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MAGNETIC LATCH

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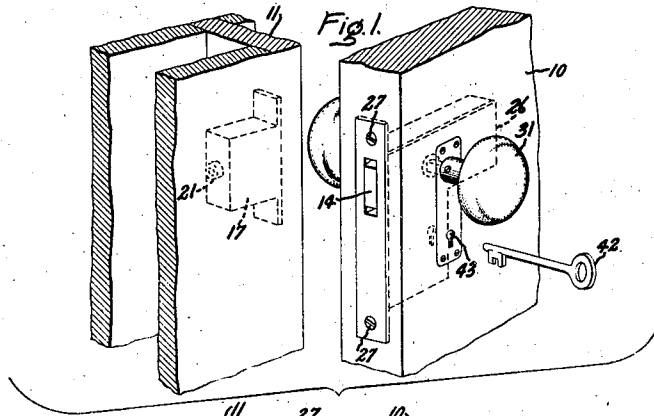


Fig. 2.

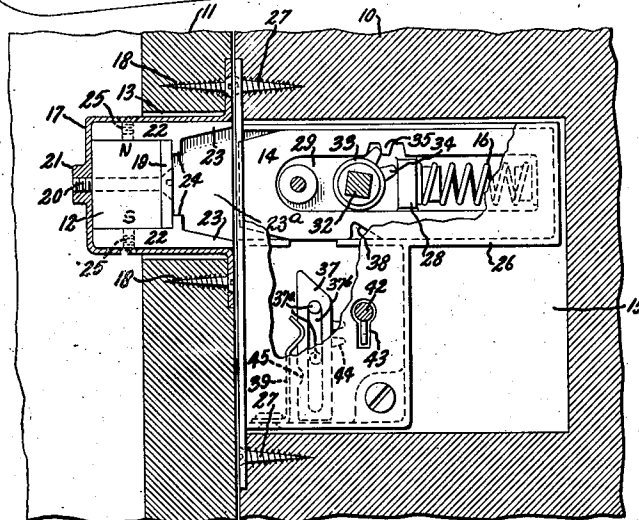
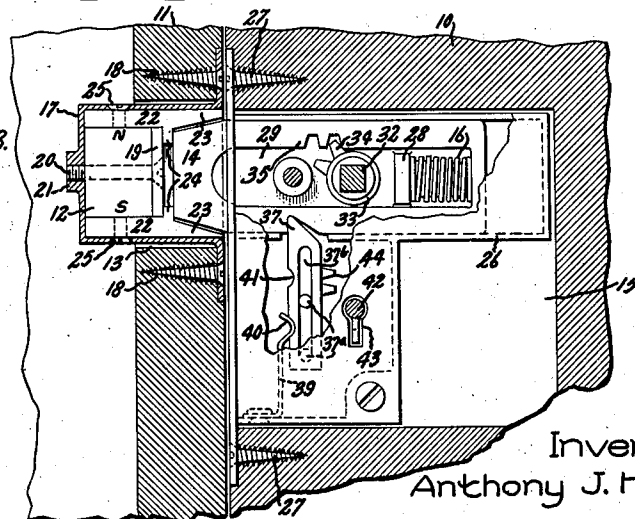


Fig. 3.



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MAGNETIC LATCH

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2 Claims. (Cl. 292-144)

This invention relates to magnetic latches and is particularly applicable to latches for doors.

It is an object of my invention to provide a magnetic latch which will not rattle and which is simple in construction and positive in operation.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference is had to the accompanying drawing in which Fig. 1 is a view in perspective of the arrangement of the parts of my latch applied to a door; Fig. 2 is a side view, partly in section, of the details of my latch showing the bolt in the unlatched position; and Fig. 3 is a view similar to Fig. 2 showing the bolt in the latched position.

In Fig. 1, I have shown a door or closure member 10 adapted to close an opening defined by a door jamb or closure frame member 11. In this embodiment of my invention I have shown a magnet 12 in a recess 13 in the door jamb 11. A latch bolt 14 spring-biased to the unlatched position is shown carried within a recess 15 in the door 10. The above-mentioned parts are so arranged that when the door is closed the magnet 12, which must be of sufficient strength to overcome the tension of spring 16, draws the bolt 14 into the recess in the door jamb for latching the door.

