the open front surface of the second magnet 32. Thus, the effective distance L' of the magnetic force contributing to actual attractive force between the first and second magnets 31 and 32 is lengthened. That is, in the present invention, the effective distance L' of the magnetic force in a direction from the second magnet 32 to the first magnet 31 is increased and the attractive force between the first and second magnets 31 and 32 is increased thereby causing the gasket 20 to be brought into tight contact with the front 16 of the body 10 and, therefore, securely maintaining the airtightness of each of the compartments 12 and 13.

[0026] Further, as illustrated in Figure 7, in accordance with an embodiment of the present invention, even when the second magnet 32 positioned inside the front 16 of the body 10 is pushed by the foam insulating material formed in the body 10 and somewhat setoff from a position corresponding to that of the first magnet 31, repulsive force is not generated between the first and second magnets 31 and 32 and, therefore, the first and second magnets 31 and 32 effectively adhere to each other. This is because lines of magnetic force extending through both sides of the second magnet 32, which may contribute to the repulsive force, are blocked by the shield member 33 and accordingly do not affect the first magnet 31. As a consequence, the construction of this embodiment of the present invention can suppress a repulsive force between the first and second magnets 31 and 32 even though the second magnet 32 embedded in the body 10 is somewhat offset from an appropriate position thereof during the manufacture of the refrigerator, thus preventing poor airtightness of the compartment.

[0027] Figure 8 is a sectional view showing a refrigerator according to another embodiment of the present invention, in which a shield member 34 is attached to inside surfaces of the first magnet 31. Figure 9 is a sectional view showing a refrigerator according to another embodiment of the present invention, in which shield members 33 and 34 are attached to inside surfaces of the first magnet 31 and outside surfaces of the second magnet 32, respectively. The effects of these aforementioned refrigerators are similar to that of the refrigerator of the first embodiment.

[0028] As described above in detail, the refrigerator of preferred embodiments of the present invention can increase attractive force between the first and second magnets by the attachment of at least one shield member to at least one of the first and second magnets, so the refrigerator can maintain the secure airtightness of the compartment of the refrigerator.

[0029] Additionally, the refrigerator of preferred embodiments of the present invention can block remaining lines of magnetic force except for lines of magnetic force contributing to an attractive force between the two magnets, so proper attractive force can be maintained between the two magnets even though the magnets are offset from each other during the manufacture of the refrigerator, thus preventing poor airtightness of the refrigerator.

[0030] Preferred embodiments of the present invention encompass a method for increasing the attractive force between a door 14 and15 and a refrigerator body 10. The first and second steps comprise installing magnets 31 and 32 in the gasket 20 and the front 16 of the body 10. This creates an attraction between the magnets 31 and 32 when the doors 14 and 15 are closed. A shield member 33 is provided to at least one of the magnets 31 and 32 along surfaces of the magnet not facing the other magnet

[0031] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents. It is also understood that the advantages found in this invention have applications in technologies outside that which has been discussed above.

[0032] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents

are incorporated herein by reference.

[0033] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0034] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0035] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A refrigerator, comprising:

a door (14,15) attached to a body (10) and which selectively opens and closes a storage chamber;

a gasket (20) along an inside surface of the door (14,15) which maintains airtightness of the storage chamber;

a first magnet (31) in the gasket (20);

a second magnet (32) inside a front (16) of the body (10) to face the first magnet (31); and

at least one shield member (33) blocking surfaces of at least one of the first and second magnets (31,32) not facing the other magnet (32,31).

2. The refrigerator as set forth in claim 1, wherein the shield member (33) is a metallic plate surrounding surfaces of the one magnet (31,32) not facing the remaining magnet (32,31).

3. The refrigerator as set forth in claim 1 or claim 2, wherein the shield member (33) blocks surfaces of the second magnet (32).

4. The refrigerator as set forth in any preceding claim, wherein the shield member (33) blocks the north pole of the one magnet (31,32).

