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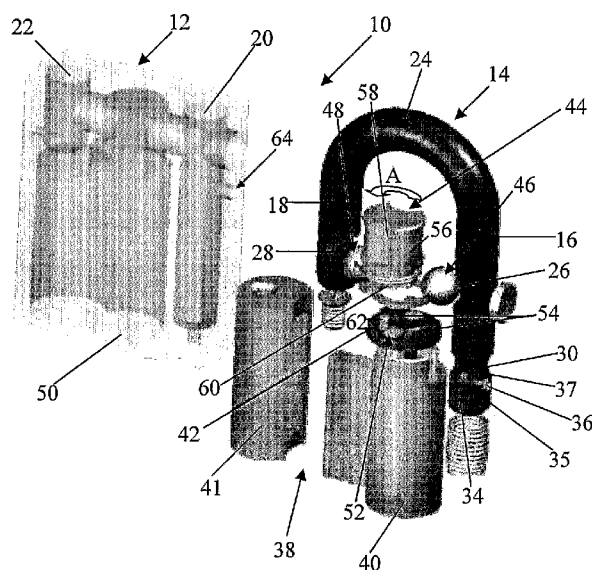
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(54) Title: A PADLOCK HAVING A REMOVABLE SHACKLE



(57) Abstract: A padlock having a body, a shackle and a shackle retaining element, the padlock also having an unlocked condition wherein the padlock is said to be open and a locked condition wherein the padlock is said to be locked, the shackle having leg members, the body having an aperture to accommodate each leg member and the body also having an opening which communicates between one leg member of the shackle and an exterior of the body, the shackle retaining element being accessible through the opening when the padlock is open, the one leg member having an aperture for receiving the shackle retaining element in a selectively protrudable manner, whereby when the shackle retaining element protrudes from the aperture of the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member and the padlock is open the shackle can be entirely removed from the body.

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A PADLOCK HAVING A REMOVABLE SHACKLE

FIELD OF THE INVENTION

The present invention relates to padlocks, and in particular to padlocks that are convertible between a condition where the shackle can be removed from the padlock when the padlock is open and a condition where the shackle is retained in engagement with the padlock when the padlock is open.

BACKGROUND

- 10 Padlocks are well known in the marketplace and are widely used to lock doors, gates and the like. Padlocks are portable locks which can be removed from the door, gate or other application when the lock is not required. This distinguishes padlocks from other forms of locks such as those that are retained in doors, windows, gates etc.
- 15 Typical padlocks are formed with a strong padlock body (generally of brass or steel), and the padlock body usually contains a main opening. A cylinder (usually in the form of a key barrel) can be fitted in the main opening so that the padlock can be opened (again, usually by inserting and turning a key).
- 20 Padlocks also typically have a shackle. The shackle generally comprises a rigid U-shaped metal member which can be formed from steel or brass. The parallel portions of the U-shaped shackle form two spaced apart parallel legs and one leg is generally longer than the other. In conventional padlocks, the longer leg passes through an opening in the top of the padlock body and is secured therein in such a manner that
- 25 the leg cannot be pulled out. When the padlock is open, the secured long leg is often able to pivot about its axis so that the short leg (i.e. the other leg of the U-shaped shackle) rotates in an arc about the long leg. The longer leg of the shackle is also generally able to slide axially inwards and outwards within the opening in the body (although in conventional padlocks the shackle cannot slide all the way out of the
- 30 body).

Typically, padlocks are locked by moving the shackle downwardly so that the short leg is inserted into a blind bore in the top of the padlock body. The short leg is then lockable therein to lock the padlock. The padlock can be unlocked by operating the

cylinder, and a spring is typically provided to bias the shackle to the open condition (i.e. where the short leg is retracted upwardly out of the body and can rotate about the long leg as described). Where the cylinder is a key barrel, a key can be inserted into the key barrel and turned to thereby release the shackle allowing the shackle to move
5 upwardly into the open condition under the bias of the spring.

One disadvantage with this type of padlock is that the shackle (and in particular the long leg thereof) is always fixed to the padlock body and cannot be removed therefrom. It is often advantageous to have different types of shackles. For instance,
10 for high security padlocks it is desirable to have a shackle made from a strong steel, while for normal padlocks the shackle can be made of a softer and possibly less expensive metal or other material. With a nonremovable shackle, it is necessary to have a large number of padlocks each with a different shackle to satisfy these different requirements. The size and shape of the shackle can also vary for padlocks
15 used in different applications. Sometimes, the length of the shackle can be between 5-15 cm, but occasionally it is necessary to have a long shackle or a shackle with a shape other than the typical U-shape. Again, if the shackle is always fixed to the padlock body, it is necessary to have a large number of padlocks each with differently shaped shackles to satisfy these requirements.

Another disadvantage associated with the inability to remove the shackle from the padlock body is that, in some cases the only way in which the padlock can be used is by initially removing the shackle from the padlock body and placing it around the item to be locked before (re-)inserting the shackle back into the body to lock the
25 padlock. This cannot be done if the shackle is permanently fixed to the padlock.

It would be desirable if locksmiths could stock a relatively small range of padlock bodies, and a large range of shackles compatible with the padlock bodies. A customer could then decide what type of padlock is required, and an appropriate combination of
30 the correct shackle and padlock body could then be assembled accordingly. Also, if the customer desires the padlock to be used in a different application requiring an alternative shackle, the alternative shackle may be purchased to allow the padlock to be applied to that new application without the need to buy an entirely new padlock.

Hence, it may be advantageous to provide padlocks having a removable shackle mode where the shackle can be removed and replaced if desired, and to provide shackles to be used with such padlocks in different applications. It may also be advantageous for such padlocks to be convertible between the removable shackle mode where the shackle can be entirely removed from the body when the padlock is open and a shackle holding mode where the shackle is retained in the padlock body in a similar manner to conventional padlocks. One reason why it may be desirable to also have a shackle holding mode is because, in some applications it is not necessary for the shackle to be removed in order to apply the padlock, and in such applications, if the shackle were to be removable this might add an unnecessary complication to the operation of the padlock and there may be a risk that the shackle could be misplaced. Therefore, it may be desirable to provide a means for converting the padlock between the above-mentioned modes.

Another consideration is that whatever mechanism is used to enable the shackle to be released entirely from the padlock body, this mechanism should be relatively tamperproof such that the shackle cannot be removed in an unauthorised manner when the padlock is locked. For this reason, the use of a screw or like member that is accessible from the outside of the lock while the padlock is locked, and which can be removed to remove the shackle, is not necessarily an acceptable alternative as an unauthorised person could remove the screw and therefore render the padlock ineffective. Therefore, simply using a screw extending through an opening in the bottom wall of the padlock and attaching to one of the shackle legs is not necessarily an acceptable solution.

Therefore, there would be an advantage if it were possible to provide a padlock with a shackle where the shackle can be selectively held within the padlock, or entirely removed therefrom, and where this changeover can be done in a simple manner. The mechanism should also be relatively tamperproof when the padlock is locked.

Another problem that is commonly associated with traditional padlocks is that the key can be removed from the padlock at any time (i.e. irrespective of whether the padlock is open or locked). This means that it is possible for a user to remove the key from the padlock when the padlock is open, and the user may then leave without

remembering to relock the padlock. Thus, there would be an advantage if it were possible to provide a padlock having a mode where the key is retained in the padlock when the padlock is open so that the user cannot leave without relocking the padlock (at least not without leaving the key behind). It may also be advantageous for the padlock to be selectively convertible between this key holding mode and a removable key mode where the key can be removed from the padlock at any time. Some reasons why it may be desirable to also have this removable key mode are because, in some applications it may be frustrating to have to lock the padlock before removing the key, or alternatively it may be necessary to use the key for another purpose while the padlock is open. Therefore, it may be desirable to provide a means for converting the padlock between the key holding mode and the removable key mode.

It will be clearly understood that any reference herein to background material or information, or to a prior publication, does not constitute an admission that any material, information or publication forms part of the common general knowledge in the art, or is otherwise admissible prior art, whether in Australia or in any other country.

DESCRIPTION OF THE INVENTION

It is an object of the invention to provide a padlock which may at least partially overcome some of the above-mentioned disadvantages, or provide a useful or commercial alternative to existing padlocks.

In one aspect, there is provided a padlock having a padlock body and a shackle, the shackle having a portion that extends into the padlock body when the shackle is held by the padlock body, the padlock body being provided with a bore to enable a shackle retaining element (typically a fastener such as a grub screw) to be selectively inserted into the said portion of the shackle substantially transverse to the longitudinal axis of that portion of the shackle.

In this aspect of the invention, the shackle portion (typically the lower portion of the longer leg of the shackle) can be releasably locked into the padlock body by attachment of the shackle retaining element (typically a grub screw) to this shackle portion but at an angle (typically transverse) to the longitudinal angle of the shackle.