In order to support the magnet 12 in the recess 13 I have provided a casing 17 suitably secured in the recess 13 as by means of screws 18. The casing 17 should be of non-magnetic material such as brass, for example, to prevent short circuiting of the magnet 12. The magnet 12 is secured to the casing 17 by means of a plate 19 of non-magnetic material such as brass and a bolt 20 which passes through the plate 19 and magnet 12 and threadingly engages a boss 21 formed in casing 17. I have also provided pole pieces 22 having tapered extensions 23 providing a bolt receiving recess 23a and also having offset portions or tips 24. These pole pieces and tips are of a material of relatively high permeability such as soft steel and may be joined to the magnet 12 in any suitable manner as by soldering or brazing. If desired, the magnet and pole structure may be more securely fastened in casing 17 by means of bolts 25 of nonmagnetic material, extending through suitable openings in the casing 17 into threaded engagement with the pole pieces 22.

Magnet 12 is preferably of the shape of a rectangular prism because the pole pieces may be more easily attached to an object of such a shape, although any desired shape may be employed. Further, the permanent magnet may be replaced

by an electro-magnet. However, I prefer to use a permanent magnet of high coercive force material, such as one containing iron, nickel and aluminum as basic ingredients such as disclosed and claimed in Mishima Patents No. 2,027,994 and No. 2,028,000 and Ruder Patents Nos. 1,947,274 and 1,968,569, although the magnet may contain other ingredients such as cobalt, tungsten, molybdenum, silicon, copper and titanium, for example. Because of the fact that soft steel has a higher permeability than the magnet material described there will be a greater flux density in the pole pieces 22 and tips 24 than if the pole pieces and tips were of the same material as the magnet, thereby providing a greater holding force.

A casing 26 of any suitable material is retained in recess 15 in any desired fashion as by means of screws 27. Latch bolt 14 is slidably retained in the upper portion of casing 26 and is biased toward the unlatched position, or the right as viewed in the drawing, by means of spring 16 interposed between shoulder 28 which extends from the casing 26 into a slot 29 formed in the bolt 14 and the right-hand end of the slot 29. With this arrangement the spring 16 is under compression in the latched position but it will be obvious that, if desired, a tension spring might be substituted between the inner end of the latch bolt 14 and the end of casing 26.

The tapered bolt design enables a small magnet to be used for exerting a lateral pull on the bolt 14 over a relatively large distance. If no pole pieces were employed a much more powerful magnet would be required to exert any appreciable pull on the latch bolt when the bolt is in the position shown in Fig. 2 as will be clear from the following considerations.

In order to latch the door a recess must be provided to receive the bolt and since the magnet is placed at the inner end of the recess it is obvious that a comparatively large air gap exists between the magnet and the bolt when the bolt is in the unlatched position. By extending the pole pieces to the front edge of the recess 13, the air gap is reduced to the distance between the ends of the pole pieces and the latch bolt; in other words, substantially to the space between the door 10 and the door jamb 11. If the pole pieces 22 are not tapered, the latch bolt 14 will be drawn to a position opposite the ends of the pole pieces 22 but, practically speaking, there will be no active force tending to pull the bolt to the fully latched position. By providing the pole pieces 22 with a taper, the air gap between the pole pieces 22 and latch bolt 14 gradually decreases until the bolt 14 strikes the offset tips 24. Thus, there is always a constantly increasing force acting to seat the bolt during the latching operation. It may also be noted that the ta-

pered construction assists in centering the bolt, thereby counteracting any sagging of the door.

The offset tips 24 are provided adjacent the bottom of recess 23a in order to concentrate the flux and thereby increase the holding force in the latched position.

In order to retract the bolt for opening the door, I have provided door knobs 31 secured in the customary fashion to a shaft 32 extending through the door 10 and also through the slot 29 in the bolt 14. A pinion 33 is carried by shaft 32 and has teeth 34 for engagement with a rack 35 cut in the inner edge of the slot 29. It will be obvious from an inspection of the drawing that as the door knob is turned in a clockwise direction as viewed in Fig. 3, the teeth 34 will mesh with the rack 35 and impress a force on latch 14 to withdraw the latch from the influence of magnet 12. The above-described means for opening the door is purely illustrative and any desired arrangement may be used.

