AUSTRALIA
Patents Act 1990

PATENT REQUEST: STANDARD PATENT

We, APPLICATION ART LABORATORIES CO., LTD., being the person(s)
identified below as the Applicant, request the grant of a standard
patent to the person identified below as the Nominated Person, for
an invention described in the accompanying complete specification.

Full application details follow.

Applicant: APPLICATION ART LABORATORIES CO., LTD.

Address: 9-16 Hanahata 2-chome, Adachi-ku, Tokyo, JAPAN

Nominated Person: APPLICATION ART LABORATORIES CO., LTD.

Address: 9-16 Hanahata 2-chome, Adachi-ku, Tokyo, JAPAN

Invention Title: "MAGNETIC LOCK DEVICE"

Name(s) of Actual Inventor(s): Yoshihiro Aoki

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BASIC CONVENTION APPLICATION(S) DETAILS

Application No 2-417578 Country JAPAN

Country Code JP

Date of Application 28 December 1990

We are not an eligible person described in Section 33 - 36 of
the Act.

Drawing number recommended to accompany the abstract 1

Dated this 17 day of December 1991

APPLICATION ART LABORATORIES CO.,

LTD. [Signature]

By: Registered Patent Attorney

56250
Commonwealth of Australia
The Patents Act 1952

DECLARATION IN SUPPORT

In support of the (Convention) Application made by: APPLICATION ART LABORATORIES CO. LTD. of 9-16 Hanahata 2-chome Adachi-ku Tokyo JAPAN

for a patent for an invention entitled: MAGNETIC LOCK DEVICE

I (We) Yoshihiro Aoki

of and care of the applicant company do solemnly and sincerely declare as follows:

- I am (We are) the applicant(s) for the patent
- b) I am (We are) authorised by the applicant(s) for the patent to make this declaration on its behalf.

Delete the following if not a Convention Application.

The basic application(s) as defined by section 141 (442) of the Act was (were) made

on 28 December 1990 in JAPAN

by APPLICATION ART LABORATORIES CO. LTD.

The basic application(s) referred to in this paragraph is (are) the first application(s) made in a Convention country in respect of the invention the subject of the application.

- I am (We are) the actual inventor(s) of the invention.

- Yoshihiro Aoki of 9-16 Hanahata 2-chome Adachi-ku Tokyo Japan

is (are) the actual inventor(s) of the invention and the facts upon which and the facts upon which THE APPLICANT COMPANY is (are) entitled to make the application are as follows:

The applicant is a person who would if a patent were granted upon an application made by the actual inventor be entitled to have the patent assigned to it

Declared at Tokyo this 4th day of December 1991

Signed Yoshihiro Aoki Status president

Declarant's Name Yoshihiro Aoki

F. B. RICE & CO PATENT ATTORNEYS
This form is suitable for any type of Patent Application. No legalisation required.
1. A magnetic lock device comprising:

   a first element including a permanent magnet having a center bore
   traversing said permanent magnet and having a first side thereof for
   providing one polarity and a second side opposite to said first side for
   the opposed polarity, a first ferromagnetic plate rigidly attached to
   said one side of said permanent magnet, and a nonferromagnetic enclosure
   packaging said permanent magnet and said first ferromagnetic plate into
   one unit and having a center bore aligned with said center bore of said
   permanent magnet;

   a second element including a second ferromagnetic plate detachably
   attached to said second side of said permanent magnet;

   said second ferromagnetic plate having a rod of ferromagnetic material
   extending therefrom and disengagably engaging said first ferromagnetic
   plate directly or indirectly through a rod of ferromagnetic material
   extending from said first ferromagnetic plate when said second and first
   ferromagnetic plates meet together inside said bores through said enclosure
   and said permanent magnet; and
said nonferromagnetic enclosure including a depressed surface inclining downwardly from the peripheral marginal edge of said enclosure toward said center bore of said enclosure, wherein the improvement includes:

a gap defined between said depressed surface of said enclosure and said second side of said permanent magnet.
Invention Title:

MAGNETIC LOCK DEVICE

The following statement is a full description of this invention including the best method of performing it known to us:
BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a magnetic lock device that makes use of the attracting action of the magnetism.

