

Feb. 15, 1966

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3,235,302

MAGNETIC CATCH

Filed Dec. 2, 1963

2 Sheets-Sheet 1

Fig. 2

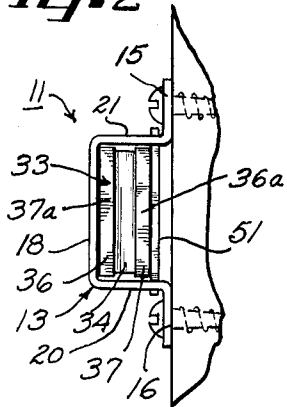


Fig. 1

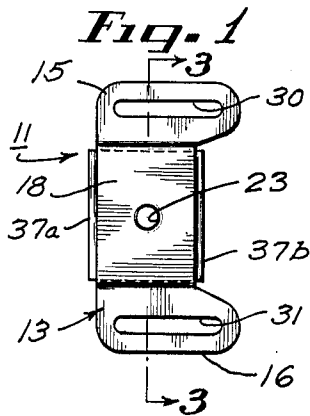


Fig. 4

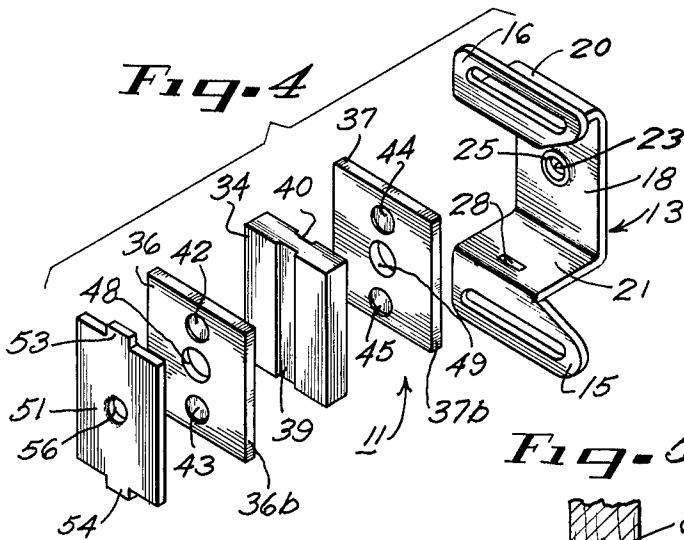


Fig. 5

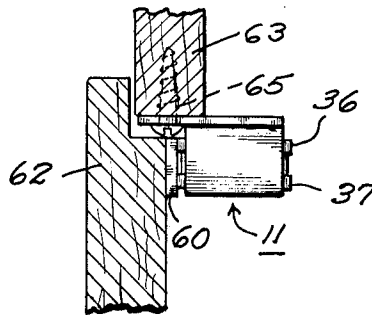
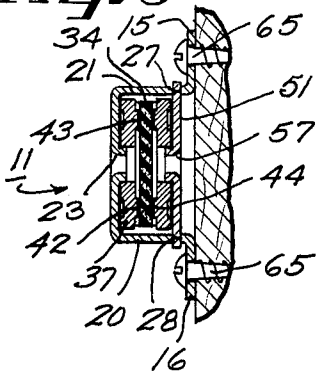


