April 15, 1969 L. L. ANDERSON 3,438,665

MAGNETIC CATCH

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Fig. 1

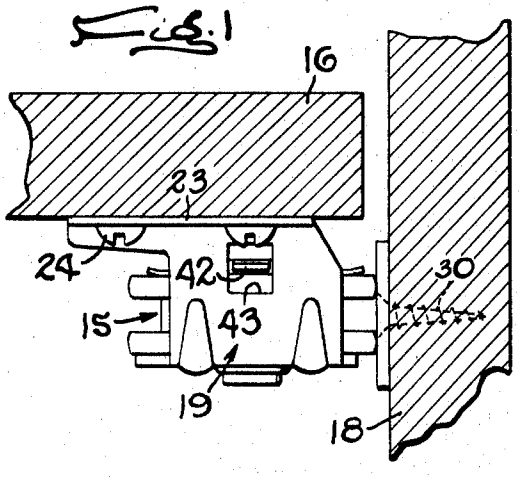


Fig. 2

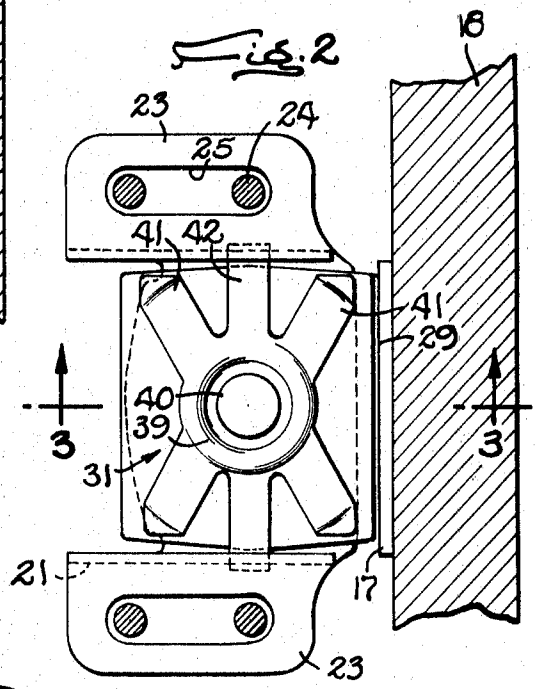


Fig. 3

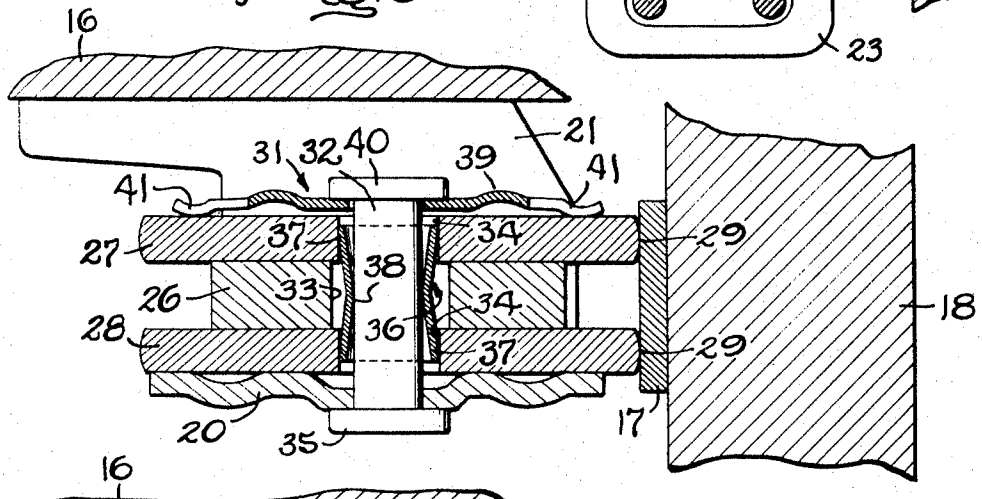
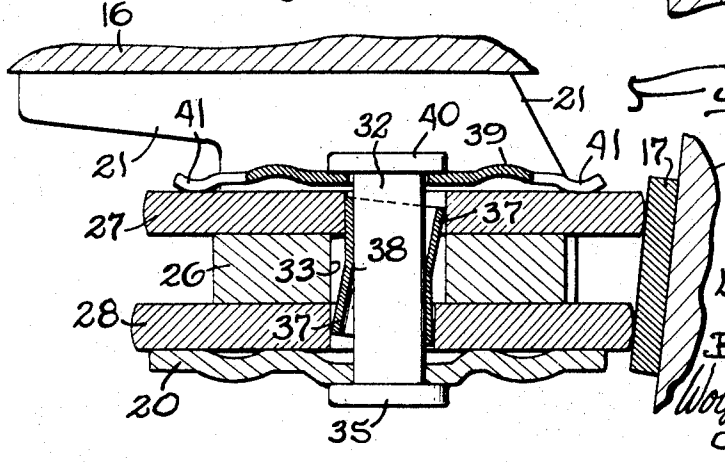