- An advantage of this is that when the padlock is locked, the shackle retaining element (grub screw) is pushed out of alignment with the bore in the padlock body, and therefore the shackle retaining element cannot be accessed or tampered with. Only when the padlock is unlocked, does the shackle retaining element go back into alignment with the bore allowing a tool (typically a small hex key) to be inserted into the bore to release or to attach the shackle retaining element thereby enabling the entire shackle to be removed from the padlock body if desired. This is in distinction to having a fastener (such as a screw) extending through the bottom wall of the padlock body (where the key is) and engaging with the shackle leg in a manner which is longitudinal (and not transverse) to the shackle. For padlocks where the fastener is in this position, the fastener cannot be pushed out of alignment with the bore and is therefore able to be tampered with when the padlock is locked, which is quite undesirable.
- According to a another aspect, the present invention resides in a padlock having a body, a shackle and a shackle retaining element, the padlock also having an unlocked condition wherein the padlock is said to be open and a locked condition wherein the padlock is said to be locked, the shackle having leg members, the body having an aperture to accommodate each leg member and the body also having an opening which communicates between one leg member of the shackle and an exterior of the body, the shackle retaining element being accessible through the opening that communicates between the one leg member and the exterior of the body, the one leg member having an aperture for receiving the shackle retaining element in a selectively protrudable manner, whereby when the shackle retaining element protrudes from the aperture of the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member and the padlock is open the shackle can be entirely removed from the body.

- According to a another aspect, the present invention resides in a padlock having a body, a shackle and a shackle retaining element, the padlock also having an unlocked condition wherein the padlock is said to be open and a locked condition wherein the padlock is said to be locked, the shackle having leg members, the body having an aperture to accommodate each leg member and the body also having a side opening which communicates between one leg member of the shackle and an exterior of the

body, the shackle retaining element being accessible through the side opening, the one leg member having an aperture for receiving the shackle retaining element in a selectively protrudable manner, whereby when the shackle retaining element protrudes from the aperture of the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member and the padlock is open the shackle can be entirely removed from the body.

According to another aspect, the present invention resides in a padlock body comprising a top, a bottom and a side, the top having an opening to accommodate each leg of a shackle, the bottom having an opening to accommodate a cylinder, the side having an opening extending therethrough that can communicate with one leg of the shackle thereby allowing access to a shackle retaining element through the opening in the side, the shackle retaining element being selectively protrudable from the one leg of the shackle.

According to another aspect, the present invention resides in a shackle for a padlock, the shackle having two or more legs members, each leg member being adapted to be inserted into an opening in a padlock body, one leg member having an aperture for receiving a shackle retaining element, the shackle retaining element being selectively protrudable from the one leg member.

According to another aspect, the present invention resides in a method for adapting a padlock which has a body, a shackle, an unlocked condition in which the padlock is said to be open and a locked condition in which the padlock is said to be locked, wherein the shackle has leg members and the body has an aperture to accommodate each leg member, by providing an opening in the body which communicates between one leg member of the shackle and an exterior of the body and a shackle retaining element which is adapted to be selectively protrudable from the one leg member, and by providing an aperture in the one leg member for receiving the shackle retaining element, so that when the shackle retaining element protrudes from the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member the shackle can be entirely removed from the body when the padlock is open.

According to another aspect, the present invention resides in a padlock having a body and a shackle,

the shackle having at least one long leg member and at least one short leg member, the

5 padlock having a locked condition (in which the padlock is said to be locked) wherein leg members of the shackle are inserted at least partially into the body and at least one locking element engages with the shackle to retain the leg members inserted in the body therein, the padlock also having an unlocked condition (in which the padlock is said to be open) wherein at least one of the shackle's short leg members is retracted
10 out of the body,

the padlock further comprising a shackle retention element distinct from the at least one locking element which can be engaged so that it contacts with the at least one long leg of the shackle preventing the said long leg from being removed from the body when the padlock is open, and which shackle retention element can also be
15 disengaged allowing the said long leg to be removed from the body when the padlock is open,

wherein, in use, the shackle retention element cannot be accessed when the shackle retention element is engaged and the padlock is locked.

20 Each respective aspect of the present invention mentioned above may involve features described with respect to others of those aspects.

Thus, the padlock has a mode where the shackle is retained by the body even when the lock is open (this mode will hereafter be referred to as the shackle holding mode),
25 and a mode where the shackle is removable from the body when the lock is open (this mode will hereafter be referred to as the removable shackle mode). In some versions of the invention described above, conversion between the removable shackle mode and the shackle holding mode may be achieved without needing to remove the padlock's cylinder (or whatever other mechanism is used in substitute therefore).

30 Instead, the shackle retaining element may be engaged through an opening in the body of the padlock to thereby protrude from a leg member of the shackle, thus trapping the shackle in the body. In other versions, the padlock's cylinder may need to be removed in order to affect the conversion by including or removing the shackle retention element.

The body of the padlock may be of any size and shape, although it is envisaged that the body may generally be substantially block shaped and sized to be easily operable by hand. The body may be made from any suitably resilient material, but preferably
5 resilient metals such as steel or brass. However, it will be clearly understood that no particular limitation is intended in relation to the size or shape of the padlock body, or the material from which it may be made.

As described above, the body of the padlock may have an aperture to accommodate
10 each leg member of the shackle. This may be a single aperture, but preferably there may be a plurality of separate apertures, one for accommodating each respective leg member of the shackle that is insertable into the body. If the body is substantially block shaped as envisaged, the body may therefore have an upper surface defining a top wall of the body, and the top wall may contain the said apertures. The separate
15 apertures may be in the form of bores extending downwardly into the body of the padlock, and it is envisaged that each bore may have a cross-sectional shape corresponding to the cross-sectional shape of the leg member which it is adapted to accommodate. This is explained in greater detail below.

20 The shackle of the present invention may be of any kind, shape or construction suitable to satisfy the requirements of the application in which the padlock is to be used. Consequently, the shackle may take a generally similar form to the a traditional rigid U-shaped shackle described above, or alternatively the shackle may be of any other nonconventional rigid shape suitable to adapt the padlock for use for a particular
25 purpose. Furthermore, the shackle may take a non-rigid form, for example a cable or chain of the kind often used to lock bicycles. It will therefore be understood that the present invention may be used with shackles having any shape, form or construction, and no limitation is intended in relation to the kind of shackle that may be used except as expressly stated herein.

30 So that the padlock of the present invention may provide a suitable level of security the shackle will preferably be constructed such that, when the padlock is locked, the shackle cannot easily be broken, severed, separated or otherwise damaged or interrogated. Therefore, the shackle will preferably be formed from materials such as

steel and the like, and in the event that the shackle takes a non-rigid form (for example a chain or wire etc), the shackle will be constructed in a manner known by the person skilled the art to be suitable for this purpose.

- 5 The shackle of the present invention has leg members, and at least a portion of some or all leg members is insertable into the body of the padlock in the manner described above. For convenience, the padlock of the present invention will be described with reference to a shackle having two leg members and a body adapted to accommodate such a shackle. However, the invention might also operate with a shackle having a
10 greater number of leg members and a body adapted to receive some or all of those leg members.

The two-leg shackle may take a form similar to the traditional rigid U-shaped shackle and the two parallel portions of the "U" may form the leg members. Similarly, rigid
15 shackles having other shapes adapted for use in specific applications may also be provided with two parallel portions which may form the leg members of the shackle. Alternatively, if the shackle takes the form of a non-rigid shackle such as a chain or wire, the opposed ends of the chain may be adapted to be insertable into the padlock body such that the two ends of the chain form the two leg members of the shackle. To
20 avoid confusion, if the shackle takes the form of a non-rigid shackle, the leg members thereof and the openings in the body for accommodating the leg members need not be parallel.

The leg members of the shackle may be of any shape, although in preferred
25 embodiments one of the leg members may be substantially longer than the other of the leg members. It is also envisaged that in most embodiments, at least the portions of the leg members that are insertable into the padlock may be substantially straight. Furthermore, whilst the leg members may have any cross-sectional shape, it is envisaged that at least the portions of the leg members that are insertable into the
30 padlock may have a substantially circular cross-section.

As explained above, if there are separate openings in the body of the padlock to accommodate the leg members, each of these openings may have a cross-sectional shape that corresponds with the cross-sectional shape of the leg member that it is

adapted to accommodate. This is so that the leg members may insert snugly into the openings without leaving any gaps that might allow for unauthorised tampering with the internal locking mechanism of the padlock. This general arrangement is well-known. Consequently, if at least the portions of the leg members each have a substantially circular cross-section, then each of the openings in the body may have a corresponding substantially circular cross-section. Similarly for other alternative cross-sectional shapes. For convenience the invention will hereinafter be described with reference to embodiments wherein the insertable portions of the leg members have a circular cross-section.

The diameter of the insertable portion of one leg member may be the same as, or different to that of the other leg member. Accordingly, the openings in the body that accommodate the leg members may have the same, or different diameters.

