United States Patent [19]

Sidiropoulos

[11] **3,857,262**

[45] **Dec. 31, 1974**

[54] **MAGNETIC LOCKING MECHANISM**

[76] Inventor: **Konstantin Sidiropoulos,** Liechtensteinerstrasse 4, 6800 Feldkirch, Austria

[22] Filed: **Feb. 8, 1973**

[21] Appl. No.: **330,667**

[52] **U.S. Cl.** ..... **70/276,** 70/38 C

[51] **Int. Cl.** **E05b 47/00**

[58] **Field of Search** ..... 70/38 L, 276, 413

[56] **References Cited**

UNITED STATES PATENTS

3,056,276	10/1962	Allander	70/413 X
3,657,907	4/1972	Boving	70/413 X

FOREIGN PATENTS OR APPLICATIONS

1,937,131	2/1971	Germany	70/276

Primary Examiner—Robert L. Wolfe

Attorney, Agent, or Firm—Hans Berman

[57] **ABSTRACT**

Steel pins of a locking mechanism are pivotally mounted in a casing on a supporting element and are biased by permanent magnets toward a rest position in which they hold an apertured lock element at a distance from the supporting element and thereby keep a latch attached to the apertured element in its locking position. When deflected from the rest position by more effective magnets on an inserted key, the locking pins enter the apertures of the apertured lock element, and thereby permit the latter to approach the supporting element, thereby withdrawing the latch from its locking position.

10 Claims, 5 Drawing Figures

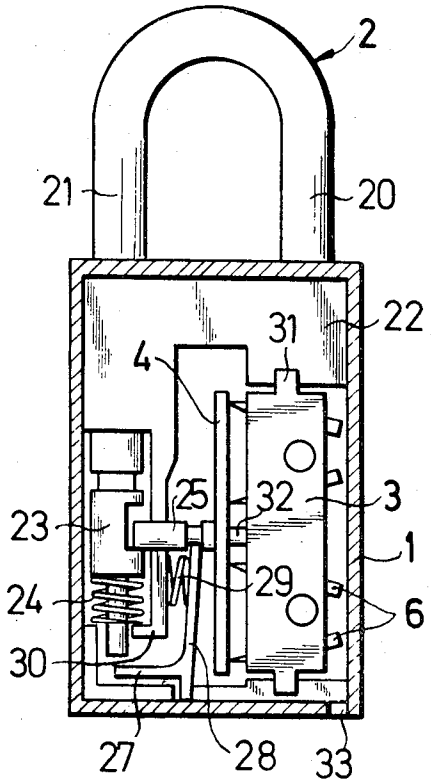


Fig. 1

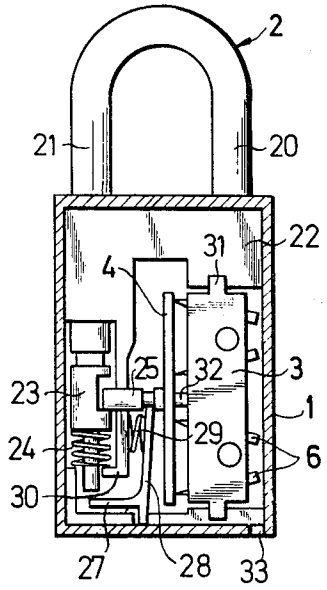
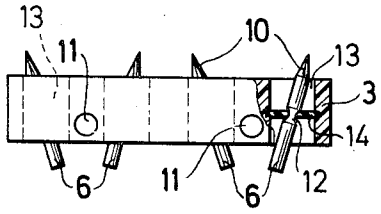


Fig. 3



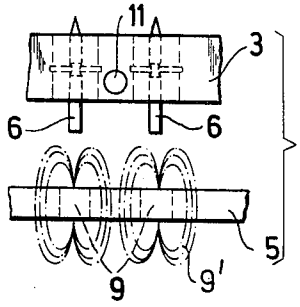
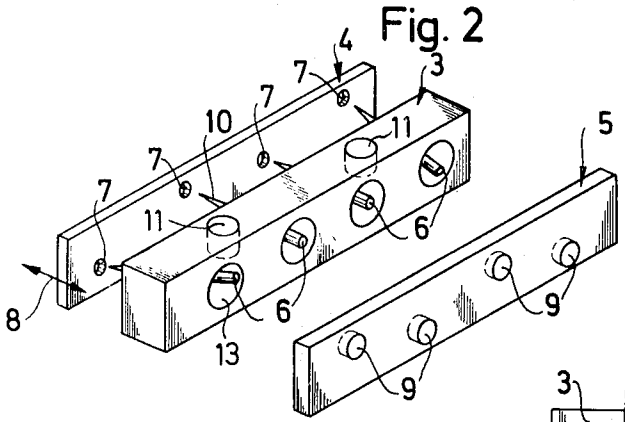