Fig. 4



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Fig. 5

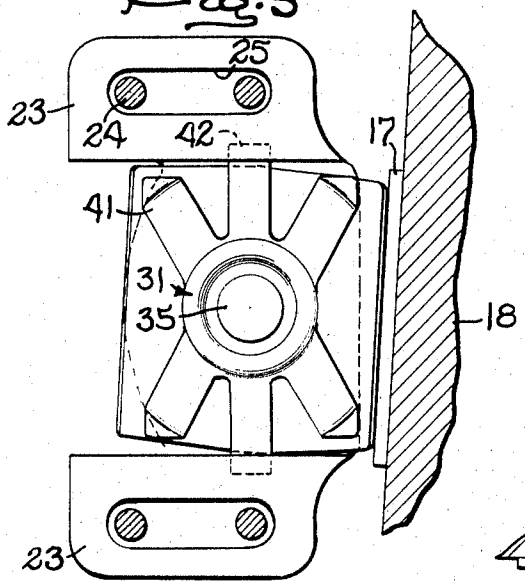


Fig. 6

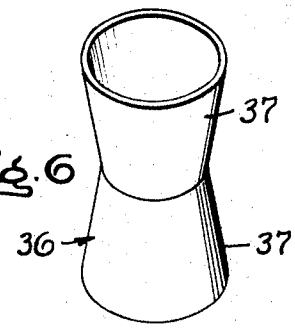


Fig. 7

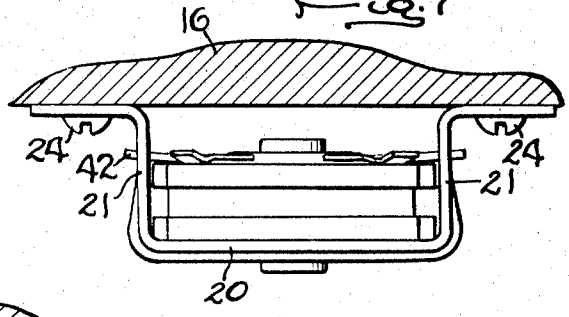


Fig. 8

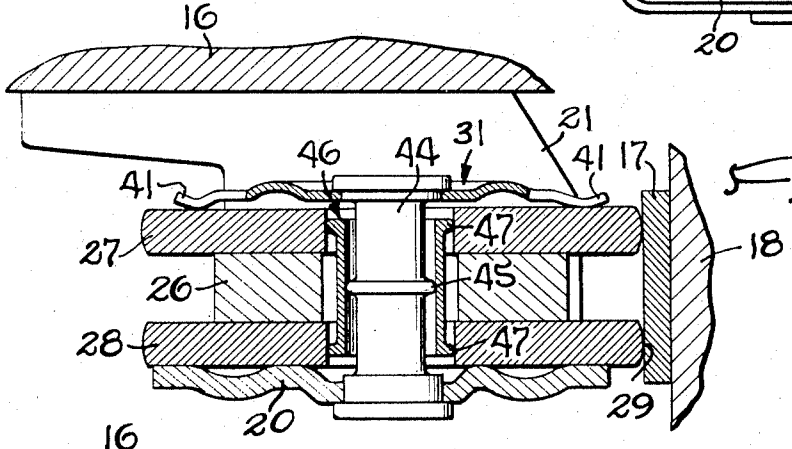
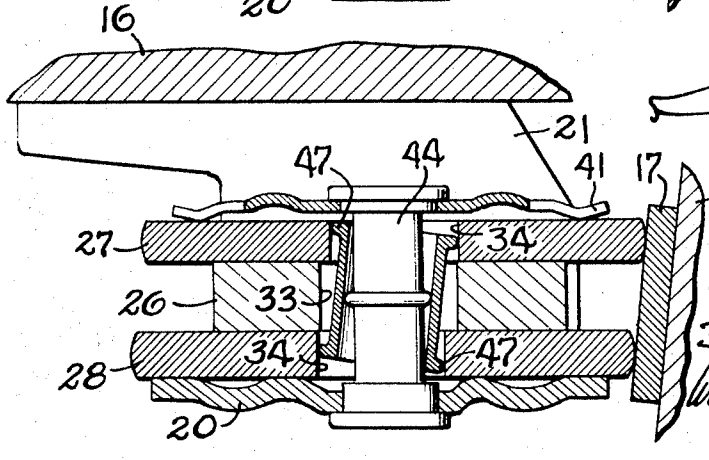


