United States Patent

[11] 3,596,958

[72] Inventor **William R. Bowerman**
34 Todd Pond Road, Lincoln, Mass. 01773

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[54] **MAGNETIC LOCK**
7 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **292/201,** 292/207, 287/119
[51] **Int. Cl.** **E05c 3/14,** E05c 3/04, F16d 1/12
[50] **Field of Search** 292/251.5, 149, 201, 207; 24/201.2; 287/119; 335/291, 295, 306, 302; 70/276, 277, 413

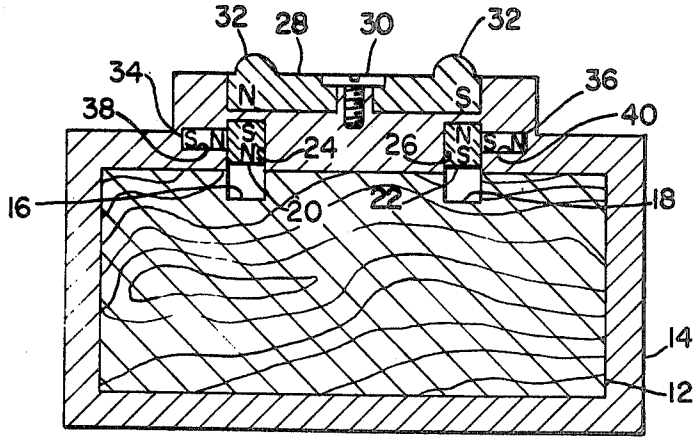
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Primary Examiner—Marvin A. Champion
Assistant Examiner—Edward J. McCarthy
Attorney—Morse, Altman & Oates

ABSTRACT: Two relatively movable members are locked in position with respect to one another by means of a pair of movable magnetic locking elements disposed in sockets in one member and adapted to move into cooperating sockets in the other member when aligned therewith. One member is provided with a control magnet in proximity to the sockets and the locking elements and movable with respect thereto. The poles of the locking elements are reversed to one another whereby the control magnet, in one position, will drive the locking elements into a locking position and, in another position, will retract the locking elements. Keeper magnets are provided to hold the locking elements in locked position.