The insertable portion of each leg member may have an aperture therein adapted to receive a locking element. These apertures will hereinafter be referred to as locking apertures. Preferably each locking aperture may be in the form of a notch (a locking notch) extending in a direction substantially transverse to the longitudinal axis of the leg member, the notch being sufficiently large and deep so that when the locking element is inserted into the aperture it may be retained therein to thereby prevent the leg member from moving axially within the aperture in the body. Even more preferably each notch may have a substantially semi-tubular shape wherein the longitudinal axis of the notch is oriented substantially transversely to the longitudinal axis of the corresponding leg member, and offset therefrom. This semi-tubular shape is particularly suitable when the locking element comprises balls. Furthermore, in embodiments having parallel leg members, and particularly in embodiments where the shackle is "U" shaped similar to that of conventional padlocks, the locking recesses may be located on the respective leg members so that they open substantially inwardly. However, the locking apertures may alternatively take other forms and they may be positioned elsewhere on the leg members, so no particular limitation is meant in relation to the shape, form or location of the locking apertures. No limitation is meant with regard to the kind of locking elements that can be used either.

The one leg member that is longer than the other leg member may have a further aperture therein (hereinafter referred to as a retaining aperture). The retaining aperture may be located below the locking aperture of the long leg member on the inner side. More particularly, the retaining aperture may be in the form of a flat
5 recess extending downwardly from a lower edge of the locking aperture. The retaining aperture may be indented into the leg member substantially less deeply than the locking aperture. The long leg member may also have a substantially circumferential groove therein. The groove may be recessed into the leg member approximately the same amount as the retaining aperture, and the groove may be
10 positioned on the leg member such that the bottom of the retaining aperture connects with an upper edge of the groove. Hence, the two may blend smoothly together. The functions of the groove and the retaining aperture will be explained in greater detail below.

15 The long leg member may also have a bottom portion extending from the lower edge of the groove to the bottom end of the long leg member. The bottom portion may have substantially the same cylindrical diameter as the other portions of the long leg member except that an outer side thereof may be in the form of a recessed flat portion (an outer flat). The outer flat may contain the aperture described in relation to some
20 aspects of the invention above for receiving the shackle retaining element, and therefore in those aspects the shackle retaining element may be selectively protrudable from that aperture. In these embodiments of the invention, the aperture in outer flat portion may be in the form of a substantially cylindrical bore, and the shackle retaining element may be in the form of a grub screw insertable and removable from
25 the bore (the shackle retaining element is described further below).

However, it will be clearly understood that in the embodiment discussed in the previous paragraph other forms of apertures and other forms of shackle retaining elements that are selectively protrudable from such apertures may equally be used.
30 Furthermore, it will be appreciated that other aspects of the invention may comprise entirely different forms of shackle retaining element. For example, the shackle retention element may comprise a ball or other blocking element that is held in position within the padlock mechanism by the cylinder. The shackle retention

element is preferably totally distinct from the locking element(s) as this significantly reduces the complexity of the mechanism associated with the locking element(s).

In preferred embodiment, the shackle retaining element may comprise a fastener. The
5 fastener will preferably comprise a threaded portion to enable the fastener to be selectively connectable to the shackle leg. Suitably, a forward portion of the fastener is threaded, and preferably, substantially the entire length of the fastener is threaded. The fastener may comprise a screw such as a grub screw. The fastener typically contains a profile to enable a tool to be passed into the opening in the padlock body to
10 attach and release the fastener from the shackle leg. The profile may comprise a slot (for a screwdriver), a philips head profile, or a socket for a hex key, or any other suitable type profile. Of course, it is possible to completely remove the shackle retaining element when it is not required. It is also envisaged that a plurality of shackle retaining elements may be provided, or that a single shackle retaining element
15 may have multiple parts.

In the preferred embodiments where there is an aperture for receiving the shackle retaining element in the form of a bore in the outer flat (on the bottom end of the shackle's long leg), and where the shackle retaining element is a grub screw, it will be
20 understood that when the grub screw is inserted into the bore, at least a portion thereof may protrude proud of the bore. Each of the grub screw and the bore may be threaded so that the grub screw may be securable in the bore, however other means of securing the grub screw in the bore may also be used.

25 The padlock may further comprise a locking means for moving the locking elements mentioned above into engagement with the locking apertures in the leg members. Preferably, the locking means may comprise a camming member, and the locking elements may preferably be in the form of balls. The balls may be oppositely positioned on respective sides of the camming member and the camming member
30 may have an opposed pair of camming surfaces each of which may engage with a respective ball. The camming surfaces may be suitably curved to provide camming engagement with the balls.

The camming member may be rotatable between a locking position and an unlocking position. Rotation of the camming member into the locking position may cause each of the camming surfaces to engage the corresponding ball thereby pushing the balls outwardly. If the leg members are inserted into the body, the outward movement of the balls may cause the balls to engage with the locking apertures in the leg members. The engagement of the balls with the locking apertures may prevent the leg members from being retracted out of the body, thus locking the padlock. The camming member may be biased towards the locking position so that upon insertion of the leg members, the padlock automatically locks.

The camming member may also have an opposed pair of cavities adapted to receive the balls. The cavities may be interposed between the camming surfaces. Therefore, rotation of the camming member into the unlocked position may allow the balls to retreat inwardly into the cavities and out of engagement with the locking apertures in the leg members. Upon disengagement of the balls with respect to the locking apertures, the leg members may be thereby released enabling each leg member (and therefore the shackle) to move upwardly with respect to the body. More specifically, the leg members may be released by the retraction of the balls into the cavities because this may allow the lower edge of each of the locking apertures to move upwardly past the balls. This upward movement of the shackle may allow the short leg member to retract out of the body thus opening the padlock. However, depending on whether the padlock is in the removable shackle mode or the shackle holding mode, the disengagement of the balls with respect to the locking apertures may, or may not, enable the long leg to be retracted from the body of the padlock.

As described above, when the camming member is rotated into the unlocked position causing the balls to retreat into the cavities, this may allow the lower edges of the respective locking apertures to move upwardly past the balls. In the case of the short leg this may allow the short leg member to be retracted out of the body of the padlock. However, it will be recalled that the long leg member may have a retaining aperture extending downwardly from the lower edge of the locking aperture, and it may also have a groove positioned substantially near the bottom of the retaining aperture which extends circumferentially around the long leg member. The retaining aperture and the groove may be substantially less deep than the locking aperture in the long leg

member. Therefore, even though retraction of the ball into the cavity in the camming member may disengage the ball from the locking aperture in the long leg member, nevertheless the ball may still extend outwardly sufficiently to engage with the retaining aperture and the groove. This engagement of the ball with the retaining
5 aperture and the groove, and in particular the engagement of the ball with a bottom edge of the groove which may form a lip, may prevent the long leg member from being retracted out of the padlock body, although the circumferential shape of the groove may allow the long leg member to rotate in the body. The engagement between the ball, the retaining aperture and the groove may also prevent the camming
10 member from rotating back into the lock position. This is because the retaining aperture and the groove may push the ball into the cavity in the camming member. Therefore the camming member may only be able to rotate back into the locked position when the leg members are reinserted into the padlock to lock the padlock (or when both legs are retracted from the padlock as described further below).

15 Reinsertion of the leg members into the body may bring the locking apertures in the leg members back into alignment with the balls, thereby allowing the balls to move outwardly into the locking apertures thus allowing the camming member to rotate back into the locked position.

20 Considering again the situation where the padlock is open (i.e. whether short leg member is retracted out of the body but the long leg member is retained therein), it will be recalled that in some preferred aspects the bottom portion of the long leg member, below the groove, may have an outer flat in the outer side thereof. It will also be recalled that in preferred embodiments, the outer flat may have an aperture for
25 receiving a shackle retaining element, for example in the form of a grub screw. If the grub screw is not positioned within the aperture so that a portion of it protrudes from the aperture, the outer flat may be recessed sufficiently deeply such that when the outer flat is rotated to face the ball (which is retracted into the camming member cavity), the shackle may be able to move upwardly past that ball. Thus, in these
30 embodiments, if the grub screw is not protruding from the aperture the padlock is in the removable shackle mode. However, if the grub screw is positioned so that a portion of it does protrude from the aperture, the protruding portion thereof may form an effective extension of the lip of the groove. Consequently, the protruding portion of the grub screw forms of barrier that prevents the outer flat from moving upwardly

past the ball, and hence causes the long leg to be retained in the body of the shackle. Thus, when the grub screw protrudes from the aperture, the padlock is in the shackle holding mode.

- 5 In other embodiments, the bottom portion of the shackle's long leg may not have the outer flat, and therefore the bottom portion may be wholly cylindrical below the lower edge of the groove. In these embodiments, when the shackle retaining element is included it may engage the lower edge of the groove to prevent the shackle from being removed. When the shackle retaining element is not included, it may not
10 engage with the engine so the shackle may be removable. The shackle retaining element may be included and removed in these embodiments by first removing the cylinder.