5. The refrigerator as set forth in claim 1, wherein the front (16) of the body (10) is a non-magnetic substance.

6. A refrigerator having a magnetic seal between a refrigerator door (14,15) and a refrigerator body (10), comprising:

the body (10);

the door (14,15), having a gasket (20) along an inside surface, which moves between an open and a closed position relative to the body (10);

first and second magnets (31,32), within the gasket (20) and a front (16) of the body (10), respectively, which are attractive when the door (14,15) is closed; and

at least one shield member (33) blocking surfaces of at least one of the first and second magnets (31,32) not facing the other magnet (32,31).

7. The refrigerator as set forth in claim 6, wherein the shield member (33) is a metallic plate.

8. The refrigerator as set forth in claim 6 or claim 7, wherein at least two shield members (33) block surfaces of the first and second magnets (31,32).

9. The refrigerator as set forth in any one of claims 6-8, wherein the south pole of the first magnet (31) faces the north pole of the second magnet (32).

10. The refrigerator as set forth in any one of claims 6-9, wherein the north pole of the first magnet (31) faces the south pole of the second magnet (32).

11. The refrigerator as set forth in any one of claims 6-10, wherein the front (16) of the body (10) is a non-magnetic substance.

12. A refrigerator having a magnetic seal between a refrigerator door (14,15) and a refrigerator body (10), comprising:

a body (10);

a door (14,15), having a gasket (20) along an inside surface, and which moves between an open and a closed position relative to the body (10);

first and second magnets (31,32), within the gasket (20) and a front (16) of the body (10), which are attractive when the door (14,15) is closed; and

at least one shield member (33), wherein the shield member (33) blocks lines of magnetic force extending from at least one magnet (31,32) which are substantially repulsive to the other magnet (32,31).

13. The refrigerator as set forth in claim 12, wherein the shield member (33) is a metallic plate.

14. The refrigerator as set forth in claim 12 or claim 13, wherein at least two shield members (33) block surfaces of the first and second magnets (31,32).

15. The refrigerator as set forth in any one of claims 12-14, wherein the south pole of the first magnet (31) faces the north pole of the second magnet (32).

16. The refrigerator as set forth in any one of claims 12-15, wherein the north pole of the first magnet (31) faces the south pole of the second magnet (32).

17. The refrigerator as set forth in any one of claims 12-16, wherein the front (16) of the body (10) is a non-magnetic substance.

18. A refrigerator having a storage chamber, comprising:

a refrigerator body (10), including the storage chamber, coupled to a cooling system;

a door (14,15) to move between open and closed positions relative to the storage chamber, respectively;

first and second magnets (31,32) in the body (10) and the door (14,15), respectively, providing an airtight seal between the body (10) and the door (14,15); and

at least one shield member (33) blocking surfaces of at least one of the first and second magnets (31,32) which are not facing the other magnet (32,31).

19. The refrigerator as set forth in claim 18, wherein the shield member (33) is a metallic plate.

20. The refrigerator as set forth in claim 18 or claim 19, wherein at least two shield members (33) block the surfaces of the first and second magnets (31,32).

21. The refrigerator as set forth in any one of claims 18-20, wherein the south pole of the first magnet (31) faces the north pole of the second magnet (32).

22. The refrigerator as set forth in any one of claims 18-21, wherein the north pole of the first magnet (31) faces the south pole of the second magnet (32).

23. The refrigerator as set forth in any one of claims 18-22, wherein the front (16) of the body (10) is a non-magnetic substance.

24. A refrigerator having a storage chamber, comprising:

a refrigerator body (10), including the storage chamber, coupled to a cooling system;

a door (14,15) able to occupy an open and a closed position relative to the storage chamber;

first and second magnets (31,32) in the body (10) and the door (14,15), respectively, providing an airtight seal between the body (10) and the door (14,15); and

at least one shield member (33), wherein the shield member (33) blocks lines of magnetic force extending from at least one magnet (31,32) which are repulsive to the other magnet (32,31).

25. The refrigerator as set forth in claim 24, wherein the shield member (33) is a metallic plate.

26. The refrigerator as set forth in claim 24 or claim 25, wherein two shield members (33) blocks surfaces of the first and second magnets (31,32).

27. The refrigerator as set forth in any one of claims 24-26, wherein the south pole of the first magnet (31) faces the north pole of the second magnet (32).