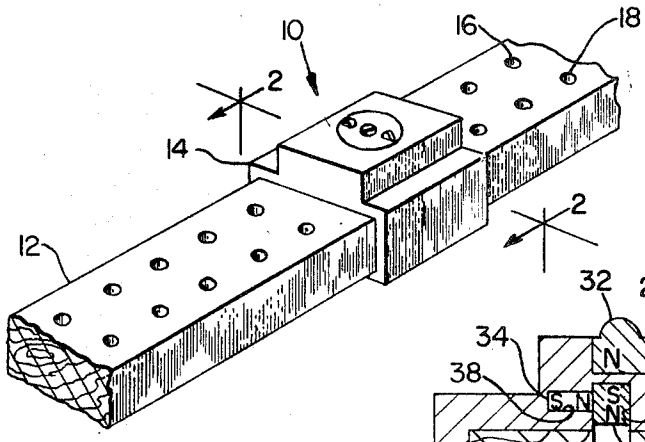


FIG. 1

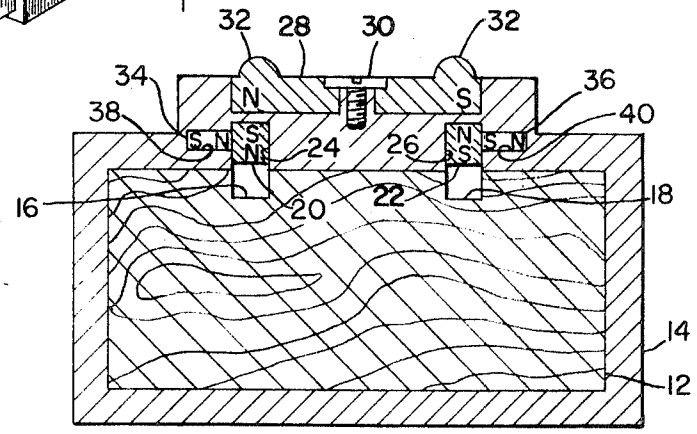


FIG. 2

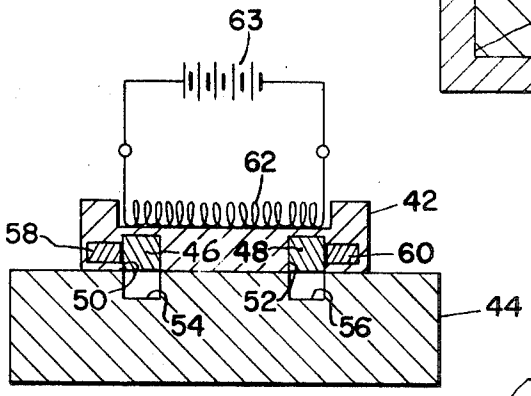


FIG. 3

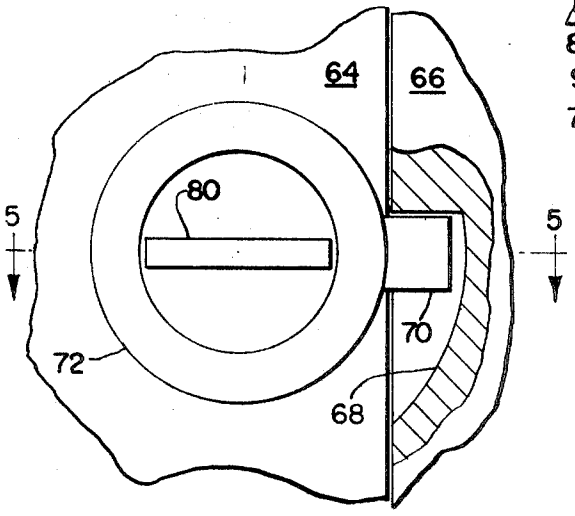


FIG. 4

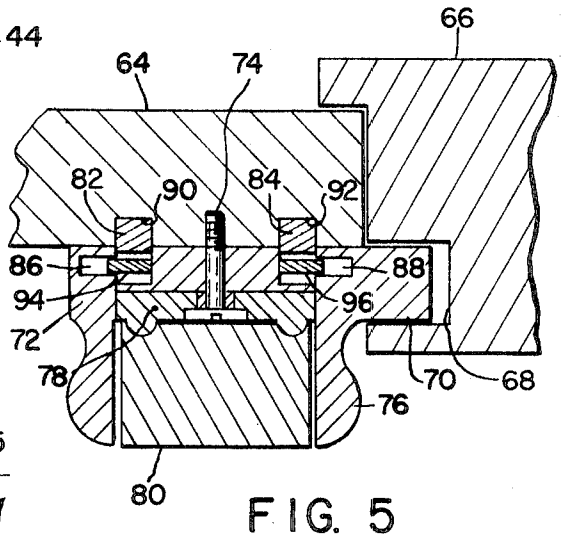


FIG. 5

INVENTOR
WILLIAM R. BOWERMAN
BY
Morse, Altman & Oates
ATTORNEYS

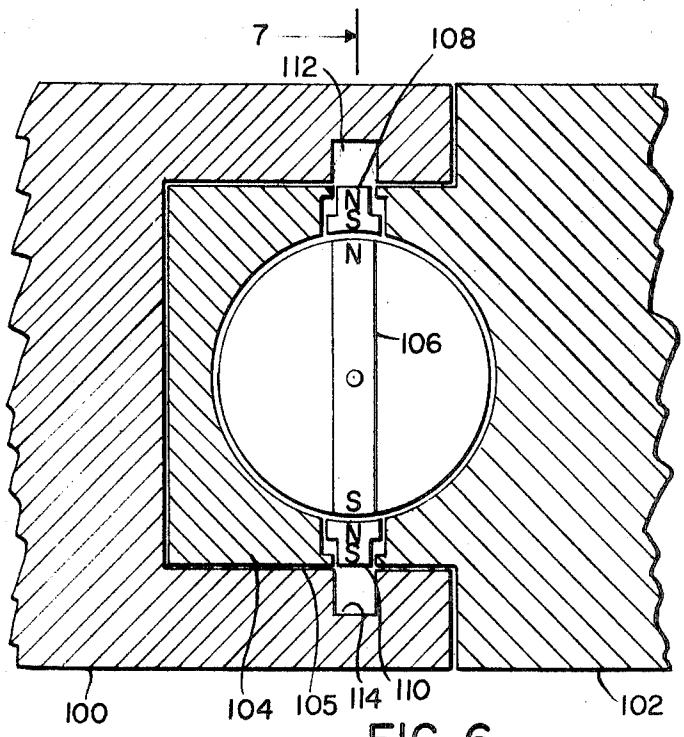


FIG. 6

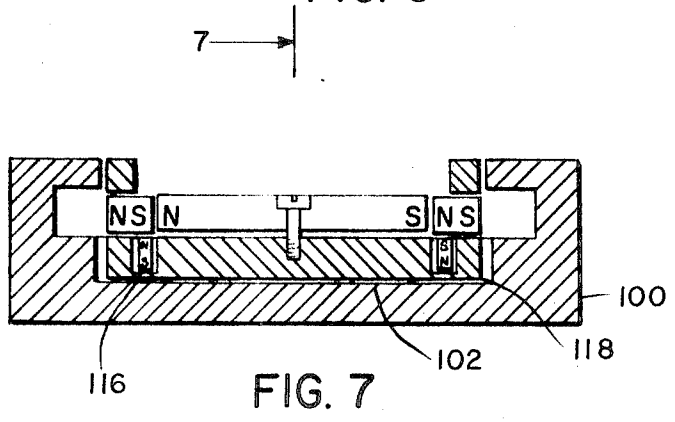


FIG. 7

INVENTOR
WILLIAM R. BOWERMAN
BY Morse, Altman & Oates
ATTORNEYS

MAGNETIC LOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to locking devices and more particularly is directed towards a new and improved magnetic locking mechanism.

2. History of the Prior Art

Various types of magnetic locking devices have been available for various uses. Most of these devices, however, are relatively complex mechanisms and do not always provide a positive-locking action. It is an object of the present invention to provide a simple, low cost, magnetic locking mechanism of improved design and construction and one which provides a positive-locking action between relatively movable parts.

SUMMARY OF THE INVENTION

This invention features a magnetic locking mechanism comprised of a pair of relatively movable members each formed with sockets adapted to be brought into register with one another by selective movement of the members. Magnetic locking elements are movably mounted within the sockets of one member with the poles thereof oriented in opposite directions. A control magnet is movably mounted in one member with the poles extending into proximity with the magnetic locking elements in the sockets. The control magnet is movable from one position to another so as either to attract or repel the locking elements from a locked to an unlocked position. Keeper magnets are mounted in recesses communicating with the sockets and adapted to move into the socket when the locking elements are in a locking position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in perspective of a magnetic lock made in accordance with the invention and embodied in a slide bar assembly,

FIG. 2 is a cross-sectional view taken along the line 2–2 of FIG. 1,

FIG. 3 is a sectional view in side elevation showing a modification of the invention,

FIG. 4 is a view in front elevation, partly in section, showing the invention embodied in a door lock,

FIG. 5 is a cross-sectional view taken along the line 5–5 of FIG. 4,

FIG. 6 is a fragmentary top sectional view of a further modification of the invention, and,

