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MAGNETIC CATCH FOR SLIDING DOORS

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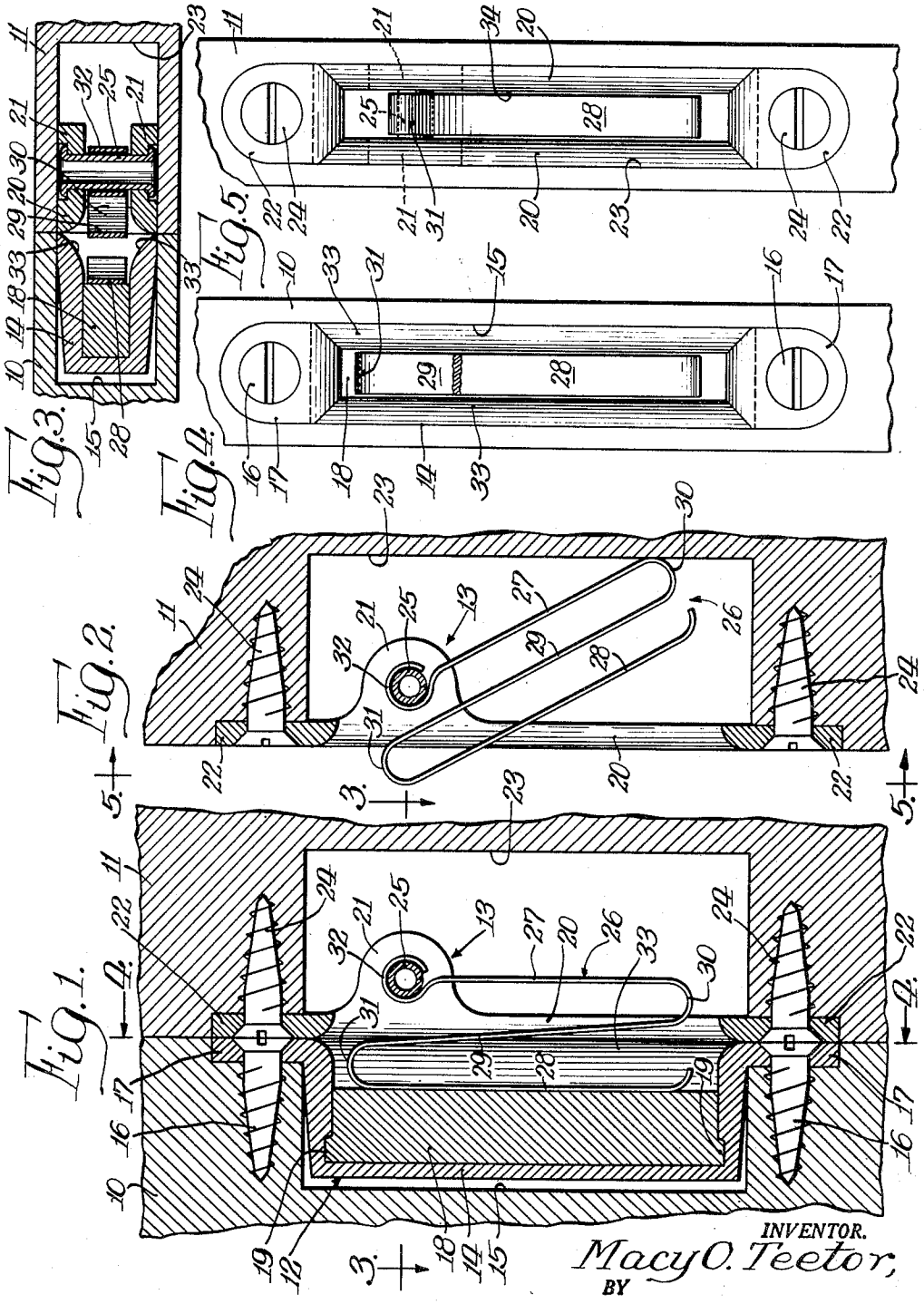


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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MAGNETIC CATCH FOR SLIDING DOORS

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This invention relates generally to door catches utilizing magnetic principles and more particularly to a novel magnetic catch which is adapted primarily for use with sliding doors or the like.

