Sept. 27, 1960 J. A. BESUCH ET AL 2,954,257

MAGNETIC ATTACHMENT DEVICE

Filed May 19, 1958

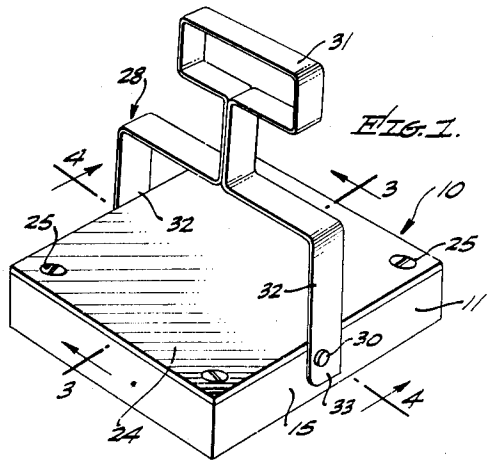

FIG. 1.

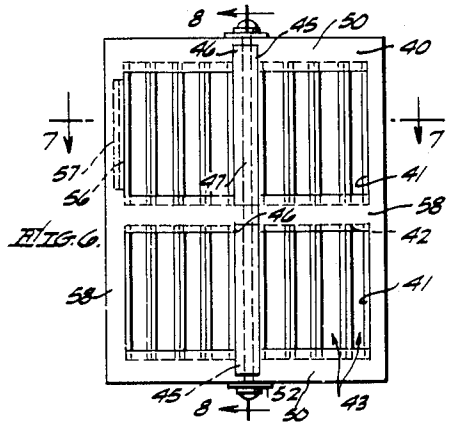

FIG. 6.

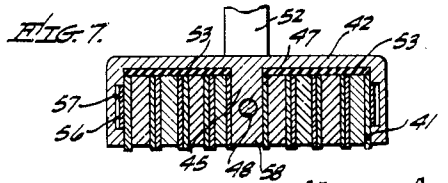

FIG. 7.

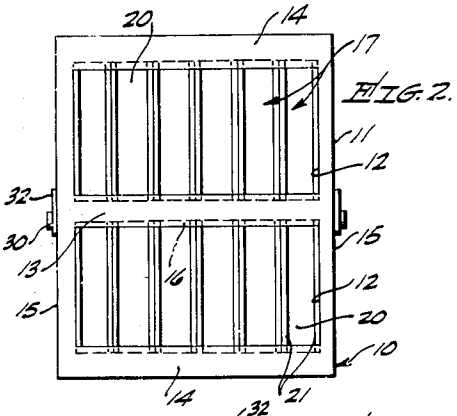

FIG. 2.

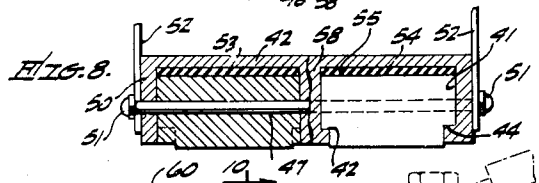

FIG. 8.

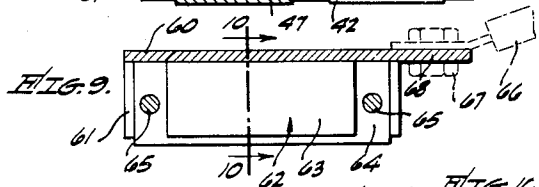

FIG. 9.

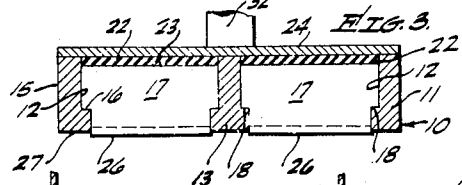

FIG. 3.

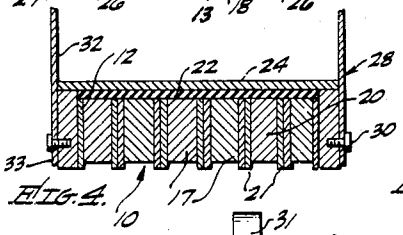

FIG. 4.

