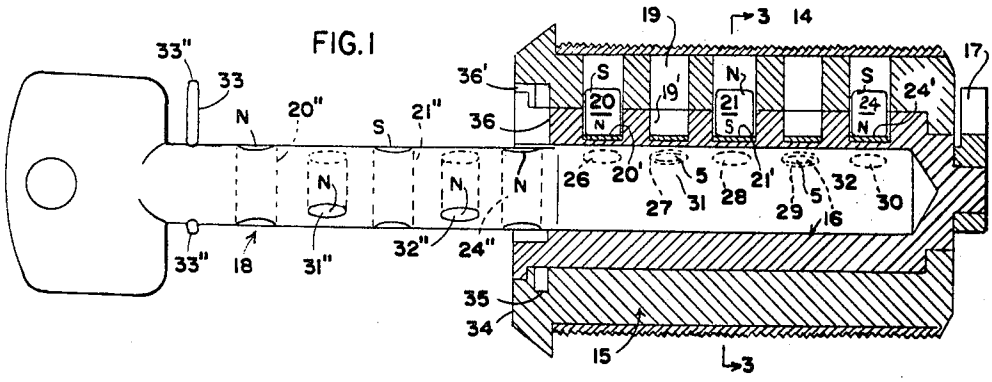
Nov. 5, 1968 R. FELSON 3,408,837

MAGNETIC LOCK DEVICES

Filed March 1, 1967

FIG. 1



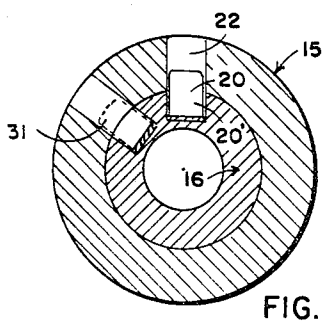


FIG. 3

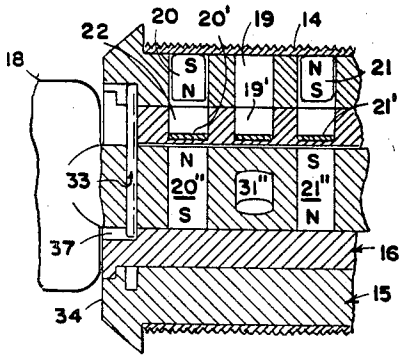


FIG. 2

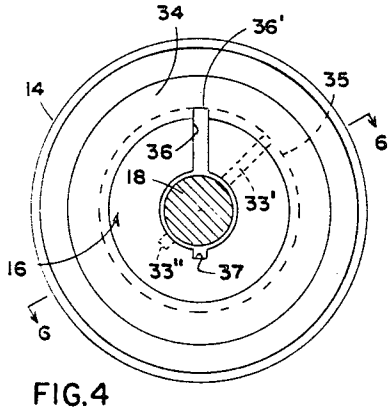


FIG. 4

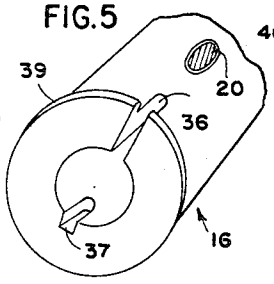


FIG. 5

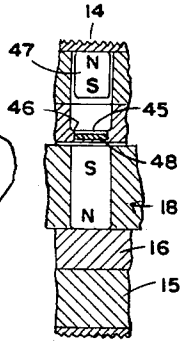


FIG. 7

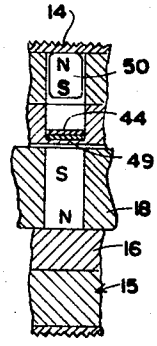


FIG. 8

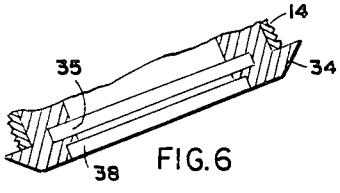


FIG. 6

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MAGNETIC LOCK DEVICES

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ABSTRACT OF THE DISCLOSURE

A spring-less magnetic lock in which each tumbler is a permanent magnet and the key has permanently magnetized inserts, one for each tumbler, and so arranged that upon insertion of the key in proper position into the lock, the tumblers are repelled by said inserts respectively, to unlocking position. For each tumbler there is a fixed foil disc of magnetizable material between each tumbler and the hole for the key, to which disc the tumbler is attracted and thus moved to locking position. The force of repulsion exerted by each of said inserts is sufficient to move the tumblers over the attraction of the tumblers for their related discs. This lock operates regardless of its position or the line and direction of movement of the tumblers. Gravity in no manner effects the operation of this lock regardless of the line and direction of movement of any tumbler.