There have been frequent proposals for the use of magnetic catches of various types on hinged doors or similar swingable closure members. However, insofar as I am aware, there has been no suggestion heretofore of a magnetic catch which is particularly adapted for use with sliding doors and panels.

Sliding doors are generally mounted between a pair of upper and lower tracks secured to the adjacent frame, suitable rollers being provided for movement along either or both sets of tracks. However, regardless of the exact manner of mounting the sliding door, there is always an appreciable lateral clearance between the door and the cooperating tracks so that the door can move slightly in a direction perpendicular to the plane of sliding movement of the door. Consequently, it will be understood that a satisfactory magnetic catch having coacting catch elements mounted on the vertical edge of the door and the adjacent jamb or frame must make some provision to compensate for this limited lateral play or movement of the door. Otherwise, it will be seen that the coacting catch elements could easily be misaligned when the door is closed so that the complete effectiveness of the magnet unit would not be realized. Moreover, as a practical matter it is also quite important for effective operation of a magnetic catch that resilient means be incorporated in at least one of the catch elements so that the door is held closed by resilient tension in addition to the magnetic attractive forces between the catch elements.

Accordingly, a primary object of my invention is to provide novel catch means for sliding doors or the like.

A further object of the invention is to provide a novel magnetic catch which is particularly adapted for use with sliding doors or panels or the like.

Another object of the invention is to provide a novel magnetic catch including a pair of coacting catch elements having means for insuring accurate matching alignment thereof with respect to a vertical plane.

Still another object of the invention is to provide a novel magnetic catch particularly adapted for installation on the vertical edges of a sliding door and the adjacent jamb or frame and having special alignment means to insure accurate coacting engagement of the catch elements in spite

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of the lateral movability of the door relative to the jamb.

An additional object of the invention is to provide a novel magnetic catch for use with sliding doors or the like and having resilient means for holding the door closed under predetermined tension.

Another object of the invention is to provide a novel magnetic catch including a pair of coacting catch elements adapted to be mounted on the vertical edges of a sliding door and its frame or jamb and having means for permitting preliminary partial engagement between the catch elements before the door is completely closed whereby to guide the elements into full accurate aligned engagement upon complete closure of the door.

Other objects and advantages of the invention will become apparent from the subsequent detailed description taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a fragmentary vertical sectional view showing portions of a sliding door in closed position against its coacting jamb and having mounted thereon a magnetic catch comprising one specific embodiment of my invention;

Fig. 2 is a similar view showing the position of one of the catch elements when the door is open;

Fig. 3 is a horizontal sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is a vertical edge view of the door taken along the line 4—4 of Fig. 1; and

Fig. 5 is a vertical edge view of the jamb as seen along the line 5—5 of Fig. 2.

Referring to the drawing, the sliding door is designated at 10 and the stationary jamb or frame is indicated at 11. The magnetic catch comprises a magnet unit 12 mounted in the vertical edge of the door 10 and a cooperating armature unit 13 mounted in a corresponding position in the vertical edge of the jamb 11.

The magnet unit 12 includes a relatively narrow elongated housing 14 of non-magnetic material such as brass, zinc, or plastic. The housing 14 is adapted to fit into a rectangular recess 15 in the door 10 and is secured in place by means of a pair of screws 16 extending through upper and lower apertured ears 17 formed on the housing 14. A bar magnet 18 is secured vertically within the housing 14 by any suitable means, the magnet being disposed in recessed relation from the outer edge of the door 10. In this instance the magnet element 18 is shown as cast in the housing which may conveniently be a die casting of suitable non-magnetic metal, the magnet 18 being formed with

a pair of end extensions or shoulder portions 19 for securely retaining the magnet integrally within the housing. A molded plastic housing for the magnet 18 may also be used to advantage.

Although any suitable magnetic metal or alloy may be employed for the bar magnet 18, the alloy of aluminum, nickel, and cobalt known commercially as Alnico is particularly desirable. For maximum economy and convenience the magnetic metal may be cast as an elongated bar or strip divided into sections by means of notches. The elongated casting may then be readily broken at the notches to provide a plurality of magnet elements 18, and the fragments of the broken notched portions constitute the end shoulders 19. Inasmuch as each bar magnet 18 so formed is ultimately encased in a die cast or molded plastic housing 14, it is unnecessary to perform expensive machining operations on the bar magnet elements. The construction of the magnet unit 12 thus lends itself readily to substantial savings, particularly in the manufacture of the magnet element which is often the most expensive part of a magnetic catch.