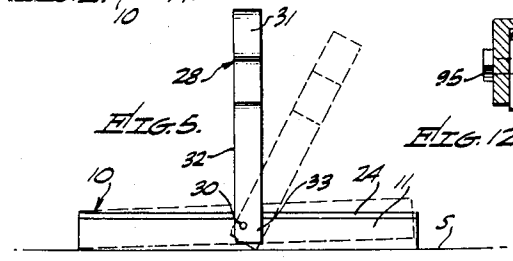

FIG. 5.

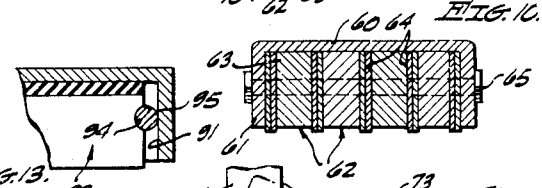

FIG. 10.

FIG. 13.

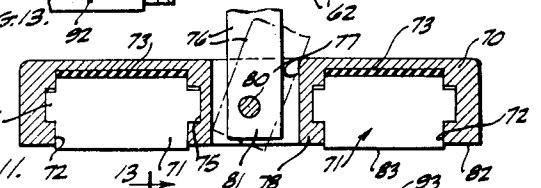

FIG. 11.

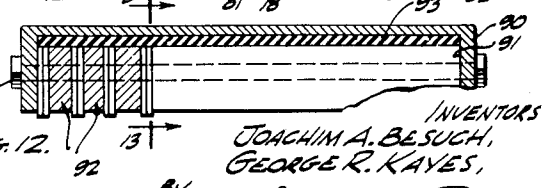

FIG. 12.

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MAGNETIC ATTACHMENT DEVICE

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12 Claims. (Cl. 294—65.5)

This invention relates generally to holding devices and relates more particularly to magnetic attachmment mechanisms that may be used for temporarily securing one member to another or for providing handle means whereby to enable lifting of sheets or pieces of material having magnetic properties.

In the handling of various articles of permeable material and more particularly in the temporary attachment of one structure to another, it has been common practice to employ permanent type magnets for the temporary securing purposes. These magnets have taken the form of the usual U-shaped structures, magnetic bar devices and more recently, magnets employing ceramic materials. Ceramic type magnets employing barium-ferrite ceramic tend to maintain magnet strength characteristics despite weakening influences like contact with other magnets or frequent sliding of the magnet from the steel armature. Ceramic magnets are also less expensive than all-metal magnets, such as the Alnico type, especially when produced in quantity. However, dimensional accuracy of the ceramic type magnets is more limited than in the all-metal type magnets and methods for supporting and retaining such ceramic magnets must necessarily allow for such dimensional differences.

It may thus be seen that the ceramic magnets offer several advantages over all-metal type magnets, even though they present more difficulty in use and support thereof.

Accordingly it is one object of the present invention to provide a magnet holding device that may be used to provide temporary attachment to an object and which employs magnetic structures mounted and retained in a specific manner to enable maximum use of the magnetic properties.

Another object of the invention is to provide a novel magnetic attachment device having a plurality of individual magnets and means for retaining such magnets in a supporting body.

A further object of the invention is to provide a magnet attachment device and supporting body for a plurality of ceramic type magnets together with a means for holding and retaining such magnets resiliently within the body.

Still another object of the invention is to provide an improved magnetic attachment device having means for securing a plurality of magnets therein and means for urging the device from the surface of permeable material whereby to enable removal of the device therefrom.

Another object of the invention is to provide means for mounting ceramic type magnets in a supporting body, together with means for resiliently positioning such magnets in the body and for locking these magnets in such position.

Other and further important objects of the invention will become apparent from the disclosures of the following detailed specification, appended claims and accompanying drawing, wherein:

Figure 1 is an isometric view of one form of the present magnetic attachment device;

Fig. 2 is a bottom plan view of the magnetic attachment device;

Fig. 3 is a longitudinal sectional view taken as indicated by line **3—3**, Fig. 1;

Fig. 4 is a transverse sectional view taken as indicated by line **4—4**, Fig. 1;

Fig. 5 is a side elevational view of the magnetic attachment device hereof and showing an operating characteristic of the breaker means for removing the device from a surface;

Fig. 6 is a bottom plan view similar to Fig. 2 showing a modified form of the present magnetic attachment device;

Fig. 7 is a transverse sectional view taken as indicated by line **7—7**, Fig. 6;

Fig. 8 is a longitudinal sectional view taken as indicated by line **8—8**, Fig. 6;

Fig. 9 is a longitudinal sectional view of another form of the present magnetic attachment device;

Fig. 10 is a transverse sectional view taken as indicated by line **10—10**, Fig. 9;

Fig. 11 is a longitudinal sectional view similar to Fig. 3 and showing another means for retaining the permanent magnets in position within a housing;

Fig. 12 is a transverse sectional view of another form of the present magnetic attachment device showing an alternative manner of retaining the individual ceramic magnets in a body; and

Fig. 13 is a fragmentary sectional view taken substantially as indicated by line **13—13**, Fig. 12.