28. The refrigerator as set forth in any one of claims 24-27, wherein the north pole of the first magnet (31) faces the south pole of the second magnet (32).

29. The refrigerator as set forth in any one of claims 24-28, wherein the front (16) of the body (10) is a non-magnetic substance.

FIG. 1

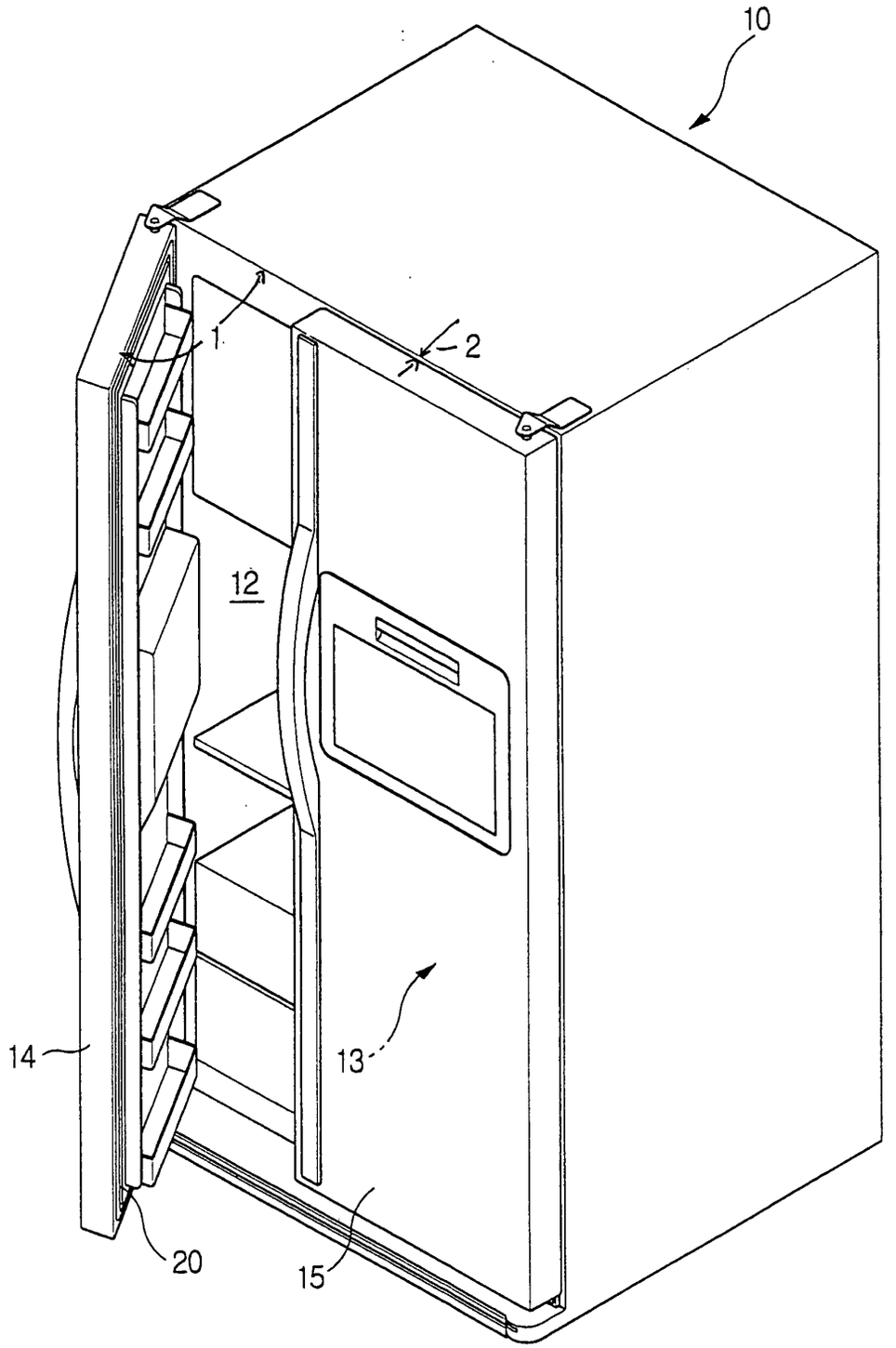

FIG. 2

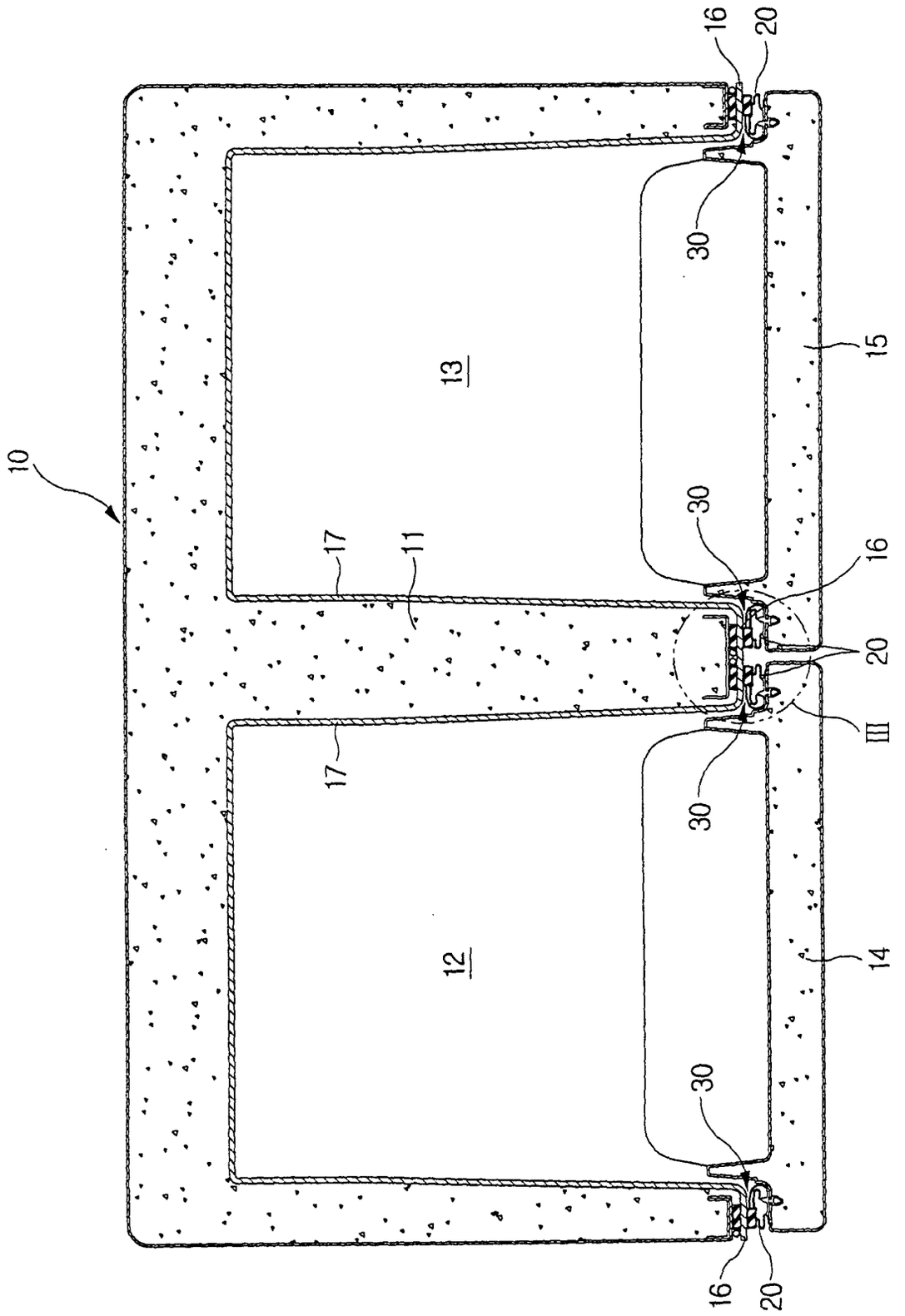

FIG. 3