The armature unit 13 is provided with an elongated support having a pair of spaced sides 20 with integral extensions or lugs 21 and a pair of upper and lower apertured ears 22. The armature support is mounted over an enlarged recess 23 in the edge of the frame 11 by means of a pair of screws 24 extending through the ears 22. The parallel lugs 21 extend inwardly within the recess 23 and a split tubular pin 25 extends therebetween for pivotally supporting the armature element, as hereinafter described.

The armature element of the device consists of a pivotally swingable spring member 26 made of magnetically attractable metal such as iron or steel. In the embodiment illustrated in the drawing, the spring 26 is formed from flat spring metal or strap of rectangular cross-section and has a generally S-shaped or double reverse bend configuration thereby providing a pair of oppositely extending U-shaped portions having an inner leg 27, and outer leg 28, and a common center leg 29 connected to the inner and outer legs by the bends 30 and 31, respectively. The upper end of the inner leg 27 is bent around the pin 25, as at 32, for swingably supporting the spring or armature member 26, and the center of gravity of the spring member 26 is such that it normally assumes the angular position shown in Fig. 2 when the sliding door 10 is open. Thus, the lower bend 30 is disposed inwardly adjacent the rear wall of the recess 23 and the upper bend 31 projects forwardly beyond the armature support and beyond the edge of the jamb 11.

The projection of the swingable armature spring 26 beyond the edge of the door jamb when the door is open constitutes a very important feature of my invention. As hereinbefore described, the sliding door 10 will have an appreciable degree of freedom of lateral movement, i. e., at right angles to the path of sliding movement of the door. Thus, as viewed in Fig. 3, the door 10 can shift slightly to either side relative to the fixed door jamb 11 with the result that the magnet unit 12 can easily become misaligned with respect to the coacting armature unit 13. My device compensates for this condition and automatically insures accurate matching alignment of the catch elements by reason of the coaction between the normally projecting upper portion 31 of the armature spring 26 and the magnet housing 14. Thus, it will be seen from Fig. 3 that the vertical sides of

the magnet housing 14 are transversely curved adjacent their front edges, as at 33, thereby providing guiding or cam surfaces adapted to engage and slide along the sides of the coacting portion of the armature spring 26. As the door 10 approaches closed position, the angularly projecting upper end of the swinging spring 26 first enters the magnet unit cavity defined between the front face of the magnet 18 and the curved side portions 33 of the magnet housing. This preliminary entry of the armature element into the magnet unit cavity occurs therefore before the door 10 is completely closed, and if the door 10 is laterally misaligned relative to the jamb 11 as a result of the clearance hereinbefore mentioned, the forwardly extending upper end of the spring 26 will obviously engage one or the other of the curved side surfaces 33. The spring 26 being relatively fixed with respect to lateral or side movement, it will be readily understood that upon continued sliding movement of the door to its final closed position, the curved surface 33 in engagement with the side of the projecting portion of the spring 26 will slide therealong and the entire door 10 will in effect be shifted or cammed laterally into alignment with the jamb 11 so that the catch units are accurately matched.

Because of the track and roller mounting commonly used in sliding doors, lateral clearance is essential thereby making it possible for the door to shift slightly at right angles to the plane of sliding movement and relative to the fixed door jamb as described above. However, only a very slight lateral force is necessary to effect the necessary realignment of the door with the jamb, and the camming engagement between the curved surfaces 33 and the sides of the armature spring 26 is sufficient to produce the desired alignment when the sliding door is closed under normal hand pressure. Consequently, my catch device is completely self-aligning during normal closing movement of the door and the invention therefore is particularly adapted for use on sliding doors and panels.