With reference to the drawing, the magnet attachment device hereof is indicated generally at **10**.

In the form of the invention in Figs. 1 to 5, inclusive, the device hereof includes a generally rectangular body **11** that is preferably cast or machined from any suitable type of non-magnetic material, such as aluminum. In this form of the invention, the body **11** has a pair of generally rectangular openings **12** that are separated by a web portion **13**, there being integral end portions **14** and side portions **15**. The web portions **13** and the end portions **14** are each provided with a shoulder **16** across the length thereof and a plurality of ceramic magnets **17** are positioned within the openings **12**, each having shoulders **18** which are adapted to engage the shoulders **16**.

As shown, each of the permanent magnets **17** includes a ceramic bar **20** having iron pole pieces **21** on each lateral side thereof. Both the ceramic bars **20** and the pole pieces **21** are formed to provide the shoulders **18** and are thus positioned within the body **11** in a free fitting manner, thus to provide slight lateral and longitudinal movement thereof for purposes to be hereinafter more fully described.

As shown primarily in Figs. 3 and 4, resilient pads **22** are positioned within the openings **12** and in contact with upper edges **23** of the individual ceramic magnets **17**. The pads **22** may be of any suitable resilient material such as rubber or plastic and are retained in position by means of a cover member **24** which extends to the periphery of the body **11** and is secured in position thereon by means of screws **25**. It is to be noted that the lower edges **26** of the magnets **17** extend slightly beyond the lower surface **27** of the body **11** and that due to the free fitting of the magnets **17** within the openings **12** of the body **11** and further due to the characteristics of the pads **22**, the magnets **17** are permitted to shift slightly or be disposed at a slight angle relative to the body **11** in order to conform to any irregularities in the surface to which the device is attached. It is to be understood that the body **11** may be of any desired shape to conform to various surfaces and may be curved or otherwise contoured to engage curved surfaces as, for

example, iron pipe or other like objects. It is also to be understood that the present invention includes the provision of a free-fitting mounting arrangement for the magnet 17 and that this mounting arrangement may take several forms, as desired in particular situations, and may be inserted from either side of the openings 12, as will be described in detail hereinafter.

The device of Figs. 1 through 5, inclusive, a handle member 28 that is pivotally secured to the side portions 15 of the body 11 as by bolts 30 or the like. The handle member 28 includes a handle portion 31 and arm portions 32 with the arm portions 32 extending a substantial distance beyond the axis of the bolts 30 as at 33. It is to be noted that the axes of the bolts 30 are disposed laterally with respect to a center of the arms 32 and upon pivotal movement of the handle 28 by the bolts 30, as shown by the dotted lines in Fig. 5, the lower edge of the arm portions 33 will engage a surface resistance whereby to force movement of the lower surfaces 26 of the magnets 17 from the surface and break the attachment device therefrom, thus to enable easy removal when desired. In connection with the handle portion 28 and the magnetic breaking operational characteristics thereof, it is to be emphasized that different types of handle configurations may be employed and positioned within areas of the attachment device, without departing from the spirit and scope of the present invention.