In order to prevent unauthorised opening of the padlock, the cylinder used for
15 operating the padlock may preferably comprise a key barrel such that the cylinder is operable only upon insertion and rotation of the correct key in the barrel. Key barrels of this type are well-known. However, it will be clearly understood that the cylinder is not limited to key barrels, and the cylinder may alternatively comprise any means or mechanism for operating the internal locking components of the padlock. Therefore,
20 the term "cylinder" as used herein is not intended to limit in any way the shape or form of the component or group of components used to unlock the padlock.

As explained immediately above, the cylinder of the padlock in preferred
embodiments will comprise a key barrel. In relation to key barrels, it will be
25 understood that a key may only be inserted into the barrel, and it may only be retracted therefrom, when the barrel is in an aligned position. In other words, if a key is inserted into the barrel and rotated (for example to unlocked the padlock), the key cannot be removed from the barrel without rotating the key back in the opposite direction to thereby returned the barrel to the position that it was in when the key was
30 inserted (this position will hereinafter be referred to as the aligned position). The importance of this will be explained in greater detail below.

The body of the padlock may have a main opening to accommodate the cylinder. If the body of the padlock is substantially block shaped as envisaged, then the body may

have a lower surface defining a base of the body and the opening for accommodating the cylinder may be contained within the base. Because the cylinder may be of any shape, the opening in the body of the padlock for accommodating the cylinder may also be of any shape. However, it may be preferable for the opening in the body to be
5 of a corresponding shape to that of the cylinder so that the cylinder fits snugly within the opening and no gaps or openings are left that may expose the inner workings of the padlock to unauthorised tampering. This arrangement where the cylinder fits snugly within an opening in the padlock body is well-known.

- 10 The padlock may comprise an entraining member operatively associated with the cylinder so that rotation of the cylinder imparts corresponding rotation to the entraining member. The entraining member may comprise a part or extension of the cylinder, or a separate component attachable to the cylinder, although no particular limitation is meant thereby. Preferably the entraining member may be adapted to
15 operatively connect the cylinder with the locking means so that rotation of the cylinder from the aligned position to an unaligned position causes disengagement of the locking elements from the locking aperture in the leg members. Even more preferably, the locking means may comprise a camming member as described above and the entraining member may be adapted to cooperate with the camming member so
20 that rotation of the cylinder (and the entraining member) thereby causes rotation of the camming member from the locked position to the unlocked position.

To achieve this the entraining member may be provided with protrusions that cooperate with corresponding protrusions on the camming member. In particularly
25 preferred embodiments, the protrusions on the entraining member may comprise a pair of upwardly extending entraining posts. The protrusions on the camming member may take any form suitable to cooperate with the entraining posts, but for convenience the protrusions in the camming member will be referred to as the cam block.

- 30 The entraining posts may be positioned such that one of the entraining posts is located on one side of the cam block, and the other entraining posts is located on the other side of the cam block. In this way, rotation of the entraining member (caused by rotation of the cylinder) in one direction causes the entraining posts to come into contact with the cam block, whilst rotation of the entraining member in the other

direction causes the entraining posts to separate from the cam block. Hence, the entraining member may be able to rotate somewhat independently of the camming member. A key retainer element may be provided to restrict this free movement as described further below.

5

As explained above, the camming member may only be able to rotate from the unlocked position back into the locked position when the leg members are reinserted into the padlock to lock the padlock (or when both legs are retracted from the padlock). Therefore, when the padlock is opened by operating the cylinder which in turn rotates the entraining member and the camming member, the camming member may then be retained in the unlocked position until the leg members are reinserted. Meanwhile (i.e. while the camming member is retained in the unlocked position), the entraining member and the cylinder mechanism may be able to rotate freely. If the entraining member and the cylinder mechanism are able to rotate freely, it may therefore be possible to return the cylinder to the aligned position. Thus, if the entraining member and the cylinder mechanism are able to rotate freely, and if the cylinder comprises a key barrel, then this may allow the key to be extracted from the barrel while the padlock is open, thus placing the padlock in the removable key mode.

20 The key retainer element mentioned briefly above may be used to convert the padlock from the removable key mode to the key holding mode. It may do this by fixing the entraining posts into engagement with the cam block. By doing this, the key retainer element would prevent the entraining member and the cylinder from rotating freely with respect to the camming member, and if the cylinder is a key barrel, this would thereby prevent the key from being rotated back into the aligned position when the padlock is open. In preferred embodiments, the key retainer member may comprise a pin that is selectively insertable and removable from an aperture in the entraining member. However, the key retainer element may comprise any other means for maintaining the entraining posts in engagement with the cam block, and no particular limitation is meant in relation to the kind of key retainer element that may be used.

30

In some particularly preferred embodiments, the key retainer pin may be insertable into the said aperture in the entraining member to convert the padlock into the key holding mode, but one of the entraining posts may also have an aperture for receiving

the pin. In these embodiments, when the pin is inserted into the aperture in the entraining post, the pin may be wholly contained therein merely for the purposes of storage and the entraining member may then operate otherwise as if the pin were not inserted. Thus, in these embodiments insertion of the pin into the pin receiving
5 aperture in the entraining member may convert the padlock into the key holding mode, whilst insertion of the pin into the aperture in the entraining post may convert the padlock into the removable key mode.

It will be clearly understood that the body of the padlock may comprise whatever
10 forms of internal shaping, sculpting or other features that may be necessary to house, interrelate and interoperate with the various components of the padlock.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings in
15 which:

Figure 1 is an exploded perspective representation of a padlock in accordance with one embodiment of present invention,

Figure 2 is a pictorial view of the padlock in accordance with the embodiment shown in Figure 1 wherein the padlock is in the shackle holding mode and the padlock
20 is open,

Figure 3 is a pictorial view of the padlock body, shackle and grub screw of the embodiment shown Figure 1,

Figure 4 illustrates the removal of the grub screw,

Figure 5 is a pictorial view of the padlock in accordance with the embodiment
25 shown in Figure 1 wherein the padlock is open and the grub screw has been removed so that the padlock is in the removable shackle mode,

Figure 6 is a pictorial view of the embodiment shown in Figure 1 wherein the shackle has been removed from the body,

Figure 7 is a perspective representation of a padlock in accordance with
30 another embodiment of the invention, and

Figure 8 is a perspective representation of a padlock in accordance with a further embodiment of the invention.

BEST MODE

With reference to Figure 1, there is shown a padlock assembly 10 in accordance with one embodiment of the present invention comprising a padlock body 12 and a shackle 14. Shackle 14 comprises a long leg 16 and short leg 18, and body 12 comprises a long leg bore 20 and a short leg bore 22. Long leg 16 is adapted to be insertable into long leg bore 20, and short leg 18 is adapted to be insertable into short leg bore 22.

Referring now to shackle 14 it can be seen that, in the orientation in Figure 1, the general shape of shackle 14 is similar to that of an inverted "U". Therefore, the two parallel portions of the U form long leg 16 and short leg 18, and the upper end of the respective legs are integrally connected by an arcuate member 24 corresponding to the curved portion of the U. More specifically, in the embodiment shown, long leg 16 and short leg 18 are both substantially cylindrical (i.e. having a substantially circular cross-section) of equal diameter, and long leg 16 is substantially longer than short leg 18 so that the lower end of long leg 16 extends substantially below the lower end of short leg 18. Because the respective legs are substantially cylindrical, therefore arcuate member 24 (which is integrally formed with the legs) has a substantially semi-toroidal shape connecting the tops of the two legs and having approximately the same cross-section as the legs.

20

Both long leg 16 and short leg 18 have a locking notch 26, 28 therein. Notches 26, 28 comprise substantially semi-tubular cutouts in the inner side of the respective legs, the cutouts being oriented such that the longitudinal axis of each semi-tubular cutout is substantially perpendicular to the longitudinal axis of the respective legs and offset inwardly thereof. Notch 28 in short leg 18 is located towards the lower end of short leg 18, and notch 26 in long leg 16 is located approximately midway down the length of long leg 16 such that both the notches are located at substantially the same level, thus effectively making each notch a mirror image of the other.

Long leg 16 further comprises a groove 30, a retaining aperture in the form of inner flat 32, a bottom portion 34 and a grub screw bore (not shown). Groove 30, located towards the lower end of long leg 16, has a substantially semicircular cross-section and extends all the way around long leg 16. Thus, groove 30 forms a substantially circumferential cutout around the lower end of long leg 16. Importantly, the

maximum depth to which groove 30 is recessed into long leg 16 is substantially less than the maximum depth to which notches 26, 28 are indented into the respective leg members. The reason for this will be explained below.

5 Inner flat 32 comprises a substantially flat surface extending down the inner side of long leg 16 from the lower edge of notch 26 to groove 30. Inner flat 32 is also slightly indented into long leg 16 and it therefore forms a slightly recessed flat surface. The depth to which inner flat 32 is recessed into long leg 16 is approximately the same as the depth of groove 30. Therefore, inner flat 32 effectively blends
10 smoothly into groove 30 at the point where the two intersect, and there is no distinct ridge, edge or other delineation between the two. This is well illustrated in Figure 6.