Referring to Figs. 1 and 3, it will be evident that upon complete closure of the door 10, the spring or armature element 26 is pivoted to substantially a vertical position and the flat contact surface of the outer leg 28 of the armature element 26 is drawn into full contact with the bar magnet 18 under the influence of the magnetic attractive forces. The slot or opening, indicated at 34 (Fig. 5), between the sides 20 of the armature support is slightly wider than the spring 26 to permit free swinging movement of the latter but the sides 20 also serve to guide the spring 26 for side rigidity during such swinging or pivotal movement. In its normal free-hanging retracted state (Fig. 2) the span or distance between the inner and outer legs 27 and 28 of the spring member is such that the legs are substantially parallel. However, when the door 10 is fully closed, the spring is extended slightly so that the span between the legs 27 and 28 is increased as clearly shown in Fig. 1. Thus, the spring 26 is expanded and placed under tension by reason of the influence of the magnet 18 and it will be understood, therefore, that the door 10 is in effect held closed by the action of the spring 26 which extends between and is firmly secured at its opposite ends to the rigidly mounted pin 25 and to the magnet 18. In other words, the magnet 18 functions primarily to make contact with or engage the armature element while the spring tension of the expanded armature element actually holds the door in closed

position. Accordingly, it is important to the proper functioning of my device that the extent of recessing of the magnet element, the dimensions of the spring element 26, and the location of the swingable spring element in the door jamb be properly correlated to insure that the armature spring is always placed under slight tension during coacting engagement with the magnet when the door is closed. It will also be seen from Fig. 1 that the height or length of the spring legs 28 and 29 is less than the corresponding internal dimension of the magnet housing 14 so that the spring can enter the magnet unit cavity with slight vertical clearance both at the top and the bottom of the cavity in order to compensate for inaccuracies in vertical alignment of the catch units due to improper mounting.

The angular projection of the swinging spring element 26 when the door is open is also quite important from a magnetic point of view in that it greatly simplifies the problem of bringing the armature element into full contact with the magnet element under the influence of the latter. Inasmuch as the projecting upper end portion 31 of the spring 26 contacts the upper end portion of the bar magnet 18 before the door 10 is completely closed, the armature thus partially completes the magnetic circuit by closing one pole of the magnet thereby greatly increasing the effectiveness or magnetic attractive force of the other pole. Consequently, with its upper pole closed by the aramture the magnet 18 exerts an amplified attractive force on the lower end of the armature spring causing the latter to pivot rapidly into full face contact with the magnet and thereby placing the spring under tension as described above. Thus, by preliminary mechanical contact of the projecting armature spring 26 with one pole of the magnet 18 during closing movement of the door, it becomes much easier for the magnet to overcome the full spring tension in order to make complete magnetic contact with the armature as compared with the magnetic force which would be required if the spring element were not pivotally mounted to permit angular projection of the spring from the jamb and toward the door.

From the foregoing, it will be apparent that my invention provides a novel magnetic catch which is relatively inexpensive to manufacture, utilizes magnetic and spring tension principles, and is particularly suited for use with sliding doors or panels. Although the invention has been described in detail with particular reference to a specific structural embodiment, it is to be understood that various modifications and equivalent structures can be employed without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A magnetic catch comprising a pair of cooperating magnet and armature elements adapted to be supported in coacting positions on a door member or the like and its adjacent frame member, means for rigidly securing one of said elements on its supporting member, and pivotal supporting means operatively connected adjacent one end portion of the other of said elements for swingably securing the latter on the other member, the opposite end portion of the pivotally mounted element being swingable outwardly under the influence of magnetic attraction from a normally retracted position into extended position in magnetic contact with the rigidly mounted element for holding the door member against the

frame member, and said pivotally mounted element also being resiliently expansible whereby the distance between said end portions is increased when said elements are in magnetic contact thereby holding the door member against the frame member by the tension of the expanded pivotally mounted element.

2. A magnetic catch for use on a pair of door and frame members, said catch including a magnet element adapted to be rigidly mounted on one of said members, and a cooperating armature element adapted to be mounted in coacting position on the other of said members, said armature element comprising an elongated resilient expansible spring element, and means for pivotally supporting one end portion of said spring element for swinging movement away from and toward said magnet element, the opposite end portion of said spring element being swingable outwardly into contact with said magnet element under the influence of the latter, and said spring element being expanded whereby the distance between said end portions is increased when said spring element is in contact with said magnet element thereby retaining the door member against the frame member under the tension of the expanded spring element.