Fig.4

Fig. 2



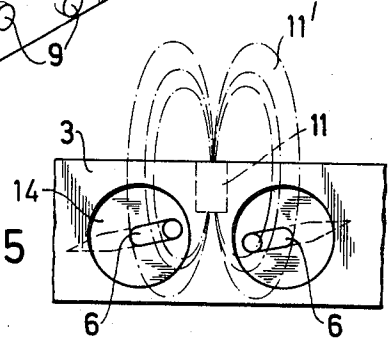


Fig. 5

MAGNETIC LOCKING MECHANISM

This invention relates to locking mechanisms, and particularly to a locking mechanism which is operated by means of a key carrying permanent magnets.

In known locking mechanisms of the type disclosed in U.S. Pat. No. 3,056,276, there is being provided an apertured locking element and another locking element carrying movable pins which are moved by magnets on the key between respective positions in which they may or cannot enter the apertures in the apertured locking element, thereby permitting more or less relative movement between the two locking elements.

In the known mechanism, the pins are moved into a well defined unlocking position when the key is inserted in the lock, but only friction holds them in this position or any other position when the key is withdrawn. When the entire mechanism is subjected to mechanical shock in a suitable direction, the pins may be jarred out of a rest or locking position into the unlocking position without the use of a key.

The primary object of this invention is the provision of a locking mechanism which requires its mating key for unlocking and cannot be unlocked by merely shaking the mechanism, regardless of the force or impact used in subjecting the mechanism to shock.

With this object and others in view, as will hereinafter become apparent, the invention provides two locking elements in a casing, a first element being fixedly fastened to the casing and the second element being guided in the casing for movement relative to the first element, one of the elements being formed with a plurality of apertures directed toward the other element. The latter carries a plurality of elongated pin members of magnetically susceptible material, such as ferrous metal, and the pin members may move between respective operative and rest positions. When in the operative position, the pin members are longitudinally directed toward the apertures of the one element and enter respective apertures when the second element approaches the first element. When in the rest position, the pin members are out of alignment with the apertures and limit movement of the second locking element toward the first element in a position in which the pin members are entirely outside the recesses. First magnets mounted in the casing bias the pin members toward their rest positions. A key carries second magnets and is guided toward and away from an unlocking position in the casing in which the second magnets bias the pin members toward the operative positions with a force sufficient for overcoming the biasing force of the first magnets. The second locking element is operatively connected with a latch or the like for simultaneous movement therewith.

Other features, additional objects, and many of the attendant advantages of this invention will readily be appreciated as the same becomes better understood by reference to the following detailed description of a preferred embodiment when considered in connection with the appended drawing in which:

FIG. 1 shows a padlock of the invention without its front wall in front elevation;

FIG. 2 shows two elements of the lock of FIG. 1 and an associated key in their operative alignment in a perspective view not drawn to scale;

FIG. 3 shows one of the elements illustrated in FIG. 2 on a larger scale than in the corresponding view of FIG. 1 and in the rest position;

FIG. 4 is a fragmentary front view of the element of FIG. 3 and of the associated key in the unlocking position; and

FIG. 5 is a fragmentary side elevation of the device of FIG. 3.

The padlock illustrated in FIG. 1 has a casing 1 from which a shackle 2 projects. One leg 20 of the shackle 2 is freely slidable in the casing 1 in a manner not shown. The other leg 21 passes through a bore in a heavy frame 22 fixedly fastened in the casing 1, and the notched end 23 of the leg 21 is exposed in the casing cavity. A helical compression spring 24 biases the end 23 outward of the casing, and a latch 25 engaging the notch in the end 23 holds the leg 21 in the illustrated position. A rocker pivoted on the inner casing wall has a short arm 27 closely adjacent the free end of the leg 21 and a longer arm 28 which engages a groove in the latch 25. A helical compression spring 29 interposed between a bracket 30 of the frame 22 and the rocker arm 28 biases the latch 25 outward of the notch in the leg end 23. The compression spring 24 abuts against a hook-shaped end portion of the bracket 30.