I have also provided means to lock the latch in the closed position. For this purpose I have provided a catch 37 adapted to project into a recess 38 formed in the underside of bolt 14. As shown in the drawing, the catch 37 is guided by means of pins 37a attached to casing 26 which extend into a slot 37b formed in the catch 37. The catch 37 is held in the unlocked position by means of a spring arm 39 which has a portion 40 pressing into a recess 41 in the catch 37. The door may be locked by inserting a key 42 into keyhole 43. By turning the key in a clockwise direction as viewed in Fig. 2, the key will engage projections 44 on catch 37. The upward force transmitted to latch 37 will cause portion 40 of arm 39 to be forced out of the recess 41 and raise the catch 37 upwardly into engagement with recess 38 at which position the portion 40 of spring arm 39 will press into recess 45 in latch 37, thereby to hold the catch 37 in the locking position. In order to unlatch the door, the key must be turned in a counter-clockwise direction as viewed in Fig. 3 in order to engage teeth 44 and press the latch 37 downwardly as will be obvious by inspection of Fig. 3. The above description of this locking mechanism is also exemplary and any desired locking arrangement may be employed. For example, the catch may be pressed into locking engagement with bolt 14 from any direction and, if desired, instead of the spring arm 39, a spring-biased catch could be used so that the door would be locked automatically upon closing.

Spring 16 may be eliminated, if desired, and a second magnet of lesser strength than magnet 12 may be employed to hold latch 14 in the open position. When the door is closed, the excess of strength of magnet 12 will draw the bolt 14 into the latched position. If desired, instead of substituting a second magnet for spring 16, a second magnet may be added to supplement the action of spring 16.

It will also be obvious that the latch bolt may be carried by the door jamb and the magnet secured to the door.

While I have shown a particular embodiment of my invention in connection with a magnetic door latch, I do not desire my invention to be limited to the particular construction shown and described. For instance, my invention is equally applicable wherever a movable member is to be drawn to and held by a second member, assuming that it is possible to use magnetic materials,

as in connection with relays and switches, for example. Therefore, I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a magnetic latch, the combination of a closure member, a closure frame member, a permanent magnet formed of high coercive force material disposed in a recess in one of said members, a latch bolt of magnetic material slidably arranged in a recess in the other of said members, said magnet being provided with a plurality of pole pieces formed from a material of higher permeability than said magnet in order to obtain a relatively high flux density in said pole pieces, said pole pieces extending beyond said magnet and providing a recess for the reception of said bolt, the ends of said pole pieces being substantially flush with the edge of said one of said members and the outer edge of said bolt being substantially flush with the edge of said other of said members in the unlatched position of said bolt in order to provide a relatively small air gap between said pole pieces and said bolt in the unlatched position of said bolt, said bolt being so positioned on said other of said members that said bolt will be drawn by said magnet into the bolt receiving recess when said closure member is in its closed position, said pole pieces and said bolt being provided with tapering portions so that when said bolt is drawn toward said magnet, the air gap between said pole pieces and said bolt will constantly decrease whereby there is a constantly increasing force acting to seat said bolt during the latching operation.

2. In a magnetic latch, the combination of a closure member, a closure frame member, a permanent magnet formed of high coercive force material disposed in a recess in one of said members, a latch bolt of magnetic material slidably arranged in a recess in the other of said members, said magnet being provided with a plurality of pole pieces formed from a material of higher permeability than said magnet in order to obtain a relatively high flux density in said pole pieces, said pole pieces extending beyond said magnet and providing a recess for the reception of said bolt, the ends of said pole pieces being substantially flush with the edge of said one of said members and the outer edge of said bolt being substantially flush with the edge of said other of said members in the unlatched position of said bolt in order to provide a relatively small air gap between said pole pieces and said bolt in the unlatched position of said bolt, said bolt being so positioned on said other of said members that said bolt will be drawn by said magnet into the bolt receiving recess when said closure member is in its closed position, said pole pieces and said bolt being provided with tapering portions so that when said bolt is drawn toward said magnet, the air gap between said pole pieces and said bolt will constantly decrease whereby there is a constantly increasing force acting to seat said bolt during the latching operation, each of said pole pieces having an offset portion adjacent the bottom of said bolt receiving recess for receiving said bolt and concentrating the flux in the latched position of said bolt, thereby increasing the holding force of said magnet on said bolt.

ANTHONY J. HORNFECK.