Fig. 3



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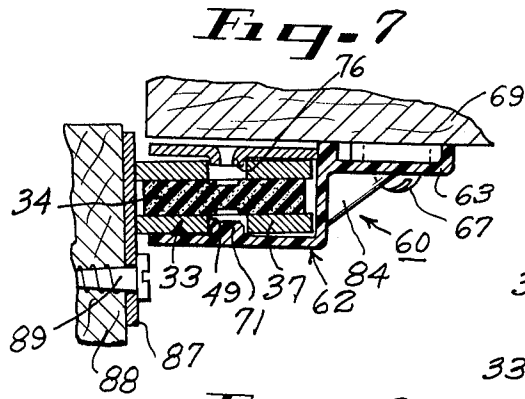
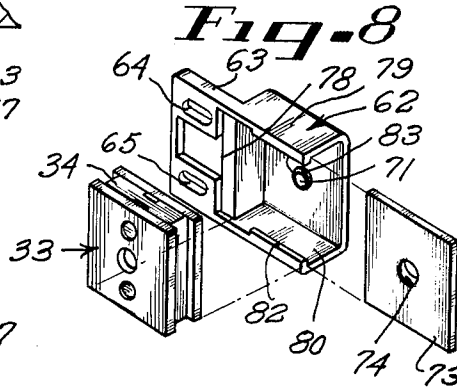
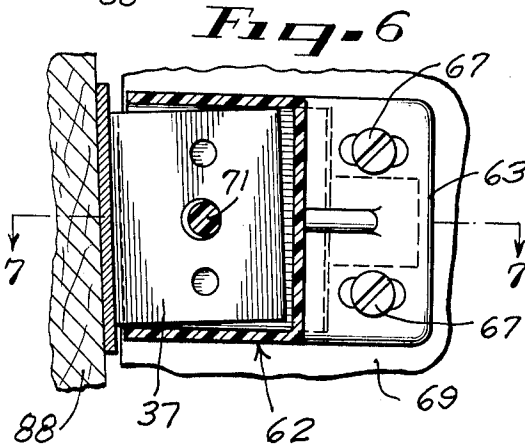
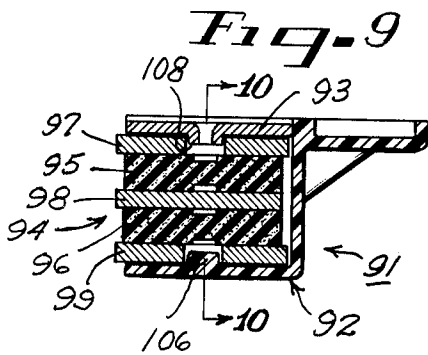
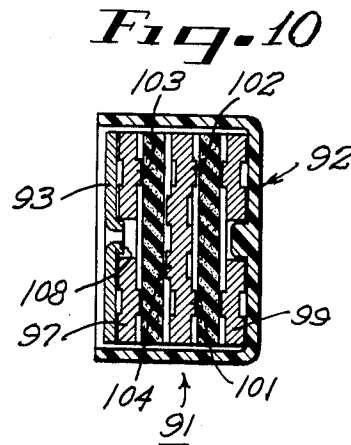
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2 Sheets-Sheet 2



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MAGNETIC CATCH

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12 Claims. (Cl. 292—251.5)

The present invention generally relates to magnetic catches and it more particularly relates to new and improved magnetic catches incorporating one or more permanent magnets which can be manufactured in an extrusion process.

In order to obtain the maximum holding power from a permanent magnet it is known in the prior art to employ a pair of magnetic pole pieces which respectively engage through a large surface area the opposite poles of the permanent magnet and which pole pieces are adapted to engage a soft magnetic armature which constitutes the strike in the over-all latch assembly. The size of the catch may be minimized and the appearance of the catch improved by employing a highly coercive magnetic material formed in a relatively thin rectangular slab, the direction of polarization of which extends from one large facial area of the magnet to the oppositely disposed large facial area. Ceramic and Alnico magnetic materials have, in the past, been employed in magnetic catches of this general type.