Description of the Prior Art

A conventional magnetic lock device includes a permanent magnet having a first side for providing one magnetic polarity to which a first ferromagnetic plate is attached and packaged in a nonmagnetic enclosure, and having a second side opposite the first side for providing the opposed magnetic polarity to which a second ferromagnetic plate may be detachably attached, the second ferromagnetic plate having a rod extending therefrom and adapted to be inserted through the respective bores in the permanent magnet and enclosure so that the rod can disengageably engage the first ferromagnetic plate or the rod extending therefrom. The conventional magnetic lock devices are used as attachments for handbags, baggages, and the like, or for clothes, belts, and the like.

According to the conventional magnetic lock device, the ferromagnetic rod on the second ferromagnetic plate is inserted through the respective bores in the permanent magnet and enclosure when the first and second ferromagnetic plates are to be coupled together. When this occurs, the sliding motion of the second ferromagnetic plate relative to the surface of the enclosure must be attempted in order to bring its rod into registry with the bore in the enclosure accurately. Usually, several attempts
must be made until the two parts are mated successfully. As those attempts are repeated each time they are to be coupled together, the surface of the enclosure will be damaged (such as scratches) by the sliding motion. There is another conventional magnetic lock device that is primarily designed to eliminate this problem (as disclosed in the Japanese patent applications Nos. 1-191404 and 2-105503). This magnetic lock device includes an enclosure which is formed to present a depressed surface on the side that engages the second ferromagnetic plate.

The last-mentioned conventional magnetic lock device has the construction that includes the enclosure having the depressed surface on the side engaging the second ferromagnetic plate. Thus, when the second ferromagnetic plate is slid relative to the depressed surface of the enclosure so that its rod can be brought into registry with the bore in the enclosure, it may be appreciated that it can be moved along the depressed surface toward the bore at the center directly, without any effort to locate the bore randomly. This can reduce any possible damages that would occur if the sliding motion would be attempted in the same manner as for the earlier-mentioned prior art construction.

SUMMARY OF THE INVENTION

It is therefore understood that the provision of the depressed surface on the enclosure provides an effective means for protecting the enclosure against those possible damages. In this regard, it is an object of the present invention to provide a new and improved construction of the magnetic lock device that permits such a depressed surface to be formed on the enclosure, without affecting the functions of the device.

In its specific form, the magnetic lock device according to the
The present invention includes a permanent magnet having a first side for providing one magnetic polarity to which a first ferromagnetic plate is rigidly attached. The permanent magnet is packaged in a nonmagnetic enclosure. It also includes a second ferromagnetic plate that is adapted to be detachably attached to a second or opposite side of the permanent magnet for providing the opposed polarity. The second ferromagnetic plate has a rod of ferromagnetic material extending therefrom, and the rod can be inserted through the respective bores in the permanent magnet and enclosure. The first ferromagnetic plate may also have a rod of ferromagnetic material extending therefrom. When the rod on the second ferromagnetic plate is inserted through the bores, it can engage the first ferromagnetic plate or the corresponding rod thereon. The nonmagnetic enclosure has a depressed surface on the side on which the second ferromagnetic plate engages the enclosure, and has a bore at the center of the depressed surface. The depressed surface is formed on the enclosure such that there is a magnetic gap between it and the second side of the permanent magnet.

The advantage of the magnetic lock device according to the present invention is that the second ferromagnetic plate can be slid along the depressed surface formed on the side of the nonmagnetic enclosure that engages the second ferromagnetic plate, to ensure that its rod can be guided directly and accurately toward the bore at the center of the enclosure.

A further advantage of the present invention is that the nonmagnetic enclosure having the depressed surface may be spaced away from the second side of the permanent magnet so that there may be a gap or magnetic gap therebetween. Thus, the enclosure may be made of brass or any other nonmagnetic material that can be machined to the desired shape. This
contributes to the reduced weight of the device as a whole. Furthermore, the manufacturing process may be simplified with less manufacturing costs.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, and advantages of the present invention will become apparent from the detailed description of the preferred embodiments of the invention that is provided with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of a first preferred embodiment of the present invention;

Fig. 2 illustrates the cross section of the part of the device according to a second preferred embodiment that provides the magnetically attracting action;

Fig. 3 illustrates the cross section of the magnetically attracting part according to a third preferred embodiment;