The present invention relates to novel and improved magnetic lock constructions and the keys therefor, and more particularly to the type which relies neither upon gravity or springs to effect return of the tumblers to locking position. This new lock operates properly wholly by magnetic action and hence the line of tumbler movement may even be upwards or horizontally. This permits the lock to be used for cabinets, chests, trunks and other movable box structures which when inverted would automatically cause their locks to open if of the gravity-return type magnetic lock, and avoids opening of the lock when used on a door, by giving the lock a half turn, which is a technique used by burglars.

It is therefore the principal object of this invention to provide a novel and improved spring-less magnetic lock which will avoid the aforementioned objectionable incidents, for my new lock operates properly without the aid of gravity and regardless of its position.

Heretofore in locks of this class, when a magnetic insert in the shank of a key is properly positioned in the lock, it will shift a magnetic tumbler from locking position to open position. Then upon withdrawal of the key, each tumbler had a companion magnet to shift it back to locking position.

It is therefore a further object of this invention to provide elements of negligible cost, in place of said companion magnets, and thus materially cheapen the cost of manufacture not only as to the cost of the parts, but also by a saving in labor for the assembling, because now no attention is necessary as formerly, that the companion magnets be properly positioned in respect to the polarity of their associated tumblers respectively.

A further object thereof is to provide a magnetic lock of the character described, of novel and improved construction, which involves a new mode of operation.

A further object of this invention is to provide a novel and improved magnetic lock structure having the stated attributes, which is simple in construction, reasonable in cost and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

This invention is applicable in lock constructions of the type which operate on the principle that when a magnetic insert in the shank of a key is properly positioned, it will react with a magnetized tumbler so that the latter will move, whereupon that element of the lock which is adapted to shift a bolt or the like, is released for movement.

For the practice of this invention in a cylinder lock, which is the preferred embodiment herein illustrated to explain this invention, each tumbler is permanently magnetized. The key has permanently magnetized inserts, one for each tumbler respectively, and so arranged that upon insertion of the key into the lock, the tumblers are repelled into unlocking position. In each tumbler's socket in the barrel of the lock, there is fixed a steel film disc, to which its related tumbler is drawn by attraction thereto when the key is withdrawn from the barrel. At all times, the tumbler is exerting attraction action to its related film disc. Of importance to note is that in each such set of two related permanent magnets and film disc, the strength of the attraction of the tumbler to the disc is sufficient to maintain the tumbler in locking position regardless of the line of movement of the tumbler, and that the strength of the magnetic key insert is sufficient to shift the tumbler into unlocking position against the action of attraction of said tumbler for said disc regardless of the line of movement of the tumbler, and that upon withdrawal of the key, the strength of such attraction will restore the tumbler into locking position regardless of the line of movement of the tumbler. These strength relationships must also prevail regardless of the direction of the tumbler need move at any time.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is an enlarged longitudinal view showing a cylinder lock embodying the teachings of this invention, and also its key. This view is shown in section taken at line 1—1 in FIG. 3. The key is shown entering the barrel. The tumblers are in locking position.

FIG. 2 is a fragmentary view of the device as shown in FIG. 1, but here in FIG. 2, the key is shown fully inserted and hence the tumblers are in their moved position and the barrel is free to turn in the casing.

FIG. 3 is a section taken at line 3—3 in FIG. 1.

FIG. 4 shows a front view of the lock, that is looking onto the left end in FIG. 1. In this FIG. 4, the key is shown partly turned from the initial position at full insertion. Of course, the barrel has turned with the key

FIG. 5 is a fragmentary perspective view which shows the front end of the barrel.