With reference to Figs. 6, 7 and 8, another form of the invention is shown wherein a body 40 includes a pair of generally rectangular openings 41 that are formed therein and which comprise recesses, the upper ends of which are closed by means of an integral wall 42. In this form of the invention, shoulders 42 similar to the previously described shoulders 16, are formed in the body and a plurality of permanent magnets 43 are positioned with shoulders 44 in contact with the shoulders 42. Initially, as shown in Fig. 6, a locking member 45 is positioned in association with each of the openings 41 and each of which have ends which extend beyond the limits of the shoulders 42. Upon removal of the locking members 45, the individual ceramic magnets 43 may be positioned through the openings normally occupied by the locking members 45 and moved laterally to the positions shown in the drawing. Thereafter, locking members 45 are positioned in slots 46 provided therefor to retain the magnets 43 in proper position. The locking members 45 are secured in place by means of a longitudinally extending rod 47 that is positioned in longitudinal openings 48 in the locking members 45 and which extend through end walls 50 of the body 40 and fitted with enlargements for nuts 51 in the outer ends thereof. The rod 47 also serves pivotally to support arms 52 of a suitable breaker handle that may be of the type shown in Fig. 1. Additionally, in the form of the invention shown in Figs. 6 through 8, resilient pads 53 are adapted for disposition between upper edges 54 of the magnets 43 and the inner surface 55 of the integral wall 42. Further, as shown in Figs. 6 and 7, leaf springs 56 may be disposed in longitudinally extending grooves 57 in side walls 58 of the body 40 whereby to urge the individual magnets 43 laterally into contact with each other.

It is to be noted in the form of the invention shown in Figs. 6 through 8 that there is an alternative means shown and described for retaining the magnets 43 in position, providing a resilient mounting arrangement in a vertical direction therefor and urging lateral engagement thereof as well as for retaining the magnets removably in position and in association with the shoulders 42.

As shown in Figs. 9 and 10, the present magnet holding device may also include a generally U-shaped body member 60 having side portions 61. In this form of the invention, a plurality of permanent ceramic magnets 62 are positioned within the confines of the side portions 61 of the body 60 and the ceramic portions 63 of the magnets 62 have ends that are spaced from ends of the magnet pole pieces 64. The individual magnets 62 may thus be retained in position by means of a pair of bolts 65 which extend laterally through suitable openings in the extended end portions of the pole pieces 64 and through side portions 61 of the body 60. As shown, the form of the invention shown in Figs. 9 and 10 may be used as an electrical contact securing means for a welding device or the like, and may be attached to a suitable cable, 66, by means of a bolt 67 which extends through a tab 68 formed from the upper portion of the body 60.

Fig. 11 illustrates still another form of the present invention in which an integral body 70 is adapted to support a plurality of permanent ceramic magnets 71 that are positioned in suitable recesses 72 and backed by means of resilient pads 73. In this form of the invention, each of the magnets 71 is provided with laterally extending tabs 74 that are adapted by free disposition grooves 75 extending laterally along sides of the recesses 72. In this form of the invention, one side of the body 70 may be sealed into the grooves 75 from the side of the body 70. Also, in the form of the invention shown in Fig. 11, a breaker handle 76 is positioned in an opening 77 in the central area of the body 70 and the web portions 78 therein. The breaker handle 76 is pivotally mounted on a rod 80 that is carried by the body 70 and has an end portion 81 which extends downwardly therefrom. Upon pivotal movement of the breaker handle 76, as shown by the dotted lines in Figure 11, the end 81 of the handle is adapted to project beyond a lower surface 82 of the body 70 and lower surface 83 of the magnets 71 whereby to engage a surface to which the magnets 71 may be attached and to break the device therefrom.

As shown in Figs. 12 and 13, still another form of the invention may include a generally rectangular body 90 having suitable openings 91 therein and in which a plurality of permanent ceramic magnets 92 are positioned and backed up by means of a resilient pad or pads 93. As shown primarily in Fig. 13, lateral ends of the magnets 92 are provided with semi-circular grooves 94 and laterally extending bolts 95 which also engage the body 90, are adapted for disposition within the semi-circular grooves 94 whereby to retain the magnets 92 in position.

It may thus be seen that the present invention includes a variety of means for securing the individual ceramic type magnets within the confines of the body structure. It may further be seen that each of the mounting arrangements enables rapid and accurate disposition of the magnets within the housing, accounts for any differences in tolerance and firmly retains the magnets therein. Additionally, it is to be noted that the mounting arrangement in each of the forms of the invention enables attachment of the present magnet attachment device to a surface that may be extremely hot, such as metal emerging from a rolling mill or the like, without damage to any of the structural components of the present device. In this connection, some prior devices have employed plastic potting compounds for securing individual magnets in a housing; however, such an arrangement not only necessitates the additional manufacturing operation of depositing the compound about the permanent magnets but also fails to withstand high temperatures and/or rough handling of the attachment device which may cause cracking or breaking of the plastic potting material.