Fig. 4 illustrates the cross section of the magnetically attracting part according to a fourth preferred embodiment;

Fig. 5 illustrates the cross section of the magnetically attracting part according to a fifth preferred embodiment;

Fig. 6 illustrates the cross section of the magnetically attracting part having a depressed surface varying in the profile from those in the preceding embodiments;

Fig. 7 illustrates the cross section of the magnetically attracted part of the device according to another preferred embodiment;

Fig. 8 illustrates the cross section of the magnetically attracting part according to a sixth preferred embodiment; and

Fig. 9 illustrates the cross section of the magnetically attracting
part according to a seventh preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates the cross section of the magnetic lock device according to the first preferred embodiment thereof. As seen from Fig. 1, the device comprises two parts, generally designated as A and B. The part A, which may be referred to as the "magnetically attracting part", attracts the part B magnetically, which may be referred to as the "magnetically attracted part". The part A includes a cylindrical permanent magnet 1 having a central bore 11 extending therethrough, a first ferromagnetic plate 2 rigidly attached to a first side of the permanent magnet 1 for providing one magnetic polarity, and an annular member 3 rigidly attached to a second or opposite side of the permanent magnet 1 for providing the opposed polarity. The permanent magnet 1, first ferromagnetic plate 2 and annular member 3 are packaged in a nonmagnetic enclosure 4 that may be made of any nonmagnetic material such as brass.

The enclosure 4 has the cylindrical shape closed at the top and open at the bottom, on its top end side, the enclosure 4 is formed to provide a depressed surface 8 like a funnel, having a peripheral flat portion 5 resting against the annular member 3, a slanted portion 7 extending downwardly and inwardly from the peripheral flat portion 5 toward the center, and a bore 6 at the center. The center bore 6 is formed to include an cylindrical extension 9 depending downwardly therefrom like a skirt. On the bottom end side, it includes nails 10, 10 extending inwardly radially for holding the permanent magnet 1 and first ferromagnetic plate 2 firmly.
The extension 9 depending downwardly from the center bore 6 forms a cylindrical shape which is fitted inside the center bore 11 through the permanent magnet 1. The first ferromagnetic plate 2 includes a rod 12 extending into half the depth of the bore 11. The rod 12 has a shaft 13 extending downwardly therefrom and which passes through the first ferromagnetic plate 2. The bottom end of the shaft 13 has a flange or rivet 15 formed by press, extending outwardly radially so that it can hold a pair of mounting legs 14 and secure it to the first ferromagnetic plate 2.

The part B, or the magnetically attracted part, includes a second ferromagnetic plate 16, a rod 17 made also of ferromagnetic material and extending from the second ferromagnetic plate 16 on the side thereof facing the part A, and a pair of mounting legs 18 secured to the second ferromagnetic plate 16 on the opposite side thereof. The second ferromagnetic plate 16 is made of iron, and is formed to include a peripheral marginal flat edge 19 whose shape conforms to the shape of the corresponding annular flat portion 5 of the enclosure 4, and a slanted portion 20 extending inwardly radially from the peripheral marginal flat edge 19, the slanted portion 20 forming the protruded surface 21 matching the shape of the corresponding depressed surface 8 on the enclosure 4. The protruded surface 21 is flat at the center thereof, as shown at 22, where a bore is provided for accepting the rod 17. The rod 17 has the diameter that allows the rod 17 to be inserted into the cylindrical part 9 on the enclosure 4, and the length or height that allows the rod 17 flatly to meet with the corresponding ferromagnetic rod 12 on the first ferromagnetic plate 2, when the second ferromagnetic plate 16 is placed on and magnetically attracted toward the enclosure 4. The rod 17 has a shaft 23 whose bottom end is formed by press to include a flange 24.
for holding a pair of mounting legs 18 and securing it to the second ferromagnetic plate 16, in the same manner as described with reference to the part A.