FIG. 6 is a fragmentary section only of the casing, taken at line 6—6 in FIG. 4.

FIG. 7 is a fragmentary sectional view of the lock and key in the manner of FIG. 2, showing a modified construction.

FIG. 8 is a view like FIG. 7, of another modified construction.

In the drawing, the numeral **15** indicates generally a lock's cylinder or casing in which a barrel is rotatably fitted, and as is well known, said barrel carries a suitable member **17** to shift the lock's bolt not shown, upon rotation of said barrel within the casing. Said barrel and casing are of non-magnetic material and so is the body of the key **18** which is slidably in and out of the barrel. There are a series of holes through the wall of the casing **15**, one such hole being shown at **19**, which series, at one position of the barrel **16**, register respectively with radial sockets in said barrel, as for instance the socket **19'** with the hole **19**. Each hole and its related socket are of like diameter, adapted to house a slidable permanently magnetized tumbler which is of a length greater than the distance it can enter into the

socket, so such tumbler can be part in the socket and part in the related hole of the cavity. A sleeve **14** of non-magnetic material on the cylinder **15**, closes all the holes in the cylinder, so each tumbler is in its own chamber. There is sufficient chamber space to allow the tumbler to reside wholly within the hole in the cylinder **15**, as do the tumblers **20** and **21** in FIG. 2, in their respective holes **22** and **23**. It is evident that when the tumblers extend into the sockets, as in FIG. 1, they are in locking position, holding the barrel **16** fast to the cylinder **15**, and that when the tumblers are out of the sockets in the barrel, they unlock the barrel and let it free for turning, as is the condition shown in FIG. 2. The key **18** has permanently magnetized inserts in the same spaced relation as the tumblers so that upon full insertion of the key into the barrel **16**, one of such inserts is in axial alignment with one of the tumblers respectively.

The holes containing the tumblers **20**, **21** and **24**, are in one row along the cylinder **15**, with the holes **19** and **25**. If desired, tumblers may be provided in the holes **19** and **25**, and such, together with the tumblers **20**, **21** and **24**, may constitute the entire locking means. However, in the illustrated embodiment, I have provided a second series of holes in another row along the cylinder **15**, with companion sockets in the barrel **16**, such sockets being indicated by the respective numerals **26–30**, and have provided tumblers **31** and **32** to be in staggered relation with the tumblers **20**, **21** and **24**, thereby leaving half the holes empty. It is evident that different choices of which holes in the cylinder are to contain tumblers, affords many combinations for the lock, each of which needs its special key respectively. The spaced magnetic inserts positioned transversely through the body of the smooth key shank, are in such relative positions that when the key **18** is fully insterted into the barrel **16**, one of said inserts is in alignment with one of the tumblers respectively.

At least in each socket of the barrel into which a tumbler enters, there is a plain film disc of steel fixed at the socket bottom as indicated by the numerals **20'**, **21'** and **24'**. In the manufacture of these locks, all sockets are provided with such steel film disc, to ready the lock for any combination. Those discs as **19'**, **25'** which have no associated tumbler, remain inactive. An important teaching of this invention is that the components which cooperate by magnetic action shall comprise sets of three pieces, namely a tumbler, one of said foil discs and a magnetic insert in the key. In each set, the tumbler is under repelling action of the insert in the key, when the key is fully inserted into the barrel **16**. The tumbler **21** is related with the foil disc **21'** and with the magnetic key insert **21''**. The tumbler **24** is related with the foil disc **24'** and with the key insert **24''**. The tumbler **21** is related with the foil disc **21'** and with the key insert **21''**. The tumbler **31** is related with the foil disc **31'** and with the key insert **31''**. The tumbler **32** is related with a foil disc not shown, and with the key insert **32''**.

It is important to note that each tumbler is being constantly drawn to its related foil disc, regardless of the line of direction of movement of the tumbler, and the strength of such attraction is sufficient to maintain the tumbler in locking position regardless of the line of movement of the tumbler, but the srtength of the magnetic key insert is sufficient to shift the tumbler by repelling it into unlocking position against the attraction of the tumbler for its related film disc, regardless of the line of direction of movement of the tumbler. It is evident that the effects of gravity are counteracted in this set up.