Magnetic catches of this general type are commonly used for securing the doors on cabinets and the like in a closed position and they find particular application where some small degree of warping and dimensional changes in the cabinet or door are to be expected. Although the position of the catch on either the cabinet door or on the associated frame can be made adjustable, inasmuch as the dimensional variations in the cabinet occur on an almost day-to-day basis due to humidity and temperature changes in the ambient environment, it is, of course, undesirable that such frequent adjustment of the catch be required. Accordingly, the usual practice has been to provide a magnetic assembly relatively movable in the catch housing so that without adjusting the position of the housing itself on the door or frame structure, the magnetic assembly may automatically position itself to accommodate for the warpage and dimensional changes in the associated structure. The armature plate, being formed of a soft magnetic material such as iron, is originally planar in construction and because of its relatively high strength as compared to the wooden or other member on which it is secured it retains such planar configuration even though the cabinet or door on which it is mounted may warp. Accordingly, since maximum holding power of the catch is achieved when a maximum contact area between the pole pieces and the armature plate occurs, the latch of the present invention employs a pair of pole pieces whose armature engaging surfaces are perfectly aligned in a common plane and are maintained in such alignment throughout the life of the catch. In order to accommodate for the heretofore described warpage and dimensional changes, the magnetic assembly comprising the permanent magnet and the associated pole pieces are mounted for limited universal movement within the housing while relative movement between the pole pieces themselves and between the pole pieces and the permanent magnet is prevented. This construction assures a maximum contact area between the pole pieces and the armature plate when the two parts are brought into cooperative engagement with the armature plate spanning the pole pieces.

From an economic standpoint, it is desirable that the manufacturing cost of the magnetic catch be minimized

and to this end the catch of the present invention employs a permanent magnet structure which is uniform in cross section throughout one linear dimension so that the magnet may be manufactured in a continuous extrusion process. The so-called rubber magnets are particularly suited for manufacture in an extrusion process and for this reason the present invention is described in connection with a rubber type permanent magnet in which the magnetic material is retained in a rubber or similar binder. Such magnets are readily available on the market.

A principal object of the present invention is, therefore, to provide a new and improved magnetic catch.

Another object of the present invention is to provide an improved magnetic catch in which the magnetic assembly is mounted in a nonmagnetic housing to provide limited universal movement of the magnetic assembly.

Still another object of the present invention is to provide an improved magnetic catch of the character described above wherein a permanent magnet and associated pole pieces are substantially immovable relative to one another and are mounted within a nonmagnetic housing in a manner to provide limited universal movement thereof relative to the housing.

A further object of the present invention is to provide an improved magnetic catch of the character described above wherein a magnetic element is adaptable to manufacture in an extrusion process.

A still further object of the present invention is to provide a new and improved permanent magnetic structure for use in a magnetic catch.

A yet further object of the present invention is to provide a new and improved magnetic catch which is efficient in operation, durable in use, and which can be manufactured at a relatively low cost.

Briefly, the above and further objects are realized in accordance with the present invention by providing a magnetic catch for use with a flat soft magnetic armature plate and which includes a nonmagnetic housing through at least one opening in which extends a pair of pole pieces between which is sandwiched a rectangularly shaped permanently magnetized slab. The permanent magnet and the pole pieces are secured together in a manner to prevent mutual relative movement, and the pole pieces thereof have marginal end portions which are flat and which are aligned in a common plane so as to provide a maximum contact area with the associated flat armature plate. The permanent magnet is provided with a pair of rectilinear grooves on the opposite surfaces thereof into which integral portions of the pole pieces extend. Integral struck-out portions of the housing extend into aligned apertures in the pole pieces thereby rotatably to secure the magnetic assembly in the housing. The struck-out portions of the pole pieces are cylindrical and have a diameter somewhat less than the diameter of the apertures in the pole pieces thereby to provide a limited amount of rotation of the magnetic assembly about an axis perpendicular to the common axis of the aligned apertures in the pole pieces.

Further objects and advantages and a better understanding of the present invention may be had by reference to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a top plan view of a magnetic catch embodying the present invention;

FIG. 2 is a side elevational view of the magnetic catch of FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 1 showing the catch attached to an associated wooden structure;

FIG. 4 is an exploded isometric view of the magnetic catch of FIGS. 1, 2, and 3;

FIG. 5 is a side elevational view showing the magnetic catch and associated armature plate in use and in cooperative engagement;

FIG. 6 is a top plan view of another magnetic catch construction embodying the present invention with a portion of the housing broken away to illustrate the internal parts of the catch, this latch being shown in operative association with an armature plate with both the plate and the catch mounted on associated structures;

FIG. 7 is a cross-sectional view of the device of FIG. 6 taken along the line 7—7 thereof;

FIG. 8 is an exploded isometric view of the magnetic catch shown in FIGS. 6 and 7;

FIG. 9 is a sectional view similar to that of FIG. 7 but showing an alternative embodiment of the present invention employing two permanent magnets; and

FIG. 10 is a sectional view of the device of FIG. 9 taken along the line 10—10 thereof assuming the entire structure to be shown in FIG. 9.