According to the embodiment of the magnetic lock device described above, it may be appreciated that the second ferromagnetic plate 16 for the part B may be magnetically attracted toward the part A including the permanent magnet 1 when the plate 16 is placed on the enclosure 4, or may be detached from the part A by pulling it away from the part A. This may be accomplished by placing the second ferromagnetic plate 16 on the enclosure in such a way that the peripheral marginal flat edge 19 and protruded surface 21 of the plate 19 can engage the corresponding respective annular flat portion 5 and depressed surface 8 of the enclosure 4. When this occurs, the rod 17 from the second ferromagnetic plate 16 can meet the rod 12 from the first ferromagnetic plate 2 at their respective ends. When those rods meet, the magnetic lines of force from the permanent magnet 1 are centered onto the rods 12 and 17 through their respective ferromagnetic plates 2 and 16. Thus, the rods can attract each other under the action of the centered magnetic force.

More specifically, the operation may be performed in the following manner. When the part A and the part B are to be coupled together, the second ferromagnetic plate 16 is placed onto the enclosure 4, and its rod 17 may be inserted into the center bores 5, 11 by sliding it relative to the top surface of the enclosure 4. By doing this, the rod 17 can be guided along the slant 7 formed by the depressed surface 8 on the enclosure 4 toward the center bore 6. The minimum amount of effort may be required to direct the rod 17 toward the bore 6 by restricting its sliding motion to the shortest way to the bore 6. In this way, the damages such as scratches on the enclosure 4 that may be caused by the sliding motion can
be avoided, as it is the case with the prior art which provides improvement
in this regard.

The annular member 3 is interposed between the permanent magnet
1 and the enclosure 4 so that a gap 25 can be defined between the top
side of the enclosure 4 and the polar side of the permanent magnet 1
facing the top side. This gap is functionally equivalent to a magnetic
gap in the magnetic circuit. The total weight of the device can be
reduced by the amount of the gap 25. The annular member 3 has the simple
configuration, and the fabrication process may be simplified by using this
annular member 3. The annular member 3 may be made of either ferro-
magnetic materials or nonmagnetic materials. Preferably, the annular
member should be made of brass or similar materials that can be cut to
the desired shape. When the annular member is made, any nonmagnetic
materials, brass, copper, or synergetic resins may be used. The annular
member may consist of two split parts, each having the identical shape
such as the semi-circular shape, which may be assembled together into one
unit.

Figs. 2 through 5 show several respective variations of the preceding
embodiment. In the variation shown in Fig. 2, the magnetic gap 25 in Fig. 1
is filled with another annular member 26 made of brass.

As seen from Fig. 2, the annular member 26 includes a bottom side
26a which engages the second polar side of the permanent magnet 1, and
an upper side 26b whose shape conforms to the shape of the top surface of
the enclosure 4. The annular member 26 may appear to have a slightly
complicated profile, but it can be shaped to the desired profile by using
brass, copper, or synthetic resin materials.

In the variation shown in Fig. 3, the permanent magnet 1 has a
center bore 11 whose upper peripheral edge is cut to provide a slant 27,
and the enclosure 4 has a depressed surface 8 that presents a steeper slant 7 that matches the slant 27. In this variation, the annular member 3 may also be made of either ferromagnetic or nonmagnetic materials.

Fig. 4 shows the variation of the annular member, in which an annular member 28 has a cylindrical shape and is disposed on the second polar side of the permanent magnet 1, and the enclosure 4 has the depressed surface 6 on its top, beginning with the peripheral edge and slanting downwardly toward the center bore 6.

Fig. 5 shows a further variation of the annular member 28 in Fig. 4, in which the first ferromagnetic plate 2 has a slightly greater in diameter than that of the permanent magnet 1, and an annular member 29 has a cylindrical shape which surrounds the permanent magnet 1.

The annular member 28 shown in Fig. 4 may be made of either ferromagnetic or nonmagnetic materials, whereas the annular member 29 in Fig. 5 should be made of nonmagnetic materials.

In each of those specific variations described above, a magnetic gap 25 may be provided between the permanent magnet 1 and the enclosure 4 on the top side thereof, or a magnetic gap may be provided by the annular member 26, 28, or 29. This gap reduces the weight, and makes the fabrication easy. When the annular member is made of nonmagnetic materials, brass, copper, or synthetic resin material may also be used. The annular member may also consist of two split pieces.

In the preceding embodiments and the variations thereof, the depressed surface 8 on the top of the enclosure 4 provides a linearly slanted surface 7. The depressed surface 8 may provide a curved slant surface 30 as shown in Fig. 6.