At the finger-piece end, there is a pin **33** transversely through the shank of the key **18**. This pin extends out of the shank, more at **33'** than at **33''** to determine the position the key is to be in, so that when inserted into the barrel **16**, the inserts **20''**, **31''**, **21''**, **32''** and **24''** shall respectively be in alignment with the tumblers **20**, **31**, **21**, **32** and **24**. Upon such insertion of the key **18**, all the tumblers will be shifted clear of the barrel **16**, and into the holes in the body of the casing or cylinder **15**, that is, the tumblers will move from their normal locking position shown in FIG. 1 when the key **18** is out, to unlocking position shown in FIG. 2, effected by mere insertion of the key in proper position to register with the tumblers.

The cylinder **15** at front end, has the counterbore **38** into which the outward flange **39** at the front end of the barrel **16** rotatably fits, and a bit behind such counterbore, the casing is provided with an internal annular channel **35** along which the tip end position of the pin part **33'** rides fitted therein, upon turning the key **18**, after such key is fully inserted into the barrel. The radial distance from the floor of the channel **35** to the axis of the key, is a bit greater than the radius of the barrel's front flange **39**. So there is a notch **36'** to afford entrance of the distal end of the pin part **33'** into said channel; such notch being in the face plate **34**, and enterable at the front of such plate. The barrel **16** has a short keyway **37** enterable at the front end by the pin part **33''**, and of a depth, just to admit it. For entrance of the pin part **33'**, the barrel has a notch **36** enterable at the front end. The length of said keyway **37** and the depth of said notch **36** are such that when the key is fully entered into the barrel, the distal end of the pin part **33'** will enter the channel **35** when the key is then turned. Said notch **36** and keyway **37** are of course so positioned that they receive the pin **33** when the key is fully inserted in the barrel. The notch **36'** in the casing, is so positioned that it registers with the notch **36** when the pin tumblers are in locking position. In normal manufacture, the "keyhole" offered by the notches **36**, **36'** and the keyway **37**, shall admit the pin **33** when the latter is vertical, in order to conform with ordinary lock practice to have the key in the vertical plane for insertion. It is evident that the key can be inserted only in one way, since the keyway **37** will not admit the pin part **33'**, but can only admit the pin part **33''** which is much shorter than **33'**.

Upon full insertion of the key **18** into the barrel **16**, meaning that the pin part **33''** is at the end of the keyway **37**, the pin part **33'** is at the closed end of the notch **36** and the distal end of said pin part **33'** is in the annular channel entrance **36'**, the key's magnetic inserts are in their proper location to effect tumbler shift to unlocked position as in FIG. 2. So mere insertion of the key as mentioned, will release the barrel for turning. Now upon turning the key, the barrel will turn and the incident movement of the member **17**, will operate the bolt mechanism not shown. The distal end of the pin part **33'** will be cached in the annular channel **35**. It is evident that in this structure as illustrated, the key cannot be withdrawn except when the tumblers would be in locking position as in FIG. **1**, upon the withdrawal of such key, and to withdraw the key, it must be in position to have the pin part **33'** leave through the notch **36'**.

As has been mentioned, the action of gravity will never cause any tumbler to shift from locking position to unlocking position. So even if the device is inverted, the tumblers will remain in locking position, and it is also evident that the tumblers may be arranged for movement along the horizontal, since at no time is gravity relied on to operate the device in any particular. Hence locks embodying this invention, may be used on cabinets, chests and the like, because turning the cabinet upside down, will not release the barrel **16**. I have indicated the arrangement for the magnetic components, by marking polarities thereof N and S. Of course, many other dispositions may be made to get different lock combinations, but always, the magnetic forces acting on a tumbler are repulsions from its associated actuating magnet insert in the key, and the attraction the tumbler has for its related foil disc. Of importance to note is that regardless how the lock is installed, said foil discs main-

tain the tumblers in locking position when the key is out, whether tumbler movement is along the horizontal, or require to be acted on by an upward force to stay in locking position or require a force in any direction to stay in locking position, and that said foil discs always do their job regardless of any shift in lock position. These incidents of structure and mode of operation, make this lock pick-proof. To ease their separation upon insertion of the key **18**, there is provided that no contact shall occur between the tumbler and its associated film disc, meaning that constantly between them, only non-magnetizable material shall be present. One way to accomplish this is to have an air gap **45** between them, which is maintained by providing a shoulder **46** to stop the tumbler **47** a bit from the disc foil **48** as in FIG. 7. Another way to have non-magnetic material between them is to have a thin piece of copper **44** fixed on the face of the film disc **49** which faces the tumbler **50**, as shown in FIG. 8.

