

Magnetic Fastener

This invention relates to a magnetic fastener for use with a handbag or a like article in the form of a bag or with clothing.

Conventionally, a fastener which makes use of a permanent magnet is used as a device for fastening a cover piece to a main body of a bag such as a handbag or a brief case or used as a fastening device in place of a button of clothing.

Various magnetic fasteners of different structures have been proposed and put into practical use so far, and one of such known magnetic fasteners includes a fixed element including a permanent magnet, a pair of ferromagnetic plates attached to opposite faces adjacent the magnetic poles of the permanent magnet, and a ferromagnetic bar implanted on one of the ferromagnetic plates and having an opposite end face flush with a surface of the other ferromagnetic plate to form a magnetic attracting face, and a movable element including a ferromagnetic member for being removably

attracted to the magnetic attracting face (for example, Japanese utility laid-open Nos. 56-65070 and 56-149416).

Since the magnetic fastener mentioned has such a structure that magnetic flux from the north and south poles of the permanent magnet are introduced to the magnetic attracting face by way of the ferromagnetic plates and the ferromagnetic bar, equivalently the north and south poles of the permanent magnet are located adjacent the magnetic attracting force. Accordingly, the magnetic fastener has a characteristic that, even before the movable element is attracted to the magnetic attracting face of the fixed element, little magnetic flux is emitted externally of the magnetic fastener.

However, it is very difficult to completely exclude external leakage of magnetic flux from the magnetic fastener. In fact, although such a magnetic fastener has a cover located a little above and around the magnetic attracting face in order to prevent the magnetic attracting face from being directly contacted by any other article, some leakage flux remains even outside the cover.

It is an object of the present invention to provide

a magnetic fastener which substantially excludes external leakage of magnetic flux therefrom.

In order to attain the object, according to the present invention, there is provided a magnetic fastener, comprising a fixed element including a permanent magnet plate magnetized so as to present the magnetic poles adjacent its faces, a pair of ferromagnetic plates located adjacent the respective faces of the permanent magnet plate, and a ferromagnetic bar mounted on one of the ferromagnetic plates and extending at right angles therefrom, the other ferromagnetic plate having its face which is remote from the permanent magnetic plate flush with the end face of the ferromagnetic bar to form a magnetic attracting face, and a movable element including a ferromagnetic member for being removably attracted to the magnetic attracting face, the fixed element further including a magnetic shield plate spaced from a portion of the said face of the said other ferromagnetic plate around the magnetic attracting face by a non-magnetic medium, the magnetic shield plate having a cylindrical portion extending from its outer edge, the cylindrical portion covering outer peripheries of the said other ferromagnetic plate and the permanent magnet plate and contacting with an outer peripheral edge of the said one ferromagnetic plate.

According to the magnetic fastener of the invention, external leakage of magnetic flux from the magnetic fastener can be minimized due to the presence of the magnetic shield plate.

Optional and preferred features and advantages of the present invention will become apparent from the following description and the appended claims, taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of a magnetic fastener, illustrating a preferred embodiment of the present invention;

Fig. 2 is a fragmentary perspective view of the magnetic fastener of Fig. 1;

Fig. 3 is a cross-sectional view of another magnetic fastener, illustrating a second embodiment of the invention; and

Fig. 4 is a cross-sectional view of a further magnetic fastener illustrating a third embodiment of the invention.

Referring first to Figs. 1 and 2, there is shown a magnetic fastener according to the present invention. The magnetic fastener shown includes a fixed element A and a movable element B. The fixed element A includes a permanent magnet plate 1 in the form of an annular ring, an iron plate 2 in the form of a disk located on a bottom face (adjacent the north or south pole) of the permanent magnet plate 1, another iron plate 3 in the form of an annular ring located on a top face (adjacent the south or north pole) of the permanent magnet plate 1, and an iron bar 4 erected uprightly at a central portion of the iron plate 2 and extending through a center hole 5 formed in the permanent magnet plate 1 toward the iron plate 3 until an upper end face 4a thereof comes flush with an upper face 3a of the iron plate 3 thereby to form a magnetic attracting face at a central portion of the iron plate 3 around the iron bar 4. An annular portion of the iron plate 3 outside the magnetic attracting face is covered with an annular

spacer 6 made of brass and having an inverted L-shaped cross section. An annular magnetic shield plate 8 having an inverted L-shaped cross section similarly to the annular spacer 6 is located above a top wall 6a of the annular spacer 6 with a magnetic gap interposed therebetween. Here, the magnetic gap is formed by a brass plate 7 in the form of an annular ring. A cylindrical portion of the magnetic shield plate 8 covers entire outer circumferential faces of the iron plate 3 and the permanent magnet plate 1 and has a lower end 8a contacted with an outer circumferential edge of and magnetically connected to the iron plate 2.

The individual members described above are covered and integrally joined together by an annular cover 9 made of brass and having four fingers 9a formed thereon which are bent to hold portions of a lower face of the iron plate 2. A channel-shaped mounting leg member 10 is secured to a central portion of the lower face of the iron plate 2. The mounting leg member 10 is secured to the iron plate 2 by caulking a base end portion of the iron bar 4 to the iron plate 2 and the mounting leg member 10.