Having thus described the invention and the present several embodiments thereof, it is desired further to emphasize the fact that many additional modifications may be resorted to in a manner limited only by a just interpretation of the following claims.

We claim:

1. In a magnetic attachment device: a body structure having a recess therein, said recess having at least two opposed walls; a plurality of permanent ceramic magnets

disposed in said recess, each of said magnets having a ceramic element and a pair of pole pieces; means formed on said pole pieces of said permanent magnets and in said body structure for retaining said magnets movably in said body structure, one edge of said magnets being disposed in substantial coextensive alignment with an outer surface of said body structure; and resilient means disposed between said magnets and said body structure for urging said magnets toward said surface of said body structure.

2. In a magnetic attachment device: a body structure having a recess therein, said recess having at least two opposed walls; a plurality of permanent ceramic magnets disposed in said recess, each of said magnets having a ceramic element and a pair of pole pieces; means formed on said pole pieces of said permanent magnets and in said body structure for retaining said magnets movably in said body structure, one edge of said magnets being disposed in substantial coextensive alignment with an outer surface of said body structure; resilient means disposed between said magnets and said body structure for urging said magnets toward said surface of said body structure; and a handle carried by said body structure and having a portion thereof extendable beyond said surface of said body structure upon pivotal movement of said handle relative to said body structure.

3. In a magnetic attachment device: a body structure having a recess therein, said recess having at least two opposed walls; a plurality of generally rectangular permanent ceramic magnets disposed in said recess, each of said magnets having a central ceramic element and a pair of iron pole pieces; means formed on said ceramic elements and said pole pieces of said permanent magnets and in said body structure for retaining said magnets movably in said body structure, one edge of said magnets being disposed in substantial coextensive alignment with an outer planar surface of said body structure; and a resilient pad disposed between said magnets and said body structure for urging said magnets toward said surface of said body structure.

4. In a magnetic attachment device: a body structure having a recess therein, said recess having at least two opposed walls; a plurality of generally rectangular permanent ceramic magnets disposed in said recess, each of said magnets having an elongated centrally disposed ceramic element and a pair of elongated iron pole pieces; shoulder means in said walls of said recess in said body structure and adapted to receive complementary shoulder means formed on said ceramic elements and said pole pieces of said permanent magnets for retaining said magnets movably in said body structure, one edge of said magnets being disposed in substantial coextensive alignment with an outer planar surface of said body structure; a resilient pad disposed between said magnets and a base of said recess in said body structure for urging said magnets toward said surface of said body structure; and a handle carried by said body structure and having a portion thereof extendable beyond said surface of said body structure upon pivotal movement of said handle relative to said body structure.

5. In a magnetic attachment device, the combination of: a generally rectangular body structure having a recess therein, said recess having at least two opposed walls; a plurality of generally rectangular permanent ceramic magnets disposed in said recess, each of said magnets having an elongated centrally disposed ceramic element and a pair of elongated iron pole pieces; shoulder means in said walls of said recess in said body structure; mating shoulders on each of said ceramic elements and said pole pieces of said permanent magnets, said mating shoulders being disposed in contact with said shoulder means for retaining said magnets movably in said body structure, one elongated edge of each of said magnets being disposed in substantial coextensive alignment with an outer planar surface of said body structure; a resilient pad disposed between another elongated edge of each of said magnets and a base of said recess in said body structure for urging said magnets toward and normally slightly beyond said planar surface of said body structure; and a handle carried by said body structure and having a portion thereof extendable beyond said surface of said body structure upon pivotal movement of said handle relative to said body structure.

6. In a magnetic attachment device, the combination of a generally rectangular having a pair of recesses therein, said recesses having opposed walls on ends thereof; a plurality of generally rectangular permanent ceramic magnets disposed in said recesses, each of said magnets having an elongated centrally disposed ceramic element and a pair of elongated iron pole pieces; shoulder means in said body structure and normally engageable with mating shoulders on each of said ceramic elements and said pole pieces of said permanent magnets for retaining said magnets movably in said body structure, one elongated edge of each of said magnets being disposed in substantial coextensive alignment with an outer planar surface of said body structure; a resilient pad disposed between another elongated edge of each of said magnets and a base of said recesses in said body structure for urging said magnets toward said shoulder means and normally slightly beyond said planar surface of said body structure; and a handle pivotally carried by said body structure and having a portion thereof extendable beyond said surface of said body structure upon pivotal movement of said handle relative to said body structure.