Bottom portion 34 is the portion of long leg 16 extending downwardly below groove 30. The outer part of bottom portion 34 (i.e. the part of long leg 16 that it is located
15 below groove 30 on the outside of the leg) forms an outer flat 35. Outer flat 35 is therefore a flat surface that is recessed into the outer side of bottom portion 34. However, it will be clearly understood that, except in the region occupied by outer flat 35, the remainder of the bottom portion 34 has the full diameter of long leg 16. Thus, except in the region occupied by outer flat 35, the edge where groove 30 meets
20 bottom portion 34 forms a lip 37.

The grub screw bore (not shown) comprises a substantially cylindrical bore positioned in outer flat 35 and extending perpendicularly into bottom portion 34. The grub screw bore is also provided with a female thread adapted to receive the grub screw 36 which
25 has a male thread. Figure 1 shows grub screw 36 inserted into the grub screw bore, and it can be seen that when grub screw 36 is so inserted, a portion of grub screw 36 protrudes outwardly proud of the bore. In fact, the distance that grub screw 36 protrudes outwardly from outer flat 35 is approximately the same as the distance that the curved cylindrical side of bottom portion 34 would extend out if outer flat 35 were
30 not indented therein. The reason grub screw 36 protrudes from outer flat 35 will be explained in greater detail below.

Grub screw 36 is also shown in Figure 5 mounted to the end of the hex wrench. From Figure 5 it is clear that grub screw 36 comprises a small cylindrical screw having a

male thread cut along substantially all of its length (i.e. grub screw 36 does not have a screw head like other forms of screw) and having a hexagonal recess in one end adapted to receive a hex wrench.

- 5 Referring again to Figure 1, it can be seen that padlock assembly 10 has an internal locking mechanism 38 for locking and unlocking the padlock. Locking mechanism 38 comprises key barrel 40, barrel cover 41, entraining member 42, camming member 44, and locking balls 46, 48.
- 10 Together, key barrel 40 and barrel cover 41 form a key mechanism which is shaped generally as a “figure 8”-like prism, and which is insertable into a correspondingly “figure 8” shaped bore 50 in the bottom of body 12. Key mechanisms of this type are widely known and used and therefore require no further explanation. Hence, it will be understood that a key may be inserted into key barrel 40 (as illustrated for example in
- 15 Figure 2) and that, if the key is the correct key for the key barrel, the key will then rotate the inner workings of the key barrel. It will also be understood that rotation of the key and key barrel mechanism causes the end of the key barrel, or a portion thereof, or a pin or other abutment, to rotate accordingly. This causes rotation to be imparted into the other components of locking mechanism 38 to operate the padlock
- 20 as explained in greater detail below.

It can be seen that camming member 44 comprises a pair of convex camming surfaces 56 located on opposite sides thereof, and a pair of concave cavities 58 also located on opposed sides thereof and interposed between the camming surfaces 56. The locking

25 balls 46, 48 are positioned one on either side of camming member 44. Camming member 44 is pivotable between a locked position and an unlocked position. Figure 1 shows camming member 44 in the locked position wherein the camming surfaces 56 contact with the balls 46, 48, thereby pushing ball 46 into engagement with notch 26 in long leg 16 and pushing ball 48 into engagement with notch 28 in short leg 18. It

30 will be clearly understood that the diameter of each of the balls 46, 48 is such that balls 46, 48 fit snugly and sufficiently deeply into notches 26 and 28 so as to prevent vertical movement of the respective legs within the body. Thus, when camming member 44 is in the locked position and both legs of the shackle are inserted into their

respective bores in body 12, the legs are retained within body 12 by engagement of the balls 46, 48, and the padlock is locked.

5 Camming member 44 can be pivoted from the locked position into the unlocked position by rotating camming member 44 approximately 90° in the direction indicated by arrow "A" in Figure 1 (counter clockwise when viewed from above). This is done by operating key barrel 40, as explained in greater detail below.

10 When camming member 44 is pivoted into the unlocked position, locking balls 46, 48 are no longer in engagement with camming surfaces 56 and therefore they are not being pushed into engagement with the notches 26 and 28 in the legs. Instead, locking balls 46, 48 are allowed to retreat into the cavities 58 in camming member 44. It will be understood that cavities 58 are sufficiently deep, and that locking balls 46, 48 can retreat sufficiently far into cavities 58, such that the bottom edges of the
15 respective notches 26 and 28 can move upwardly past balls 46, 48. Hence, rotation of camming member 44 into the unlocked position allows legs 16 and 18 of the shackle to move upwardly within the body 12. In particular, it allows short leg 18 to be retracted entirely out of short leg bore 22, thus opening the padlock.

20 However, it will also be understood that, even when balls 46, 48 are retracted into recesses 58, they are not retracted entirely within the cavities. Therefore, balls 46, 48 extend outwardly to some extent even when they are retracted into cavities 58, albeit to a lesser extent than they do when they are pushed into engagement with notches 26, 28 by camming surfaces 56. This is particularly important in relation to ball 46. It
25 will be recalled that inner flat 32 (which is recessed slightly into long leg 16 but less deeply than notch 26) extends down the inside of long leg 16 between the lower edge of notch 26 and groove 30. Therefore, even though ball 46 retracts out of notch 26 when the balls are retracted into cavities 58, nevertheless ball 26 still extends outwardly sufficiently to engage with inner flat 32. It will also be recalled that the
30 lower edge of groove 30 forms a lip 37. Therefore, even when ball 46 is retracted into cavities 58 and the short leg 18 is retracted out of short leg bore 22 so that the padlock is open, nevertheless the engagement of ball 46 with inner flat 32 and lip 37 prevents long leg 16 from being retracted out of long leg bore 20.

The circumferential shape of groove 30 allows long leg 16 to rotate within long leg bore 20 (i.e. shackle 14 can be rotated about long leg 16) when the padlock is open. Groove 30 effectively creates track within which ball 46 can roll as shackle 14 rotates.

5 Referring now to grub screw 36, it will be appreciated that when shackle 14 is rotated as described, if grub screw 36 is positioned to protrude from the grub screw bore, then the protruding portion of grub screw 36 will function effectively as an extension of lip 37. In other words, because grub screw 36 protrudes from outer flat 35, therefore the protruding portion of grub screw 36 acts to prevent long leg 16 from moving
10 upwardly past ball 46 in the same way that lip 37 does. Hence, when grub screw 36 is positioned to protrude from the grub screw bore, the padlock is in the shackle holding mode. Grub screw 36 protrudes the same distance out from outer flat 35 as the curved surface of bottom portion 34 would if outer flat 35 were not there so that the protruding portion of grub screw 36 does not inhibit rotation of long leg 16 in long leg
15 bore 22.

If grub screw 36 is not inserted into the grub screw bore (or if it is screwed further in so it does not protrude), then there is nothing to act as an extension of lip 37. Therefore, if the grub screw is not inserted (or does not protrude), it is possible to
20 remove shackle 14 from padlock body 12 entirely. This is done by first rotating shackle 14 about long leg 16 so that outer flat 35 faces towards ball 46. Then, because grub screw 36 does not engage with ball 46, outer flat 35 (which is recessed) is able to move upwardly past partially extending ball 46 and out of long leg bore 20. Thus, when grub screw 36 is not inserted into, or does not protrude from the grub
25 screw bore, the padlock is in the removable shackle mode.

Grub screw 36 may be accessed through a small grub screw opening 64 on the side of body 12. Therefore, a hex wrench may be inserted through grub screw opening 64 to insert or remove grub screw 36 from the grub screw bore. This is explained further
30 below.

Figure 1 shows that entraining member 42 comprises a substantially disk shaped member having approximately the same diameter as key barrel 40 (i.e. approximately the same diameter as one lobe of the "figure 8"). It can also be seen from Figure 1

that entraining member 42 is secured to the top of the key barrel 40, coaxially therewith, by a pair of screws 52. Hence, rotation of key barrel 40 by a key in the manner described above causes corresponding rotation of entraining member 42. The heads of screws 52 sit approximately flush with, or slightly below, the upper surface
5 of entraining member 42 when the screws are inserted. This prevents the screws from interfering with the operation of entraining member 42. Entraining member 42 also has a pair of entraining posts 54. The respective entraining posts 54 are positioned directly opposite each other on the upper surface of entraining member 42, towards the outer edge thereof, and they extend vertically upwards.

10

Figure 1 also shows that camming member 44 has a cam block in the form of entraining beam 60 protruding downwardly from its base and extending substantially the entire width thereof. When lock assembly 10 is assembled, entraining beam 60 resides between the respective entraining posts 54 of entraining member 42. Hence,
15 rotation of entraining member 44 (caused by rotation of key barrel 40) in the direction indicated by arrow "A" in Figure 1 causes entraining posts 54 to come into contact with entraining beam 60. Conversely, rotation of entraining member 42 in the opposite direction causes entraining posts 54 to separate from entraining beam 60. Hence, the entraining member 44 can rotate somewhat independently of the camming
20 member 44. A relocatable key retainer pin 62 is also shown, but this will be described in greater detail below.