Referring now to the drawings and particularly to FIGS. 1-5 thereof, a magnetic catch 11 comprises a non-magnetic metallic housing member 13 formed of a suitable material such as aluminum. The member 13 is essentially U-shaped in construction and includes as an integral part thereof a pair of elongated mounting flanges 15 and 16.

The mounting flanges 15 and 16 are each provided with elongated slots 30 and 31, respectively, for receiving mounting screws which as described more fully hereinafter are used to adjustably secure the housing 13 to an associated support structure with which it is used.

The central portion of the housing 13 comprises a flat wall section 18 disposed intermediate a pair of side wall portions 20 and 21 which are arranged in mutually parallel relationship at right angles to the central portion 18. Centrally positioned in the center portion 18 is a circular aperture 23 which is surrounded by a depending or inwardly extending annular flange 25 which is best shown in FIG. 3. A pair of rectangular apertures or slots 27 and 28 are provided in the side walls 20 and 21, respectively, at a position just above the mounting flanges 15 and 16.

Mounted within the housing 13 is a magnetic assembly 33 consisting of a permanent magnet 34 in the shape of a relatively thin rectangular slab and a pair of flat rectangular pole pieces or plates 36 and 37 positioned over the opposite large area faces of the magnet 34. The magnet 34 is polarized perpendicularly to its flat, pole piece engaging faces which are juxtaposed with the pole pieces 36 and 37.

As is well known to those skilled in the art, the pole pieces 36 and 37 are formed of a soft, highly permeable magnetic material such, for example, as iron. Both the magnet 34 and the pole pieces 36 and 37 are preferably rectangular in configuration but the pole pieces should be somewhat larger than the magnet 34 in their over-all dimensions so as to extend beyond the edges of the magnet 34.

In order to prevent relative movement between the magnet 34 and the associated pole pieces 36 and 37, the magnet 34 is provided, as best shown in FIG. 4, with a pair of rectilinear grooves 39 and 40 disposed on the opposite polar faces of the magnet. The grooves 39 and 40 extend parallel to the parallel side edges 34a and 34b of the magnet so that the magnet 34 may be molded in an extrusion process. It will be noted that the magnet 34 has the same cross section throughout from the top to the bottom thereof as viewed in FIG. 4.

The pole pieces 36 and 37 are each provided with a pair of pressed out lugs 42, 43 and 44, 45, respectively. The lugs 42-44 each have an external diameter substantially equal to the width of the grooves 39 and 40 so that when the pole pieces 36 and 37 are pressed against the magnet 34 relative movement between the parts in

a direction transverse to the length of the grooves 39 and 40 is prevented. The lugs 42-44 must not, however, prevent the large face-to-face contact area between the magnet 34 and the pole pieces 36 and 37.

In order to secure the magnetic assembly 33 in the housing 13, each of the pole pieces 36 and 37 is provided with a centrally disposed aperture, identified as 48 and 49 respectively. The apertures 48 and 49 have a diameter exceeding the external diameter of the flange 25 on the housing 13 by several thousandths of an inch so as to provide a loose fit between the pole piece 37 and the flange 25. Moreover, as best shown in FIG. 3 the flange 25 has a length substantially less than the thickness of the pole piece 37 and thus terminates short of the magnet 34.