In each of the preceding embodiments, the second ferromagnetic plate 16 on the part B provides the protruded surface 21 whose shape matches
the shape of the depressed surface 8 on the enclosure 4. Alternatively, the shape may be flat as shown in Fig. 7. In this case, it is important to ensure that the rod 12 for the part A and the rod 17 for the part B can meet each other flatly, when the two parts A and B are coupled.

The variation shown in Fig. 5 may be varied as shown in Fig. 8 and Fig. 9, respectively.

In Fig. 8, the annular member 29 may be omitted, and instead an annular member 31 which may be made of ferromagnetic or nonmagnetic materials may be fitted inside the bore 11 through the permanent magnet 1. In this case, the peripheral bottom end 9 of the enclosure 4 that extends into the bore 11 may be supported by the peripheral upper end of the annular member 31.

In Fig. 9, the peripheral bottom end 9 of the enclosure 4 may be supported by the peripheral marginal edge of the rod 12.

In Figs. 8 and 9, the enclosure 4 can be also supported firmly, and the magnetic gap can be defined between the enclosure 4 and permanent magnet 1. The constructions in Figs. 8 and 9 may provide the same functional effects as those in the preceding embodiment and variations thereof.

According to the present invention, the rod for the magnetically attracted part can be directed toward the center bore by sliding it relative to the enclosure when that part is coupled with the magnetically attracting part, without causing any possible damages such as scratches on the enclosure during the sliding motion. The gap provided between the permanent magnet and enclosure reduces the weight and makes the fabrication easy.

Although the present invention has been described in full detail by referring to the preferred embodiments and variations thereof, it should
be understood that various changes and modifications may be made without departing from the spirit and scope of the invention.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A magnetic lock device comprising:

   a first element including a permanent magnet having a center bore traversing said permanent magnet and having a first side thereof for providing one polarity and a second side opposite to said first side for the opposed polarity, a first ferromagnetic plate rigidly attached to said one side of said permanent magnet, and a nonferromagnetic enclosure packaging said permanent magnet and said first ferromagnetic plate into one unit and having a center bore aligned with said center bore of said permanent magnet;

   a second element including a second ferromagnetic plate detachably attached to said second side of said permanent magnet;

   said second ferromagnetic plate having a rod of ferromagnetic material extending therefrom and disengageably engaging said first ferromagnetic plate directly or indirectly through a rod of ferromagnetic material extending from said first ferromagnetic plate when said second and first ferromagnetic plates meet together inside said bores through said enclosure and said permanent magnet; and

   said nonferromagnetic enclosure including a depressed surface inclining downwardly from the peripheral marginal edge of said enclosure toward said center bore of said enclosure, wherein the improvement includes:

   a gap defined between said depressed surface of said enclosure and said second side of said permanent magnet.
2. A magnetic lock device as defined in Claim 1, wherein said depressed surface of said enclosure is formed to provide a linear or curved surface inclining downwardly from the peripheral marginal edge of said enclosure toward said center bore of said enclosure.

3. A magnetic lock device as defined in Claim 1, wherein said depressed surface of said enclosure is formed over the total surface area of said enclosure, and wherein said second ferromagnetic plate is formed to provide the shape that matches the shape of said depressed surface.

4. A magnetic lock device as defined in Claim 1, wherein said depressed surface of said enclosure is formed to include a flat portion around the peripheral marginal edge of said enclosure, and wherein said second ferromagnetic plate is formed to provide the shape that matches the shape of said depressed surface, including a flat portion corresponding to said flat portion of said enclosure.

5. A magnetic lock device as defined in Claim 1, wherein said gap provides a magnetic gap defined without or with an intervening nonmagnetic member between said permanent magnet and said enclosure.

6. A magnetic lock device as defined in Claim 5, wherein said intervening nonmagnetic member defining said magnetic gap is an annular nonmagnetic member disposed between said permanent magnet and said enclosure, for backing up said depressed surface of said enclosure behind said enclosure.

DATED THIS 17th DAY OF DECEMBER 1991

APPLICATION ART LABORATORIES CO. LTD

Patent Attorneys for the Applicant:

F B RICE & CO
FIG. 1

FIG. 2

FIG. 3
FIG. 7

FIG. 8

FIG. 9
END