3. A magnetic catch for use on a pair of door and frame members, said catch including a pair of supports adapted to be mounted in coacting positions on said members, a permanent magnet element rigidly carried by one of said supports, and an elongated resilient armature element pivotally mounted adjacent one end portion thereof on the other of said supports for swinging movement toward and away from said magnet element, the opposite end portion of said armature element being pivoted inwardly relative to its support and said armature element being in contracted condition when the door member is spaced from the frame member, and said opposite end portion of said armature element being pivoted outwardly into engagement with the magnet element under the influence of the latter when the door member is adjacent the frame member, and said armature element being in expanded condition whereby the distance between said end portions is increased when said armature element engages said magnet element thereby retaining the door member against the frame member under the tension of the expanded armature element.

4. The device of claim 3 further characterized in that said supports are recessed in the respective door and frame members whereby to insure that said resilient armature element is expanded and under tension when in engagement with said magnet element.

5. A magnetic catch for use on a pair of door and frame members, said catch including an elongated magnet element, means for rigidly mounting said magnet element in recessed relation in one of said members, a movable armature element having at one end portion thereof an elongated contact portion adapted to engage said magnet element longitudinally, and means for pivotally supporting the opposite end portion of said armature element on the other of said members, said opposite end portion of said armature element being swingable outwardly to permit full engagement of the elongated contact portion thereof with said magnet element under the influence of the latter when the door member is disposed adjacent the frame member, and said armature element being resiliently expansible from its normally retracted position when in said full en-

gagement whereby the distance between said end portions is increased for retaining the door member against the frame member under the tension of the expanded armature element.

6. A magnetic catch for use on a pair of door and frame members, said catch comprising an elongated permanent magnet element adapted to be rigidly mounted on one of said members, a generally S-shaped armature element having an end portion adapted to engage said magnet element, and pivotal mounting means at the opposite end portion of said armature element for swingably supporting the latter in coacting position on the other of said members, said armature element being swingable outwardly into contact with said magnet element under the influence of the latter for holding the door member against the frame member, and said armature element being resiliently expansible whereby the distance between said end portions is increased when the armature element is in contact with said magnet element for holding the door member against the frame member by the tension of the expanded armature element.

7. A magnetic catch for use on a pair of door and frame members, said catch comprising an elongated non-magnetic housing adapted to be mounted on one of said members, an elongated bar magnet rigidly secured in said housing, an elongated armature support adapted to be mounted in coacting position on the other of said members, a movable armature in the form of an expansible generally S-shaped resilient element having a pair of integrally connected oppositely extending U-shaped portions, said armature being pivotally attached to said support adjacent the free leg of one of said U-shaped portions for swinging movement of the armature away from and toward the magnet with the free leg of the other of said U-shaped portions being swingable into engagement with said magnet under the influence of the latter, and said free leg portions being spreadable and expansible for holding the door member against the frame member under the tension of the expanded armature.

8. A magnet catch for use on a pair of door and frame members, said catch comprising an elongated non-magnetic housing adapted to be mounted on one of said members, an elongated bar magnet rigidly secured in recessed relation within said housing whereby to define an elongated armature-receiving cavity at the front of said housing, an elongated armature support adapted to be mounted in coacting position on the other of said members, a transverse pivot pin at the upper portion of said support, and an armature in the form of an elongated element having a double reverse bend configuration and swingably supported at one end portion thereof on said pivot pin, said armature being swingable toward said magnet under the influence of the latter whereby to permit the other end portion of the armature to enter said cavity and engage said magnet, and said armature thereby being expanded between said pin and said magnet for holding the door member against the frame member under the tension of the expanded armature.

9. A magnetic catch for use on a pair of door and frame members, said catch comprising a magnet element adapted to be rigidly mounted on one of said members, and an armature element adapted to be pivotally mounted on the other of said members in coacting position relative to said magnet element, the center of gravity of said armature element being so disposed that when the armature element is in its normal free-hanging position with the door member spaced from the frame member the armature element is pivoted inwardly relative to said other member and a portion thereof projects beyond said other member whereby upon closure of the door member against the frame member the projecting portion of the armature element first engages said magnet element in partial contact therewith and thereafter said armature element swings outwardly under the influence of the magnet element into complete contact with the latter.