Meanwhile, the movable element B includes a core metal member 11 made of iron and having a diameter

substantially equal to or, more accurately, a little smaller than that of an inner cylindrical portion 9b of the cover 9 so that it may be removably attracted to and contacted with the magnetic attracting face of the fixed element A described above. The movable element B further includes a disk 12 placed on the core metal member 11, and a mounting leg member 13 joined together to the core metal member 11 and the disk 12 by caulking the core metal member 11 to the mounting leg member 13 and the disk 12. It is to be noted that the disk 12 is shown having a substantially equal outer diameter to that of the cover 9; the diameters of the two members may not necessarily be equal to each other, and besides the disk 12 may be made of a magnetic material or a non-magnetic material. The thickness of the core metal member 11 is selected such that when the disk 12 is contacted with a top wall 9c of the cover 9, a bottom face of the core metal member 11 may just be contacted with the magnetic attracting face of the fixed element A.

In the magnetic fastener having the construction described above, if the bottom face of the magnetic core member 11 of the movable element B is contacted with the magnetic attracting face of the fixed element A, then a

magnetic path without an air gap is completed by the iron plates 2, 3, the iron bar 4 and the core metal member 11 so that the movable element B is attracted strongly to the fixed element A. To the contrary, if the movable element B is pulled apart from the fixed element A defeating the attracting force therebetween, most of magnetic flux of the permanent magnet plate 1 will appear, in a general case, between an upper portion of a side wall of the iron bar 4 and an opposing portion of an inner circumferential wall of the iron plate 3 as indicated by chain lines 14 in Fig. 1 but some part of the magnetic flux may appear between an upper surface of the iron plate 3 and the top end face of the iron bar 4 as indicated by a chain line 15 in Fig. 1. However, the magnetic shield plate 8 shields such part of magnetic flux which may otherwise appear outside the fixed element A as indicated by the chain line 15 in Fig. 1. In particular, magnetic flux emitted from the iron plate 3 will be introduced to the iron plate 2 by way of the magnetic shield plate 8 which has the same magnetic polarity with the iron plate 2. Accordingly, such magnetic flux which may appear outside the fixed member A as indicated by the chain line in Fig. 1 can be minimized.

Actual measurement proved that the intensity of magnetic field at a location just above the top wall 9c of the cover 9 was about 800 gauss in the case of a conventional magnetic fastener having no such a magnetic shield like the magnetic shield 8 but was reduced to about 100 gauss in the case of the magnetic fastener of the embodiment.

Also in the case of a modified magnetic fastener in which the brass plate 7 of the magnetic fastener of the embodiment is replaced by an air gap, the intensity of magnetic field is about 100 gauss similarly.

It is to be noted that while in the embodiment described above the iron bar 4 is erected uprightly at a central portion of the iron plate 2, a similar function will be obtained if it is erected uprightly otherwise at a side or eccentric portion of the iron plate 2 as shown in Fig. 3 so as to form the magnetic attracting face at an eccentric location of the fixed element A. Further, while the individual elements of the fixed and movable elements A, B of the magnetic fastener of the embodiment except the mounting leg members 10, 13 are each in the form of a disk or an annular ring and accordingly the magnetic fastener has a circular profile, it is also possible to produce a magnetic fastener of a

rectangular, polygonal or elliptical profile using rectangular, polygonal or elliptical components.

Further, the top wall of the cover 9 of the fixed element A and an opposing portion of the disk 12 of the movable element B may each be modified into a funnel shape as shown in Fig. 4 so that the magnetic attracting face may be located at a deeper position with respect to the top of the fixed element. With the construction shown in Fig. 4, an article which dislikes magnetism cannot approach the magnetic attracting face of the fixed element A nearer than the depth of the inner cylindrical portion 9b of the cover 9.

As apparent from the foregoing description, according to the present invention, external leakage of magnetic flux from a fixed element when a movable element is pulled away from the fixed element can be minimized. Accordingly, the magnetic fastener of the invention has an effect that the safety thereof to an article such as a magnetic card which is apt to be easily damaged by magnetism can be improved.

Having now fully described the invention, it will be apparent to one of ordinary skill in the art that many changes and modifications can be made thereto without departing from the scope of the invention as

set forth herein.



Claims:-

1. A magnetic fastener, comprising a fixed element including a permanent magnet plate magnetized so as to present the magnetic poles adjacent its faces, a pair of ferromagnetic plates located adjacent the respective faces of the permanent magnet plate, and a ferromagnetic bar mounted on one of the ferromagnetic plates and extending at right angles therefrom, the other ferromagnetic plate having its face which is remote from the permanent magnetic plate flush with the end face of the ferromagnetic bar to form a magnetic attracting face, and a movable element including a ferromagnetic member for being removably attracted to the magnetic attracting face, the fixed element further including a magnetic shield plate spaced from a portion of the said face of the said other ferromagnetic plate around the magnetic attracting face by a non-magnetic medium, the magnetic shield plate having a cylindrical portion extending from its outer edge, the cylindrical portion covering outer peripheries of the said other ferromagnetic plate and the permanent magnet plate and contacting with an outer peripheral edge of the said one ferromagnetic plate.
2. A magnetic fastener according to claim 1, wherein the said non magnetic medium is constituted either by an air gap or by a member of a non-magnetic material.



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3. A magnetic fastener according to claim 1 or 2, wherein a spacer is interposed between the said other ferromagnetic plate and the permanent magnet plate within the cylindrical portion of the magnetic shield plate.
 4. A magnetic fastener according to any preceding claim, wherein the ferromagnetic bar is mounted either at a central portion or at a side portion of the said one ferromagnetic plate.
 5. A magnetic fastener according to any preceding claim, wherein the portion of the said other ferromagnetic plate around the magnetic attracting face is covered by a cover.
 6. A magnetic fastener according to claim 5, wherein a portion of the cover at which the cover contacts with the movable element has a funnel-like shape.
 7. A magnetic fastener substantially as described with reference to, and as shown in, Figures 1 and 2, Figure 3, or Figure 4 of the accompanying drawings.
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