Fig. 9



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Fig. 10

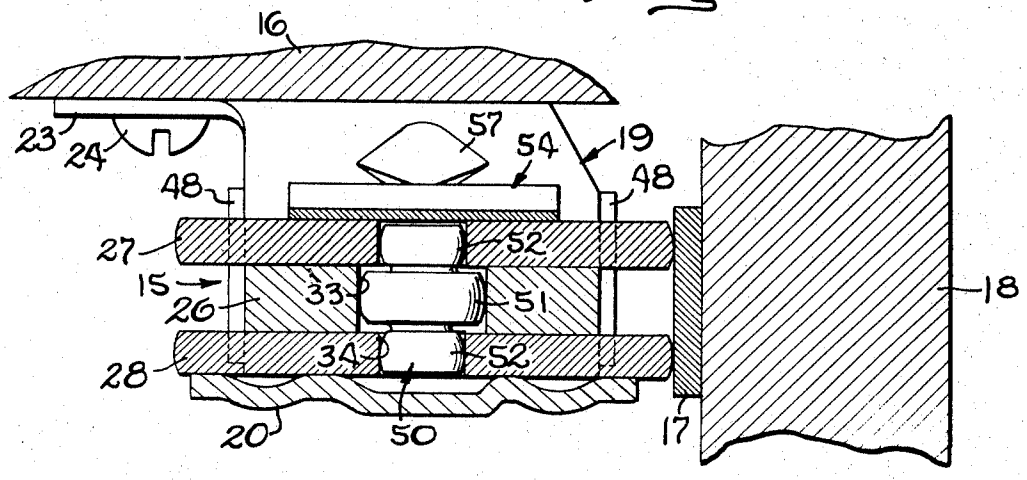


Fig. 11

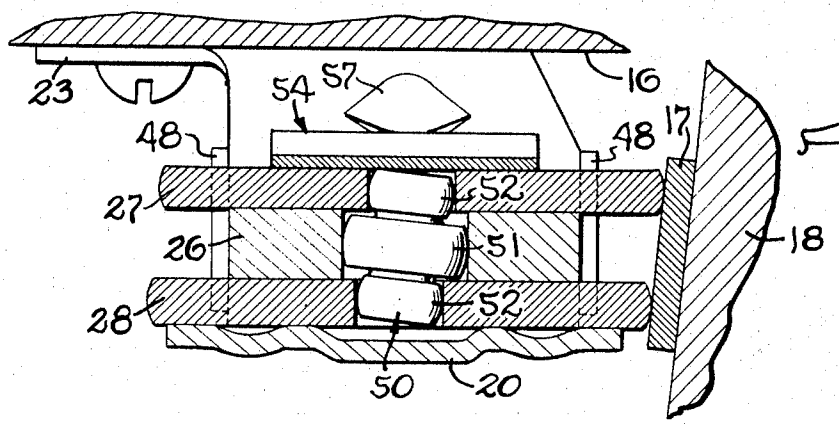
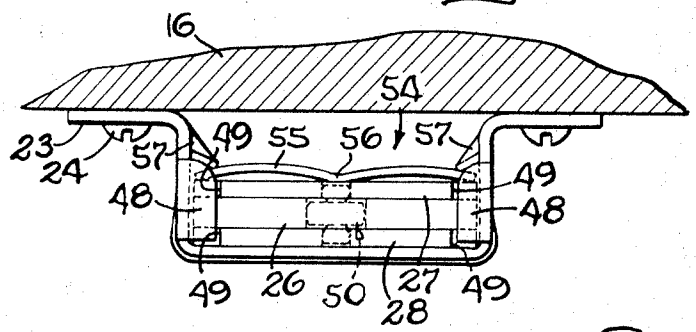


