

MAGNETIC LOCK CLOSURE DEVICE

The present invention relates to a magnetic lock closure device making use of the attractive action provided by a permanent magnet.

Conventionally, there is a magnetic lock closure device that may be found on bags such as women's handbags, baggage, and the like as a locking device, or on wear or accessories such as waist belts. In either case, the magnetic lock closure device comprises a first part including an annular permanent magnet and a first ferromagnetic plate attached to one side of the permanent magnet that provides one polarity, and a second part including a second ferromagnetic plate which may be removably attached to the other side of the permanent magnet that provides the opposite polarity. The first part is completely enclosed by a nonmagnetic cover, and the first ferromagnetic plate may or may not have a rod at the center extending therefrom, which is also ferromagnetic. On the second part, the second ferromagnetic plate has a rod at the center extending therefrom, which is also ferromagnetic. When those two parts are to be coupled together, the second ferromagnetic plate may be attached to the first part by engaging the rod on the second part with the rod on the

first part or directly the first ferromagnetic plate which in this case has no such rod, through the bore of the permanent magnet and cover. The two parts may be decoupled by pulling the second part away from the first part.

When the conventional magnetic lock closure device is employed for the handbag, for example, the first part which contains the permanent magnet is mounted on the body side of the handbag, and the second part is mounted on the flap side of the handbag. When the first and second parts are to be coupled together under the attracting force of the first part, the second ferromagnetic plate is placed on the first part so that the rod on the second ferromagnetic plate can first engage the portion of the cover that is located between the outer marginal periphery of the annular permanent magnet and the peripheral marginal edge of the bore through the magnet. This is because that portion of the outer cover or permanent magnet provides the highest magnetic flux density which tends to attract the rod on the second ferromagnetic plate more coercively than the other areas when the second part is placed on the first part. Then, an attempt is made to locate the bore through the outer cover and permanent magnet and force the rod on the second ferromagnetic plate into the bore against the most coercive attracting action of that portion. As the rod on the second ferromagnetic plate is magnetically attracted by that portion, it can only be moved away from that highest density area toward the bore in the zigzag fashion rather than directly, before it can successfully engage the bore. This may disadvantageously cause damage such as scratches on the outer cover.

Usually and in practice, prospective customers check to see if the devices on handbags or other articles will work well by trying to couple or decouple the two parts before they have decided upon one of their

choice. In particular, the coupling action which involves the sliding motion may cause damage as described above that may degrade the commercial value of the articles. One practically proposed method whereby such damage may be prevented is to provide an additional protective sealing over the outer cover, or to provide a mesh pattern on the outer cover that hides any possible damage.

Another suggested method is to minimize the sliding motion of the rod on the second ferromagnetic plate onto the outer cover. This method may consist of providing a concavely-formed surface on the side of the permanent magnet that meets with the second ferromagnetic plate. The outer cover also has the corresponding surface on that side. This particular form may serve to guide the rod on the second ferromagnetic plate toward the center bore with the minimum effort and therefore with the minimum sliding motion. This particular form may be obtained by grinding or polishing an annular permanent magnet to conform to such form, but the grinding or polishing process is not adequate for the permanent magnet in particular, since the high dimensional or precision requirements that the permanent magnet must meet cannot be provided by the grinding or polishing process. This will disadvantageously affect the assembly process of the device that contains the thus formed permanent magnet as well as the other subassembly parts. Thus, the device that incorporates such formed permanent magnet may not provide the attracting action that is strong enough to couple its two parts together magnetically. It is therefore to be noted that the products which have been manufactured in that manner may include many defective ones, which means a lower productivity or yield.

As an alternative solution to the above disadvantage, it is suggested that an annular permanent magnet be provided with an additional

part that may be formed from a ferromagnetic material as a yoke having a concavely formed surface on its one side. This yoke may eliminate the need of forming the permanent magnet itself, but may also increase the number of the component parts to be assembled. As the number of the component parts is increased, the accumulated dimensional errors for each individual part will become the greater. Thus, the precision problem that will occur during the assembly process remains unsolved.

It is therefore a principal object of the present invention to offer a magnetic lock closure device that includes an annular permanent magnet having a central bore with its peripheral margin formed like a funnel specifically designed to guide the rod on the second ferromagnetic plate toward and into the central bore through the permanent magnet. All individual permanent magnets can advantageously be formed in this manner to meet the dimensional precision requirements.