25

It will be appreciated from the above description, and from Figure 1, that camming member 44 can rotate from the unlocked position back into the locked position only when the legs 16 and 18 are reinserted into bores 20 and 22 to lock the padlock (or when both legs are retracted from the bores). Therefore, when key barrel 40 is operated which in turn rotates entraining member 42 and camming member 44, camming member 44 becomes retained in the unlocked position until the legs 16, 18 are reinserted. Meanwhile (i.e. while camming member 44 retained in the unlocked
30 position), if pin 62 is not present, entraining member 42 is able to rotate freely. It is therefore possible to return the key barrel 40 to the aligned position and extract the key while the lock is open.

Relocatable key retainer pin 62 mentioned briefly above is used to convert the padlock from the removable key mode to the key holding mode. It does this by fixing entraining posts 54 into engagement with the entraining beam 60. By doing this, relocatable pin 62 prevents entraining member 42 and key barrel 40 from rotating freely with respect to the camming member 44, thereby preventing key barrel 40 from being rotated back into the aligned position when the padlock is open. This therefore prevents the key from being retracted when the padlock is open. Relocatable pin 62 is selectively insertable and removable from an aperture (not shown) in entraining member 42. It is also insertable into a further aperture (not shown) contained within one of the entraining posts 54 for storage. This latter aperture takes the form of a bore of corresponding shape to relocatable pin 62 such that insertion of relocatable pin 62 into the further aperture allows entraining member 42 to operate as if relocatable pin 62 were not present.

Finally, Figures 2-6 show a step-by-step procedure for converting the padlock assembly 10 from the shackle holding mode to the removable shackle mode. Figure 2 shows the padlock assembly 10 in the shackle holding mode. Figure 3 then shows that in order to expose grub screw 36 through grub screw opening 64, shackle 14 must be pressed downwardly into body 12 against the bias of spring 66. A hex wrench can then be inserted to remove grub screw 36 as shown in Figures 4 and 5. Upon removal of grub screw 36 from the grub screw bore, the padlock 10 is placed in the removable shackle mode. In order to remove shackle 14, if the padlock is open, shackle 14 can be rotated approximately 180° so that outer flat 35 faces ball 46. Finally, shackle 14 can then be moved upwardly retracting long leg 16 out of long leg bore 20 to remove the shackle. This is shown in Figure 6.

Thus, the padlock according to this embodiment of the present invention contains a shackle that can be either retained to the padlock body or which is able to be completely removed from the padlock body using a simple tamper resistant mechanism. The mechanism comprises a bore extending through the side wall of the body and into which a grub screw can be manipulated (to screw the grub screw either into engagement with one leg of the shackle member to enable the shackle member to move in a conventional manner from the locked position to the unlocked position but preventing the shackle member from being entirely removed from the padlock body),

or retracting the grub screw (to enable the shackle element to be entirely removed from the padlock body). When the padlock is locked, the grub screw is out of alignment with the bore in the body and therefore cannot be tampered with. When the padlock is unlocked, the grub screw can be brought into alignment with the bore, and
5 a hex tool can be inserted to rotate the grub screw either into engagement or out of engagement with the shackle.

Figure 7 shows an alternative embodiment of the invention wherein the shackle retaining element comprises a retaining ball 70. Retaining ball 70 is significantly
10 smaller than locking balls 46', 48' and it is maintained in engagement with inner flat 32' by the side of key barrel 40'. The padlock body 12' may also have internal walls or the like (not shown) for restraining vertical movement of retaining ball 70. When retaining ball 70 is installed, it prevents the shackle 14' from being removed from the body 12'. It does this by engaging with lower lip 37' of groove 30' when the padlock
15 is open. Therefore, in this embodiment, when retaining ball 70 is installed, the padlock is in the shackle retaining mode.

Conversely, when the retaining ball 70 is removed, the padlock is in the removable shackle mode. In this mode, the long leg of the shackle can pass upwardly past the
20 position where retaining ball 70 would otherwise have been, and it can then pass by locking ball 46' in a similar way to the previous embodiment described above.

In order to convert the padlock in the embodiment shown in Figure 7 from the shackle retaining mode into the removable shackle mode, retaining ball 70 must be removed.
25 However, before retaining ball 70 can be removed, key barrel 40' must first be removed. Once key barrel 40' has been removed, retaining ball 70 can be removed (through the key cylinder bore) to place the padlock in the removable shackle mode. To place the padlock in the shackle retaining mode, the key barrel must again be removed and retaining ball 70 reinserted.

30

Figure 8 shows yet a further embodiment which operates in much the same way as the embodiment in Figure 7, except that retaining ball 70 has been replaced with an alternative shackle retaining element in the form of blocking element 72. Blocking element 72 can be inserted and removed to convert the padlock between the modes as

described above. The lower end of long leg 16a' of the shackle in the embodiment of Figure 8 has also been reshaped to allow that lower end of the shackle leg to interact with blocking element 72 in a similar manner to that described above.

- 5 In the embodiments in Figures 7 and 8, the shackle retaining element is particularly tamperproof because the respective elements cannot be accessed when the padlock is locked. In fact, the shackle retaining elements cannot be accessed from the exterior of the padlock at all, except by removing the key barrel.
- 10 It should be appreciated that various other changes and modifications can be made to the embodiments described without departing from the spirit and scope of the invention.

CLAIMS:

1. A padlock having a body, a shackle and a shackle retaining element, the padlock also having an unlocked condition wherein the padlock is said to be open and a locked condition wherein the padlock is said to be locked, the shackle having leg members, the body having an aperture to accommodate each leg member and the body also having an opening which communicates between one leg member of the shackle and an exterior of the body, the shackle retaining element being accessible through the opening when the padlock is open, the one leg member having an aperture for receiving the shackle retaining element in a selectively protrudable manner, whereby when the shackle retaining element protrudes from the aperture of the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member and the padlock is open the shackle can be entirely removed from the body.
2. A padlock as claimed in claim 1, wherein the one leg member which has the aperture for receiving the shackle retaining element is longer than others of the leg members.
3. A padlock as claimed in claim 2, wherein the aperture for receiving the shackle retaining element is in a bottom end portion of the long leg member.
4. A padlock as claimed in any one of the preceding claims, wherein the shackle retaining element is threaded and the aperture for receiving the shackle retaining element has a corresponding thread.
5. A padlock as claimed in claim 4, wherein the shackle retaining element comprises a grub screw.
6. A padlock as claimed in claim 3, wherein the bottom end portion of the long leg has an outer flat portion, the aperture for receiving the shackle retaining element is in the outer flat portion, and the outer flat portion is recessed allowing the long leg of the shackle to move past all components of the padlock's internal locking mechanism and out of the padlock when the shackle retaining element is not protruding and the padlock is open.

7. A padlock as claimed in any one of the preceding claims, wherein the opening which communicates between one leg member of the shackle and an exterior of the body is in a side of the body.
8. A padlock as claimed in claim 7, wherein the opening extends transversely within the body and the aperture for receiving the shackle retaining element extends transversely to the axis of the one leg member.
9. A padlock having a padlock body and a shackle, the shackle having a portion that extends into the padlock body when the shackle is held by the padlock body, the padlock body being provided with a bore to enable a shackle retaining element to be selectively inserted into the said portion of the shackle substantially transverse to the longitudinal axis of that portion of the shackle.
10. A padlock as claimed in any one of the preceding claims, wherein when the padlock is locked, the shackle retaining element is inaccessible from the exterior of the padlock.
11. A padlock as claimed in any one of the preceding claims, including means for converting the padlock between a key holding mode and a removable key mode.
12. A padlock body comprising a top, a bottom and a side, the top having an opening to accommodate each leg of a shackle, the bottom having an opening to accommodate a cylinder, the side having an opening extending therethrough that can communicate with one leg of the shackle thereby allowing access to a shackle retaining element through the opening, the shackle retaining element being selectively protrudable from the one leg of the shackle.
13. A padlock shackle, the shackle having two or more leg members, each leg member being adapted to be inserted into an opening in a padlock body, one leg member having an aperture for receiving a shackle retaining element, the shackle retaining element being selectively protrudable from the one leg member.

14. A method for adapting a padlock which has a body, a shackle, an unlocked condition in which the padlock is said to be open and a locked condition in which the padlock is said to be locked, wherein the shackle has leg members and the body has an aperture to accommodate each leg member, by providing an opening in the body which communicates between one leg member of the shackle and an exterior of the body, a shackle retaining element which is adapted to be selectively protrudable from the one leg member, and an aperture in the one leg member for receiving the shackle retaining element, so that when the shackle retaining element protrudes from the one leg member the shackle cannot be entirely removed from the body, and when the shackle retaining element does not protrude from the one leg member the shackle can be entirely removed from the body when the padlock is open.