The magnet assembly 33 is held in the housing 13 by a cover plate 51. The cover plate 51, which is generally rectangular in construction, has a pair of elongated lugs or tabs 53 and 54 extending from opposite ends thereof for reception in the slots 27 and 28. The length of the body portion of the plate 51 in the direction of the lugs 53 and 54 is approximately equal to the corresponding dimension of the central portion 18 of the housing 13. The plate 51 is further provided with a centrally disposed aperture 56 surrounded by an integral annular flange 57 substantially identical to the flange 25 on the housing member 13. The flange 57 is thus loosely received in the aperture 48 in the pole piece 36 when the plate 51 is secured to the housing 13 by the tabs 53 and 54 located within the slots 27 and 28. It will be apparent that the latch 11 may be fabricated by first assembling the magnetic elements as a unit, then placing them within the housing member 13, and then snapping the cover plate 51 in place by springing the side walls 20 and 21 apart a sufficient distance to override the tabs 53 and 54. The natural resilience of the metal or other material from which the housing member 13 is constructed then causes the walls 20 and 21 to snap back to their initial state wherein the plate 51 is secured to the housing member 13. The pole pieces 36 and 37 are thus held in place by the annular flanges 25 and 57 and the magnet 34 is held in place by virtue of the fact that the lugs 42-45 are tightly received within the grooves 29 and 40, which grooves extend transverse to the housing walls 20 and 21.

Referring to FIG. 1 it will be seen that the forwardly extending edges of the pole pieces identified as 36a and 37a lie in a common plane and that the rearwardly extending edges 36b and 37b of the pole pieces also lie in a common plane with both sets of edges extending beyond the adjacent edges of the housing parts 13 and 51. A limited amount of rotational movement of the magnetic assembly 33 is provided since the plate 51 and the body portion 18 have a length exceeding the corresponding dimension of the pole pieces 36 and 37. Moreover, a limited amount of rotational movement about an axis perpendicular to the principal axis of the apertures 48 and 49 is provided by virtue of the fact that the apertures 48 and 49 have a greater diameter than the external diameter of the flanges 25 and 57. Moreover, this loose fit between the pole pieces 36 and 37 and the flanges 25 and 57 provide a limited amount of fore and aft lateral movement of the assembly within the housing. However, the magnetic assembly 33 of the magnet 34 and the associated pole pieces 36 and 37 moves only as a unit since the depth of the grooves 39 and 40 and the length of the lugs 42-44 is greater than the amount of top-to-bottom play within the housing between the wall portion 18 and the plate 51. It will be understood that the amount of clearance required between the magnetic assembly and the housing to permit the limited universal movement hereinabove described varies with the over-all size of the catch. Where the magnet 34 has a length and width of three-fourths of an inch, a total clearance of one-sixteenth of an inch is sufficient between the sides 20 and 21 and the pole pieces 36 and 37. A lesser clearance between the pole pieces

36 and 37 and the plate 51 and the housing wall 18 of about one-thirty-second of an inch is sufficient.

Referring to FIG. 5 there is shown a portion of a cabinet or the like in which the catch 11 is mounted in co-operative relationship with an armature or strike plate 60 for latching a door 62 against a frame 63. As there shown, the armature plate 60, which is formed of a soft magnetic material such as iron, is secured by any suitable means, not visible in the drawings, to the inner side of the door 62, and the catch 11 is secured to the frame 63 by means of a plurality of screws 65, only one of which is visible in FIG. 5. Both of the screws 65 are, however, shown in FIG. 3. In the embodiment of FIG. 5 the rearward edges 36b and 37b of the pole pieces 36 and 37 are shown in engagement with the armature plate 60. However, it will be understood by those skilled in the art that the catch 11 may be reversed for some applications so that the forward edges 36a and 37a of the pole pieces 36 and 37 would be adapted to engage the armature plate 60. In either position, however, the armature engaging faces of the pole pieces 36 and 37 are maintained in mutually coplanar relationship and a planar faced armature plate 60 is employed. Accordingly, the maximum area contact surface between the armature 60 and the pole pieces 36 and 37 is assured and the maximum holding power for the particular magnet employed is achieved.