Fig. 12



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3,438,665

MAGNETIC CATCH

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Filed May 27, 1966, Ser. No. 553,403
The portion of the term of the patent subsequent to Nov. 22, 1983, has been disclaimed and dedicated to the Public
Int. Cl. E05c 19/16
U.S. Cl. 292—251.5 17 Claims

ABSTRACT OF THE DISCLOSURE

For holding the door of a cabinet in a closed position, a magnetic catch mounted on the cabinet includes a pair of pole plates disposed on opposite sides of a permanent magnet and engageable with a strike on the door to hold the door closed with magnetic force. Full face engagement of the poles plates with the strike is insured in spite of misalinement between the plates and the strike by utilizing a lever to mount the plates for bodily shifting in opposite directions and also for rotation in their respective planes so that engagement of the strike with the plates as an incident to initial closing of the door will adjust the positions of the plates automatically to compensate for any misalinement. To promote uniform holding force, a resiliently yieldable spring exerts a restraining force on the plates to prevent the latter from being shifted out of their adjusted positions as the door is opened repeatedly during service use.

This invention relates to a magnetic holding device such as a catch for holding the door of a cabinet closed and, more particularly, to a catch which includes two units, one being a strike and the other being a magnet assembly. In such a catch, the magnet unit is formed with a permanent magnet sandwiched between a pair of plates of magnetic material which engage the strike whereby the strike completes the flux path for the magnet unit and the two units are held together magnetically. To insure full face engagement of the plates with the strike, the plates are supported on the magnet to shift bodily relative to one another by substantially equal amounts in opposite directions and to rotate in their respective planes so that the plates automatically adjust as an incident to closing the door and thereby fully engage the strike even though the two units themselves may be considerably misalined.

The general object of the present invention is to provide a new and improved magnetic holding device of the above character which produces a substantially more uniform magnetic holding force than prior devices of this type and, at the same time, enables separation of the units with substantially the same pulling force during the service life of the device.

A related object is to achieve the foregoing by applying a restraining force to the plates so that the plates, having once been shifted oppositely and rotated to proper adjusted positions by a mechanical force, will remain in the adjusted positions in spite of magnetic force acting on the plates during normal separation of the units.

A more detailed object is to utilize a resilient element for producing a frictional restraining force between the magnet and the plates to prevent the later from shifting and rotating under the influence of magnetic force.

The invention also resides in the particular construction used to mount the plates for shifting and rotation in conjunction with the construction of the resilient element for producing the restraining force.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a side elevation of a magnetic catch embodying the novel features of the present invention and shown as mounted on a typical cabinet.

FIG. 2 is a plan view of the catch.

FIG. 3 is an enlarged cross-section taken substantially along the line 3—3 of FIG. 2.

FIG. 4 is a view similar to FIG. 3 showing the plates in shifted positions to accommodate misalinement of the strike in one plane.

FIG. 5 is a view similar to FIG. 2 showing the plates in rotated positions to accommodate misalinement of the strike in another plane.

FIG. 6 is an enlarged perspective view of a part which mounts the plates for shifting and rotation.

FIG. 7 is an end view of the catch.

FIG. 8 is a longitudinal sectional view of another form of the invention.

FIG. 9 is a view similar to FIG. 8 showing the plates in shifted positions.

FIG. 10 is a longitudinal sectional view of still another form of catch constructed according to the invention.

FIG. 11 is a view similar to FIG. 10 showing the plates in shifted positions.

FIG. 12 is an end view on a reduced scale of the catch shown in FIG. 10.