The present invention provides a magnetic lock closure device which comprises a first, magnetically attracting part and a second, magnetically attracted part, the first part including an annular permanent magnet having a central bore, a first disk-shaped ferromagnetic member attached to one polarity side of the permanent magnet and a nonmagnetic outer cover having a central bore and enclosing the permanent magnet and the first ferromagnetic member, and the second part including a second disk-shaped ferromagnetic member adapted to be removably attached to the other polarity side of the permanent magnet, the first and

second ferromagnetic members having respective central ferromagnetic elements extending therefrom and adapted to meet each other through the central bore when the first and second parts are coupled together, means being provided on the permanent magnet and outer cover for accepting the ferromagnetic element on the second ferromagnetic member and guiding it into the central bore, the said means including:

- a funnel-shaped portion having an outwardly expanded opening extending from the central bore; and

- a peripheral flat portion extending radially outwardly from the outwardly expanded opening.

It should be noted that the outwardly expanded opening may be either flat or curved.

The functional features of the magnetic lock closure device according to the present invention may readily be appreciated by understanding how the device is operated. When the two parts of the device are to be coupled together, the second part is first placed upon the first part to allow the second ferromagnetic plate on the second part magnetically to be attracted by the permanent magnet on the first part. This action then causes the rod on the second ferromagnetic plate to be placed at any point on the outer cover that is located between the peripheral marginal edge of the permanent magnet and the marginal edge of the central bore through the magnet. Then, the second rod is magnetically attracted, and it may be guided into the central bore simply by sliding it along the funnel-shaped opening wall toward the bore. As the path followed by the second rod from the

point of its contact to the central bore is direct and shortest, any possible damage or scratches that may occur on the outer cover can advantageously be reduced to the minimum.

The funnel shape having an expanded opening extending outwardly from the central bore and a peripheral marginal flat portion extending outwardly radially from the funnel shape ensure that the high dimensional precision can be provided by machining a particular permanent magnet in the direction of its depth or thickness by techniques such as grinding or polishing. The high dimensional precision that can be obtained in this way allows all the component subassembly parts or elements to be fabricated with the corresponding precision requirements.

Those and other features and advantages of the present invention may be more clearly appreciated by reading the remainder of the specification, in which some preferred embodiments will be described in further detail by referring to the accompanying drawings, in which:

Fig. 1 is an exploded perspective view illustrating the component subassembly parts or elements which make up a magnetic lock closure device in one preferred embodiment of the present invention;

Fig. 2 is a sectional view illustrating how the first and second parts of the device in Fig. 1 will have been coupled together under the magnetic attraction of a permanent magnet;

Fig. 3 is a sectional view illustrating how those two parts are in _____

the process of being coupled together:

Fig. 4 is a sectional view illustrating how the second part or magnetically attracted part of the device in Fig. 1 is fastened;

Figs. 5 and 6 are sectional views of a variation of the fastening member, respectively, that allows the respective first or second part to be attached to the corresponding part of a particular article; and

Fig. 7 is a sectional view illustrating how the first and second parts will have been coupled together in another preferred embodiment.

Several preferred embodiments of the present invention will now be described by referring to the drawings.

Fig. 1 is an exploded perspective view of the subassembly parts which are put together to build a magnetic lock closure device in one preferred embodiment, and Fig. 2 illustrates in a cross-section how the first and second parts together making up the device have been coupled together under the action of the magnetism.

Referring to those figures, a device comprises a magnetically attracting part or first part A incorporating an annular permanent magnet and a magnetically attracted part or second part B. The first part A is usually attached to the body side of an article such as a woman's handbag, and the second part B is usually attached to the flap side of the article. Specifically, the first part A includes a permanent magnet 1 which has an annular form having a center hole extending therethrough, and a first ferromagnetic member 2 which is formed like a disk plate from any suitable soft iron material and is mounted to one polarity side of the permanent magnet 1. The permanent magnet 1 and first

ferromagnetic member 2 are contained within an enclosure or cover 3 which is made of any suitable nonmagnetic material. The enclosure 3 is closed at the top and has a number of nails 4, 4 extending downwardly from the peripheral bottom edge of the enclosure 3 and having the respective ends extending inwardly.

As described, the permanent magnet 1 has a center bore 5 extending through it and has a funnel-shaped portion 5a having an expanded opening extending outwardly from the peripheral marginal edge of the center bore 5 and having a peripheral marginal flat portion 5b extending radially outwardly from the funnel-shape portion 5a. Similarly, the enclosure 3 has a center bore 6 at the top which is provided to align with the center bore 5 in the permanent magnet 1, and a peripheral marginal flat portion 3a which surrounds the center bore 6 and matches the corresponding flat portion 5b of the permanent magnet 1. An inner tubular portion 7 extends downwardly from the center bore 6 along the length of the center bore 5 such that it covers the inner wall of the center bore 5. At the top, the enclosure 3 has a funnel-shaped portion 6a having an expanded opening extending outwardly from the center bore 6 and which matches the corresponding funnel-shaped portion 5a for the permanent magnet 1.