FIG. 7 is a cross-sectional view taken along the line 7–7 of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2 of the drawings, there is illustrated a slide bar lock assembly 10 comprised of an elongated bar 12 and a slide 14 mounted for movement therealong. The bar 12 typically is rectangular in cross section and is formed with a plurality of sockets 16 and 18 in spaced pairs along one face thereof. Magnetic locking means are employed for securing the slide member 14 at any selected position along the length of the bar 12 in register with a pair of sockets 16 and 18. The magnetic locking means includes a pair of locking magnets 20 and 22, one magnet being mounted in each of a pair of sockets 24 and 26 formed in the inner face of the slide member 14 and adapted to register with a cooperating pair of sockets 16 and 18 in the bar 12 by movement of the slide therealong. The slide itself, as shown, is in the form of a sleeve dimensioned to accommodate the bar 12 in sliding engagement.

The locking magnets 20 and 22 are of a length such that when fully retracted, as shown in FIG. 2, their lower ends will be clear of the bar 12 and sockets 16 and 18 to permit the slide

to be moved to any selected position. The depth of each of the sockets 16 and 18 is such that, when the slide is in register with a selected pair of sockets 16 and 18, the locking magnets 20 and 22 will move into locking position by operation of a control magnet 28. The depth of the sockets 16 and 18 and the length of the magnets 20 and 22 are selected so that when in a locked or down position the magnets 20 and 22 will bear against the lower end of the sockets 16 and 18 and extend partly into the slide sockets 24 and 26, thereby effectively locking the bar and slide against relative movement.

The control magnet 28 typically is a bar magnet rotatably mounted as by a pin 30 in the upper face of the slide member 14. The control magnet 28 is positioned so that its pole ends can be rotated into closely spaced relation to the upper ends of the sockets 24 and 26 whereby the locking magnets 20 and 22 will be affected by the field of the control magnet. The locking magnets are oriented in their respective sockets in reversed polarity positions and, in the illustrated embodiment of FIG. 2, the magnet 20 is positioned with its south pole up and its north pole down while the magnet 22 is positioned with its north pole up and its south pole down. With the control magnet 28 in the position shown in FIG. 2 both locking magnets will be attracted upwardly into the unlocked position shown. By turning the control magnet 28 180° the locking magnets 20 and 22 will be repulsed downwardly into locking position. To facilitate rotation of the control magnet 28, finger tabs 32 may be provided.

To prevent the locking magnets 20 and 22 from being jarred accidentally into an unlocked position, small keeper magnets 34 and 36 are provided. The keeper magnets 34 and 36 are mounted for movement into and out of recesses 38 and 40 formed perpendicularly to and communicating with the sockets 24 and 26 in the slide member 14. The length of each keeper magnet is such that, in the retracted position of FIG. 2, each will be sufficiently withdrawn into its associated recess as to permit the locking magnets 20 and 22 to be fully retracted. When the locking magnets 20 and 22 are in a lowered or locked position the keeper magnets are drawn out of their recesses by means of the field of the control magnet 28 and extend out across the upper portion of each socket 24 and 26, thereby preventing the locking magnets 20 and 22 from being accidentally jarred back up into an unlocked position. The length of each keeper magnet is such that it does not come entirely clear of its cooperating recess whereby when the keeper magnet is subsequently repulsed into a retracted position it will move easily back into its recess. The keeper magnets are oriented in such a polar arrangement that they will be repelled into a retracted position when the locking magnets are in a retracted unlocked position and will be extended into a locking position at the same time that the locking magnets are in an extended or locking position.

The slide assembly of FIGS. 1 and 2 may be employed in various applications such as in sailboat rigging wherein a line may be attached to the slide member 14 as by a cleat, ring or the like and the bar 12 mounted to the vessel to permit easy change in the position of the line. Typically the bar may serve as a boom or may be employed for other purposes where it is desired to lock two relatively slidable members in a selected position.