The magnetic catch shown and described in connection with FIGS. 1-5 has several advantages over the prior art catches employing permanent magnets. In this construction, only five different parts are required and two of these parts of the pole pieces are identical, thereby minimizing the number of different parts which must be retained in inventory. Secondly, a magnetic subassembly is provided which eliminates movement between the parts thereof whereby a planar armature contacting surface is insured for all relative positions of the armature plate and the magnetic catch, within, of course, reasonable limits. Furthermore, the magnet 34 is a solid member having no apertures or the like therein thereby to maximize the mass or volume thereof and thus maximize the magnetic holding power available for a given size magnet. Thirdly the magnet 34 is of such a construction that it can be molded in a continuous extrusion process without any further operations other than to cut such magnets to the desired length from a continuous strip.

Refer now to FIGS. 6-8, inclusive, wherein is shown another embodiment of the present invention employing a molded plastic housing. As there shown, a magnetic catch 60 comprises a plastic housing member 62 in which the magnetic assembly 33 described hereinabove is employed. The housing 62 which may be molded as a unitary member includes a rearwardly extending mounting flange 63 provided with a pair of slots 64 and 65 for receiving mounting screws 67. In FIG. 7 the catch 60 is shown mounted on a door frame structure 69 by means of screws 67. As best shown in FIG. 8, the housing member 62 is open at two sides, the front and top, respectively, as viewed in FIG. 7, and an integral depending cylindrical boss 71 is provided for loose reception in the aperture 49 in the pole piece 37. The open forward side of the housing 62 is rectangular and is somewhat larger in both length and width than the corresponding dimensions of the magnetic assembly 33 thereby to permit limited universal movement of the magnetic assembly 33 within the housing. With the magnetic assembly 33 positioned within the housing member 62 over the boss 71, a cover plate 73 having a central aperture 74 therein surrounded by a cylindrical flange 76 is placed within the rearward edge thereof on a shoulder 77 of the housing member 62, and the side walls 79 and 80 of the housing member 62 are then spread a sufficient distance apart so that a pair of reentrant elongated flanges 82 and 83 thereon may be snapped over the plate 73 thereby to hold it in place on the housing member 62.

A triangular strengthening gusset 84 is provided between the rear wall 85 and the rearwardly extending mounting flange 63. If desired, the rearward edges of the pole pieces 36 and 37 may be flush with the rearward side of the magnet 34 in this embodiment of the invention inasmuch as the rear side of the magnetic assembly is not adapted to engage an armature plate.

As shown in FIG. 7 a soft magnetic armature plate 87 is mounted on the doors 88 by means of a wood screw 89 at a position to engage the forwardly extending faces of the magnetic assembly 33 when the door is in a closed position. In this embodiment of the invention as in the embodiment described in connection with FIGS. 1-5, the magnetic assembly 33 provides a planar armature engaging surface at all times. Limited universal movement of the magnetic assembly 33 accommodates for warping and dimensional changes of the associated structure.

Referring to FIGS. 9 and 10 there is shown an alternative embodiment of the present invention wherein is provided a magnetic catch 91. The assembly 91 is similar to the catch assembly of FIGS. 6, 7 and 8 and thus comprises a plastic housing member 92 to which is secured a nonmagnetic cover plate 93. A magnetic assembly 94 is mounted within the nonmagnetic housing and comprises a pair of grooved permanent magnets 95 and 96 and three pole pieces 97, 98 and 99. The pole piece 98 is common to the magnets 95 and 96 and includes two pairs of lugs 101, 102 and 103, 104 for reception in the respective rectilinear grooves of the magnets 95 and 96. The center pole piece 98 need not be apertured. The pole pieces 97 and 99 may be identical to the pole pieces 36 and 37 and the cover plate 93 may be identical to the cover plate 73. This embodiment of the invention shown in FIGS. 9 and 10 incorporates two permanent magnets 95 and 96, both of which include rectilinear grooves on the opposite faces thereof thereby to maintain the magnetic assembly in unitary relationship so that the forward faces of the pole pieces 97, 98 and 99 are maintained in coplanar relationship. The entire magnetic assembly is, however, mounted for limited universal movement on a lug 106 which depends into the magnetic assembly from the housing member 92 and on an annular flange 108 which depends into the magnetic assembly 94 from the cover plate 93 in alignment with the lug 106.