The first ferromagnetic member 2 has a rod 8 at the center extending upwardly from it as viewed in Fig. 2, the rod 8 being made of any suitable ferromagnetic material and having the diameter slightly smaller than that of the center bore 5 through the permanent magnet 1 and the depth or thickness substantially equal to half the depth or thickness of the permanent magnet 1. The first ferromagnetic member 2 also has a center bore 10 extending through it, and the rod 8 has an extension 9 which extends downwardly through the center bore 10 as viewed in Fig. 2. The portion 9 of the rod 8 has its bottom end extending out of the center

bore 10. A fastening member 13 which allows the first part A to be attached to the corresponding body part of the article includes a transverse base 12 and a pair of legs 11, 11 extending downwardly from each of the opposite ends of the transverse base 12 as viewed in Fig. 2. The transverse base 12 of the fastening member 13 has a center bore 14 extending through it, into which the bottom end of the rod extension 9 is to be inserted. The fastening member 13 and rod 8 may be combined together by pressing the bottom end of the rod extension 9 against the transverse base 12 of the fastening member 13 and rivetting the former to the latter.

The magnetically attracted part or second part B includes a second ferromagnetic member 15 formed like a disk plate, a second ferromagnetic rod 16 extending from the center of the second ferromagnetic member 15, and a second fastening member 13. The second ferromagnetic member 15 has the same diameter as the first ferromagnetic member 2, and is formed like a dish shape having a bore 17 at the center and a donwardly curved portion 15a extendng inwardly radially toward the center bore 17, such that the portion 15a can closely engage the flat portion 3a and funnel-shaped portion 6a of the outer enclosure 3. The second ferromagnetic rod 16 has an extension 18 which extends into the center bore 17. As for the first part A, a fastening member 13 which also allows the second part B to be attached to the corresponding flap part of the article includes a transverse base 12 and a pair of legs 11, 11 extending downwardly from each of the opposite ends of the transverse base 12 as viewed in Fig. 2. The transverse base 12 of the fastening member 13 has a center bore 14 extending through it, into which the bottom end of the rod extension 9 is to be inserted. The fastening member 13 and rod 16 may be combined together by pressing the bottom end of the extension 18 of the rod 16

against the transverse base 12 of the fastening member 13 and rivetting the former to the latter.

It should be noted that for both of the first and second parts A and B, the combinations of the first ferromagnetic member 2 and rod 8, and the second ferromagnetic member 15 and rod 16 may be provided as a single integral unit, respectively.

In the embodiment described above, when the second ferromagnetic member 15 on the second part B is placed upon the outer cover 3 on the first part A as particularly shown in Fig. 2, the lines of magnetic force from the permanent magnet 1 are centered into the first and second rods 8 and 16 which meet each other inside the bore 5 of the permanent magnet 1. Thus, those two parts A and B are coupled together under the action of the powerful magnetic attraction that is produced by the centered lines of magnetic force.

It may be noticed that when the second part B is placed upon the first part A or vice versa, the second ferromagnetic rod 16 on the second part B will more easily be attracted magnetically toward the particular area on the flat portion 3a of the outer cover 3 between its outer peripheral margin and center bore 6, rather than being directed toward the center bore 6, since that area provides the highest magnetic flux. In this case, it may be necessary to force the rod 16 to slide from that area toward the center bore 6 against the strong magnetic attraction of the area, but this may be accomplished simply by using the funnel-shaped portion 6a of the outer cover 3. As described, this portion 6a has the outwardly expanded opening, which allows the rod 16 to be slid directly toward the center bore 6. As a result, the distance between the initial contact point of the rod 16 on the outer cover 3 and the center bore 6 is reduced to the minimum. Thus, the rod 16 can be entered into the center

bore 6 with the minimum effort and therefore with the minimal scratches on the outer cover 3.

In order to develop the magnetic attraction as powerfully as possible with the two parts A and B coupled together, it may be necessary to eliminate any air gaps between the first rod 8 and second rod 16 so that the two rods can closely meet each other, as well as any air gaps between the second ferromagnetic member 15 and the outer cover 3 so that they can closely contact each other. This is achieved by providing an annular permanent magnet 1 formed like a flat disk plate having a center bore 5 and providing a funnel-shaped portion 5a having an outwardly expanded opening extending from the peripheral marginal edge of the center bore 5 and a peripheral flat portion 5b extending radially outwardly from the center bore 5. The peripheral flat portion 5b alone is formed by any proper grinding or polishing means to provide a precisely flat surface. Thus, any leaks of the magnetism that may otherwise occur due to any possible air gaps can effectively be avoided, and the powerful magnetic attraction can be obtained.