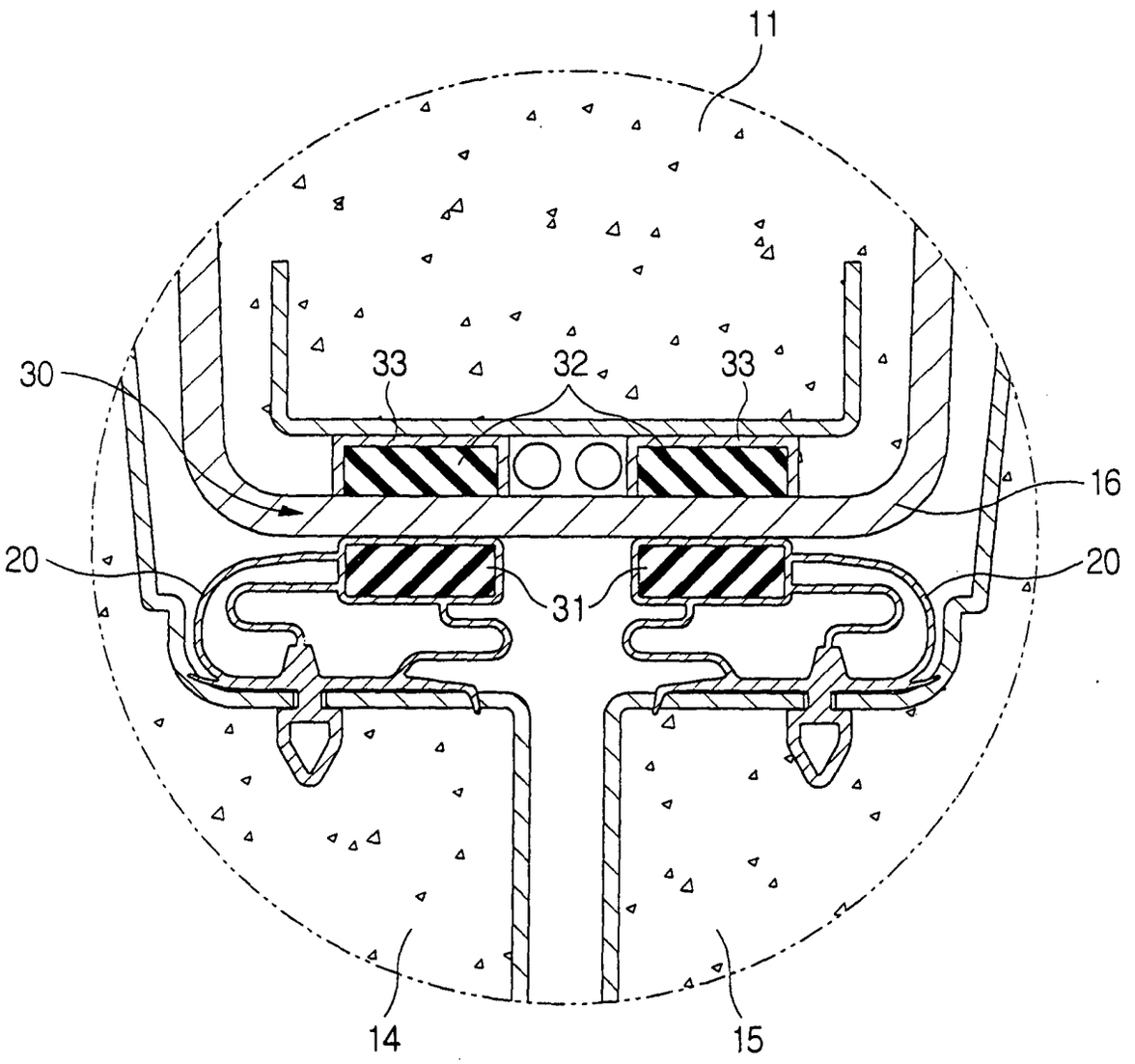

FIG. 4

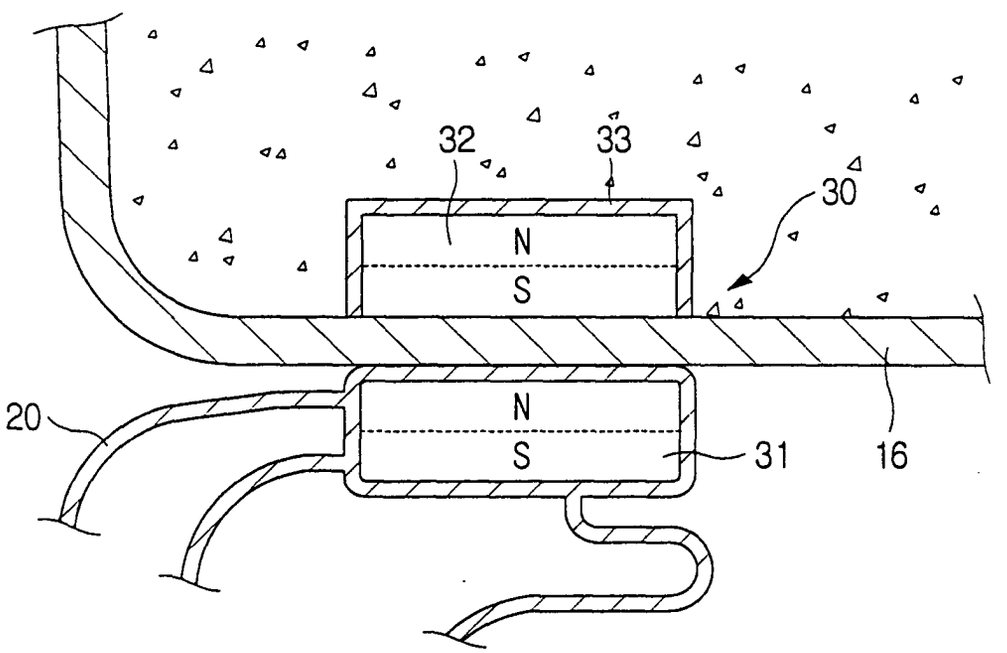

FIG. 5

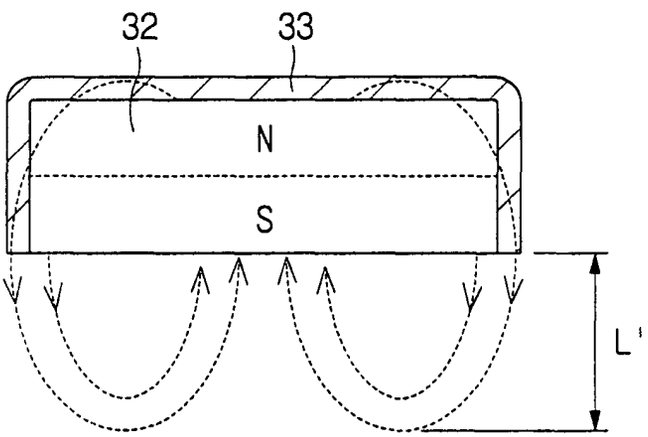

FIG. 6