15. A padlock having a body and a shackle, the shackle having at least one long leg member and at least one short leg member, the padlock having a locked condition (in which the padlock is said to be locked) wherein leg members of the shackle are inserted at least partially into the body and at least one locking element engages with the shackle to retain the leg members inserted in the body therein, the padlock also having an unlocked condition (in which the padlock is said to be open) wherein at least one of the shackle's short leg members is retracted out of the body, the padlock further comprising a shackle retention element distinct from the at least one locking element which can be engaged so that it contacts with the at least one long leg of the shackle preventing the said long leg from being removed from the body when the padlock is open, and which shackle retention element can also be disengaged allowing the said long leg to be removed from the body when the padlock is open, wherein, in use, the shackle retention element cannot be accessed when the shackle retention element is engaged and the padlock is locked.

1/4

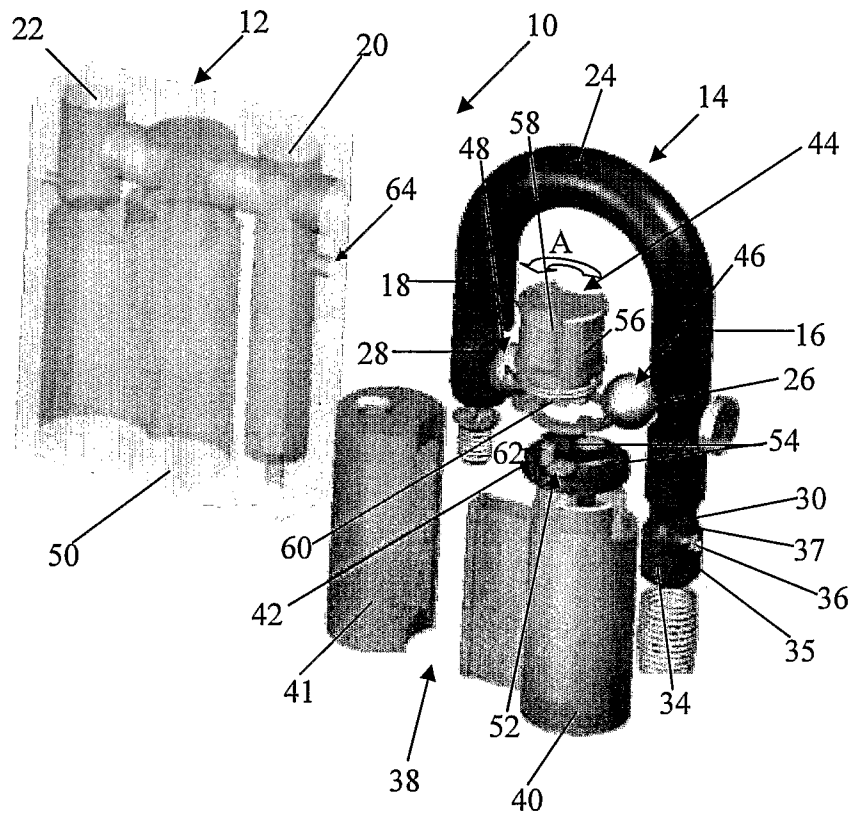


FIG 1

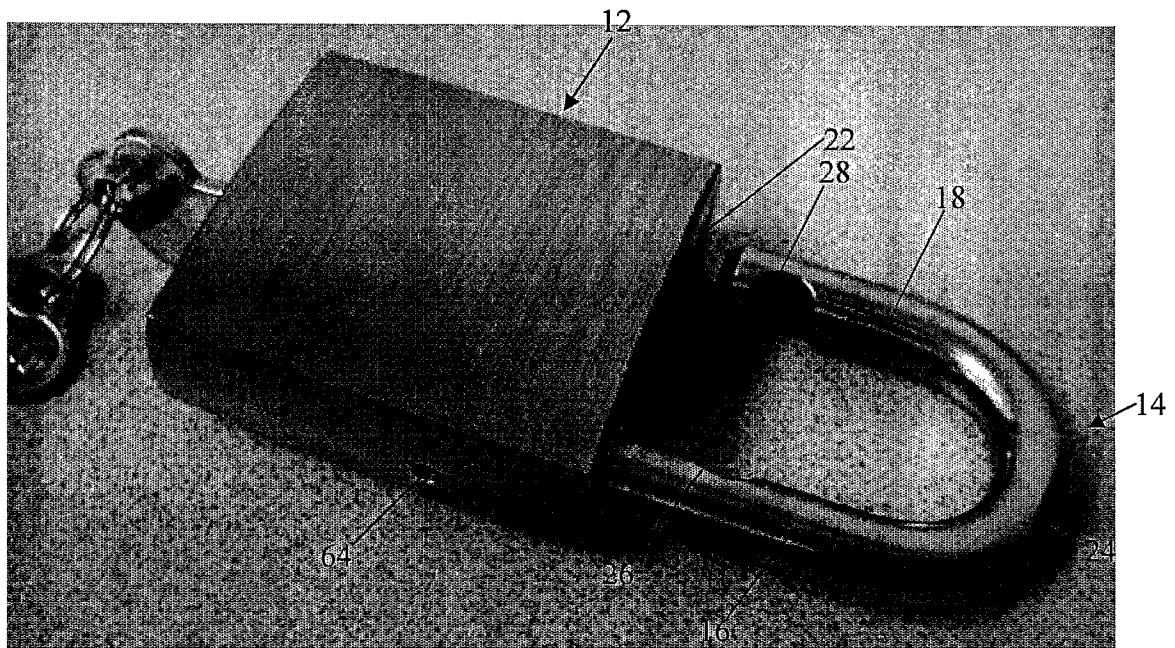


FIG 2

2/4

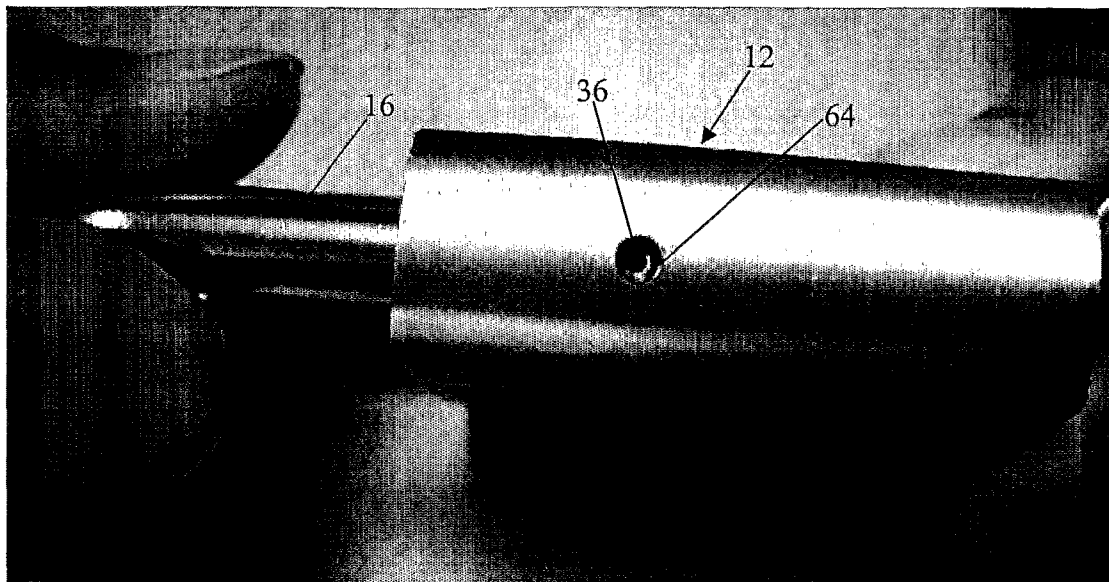