As shown in the drawings for purposes of illustration, the invention is embodied in a magnetic catch employing a permanent magnet and adapted to hold a closure member in a closed position. A typical application of the catch may be in connection with a cabinet where the permanent magnet unit **15** of the catch is mounted on a part of the cabinet frame such as a shelf **16** and the strike **17** of the catch is mounted on the cabinet door **18**.

In this instance, the magnet unit **15** is housed within a casing **19** made of non-magnetic material and formed with a bottom supporting wall **20**, upstanding side walls **21**, and mounting wings **23** projecting outwardly from the side walls, the casing being fastened to the underside of the shelf **16** by screws **24** passing through slots **25** (FIG. 2) in the mounting wings. The magnet unit is positioned between the side walls and includes a permanent magnet wafer **26** sandwiched between flat pole plates **27** and **28** of magnetic material lying against the two poles of the magnet and projecting beyond the magnet to present edges or pole faces **29** which abut the strike **17**. The latter is a flat plate of magnetic material fastened to the inside of the door **18** by a screw **30**. Thus, the strike completes the flux path of the magnet **26** whereby the path extends from the magnet through one pole plate **27** to the strike **17** and back to the magnet through the other pole plate **28**. As a result, the strike is held against the pole faces **29** and the door is retained in a closed position by the magnetic force. By rounding the pole faces on a full radius as shown most clearly in FIG. 3, a more consistent holding force is achieved than when the pole faces are square or semi-radiused.

For a permanent magnet of given strength, the force with which the catch holds the door **18** closed depends in large upon whether or not the pole faces **29** of the magnet unit **15** are in full face engagement with the strike **17**. Anything less than full face engagement introduces an air gap in the flux path and reduces the magnetic holding force. To insure full face engagement of the pole faces **29** with the strike, the plates **27** and **28** are mounted to shift bodily by substantially equal amounts in opposite directions and also to rotate in their respective planes. Thus, if the strike **17** is not at a 90 degree angle

with the pole faces **29**, one of the plates will shift in one direction and the other plate will shift a corresponding distance in the opposite direction, as shown in FIG. 4, until the two pole faces lie in the same plane as the strike. Similarly, should the strike and the pole faces be misalined along the longitudinal axis of the latter as illustrated in FIG. 5, the plates will rotate in unison and in the same direction to assume a position in which the pole faces engage the strike along their entire length. In most installations, both types of motion are likely to occur due to factors such as cabinet warpage and imprecise mounting of the magnet unit **15** and the strike **17**.

The present invention contemplates a new and improved catch in which a restraining force is applied to the pole plates **27** and **28** to hold the latter in their shifted and rotated positions after the pole faces **29** once have become properly positioned relative to the strike **17** so that substantially the same manual pulling force is required to separate the plates and the strike throughout the service life of the catch. To these ends, a resilient element **31** presses the plates **27** and **28** into mating contact with the surfaces of the magnet **26** and presses the plate **28** into contact with the surface of the bottom wall **20** with sufficient force to develop enough friction between the surfaces and the plates to resist shifting and rotation of the latter under the influence of magnetic force applied to the plates as when the door **18** is pulled from a closed to an open position. Since the plates thus are held in their initial adjusted positions, they do not peel away from the strike as the door is opened and, as a result, there are only small variations in the force necessary to pull the door open each time.

Herein, the plates **27** and **28** and the magnet **26** are fastened to the casing **19** by an upright pin **32** projecting loosely through a hole **33** in the magnet and holes **34** in each of the plates, the pin also extending through the bottom wall **20** of the casing and being formed with an enlarged head **35** bearing against the bottom wall. To mount the plates for bodily shifting in opposite directions and for rotation in their respective planes, a lever in the form of a tubular member **36** is telescoped over the pin and projects into the holes **34** in the plates. As shown most clearly in FIGS. 3, 4 and 6, the tubular member is formed in the shape of a pair of truncated cones **37** joined at their smaller ends to present an annular surface or edge **38** which rockably engages the pin near the midportion of the latter. The larger ends of the cones loosely surround the pin and engage the edges of the holes in the plates. Thus, when the strike **17** is alined as shown in FIG. 4, the lower plate **28** is engaged first and is pushed rearwardly upon initial closing of the door **18**. The rearward movement of this plate, acting through the tubular member **36**, produces a corresponding but opposite movement of the upper plate **27** and results in full face engagement of the pole faces **29** with the strike. In addition, the plates will rotate in unison about the axis of the pin and will assume the positions shown in FIG. 5 when the door is initially closed if the strike should be misalined along the longitudinal axis of the pole faces.