As described, the second ferromagnetic member 15 has the downwardly curved portion 15a which provides a depressed portion 15b on its upper side corresponding to the shape of the downwardly curved portion. This has the following advantage.

As for the second part B shown in Fig. 4, for example, the fastening member 13 has the legs 11, 11 which may be attached to the flap side 19 of the handbag, for example, by folding them over.

In this case, part of the fastening member 13 including the legs 11, 11 as foled over may be accommodated within the depressed portion 15b, and the thickness of the outer layer 19a of the usually double-layered handbag material (such as leather, cloth, etc.) may be reduced by the amount of that part. That is, the portion of the outer layer 19a that would otherwise be raised by the fastening member 13 is eliminated, keeping the handbag in good shape and outlook.

The fastening member 13 may be provided in varied forms. As shown in Fig. 5, the fastening member 13 may consist of a metal member 20 formed like a bag open at the top and a metal member 21 having its traverse base portion supported within the metal member 20 and a pair of leg portions extending upwardly from the base portion as viewed in Fig. 5. As shown in Fig. 6, the fastening member 13 may consist of a metal member 22 formed like a bag open at the top and a pair of leg portions 23 having nails which engage the metal member 22. In either case, part of the fastening member 13 may be accommodated within the depressed portion 15b, eliminating the portion of the outer layer 19a which would otherwise be raised.

Referring next to Fig. 7, there is a device construction according to another preferred embodiment of the present invention, which is shown in cross section. In the presently described embodiment, the second ferromagnetic plate 24 on the second part B is not formed like the portion 15a in the preceding embodiment to accept part of the fastening member 13, but is formed flatly. The subassembly parts other than the second ferromagnetic plate 24 itself are given the same numerals as the corresponding parts in the preceding embodiment.

The presently described embodiment may not provide the equivalent effect provided by the preceding embodiment, particularly in respect of

the reduced raised portion of the fastening member 13. It should be noted, however, that any possible scratches that may be produced by sliding the rod on the second ferromagnetic plate 16 can be minimized, and the subassembly parts can be fabricated with the high dimensional precision requirements. In this respect, this present embodiment also provides the equivalent functional effect provided by the preceding embodiment, in that the powerful magnetic attraction can be provided.

The present invention has been described with particular reference to the several preferred embodiments thereof. One advantage of the present invention may be obtained by providing the funnel-shaped opening extending from the center bore through the combination of the permanent magnet and outer cover and the peripheral flat portion extending radially outwardly from the funnel-shaped opening. This effectively minimizes any possible scratches on the outer cover which may occur during the sliding motion of the second ferromagnetic rod on the cover. This also eliminates the need of providing the additional sealing on the cover to protect it against such scratches. This also ensures that the two parts can be coupled together in a quick action.

Another advantage may be obtained by providing a permanent magnet that can meet the high dimensional precision requirements. This ensures that the permanent magnet provides the strong magnetic attraction when the two parts are coupled together. The fabrication yield may also be improved.

For the first embodiment in particular, an additional advantage may be obtained by providing the shape of the second ferromagnetic plate on the second part that matches the shape of the funnel portion on the first part. This allows part of the fastening member to be accommodated within the second ferromagnetic plate when the fastening member is attached to

the corresponding part of an article, thus eliminating the raised portion of the fastening member.

Although the present invention has been described with particular reference to the several preferred embodiments thereof, it should be understood that various changes and modifications may be made without departing from the scope of the invention.

Claims:-

1. A magnetic lock closure device which comprises a first, magnetically attracting part and a second, magnetically attracted part, the first part including an annular permanent magnet having a central bore, a first disk-shaped ferromagnetic member attached to one polarity side of the permanent magnet and a nonmagnetic outer cover having a central bore and enclosing the permanent magnet and the first ferromagnetic member, and the second part including a second disk-shaped ferromagnetic member adapted to be removably attached to the other polarity side of the permanent magnet, the first and second ferromagnetic members having respective central ferromagnetic elements extending therefrom and adapted to meet each other through the central bore when the first and second parts are coupled together, means being provided on the permanent magnet and outer cover for accepting the ferromagnetic element on the second ferromagnetic member and guiding it into the central bore, the said means including:

a funnel-shaped portion having an outwardly expanded opening extending from the central bore; and

a peripheral flat portion extending radially outwardly from the outwardly expanded opening.



2. A magnetic lock closure device as claimed in claim 1, wherein the second ferromagnetic member is shaped like a dish having a central bore and is adapted to match the shape of the said funnel-shaped portion, and wherein its ferromagnetic element extends through its central bore and is secured thereto.

3. A magnetic lock closure device substantially as described with reference to any of the embodiments shown in the accompanying drawings.



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