7. A magnetic attachment device comprising, in combination: a body having a pair of rectangular recesses therein; a cover secured to one side of said body and forming a base for said recesses; shoulders along opposite edges of said recesses; a plurality of permanent ceramic magnets disposed in said recesses, each of said magnets having a ceramic element and a pair of pole pieces; shoulders formed in said magnets, said shoulders being adapted for cooperation with said shoulders in said recesses, said magnets having edges disposed in substantial alignment with an outer surface of said body remote from said cover; a resilient body disposed between other edges of said magnets and said cover whereby to urge said magnets toward said surface of said body; and a handle pivotally mounted in lateral sides of said body, said handle having extension portions disposed toward said surface of said body and adapted for extension beyond said surface upon pivotal movement of said handle relative to said body.

8. A magnetic attachment device comprising, in combination: a generally rectangular body having a pair of recesses therein; shoulders along edges of said recesses; a plurality of permanent ceramic magnets disposed in said recesses and having shoulders cooperable with said shoulders in said recesses, each of said magnets having a ceramic element and a pair of pole pieces; a locking member disposed laterally across each of said recesses, said locking member having a width substantially equal to a width of said permanent magnets and a length in excess of a length of said permanent magnets; means for retaining said locking members in position whereby to retain said magnets in position in said body; and a resilient pad disposed between a base of said recesses in said body and lateral edges of said magnets whereby to urge said magnets toward an outer surface of said body.

9. A magnetic attachment device comprising, in combination: a generally rectangular body having a pair of recesses therein; shoulders along edges of said recesses; a plurality of permanent ceramic magnets disposed in said recesses and having shoulders cooperable with said shoulders in said recesses, each of said magnets having a ceramic element and a pair of pole pieces; a locking member disposed laterally across each of said recesses, said locking member having a width substantially equal to a width of said permanent magnets and a length in excess of a length of said permanent magnets; means for retain-

ing said locking members in position whereby to retain said magnets in position in said body; and a breaker handle carried by said locking member securing means and pivotally disposed to said body, said breaker handle having a portion extending beyond said pivotal connection therefor and extendable beyond said surface of said body on pivotal movement of said handle relative to said body.

10. A magnetic attachment device comprising, in combination: a generally rectangular body having a pair of recesses therein; shoulders along edges of said recesses; a plurality of permanent ceramic magnets disposed in said recesses and having shoulders cooperable with said shoulders in said recesses, each of said magnets having a ceramic element and a pair of pole pieces; a locking member disposed laterally across each of said recesses, said locking member having a width equal substantially to a width of said permanent magnets and a length in excess of a length of said permanent magnets; means for retaining said locking members in position whereby to retain said magnets in position in said body; breaker handle carried by said locking member securing means and pivotally disposed to said body, said breaker handle having a portion extending beyond said pivotal connection therefor and extendable beyond said surface of said body on pivotal movement of said handle relative to said body; and leaf spring means disposed in said body and engageable with lateral sides of the endmost of said magnets whereby to urge said magnets into lateral engagement with each other.

11. A magnetic attachment device comprising, in combination: a body having at least one recess therein; a movable side member on said body; elongated grooves on lateral sides of said recess; a plurality of permanent ceramic magnets disposed in said recess, each of said magnets having a ceramic element and a pair of pole pieces; laterally extending projections on ends of said magnets, said projections being adapted for disposition

in said recess grooves, said removable and member serving to secure said magnets in said recess and said grooves; and a resilient pad disposed between edges of said magnets and a base of said recess, said pad serving to urge said magnets toward an outer planar surface of said body.

12. A magnetic attachment device comprising, in combination; a body having at least one recess therein; a removable side member of said body; elongated grooves on lateral sides of said recess; a plurality of permanent ceramic magnets disposed in said recess, each of said magnets having a ceramic element and a pair of pole pieces; laterally extending projections on ends of said magnets, said projections being adapted for disposition in said recess grooves; said removable end member serving to secure said magnets in said recess and said grooves; a resilient pad disposed between edges of said magnets and the base of said recess, said pad serving to urge said magnets toward a planar surface of said body; an opening through said body; and a handle disposed in said opening and pivotally mounted to said body, said handle having a portion extending beyond said pivotal connection therefor and extendable beyond said surface of said body upon pivotal movement of said handle relative to said body.

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