10. A magnetic catch for use on a pair of door and frame members comprising a magnet housing adapted to be rigidly mounted on one of said members, a magnet element carried in said housing in recessed relation therein whereby to define an armature-receiving cavity at the front of said housing, an armature support adapted to be rigidly mounted in coacting position on the other of said members, and an elongated swingable armature element pivotally mounted on said support and adapted to assume a normally inwardly pivoted position with only a portion thereof projecting beyond said other member when the door and frame members are spaced apart, the projecting portion of said armature element being adapted to enter said cavity for making preliminary partial contact with said magnet element during movement of the door member toward the frame member and said armature element being thereafter swingable outwardly under the influence of the magnet element for making full contact with the latter whereby to hold the door member against the frame member.

11. A magnetic catch adapted for use on a sliding door member and its adjacent frame member, said catch comprising a magnet unit adapted to be rigidly mounted on one of said members and including a permanent magnet element, a movable armature element adapted to be mounted in coacting position on the other of said members, means for pivotally supporting said armature element adjacent one end portion thereof whereby the opposite end portion of the armature element can swing into magnet-engaging position upon sliding movement of the door member against the frame member, and cam means coacting between said magnet unit and said armature element for effecting slight transverse shifting of the door member in response to said sliding movement whereby to insure alignment of the door and frame members and the coacting magnet and armature elements carried thereon, said armature element also being resiliently expansible whereby the distance between said end portions is increased when said elements are engaged thereby holding the door member against the frame member under tension.

12. The device of claim 11 further characterized in that said magnet unit comprises a non-magnetic housing with said magnet element fixed therein and said cam means comprises coacting portions on said housing and said armature element.

13. A magnetic catch adapted for use on a sliding door member and its adjacent frame member, said catch comprising a magnet unit adapted to be rigidly mounted on one of said members and including a permanent magnet element, and a movable armature element adapted

to be mounted in coacting position on the other of said members, said armature element having a portion adapted to project outwardly from said other member toward said magnet unit with the remainder of the armature element being retracted within said other member when the door and frame members are spaced apart, and cam means on said magnet unit adapted to coact with the outwardly projecting portion of said armature element upon sliding movement of the door member against the frame member whereby to effect slight shifting of the door member transversely of its plane of sliding movement for insuring alignment of the door and frame members and their coacting catch elements, said armature element being movable outwardly from said other member into extended magnet-engaging position subsequent to said camming action.

14. A magnetic catch adapted for use on a sliding door member and its adjacent frame member, said catch comprising an elongated magnet housing adapted to be recessed in one of said members and having inwardly curved side edges adjacent the front of the housing, a magnet element rigidly carried adjacent the rear of the housing whereby to define an armature-receiving cavity at the front portion of the housing, an armature support adapted to be rigidly mounted in coacting position on the other of said members, and an armature element having one end portion thereof pivotally mounted on said support and the opposite end portion of the armature element being adapted to swing outwardly from said support for entering said cavity and engaging said magnet element when the door member is moved toward the frame member, said armature element being engageable at its sides with the inwardly curved side edges of said magnet housing during entry of the armature element into said cavity for effecting camming and slight shifting of the door member transversely of its plane of sliding movement whereby to insure alignment of the door and frame members and the coacting magnet and armature elements carried thereon, and said armature element also being resiliently expansible whereby the distance between said end portions is increased when said elements are engaged thereby holding the door member against the frame member under tension.

15. A magnetic catch adapted for use on a sliding door member and its adjacent frame member, said catch comprising an elongated magnet housing adapted to be recessed in one of said members and having inwardly curved side edges adjacent the front of the housing, a magnet element rigidly carried adjacent the rear of the housing whereby to define an armature-receiving cavity at the front portion of the housing, an armature support adapted to be rigidly mounted in coacting position on the other of said members, and an elongated armature element pivotally mounted on said support for swinging movement in the plane of the door and frame members, said armature element having its center of gravity disposed relative to the pivot point thereof such that the armature element assumes an angularly extending and rearwardly pivoted position with a portion thereof projecting outwardly from said other member when the door and frame members are spaced apart, the outwardly projecting portion of the armature element thereby being adapted to enter said cavity first during movement of the door member toward the frame member whereby to make initial partial contact with the magnet element and at the same time being engageable with the inwardly curved side edges of said housing for camming the door member transversely into alignment with the frame member, and the armature element being swingable outwardly thereafter into full engagement with the magnet element.

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