In this instance, the resilient element **31** comprises a so-called star spring formed with a central portion **39** (FIG. 2) encircling the pin **32** and bearing against the underside of a head **40** on the upper end of the pin. Radiating outwardly from the central portion of the spring **31** are a plurality of spaced legs **41** flexed into pressing engagement with the upper plate **28** and distributing the spring force over a substantial area of the magnet unit **15**. An additional pair of spring legs **42** are made slightly longer than the legs **41** and project through slots **43** (FIGS. 1 and 2) formed in the side walls **21** of the casing **19** to prevent the spring from rotating about the axis of the pin. With this arrangement, the plates adjust themselves for full face engagement of the pole faces **29** with the strike **17** as an incident to the initial closing of the door, and the spring **31** develops enough friction between the plates, the magnet **26**, and the bottom wall **20** of the casing to hold the plates in their adjusted positions in spite of the magnetic force which acts on the plates as the door **18** is pulled open.

A second form of the catch is shown in FIGS. 8 and 9 with the parts corresponding to those of the first embodiment being indicated by the same reference numerals. In this instance, a pin **44** is formed with an annular bead **45** around its mid-portion, and a cylinder **46** is telescoped over the pin and fulcrumed on the bead to form the pivot lever for the plates **27** and **28**. At its ends, the cylinder **46** is formed with enlarged annular lips **47** which project into the holes **34** in the plates and engage the edges of the holes. Thus, when the strike **17** engages one of the plates as shown in FIG. 9, this plate moves rearwardly thereby rocking the cylinder about the bead **45** on the pin **44** to force the other plate in the opposite direction and into engagement with the strike. As in the first embodiment, the plates rotate about the axis of the pin in order to accommodae misalignment of the strike along the longitudinal axis of the pole faces **29**. The spring **31** for applying the restraining force is identical to the spring employed in the first form of the catch.

Still another embodiment of the invention is illustrated in FIGS. 10 to 12 and employs a modified spring construction and a different type of a pivot lever for mounting the pole plates **27** and **28**. In this embodiment, the magnet unit **15** is held in the casing **19** by tabs **48** turned inwardly from the front and rear edges of the side walls **21** of the casing. The tabs abut the forward and rear sides of the permanent magnet **26** to hold the latter snugly in the casing while the corners of the pole plates are formed with notches **49** (FIG. 12) to accommodate the tabs. These notches are of such size that the tabs **48** do not interfere with adjustment of the plates.

Mounting the plates **27** and **28** for rotation and bodily shifting is a pin **50** formed with an enlarged rounded mid-portion **51** pivotally engaging the edges of the hole **33** in the magnet **26** and formed with smaller rounded ends **52** pivotally socketed in the holes **34** in the pole plates. The plates are free to rotate about the end portions **52** of the pin and the latter pivots about its midportion **51** to enable shifting of the plates by equal amounts in opposite directions.

In this instance, the spring **54** for applying the restraining force to the plates **27** and **28** is a strip of resilient material depressed intermediate its ends to form a pair of bowed wings **55** extending in opposite directions from a curved central portion **56**. The outer end portions of the wings are flexed beneath inwardly projecting tangs **57** struck from the side walls **21** of the casing **19** so that the central portion of the spring overlies and bears downwardly on the central area of the plate.

From the foregoing, it will be apparent that by employing a spring in conjunction with the shiftable and rotatable plates, the latter may be adjusted as an incident to the initial use of the catch and the frictional restraining force will hold the plates in their adjusted positions during normal service use so that pull variations are reduced. In addition, if the permanent magnet is of the type compounded with rubber and likely to be bowed, or if the plates are slightly warped, the spring will exert a constant force against the magnetic sandwich tending to flatten the parts into mating contact. Such flattening action eliminates air gaps introduced by improper mating and thereby results in increased magnetic performance.