The structure described so far is conventional and operates in a conventional manner. When the shackle 2 is inserted in the casing 1, its inward movement is ultimately braked by the spring 24 until the free end of the leg 21 hits the rocker arm 27, whereby the arm 28 pushes the latch 25 into the notch of the leg end 23 against the restraint of the spring 29.

This invention is concerned with the locking mechanism which holds the latch 25 in the illustrated position, and which permits the latch to be withdrawn by the spring 29 so as to permit the shackle 2 to be released from the casing 1.

The mechanism includes an elongated, generally rectangular plastic block 3 fixedly fastened in the casing 1 in the assembled condition of the latter between the front wall, removed in FIG. 1, and the rear wall of the casing and by integral ribs 31 longitudinally projecting from the block 3 into conforming notches of the frame 22. A rod 32, longitudinally aligned with the latch 25 is guided in a non-illustrated bore of the block 3 and carries an elongated brass plate 4 which is fixedly fastened to the latch 25 and guided between the front and rear walls of the casing 1 for movement in the direction of the double arrow 8 (FIG. 2). The plate 4 is held in the position shown in FIG. 1 by two pairs of round steel pins 6.

As is better seen in FIG. 3, the pins 6 are received with ample clearance in respective bores 13 of the block 3, and have each a circumferential groove 12 approximately equidistant from the ends of the pin, one end 10 being pointed. A flexible diaphragm 14 in each bore 13 is integral with the block 3 and has a central aperture through which the pin 6 passes. The rim of the diaphragm is received in the groove 12 and thereby axially secures the pin while the flexibility of the diaphragm permits universal angular movement of the pin within the limits set by the walls of the bore 13.

Two small bar magnets 11 are fixedly fastened in conforming recesses of the block 3 between the bores 13 associated with each pair of pins 6, the axis of the magnet 11 being perpendicular to the common plane defined by the axes of the bores. The magnets 11 are

offset from the median longitudinal plane of the block 3 perpendicular to the bore axes in a direction away from the pointed ends 10 of the pins 6 so that the pointed ends 10 of each pair of pins diverge under the effect of the magnetic field 11' of the associated magnet 11, as is best seen in FIG. 5.

The ribs 31, the rod 32, and the bore in the block 3 slidably receiving the rod 32 have been omitted from FIGS. 2 to 5 for the sake of clarity.

Reverting now to FIG. 1, it is seen that the spring 29 urges the brass plate 4 against the diverging pointed ends 10 of the pins 6, thereby spreading the pins to the limits available in the bores 13, the pins being held against the force of the spring 29 by the associated diaphragms 14, but also by frictional engagement with the walls of the block 3.

The plate 4 has four apertures 7 dimensioned to receive the pointed ends 10 of respective pins 6, but far out of alignment with the pins in the rest position of the pins shown in FIGS. 1, 3, and 5. The pins 6 are moved into an operative or unlocking position of alignment with the apertures 7 by a key 5 which is a flat brass strip having four bar magnets 9 inserted therein. The magnets 9 are identical with the afore-described magnets 11, but their axes are parallel to those of associated bores 13 when the key is inserted into the casing 1 through a key slot 33 in the bottom wall of the casing so that it is located between a side wall of the casing 1 and the block 3 and longitudinally abuts against the frame 22, as is not explicitly shown. The relative longitudinal positions of the plate 4, the block 3, and the key 5 are illustrated in FIG. 2, but their transverse spacing has been increased for clearer pictorial representation. The handle portion of the key 5, which projects from the slot 33, has been omitted.

As is best seen in FIG. 4, the magnetic fields 9' of the magnets 9, because of their more favorable orientation relative to the pins 6, overcome the field 11' and pivot the pins 6 in the diaphragms 14 into respective positions of alignment with the apertures 7, thereby permitting the spring 29 to move the plate 4 in the direction of the arrow 8, and to withdraw the latch 25 from the notch in the leg end 23 of the shackle 2. The spring 24 thereafter at least partly ejects the shackle 2 from the casing 1, permitting its further withdrawal whether the key 5 is left in the casing 1 or removed.