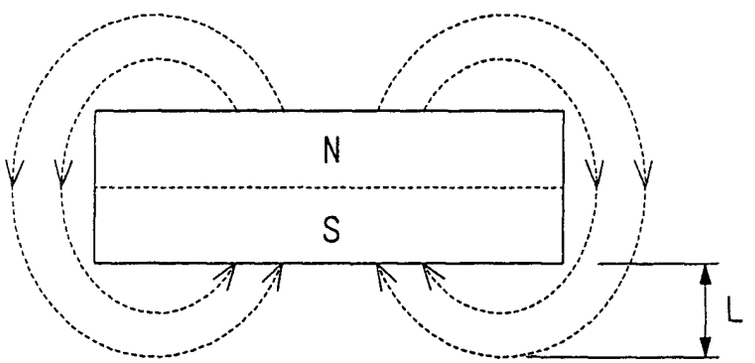

FIG. 7

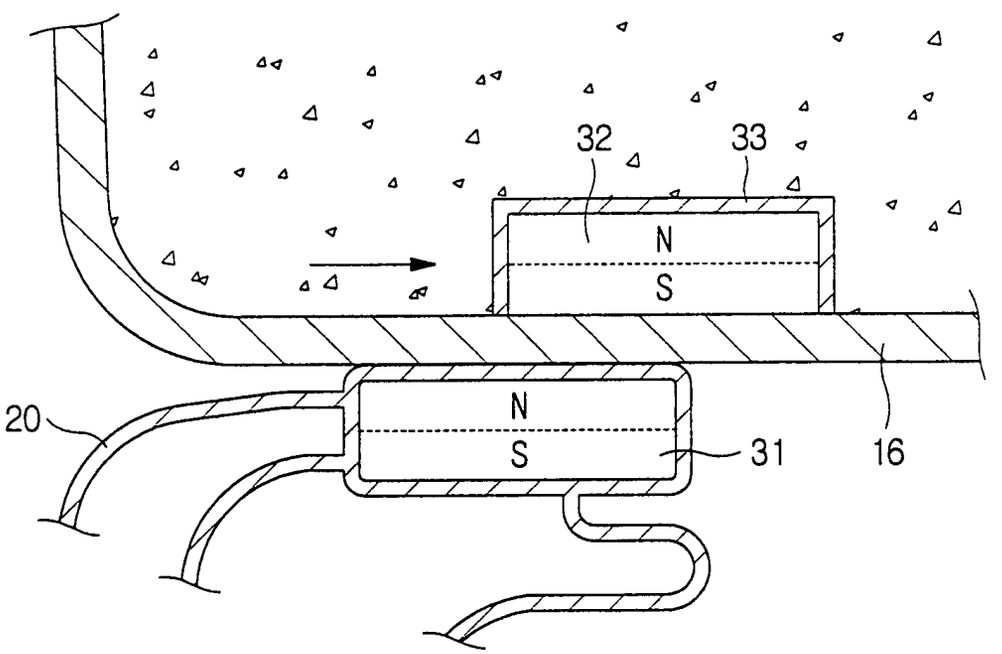

FIG. 8

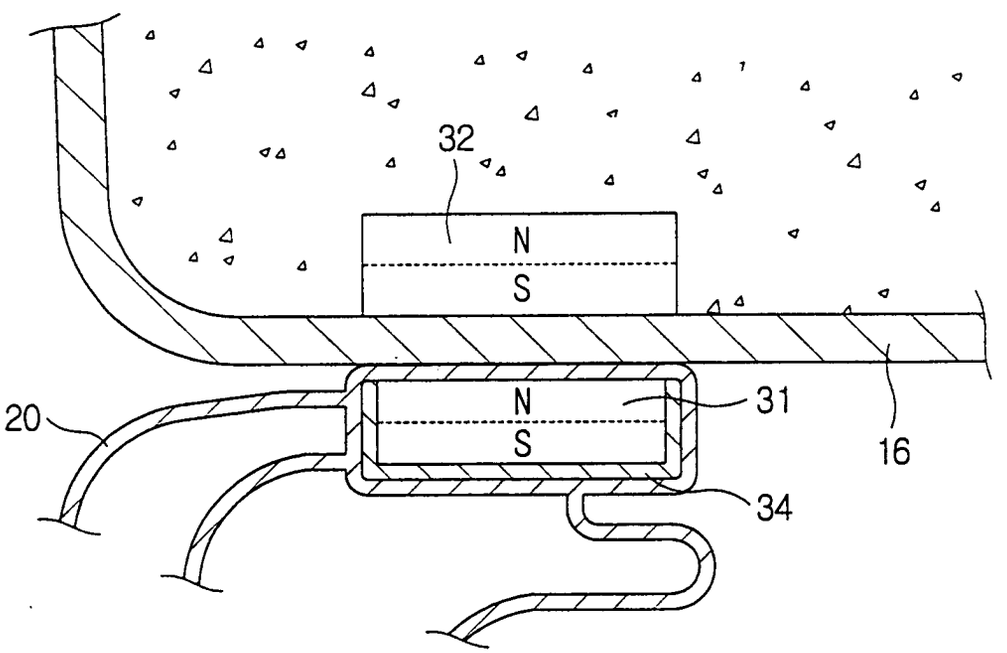

FIG. 9