The term "disc" in the appended claims shall not be deemed limited to round shape but shall include other perimetrical forms.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiments shown herein shall be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific showings and description herein to indicate the scope of this invention.

I claim:

1. In a magnetic lock device, a first member, a second member movably mounted on the first member; said members being of non-magnetic material; the first member having a hole therethrough and the second member having a socket therein in alignment with said hole, a permanently magnetized tumbler longitudinally slidable and fitted in said hole and socket, and positioned part in said hole and part in said socket, a film disc of magnetic material positioned fixed in said socket and facing the end of the tumbler which is in said socket; said tumbler being capable of being entirely within said hole; said tumbler in all of its positions, being attracted to said film disc, in combination with a key of non-magnetic material having a permanently magnetized insert; said disc being between said tumbler and said key, said key, when placed in a position so that its magnetic insert is in alignment with said tumbler and acting to repel the tumbler so the tumbler is moved entirely within said hole in the first member, the second member will thereby be released for movement in relation to the first member; the strength of the attraction of the tumbler to the film disc being such that, regardless of the line of direction of movement of the tumbler to leave the socket, it will be attracted by said disc film to maintain it entered into the socket when said socket and hole are in alignment and said key is away from said position; the strength of said magnetic insert being such that regardless of the line of movement and direction of movement of the tumbler to leave the socket, said insert will act on the tumbler to maintain it wholly in said hole when said key is in said position, regardless of the attraction of the tumbler for said film disc, and means for each hole for limiting the distance the tumbler can travel thereinto.

2. A magnetic lock device as defined in claim **1**, wherein the first member is a casing and the second member is a barrel rotatably fitted in said casing; the mentioned hole being through the wall of said casing; said barrel having a bore therein therealong and said bore being accessible for the admission of the key therein.

3. A magnetic lock device as defined in claim **1**, including means on said key and second member which come into alignment upon placing said key so that its magnetic insert is in alignment with said tumbler, and upon such positioning of the key and when said tumbler is entirely within said hole in the first member, the key can be manipulated to move the second member, in relation to the first member.

4. A magnetic lock device as defined in claim **3**, wherein the first member is a casing and the second member is a barrel rotatably fitted in said casing; the mentioned hole being through the wall of the casing; said barrel having a bore therein therealong and said bore being accessible for the admission of the key therein; the mentioned means being provided by having an internal annular channel in the casing near that end thereof into which the key is inserted in the bore of the barrel; there being a notch in the casing, providing an entrance for movement in the direction along the barrel, into said annular channel and by having a notch in that end of the barrel into which the key is inserted and also by having a pin extending laterally from the key; said notches being aligned when the tumbler is in locking position and the key is withdrawn; said pin being of a size to be entered and fitted in said notches when the key is fully inserted into the barrel; the direction of the magnetic insert in the key being such that upon full insertion of the key so that said pin shall be entered in both said notches, said magnetic insert shall be in alignment with the tumbler, whereupon inserting the key into the bore in the barrel, so that the pin is entered in both said notches, said tumbler will be shifted into unlocked position thus freeing the barrel for rotation in the casing and then upon turning the key, the distal end of said pin will enter said annular channel as it moves along said channel, whereby the key once fully inserted into the barrel, can be withdrawn therefrom only when said hole and socket are in alignment to allow the tumbler passage into said socket.

5. A magnetic lock device as defined in claim **1**, including means constantly providing only non-magnetizable material between said tumbler and foil disc.

6. A magnetic lock device as defined in claim **5**, wherein the material constantly between the tumbler and foil disc is a non-magnetic element carried on one of them.

7. A magnetic lock device as defined in claim **5**, wherein the material constantly between the tumbler and foil disc is air.

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