I claim as my invention:

1. In a catch, the combination of a support, a permanent magnet having generally flat parallel surfaces at the poles thereof, first and second generally flat plates of magnetic material lying against said surfaces and constituting pole pieces for said magnet, said magnet and said plates being disposed on one side of said support with said first plate bearing against the surface of the support, said magnet and said plates having alined holes near the central

portions thereof, a pin fastened to said support and projecting through said holes to hold said magnet and said plates on the support, a tubular member telescoped over said pin and fitting loosely within the hole in said magnet, said tubular member being fulcrumed intermediate its ends on said pin near the mid-portion of the latter and having opposite ends telescoped into and fulcrumed in the holes in said plates thereby interconnecting the plates and causing the latter to shift relative to one another by substantially equal amounts in opposite directions and to rotate about the axis of said pin when a force of predetermined magnitude is applied to the edges of the plates, and a resilient element engaging said second plate and continuously pressing the plates into mating frictional contact with the surfaces of said magnet and pressing said first plate into frictional contact with the surface of said support with sufficient force to develop enough friction between said plates and said surfaces to resist shifting and rotation of the plates when force of less than predetermined magnitude is applied to the edges of the plates.

2. A catch as defined in claim **1** in which said tubular member comprises a pair of truncated cones having their smaller ends joined together near the mid-portion of said pin to form an annular rocking surface fulcrumed on the pin, the larger ends of the cones loosely surrounding said pin and engageable with the edges of the holes in said plates whereby said annular surface rocks about said pin when force of predetermined magnitude is applied to the edges of the plates.

3. A catch as defined in claim **2** in which said pin has an enlarged head at the end adjacent said second plate, and said resilient element includes a spring having a central portion encircling said pin and bearing against said head, said spring having legs projecting outwardly from said central portion and stressed into engagement with said second plate at spaced points thereon to distribute the force applied by the spring over a substantial area of said plates, said magnet, and said support.

4. A catch as defined in claim **1** in which said pin has an enlarged mid-portion and smaller end portions, and said tubular member comprises a hollow cylinder telescoped over said pin and fulcrumed on said mid-portion, said cylinder having end portions loosely surrounding the end portions of said pin an engageable with the edges of the holes in said plates.

5. A catch as defined in claim **4** in which said pin has an enlarged head at the end adjacent said second plate, and said resilient element includes a spring having a central portion encircling said pin and bearing against said head, said spring having a series of legs radiating outwardly from said central portion and stressed into engagement with said second plate at various points thereon to distribute the force applied by the spring over a substantial area of said plates, said magnet and said support.

6. In a catch, the combination of, a support, a permanent magnet having generally flat parallel surfaces at the poles thereof, two generally flat plates of magnetic material lying against said surfaces and constituting pole pieces for said magnet, said magnet and said plates being disposed on one side of said support with one of the plates bearing against the surface of the support, said magnet and said plates having alined holes near the central portions thereof, means projecting into said holes to interconnect said plates and to cause the latter to shift bodily by substantially equal amounts in opposite directions relative to one another while leaving the plates free for rotation in their respective planes when force of predetermined magnitude is applied to the edges of the plates, and yieldable means engaging the other of said plates and continuously pressing the plates into mating frictional contact with the surfaces of said magnet and pressing said one plate into frictional contact with the surface of said support under a force of sufficient magnitude to develop enough friction between said surfaces and said plates to resist shifting and rotation of the plates as an incident to the application of force less than predetermined magnitude to the edges of the plates.

7. A catch as defined in claim **6** in which said interconnecting means comprises a pin projecting into said holes in said magnet and said plates, said plates being fulcrumed intermediate the ends of said pin to shift simultaneously in opposite directions relative to one another.

8. A catch as defined in claim **7** in which said interconnecting means further includes a tubular member telescoped over said pin, said tubular member having opposite ends telescoped into and fulcrumed in the holes in said plates and being fulcrumed intermediate its ends on said pin.

9. A catch as defined in claim **8** in which said pin has a circumferential bead formed thereon between its ends, and said tubular member comprises a hollow cylinder loosely telescoped over said pin and fulcrumed on said bead.