Referring now to FIG. 3 of the drawings there is illustrated a modification of the invention and in this embodiment members 42 and 44 are movable relative to one another and adapted to be locked in a selected position by means of movable locking magnets 46 and 48 located in cooperating sockets 50 and 22 registerable with sockets 54 and 56. Keeper magnets 58 and 60 are provided as before. In this embodiment, in place of a control bar magnet an inductive coil 62 is provided and extends into operating proximity with the locking magnets 46 and 48 as well as the keeper magnets 58 and 60. The coil 62 is adapted to be connected to a power source such as a battery 63 which will energize the coil and develop a field adapted to drive the magnet 46 and 48 into a locked position. By means of a switch or by reversing the battery 63 the polari-

ty of the coil may be reversed so as to move the magnets into an unlocked position.

Referring now to FIGS. 4 and 5 there is illustrated a further modification of the invention and in this embodiment the lock is incorporated in a door latch. In FIGS. 4 and 5 reference character 64 generally indicates a door adapted to be locked against a jamb 66. The jamb 66 is provided with a socket 68 adapted to receive a bolt 70 mounted to or integral with a member 72 rotatably mounted to the door 64 as by a pivot pin 74 and which may be provided with a handle or knob portion 76 for operation thereof. The member 72 is provided with a control magnet 78 which may be rotated from a locked to an unlocked position by means of an extension stem 80. The control magnet 78 is adapted to move locking magnets 82 and 84 as well as keeper magnets 86 and 88 from locked to unlocked positions and vice versa in the same fashion as in the principal embodiment. To this end the door 64 is formed with sockets 90 and 92 adapted to register with cooperating sockets 94 and 96 formed on the inner face of the member 72. In this fashion the member 72, together with the bolt 70, may be locked in the position illustrated or unlocked by rotating the stem together with its control magnet 78 180° so as to move the magnets 82 and 84 into unlocked positions thereby permitting the member 72 to be rotated by its knob 76 to disengage the bolt from the socket 68.

Referring now to FIGS. 6 and 7 of the drawings there is disclosed a further modification of the invention and in this embodiment a pair of male and female members 100 and 102 are detachably connected in end-to-end relation by a magnetic locking mechanism made according to the invention. The member 102 is formed with an extension 104 adapted to slide into a cooperating recess 105 in the member 100 and carries a rotary control magnet 106 and a pair of locking magnets 108 and 110 in the same plane. The magnets 108 and 110 are formed with shoulders for retaining the magnets in their slideways.

The member 100 is formed with oppositely facing sockets 112 and 114 to receive the locking magnets 108 and 110 when forced outwardly by operation of the control magnet. Keeper magnets 116 and 118 are provided in sockets formed in the member 102 below the control magnet and operate in a manner similar to those of the principal embodiment.

Having thus described the invention what I claim and desire to obtain by Letters Patent of the United States is:

1. Locking apparatus, comprising
   a. a first member,
   b. a second member movably engaging said first member and lockable thereto,
   c. said members each being formed with at least one socket adapted to register with one another by movement of said members,
   d. a locking magnet mounted in the socket of said first member and movable into the socket of said second member when in register therewith,
   e. magnetic field-producing means mounted to said first member in proximity to said locking member,
   f. means for changing the polarity of said field-producing means for selectively moving said locking magnet into and out of the socket of said second member,
   g. said first member being formed with a chamber in communication with and substantially perpendicular to said socket, and,
   h. a keeper magnet movably mounted in said chamber and adapted to extend into said first member socket when said locking magnet is in said second member socket.

2. Locking apparatus according to claim 1 wherein said magnetic field-producing means is a magnet movably mounted to said first member.

3. Locking apparatus according to claim 1 wherein said magnetic field-producing means is a coil.

4. Locking apparatus according to claim 1 wherein said first member is in the form of a sleeve and said second member is elongated and slidably received in said first member.

5. Locking apparatus according to claim 4 wherein said second member is formed with a plurality of sockets spaced along the length thereof.

6. Locking apparatus according to claim 1 wherein said first member is rotatably mounted to said second member, said first member being formed with a bolt movable into and out of a locking position.

7. Locking apparatus according to claim 1 wherein said locking magnet is in the plane of said field-producing means.