FIG 3

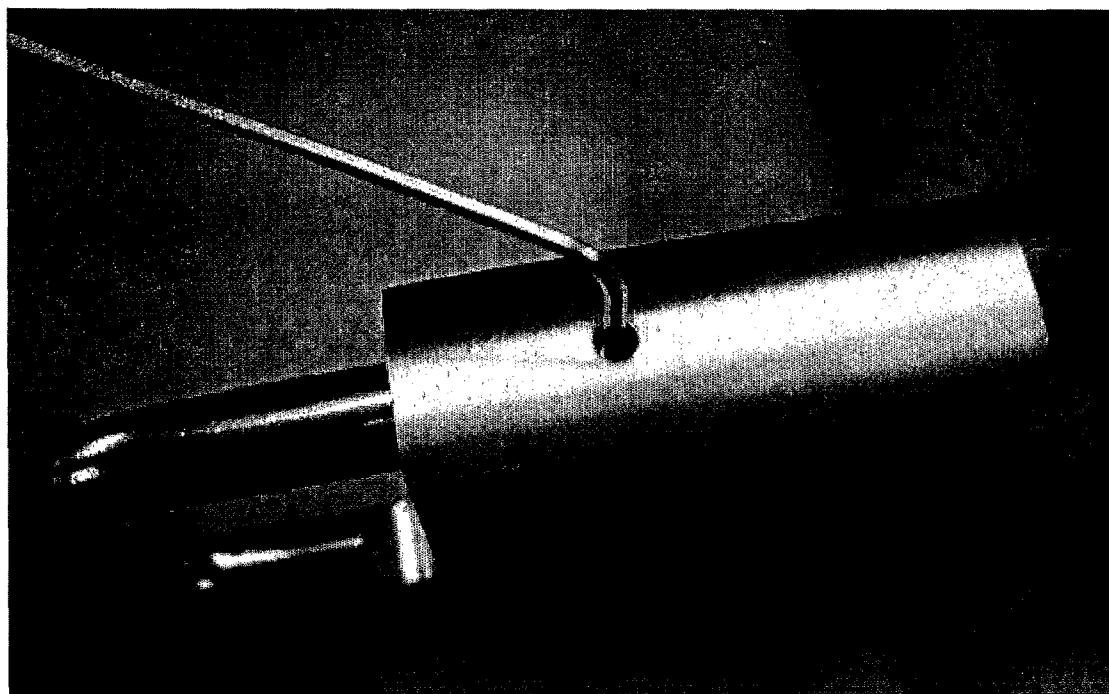
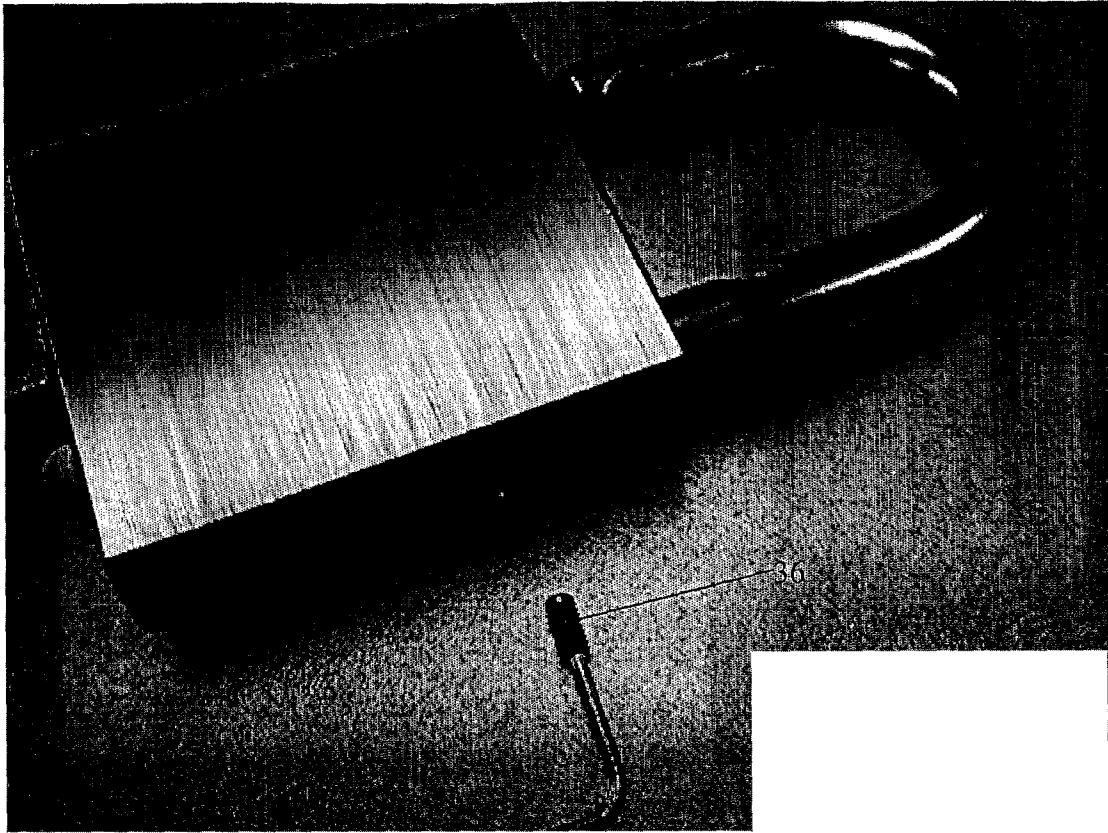
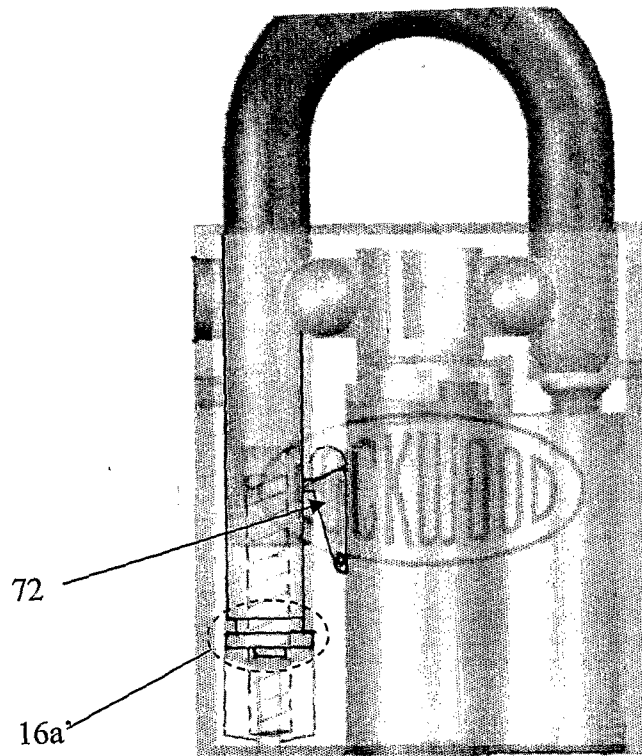
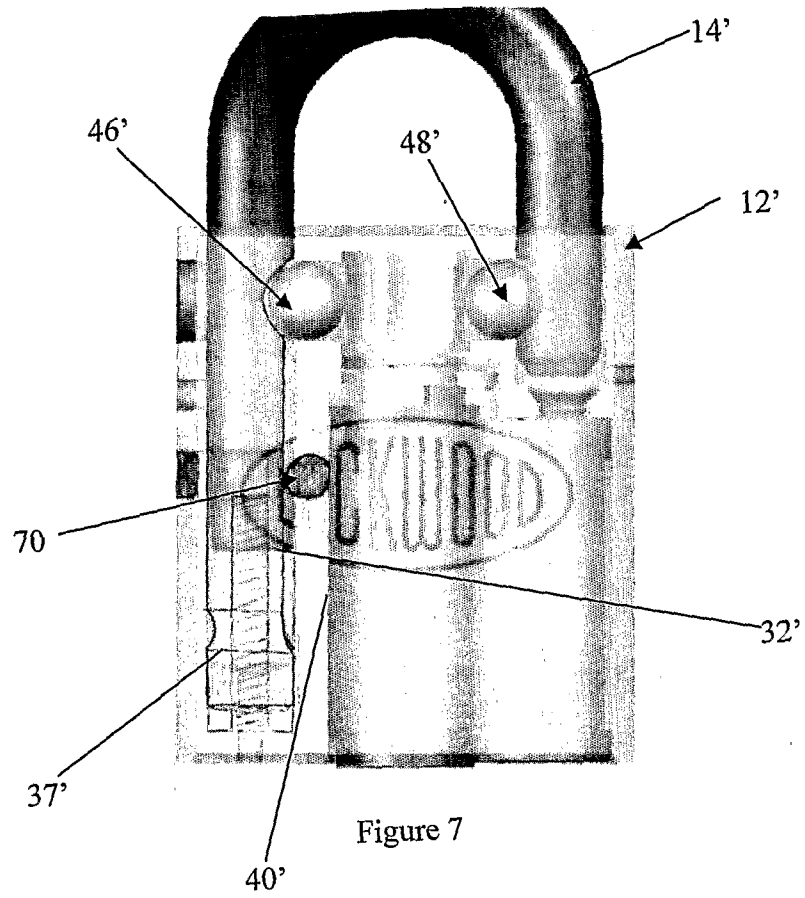


FIG 4



4/4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/001186

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

E05B 67/06 (2006.01) **E05B 67/24** (2006.01) **E05B 67/38** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI, E05B 67/IC key words KEY+, RETAIN+, NONREMOV+, HOLD+, SECUR+, GRUB+, SCREW+, FASTEN+, WITHELD+, WITHOLD+, SIDE+, SHACKLE+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2424032 A (ASSA ABLOY LIMITED) 13 September 2006 Whole document	1-15
A	US 5394711 A (PITKANEN) 7 March 1995 Whole document	1-15
A	US 2005/0061040 A (GAST et al.) 24 March 2005 Whole document	1-15

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
08 November 2006

Date of mailing of the international search report

14 NOV 2006

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2006/001186

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Member			
GB	2424032	NONE				
US	5394711	CA 2109533	EP 0611027	NO 940412		
		SG 45457				
US	2005061040	US 6766673	US 7036344	US 2003070453		
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.						
END OF ANNEX						