When the shackle 2 is again inserted into the casing 1 to the locked position shown in FIG. 1, the plate 4 is retracted by the rocker arm 28 which inserts the latch 25 into the notch of the leg end 23, and the released pins 6 are free to revert to their rest position under the attraction of the magnets 11 if the key 5 is absent.

While the invention has been described with reference to a padlock whose shackle may be fully removed, it is obviously equally applicable to a padlock whose shackle, when partly released, may be swung about one of its legs which remains attached to the lock casing. The pins 6 have been shown to be fastened in the block 3 by universal joints permitting pivoting movement in all directions. A simpler locking arrangement in which the pins can swing in one plane only will readily be devised on the basis of the above teachings. It provides a smaller number of combinations for the positions of the magnets 9, and thus a smaller number of different keys. Instead of pivotally mounted pins, the invention is equally applicable to locks, known in themselves, in which the pins are guided for longitudinal movement only.

It is a common feature of the illustrated embodiment and of all variations that a set of magnets fixedly mounted in the lock casing hold the pins in a locking or rest position or at least biases the pins toward a rest position from which they cannot readily be dislodged by mere mechanical shock, but that magnets correctly positioned on a mating key shift the pins from the rest position to an unlocking position against the restraint of the fixed magnets.

It is more economical to make the magnets 9 and 11 identical in size, shape, composition, and field strength, and to vary their effects on the pins 6 by suitably orienting the axes of the magnets, but analogous results can be achieved by identically oriented magnetic fields differing in strength. Other variations will readily suggest themselves to those skilled in the art.

It should be understood, therefore, that the foregoing disclosure relates only to a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the appended claims.

What is claimed is:

1. A locking mechanism comprising, in combination:
   a. a casing;
   b. a first locking element fixedly fastened in said casing;
   c. a second locking element guided in said casing for movement relative to said first element,
      1. one of said elements being formed with a plurality of apertures directed toward the other element;
   d. a plurality of elongated pin members of magnetically susceptible material mounted on the other element for movement between respective operative and rest positions,
      1. said pin members, when in said operative position, being longitudinally directed toward said apertures and entering respective ones of said apertures when said second element approaches said first element,
      2. said pin members, when in said rest positions, being out of alignment with said apertures and limiting movement of said second element toward said first element in a position in which said pin members are outside said apertures;
   e. first magnetic means fixedly mounted on said other element and biasing said pin members toward said rest positions thereof;
   f. a key carrying a plurality of second magnetic means; and
   g. guide means on said casing for guiding said key toward and away from an unlocking position in which said second magnetic means bias said pin members toward the operative positions thereof with a force sufficient to overcome the biasing force of said first magnetic means; and
   h. latching means operatively connected to said second locking element for simultaneous movement therewith.

2. A mechanism as set forth in claim 1, wherein said first magnetic means and said second magnetic means

generate respective fields in said pin members when said key is in said unlocking position thereof.

3. A mechanism as set forth in claim **2,** wherein said fields are transverse to each other.

4. A mechanism as set forth in claim **2,** wherein said latching means are connected to said one locking element for simultaneous movement therewith relative to said other element.

5. A mechanism as set forth in claim **2,** wherein said members constitute at least one pair of pin members, and said first magnetic means include a single permanent magnet member associated with the pin members of each pair for biasing the associated pin members toward the respective rest positions.

6. A mechanism as set forth in claim **2,** wherein said first magnetic means include a permanent magnet member.

7. A mechanism as set forth in claim **6,** wherein said magnet member has an axis transverse to the direction of elongation of said associated pin member.

8. A mechanism as set forth in claim **7,** wherein said second magnetic means each include a permanent magnet member having an axis, the magnet members of said second magnet means being associated with respective pin members, when in said unlocking position, and having respective axes extending in the direction of elongation of the associated pin members.

9. A mechanism as set forth in claim **7,** wherein said first element is said other element.

10. A mechanism as set forth in claim **9,** wherein said pin members are mounted on said first element for pivotal movement between said positions thereof.

* * * * *