10. A catch as defined in claim **7** in which said pin has an enlarged head at the end adjacent the other of said plates, and said yieldable means comprises a resilient element acting between said head and the other of said plates and producing frictional contact between said surfaces to resist movement of said plates.

11. A catch as defined in claim **7** in which said pin has an enlarged, rounded mid-portion pivotally engaging the edges of the hole in said magnet, and smaller rounded ends pivotally socketed in the holes in said plates.

12. A catch as defined in claim **11** further including a pair of walls disposed perpendicular to said support and extending alongside opposite margins of said plates, said yieldable means comprising a resilient element having a central portion bearing against said other plate and having a pair of wings extending in opposite directions from said central portion and bearing against said walls.

13. A catch as defined in claim **12** further including tangs formed integrally with each of said walls and projecting toward each other, the wings of said resilient element being stressed between said tangs and said other plate.

14. In a device for selectively holding first and second separable parts in a predetermined position relative to each other, the combination of, a support mounted on said first part, a permanent magnet having generally flat parallel surfaces at the poles thereof, two generally flat plates of magnetic material lying against said surfaces and having edges facing said second part, said plates and said magnet being disposed on one side of said support with one of the plates being in contact with the surface of the support, a member composed of magnetic material mounted on said second part and having a face adapted for engagement with the edges of said plates whereby the flux path of said magnet extends through said face and said edges to hold the face and the edges in rigid abutment, said magnet and said plates having alined holes therein spaced inwardly from said edges, means projecting into said holes to interconnect said plates and to cause the latter to shift simultaneously by substantially equal amounts in opposite directions relative to one another whereby a mechanical force adjusts the plates for full face engagement of said edges with said face, and a spring engaging the other of said plates and continuously pressing the plates into frictional mating engagement with the surfaces of said magnet and pressing said one plate into frictional engagement with the surface of said support to develop sufficient friction between said surfaces and said plates for restraining such shifting under normal separation of said first and second parts thereby to retain said plates in their adjusted positions during service use of the device.

15. In a catch, the combination of, magnetic unit including a permanent magnet and a pair of pole pieces disposed on opposite sides of said magnet, a strike unit adaped for engagement with said pole pieces whereby

said units are held together by magnetic force, means including a pin interconnecting said pole pieces for bodily movement in opposite directions relative to each other in response to mechanical force applied to the pole pieces as an incident to the strike unit moving into engagement with the magnetic unit, and resilient means resisting movement of said pole pieces when magnetic force of less magnitude than the mechanical force is applied to the pole pieces as an incident to separation of the strike unit and the magnetic unit.

16. A catch as defined in claim **15** in which said pin is formed with a rounded mid-portion pivotally engaging said magnet and smaller rounded end portions pivotally socketed in said pole pieces.

17. In a device for selectively holding first and second separable parts in a predetermined position relative to each other, the combination of, a case mounted on said first part, a permanent magnet having generally flat parallel surfaces at the poles thereof, two generally flat plates of magnetic material lying against said surfaces and having edges facing said second part, said plates and said magnet being disposed within said case with one of the plates being in contact with one surface of the case, a member composed of magnetic material mounted on said second part and having a face adapted for engagement with the edges of said plates whereby the flux path of said magnet extends through said face and said edges to hold the face and the edges in rigid abutment, said magnet and said plates having alined holes therein spaced inwardly from said edges, a pin projecting into said holes to interconect said plates and to cause the latter to shift

simultaneously by substantially equal amounts in opposite directions relative to one another while leaving the plates free for rotation in their respective planes whereby a mechanical force adjusts the plates for full face engagement of said edges with said face, said pin being formed with a rounded mid-portion pivotally engaging said magnet and being formed with smaller rounded end portions pivotally socketed in the holes in said plates, and said case including resiliently yieldable means disposed adjacent and engaging the other of said plates and continuously pressing the plates into frictional mating egagement with the surfaces of said magnet and pressing said one plate into frictional engagement with said one surface of said case to develop sufficient friction between said surfaces and said plates for restraining shifting and rotation of the plates under normal separation of said first and second parts thereby to retain said plates in their adjusted positions during service use of the device.

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