While the present invention has been described in connection with particular embodiments thereof, it will be understood by those skilled in the art that many changes and modifications may be made to the described structure without departing from the invention. Accordingly, it is intended by the appended claims to cover all such changes and modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. A magnetic latch for use with a flat armature plate formed of a magnetic material, comprising
 - a nonmagnetic housing defining therein a chamber and having at least one opening in a side wall thereof, said housing further including a bottom wall and a top wall,
 - a magnetic assembly disposed in said chamber between said top and bottom walls and having a portion thereof extending outwardly of said housing through said opening,
 - said magnetic assembly including a permanent magnet having a pair of flat, oppositely disposed faces each having a rectilinear groove therein extending from one edge of said magnet to the other,
 - one of said faces being a north pole and the other of said faces being a south pole,
 - a pair of plate-like pole pieces formed of magnetic material and respectively lying against said polar faces of said magnet,
 - each of said pole pieces having a plurality of projections extending into said grooves to prevent relative rotation between said pole pieces and said magnet,

and means pivotally connecting said pole pieces to said housing.

2. A magnetic latch for use with a flat armature plate formed of a magnetic material, comprising

a nonmagnetic housing defining therein a chamber, said housing having at least one opening in a side wall thereof communicating with said chamber, said housing further including a flat bottom wall and a flat top wall,

a magnetic assembly disposed in said chamber between said top and bottom walls and having a portion thereof protruding outwardly of said housing through said opening,

said magnetic assembly including at least one permanent magnet having a pair of flat, oppositely disposed faces, said faces each being provided with an elongated recess,

one of said faces being a north pole and the other of said faces being a south pole,

a pair of plate-like pole pieces formed of magnetic material and respectively lying against said polar faces of said magnet,

each of said pole pieces having a plurality of projections extending snugly into the recesses in said magnet to prevent relative rotation between said pole pieces and said magnet,

and means pivotally connecting said pole pieces to said housing.

3. A magnetic latch for use with a flat armature formed of a magnetic material, comprising

a nonmagnetic housing having at least one opening therein,

a magnetic assembly disposed in said housing with a portion thereof protruding through said opening, said assembly comprising a rectangularly shaped magnet and a pair of rectangular pole pieces positioned on opposite sides of said magnet,

said pole pieces each having a pair of protrusions extending into grooves in the opposite faces of said magnet,

said grooves extending parallel to an edge of and through said magnet,

and integral portions of said housing extending into aligned apertures in said pole pieces to pivotally secure said magnet assembly in said housing.

4. A magnetic latch for use with a flat armature formed of a magnetic material, comprising

a nonmagnetic housing having at least one opening therein,

a magnetic assembly disposed in said housing, said assembly comprising a rectangularly shaped magnet and a pair of rectangular pole pieces positioned on opposite sides of said magnet,

said pole pieces extending outwardly of said housing through said opening, the marginal protruding edges of said pole pieces being flat and lying in a common plane,

said pole pieces each having at least two protrusions extending snugly into elongated recesses in the opposite faces of said magnet,

and means on said housing extending into aligned recesses in said magnetic assembly for pivotally securing said magnet assembly in said housing.

5. For use in a magnetic catch, a magnetic assembly comprising

a permanently magnetized member having a uniform cross-sectional configuration in a given axial direction,

said member having a plurality of grooves disposed on opposite sides thereof and extending parallel to said axial direction,

first and second soft magnetic pole pieces juxtaposed with said sides of said member respectively, and

said pole pieces each having a plurality of lugs extending into said grooves,

6. For use in a magnetic catch, a magnetic assembly comprising

a permanently magnetized elastomeric member having a uniform cross-sectional configuration in a given direction,

said member having a plurality of grooves disposed on opposite sides thereof, said grooves each extending parallel to said direction,

first and second soft magnetic pole pieces respectively juxtaposed with said sides of said member, and

said pole pieces each having a plurality of spaced-apart, integral lug portions extending into said grooves.

7. A magnetic assembly as set forth in claim 5 wherein each of said pole pieces includes an aperture disposed between at least two of said lugs.

8. A permanent magnet for use in a magnetic assembly comprising

a solid member formed of a permanently magnetizable elastomeric material,

said member having a constant cross-sectional configuration in a given direction, and

said member having a pair of planar oppositely disposed surface in mutually parallel relationship, said surfaces being parallel to said given direction, and said surfaces each having a rectilinear retaining groove of substantially rectangular cross-sectional configuration for receiving correspondingly shaped shaped retaining means on said assembly and extending parallel to said direction.

9. A magnetic assembly as set forth in claim 5 wherein said magnet member is imperforate.

10. A magnetic catch comprising

a nonmagnetic, metallic housing member of generally U-shaped configuration having a rectangularly shaped intermediate flat wall portion and a pair of side wall portions extending from opposite side edges of said intermediate flat wall portion at right angles thereto.

a flat, rectangularly shaped cover plate approximately equal in length and width to said intermediate wall portion,

a pair of tabs extending from opposite ends of said cover plate into respective slots located in said side wall portions remote from said intermediate wall portion,

a magnetic assembly disposed in said housing between said wall portions and said cover plate,

said assembly comprising a plurality of thin rectangular plates of permanently magnetized material each having a pair of flat face portions directed respectively toward said cover plate and said intermediate wall portion,

said material being polarized in a direction normal to said face portions,

said plates having rectilinear grooves in each of said face portions, said grooves being mutually parallel and extending in a direction from one of said side wall portions to the other of said side wall portions, at least three pole pieces respectively juxtaposed with said face portions,

lug means on each of said pole pieces extending into said grooves,

said pole pieces protruding from said housing and each having flat, outwardly extending marginal edges lying in a common plane,

said magnetic assembly including a pair of aligned recesses respectively opening toward said cover plate and said intermediate wall portion,

and means mounted by said cover plate and by said intermediate wall portion fitting loosely in said recesses for mounting said magnetic assembly in said housing,

the distance between said intermediate wall portion and said cover plate exceeding the corresponding dimension of said magnetic assembly to permit limited rocking of said magnetic assembly in said housing, and

the distance between said side wall portions exceeding the corresponding dimension of said magnetic assembly to permit limited pivotal movement of said magnetic assembly in said housing.

11. A magnetic catch comprising

a nonmagnetic, metallic housing member of generally U-shaped configuration having an intermediate flat wall portion and a pair of side wall portions extending at right angles from opposite side edges of said intermediate flat wall portion,

a flat, rectangularly shaped cover plate approximately equal in size to said intermediate wall portion,

a pair of tabs extending from opposite ends of said cover plate into respective apertures in said side wall portions,

a magnetic assembly disposed in said housing between said wall portions and said cover plate,

said assembly comprising a permanent magnet in the configuration of a thin rectangular plate of permanently magnetized material having a pair of flat face portions directed respectively toward said cover plate and said intermediate wall portion,

said permanent magnet plate having a plurality of rectangular grooves respectively provided in each of said face portions, said grooves being mutually parallel and extending in a direction from one of said side wall portions to the other of said side wall portions, a pair of pole pieces respectively juxtaposed with said face portions,

lug means on said pole pieces extending into said grooves,

said pole pieces protruding from said housing and hav-

ing flat, outwardly extending marginal edges lying in a common plane,

said magnetic assembly including a pair of aligned recesses respectively opening toward said cover plate and said intermediate wall portion,

and means on said cover plate and on said intermediate wall portion fitting loosely in said recesses for pivotally mounting said magnetic assembly in said housing, the distance between said intermediate wall portion and said cover plate exceeding the corresponding dimension of said magnetic assembly to permit limited rocking of said magnetic assembly in said housing, and

the distance between said side wall portions exceeding the corresponding dimension of said magnetic assembly to permit limited pivotal movement of said magnetic assembly in said housing.

12. A permanent magnet according to claim 8 wherein said elastomeric material is magnetically polarized in a direction perpendicular to the planes of said surfaces.

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