

SPECIFICATION

Improvements relating to combination locks

Background of the Invention

The use of combination locks, which dispense with the need for a separate key, has in recent years become increasingly popular on articles such as luggage articles, camera and instrument cases, and the like.

Such locks commonly employ a mechanism whereby the combination of the lock can be changed to one of the user's own choice, by manipulation of a combination-changing device. In the case of locks, for example of the rotary dial and sleeve type, where for combination changing it is necessary to move the sleeves or other combination elements axially out of coupling engagement with the dials or the like, this is normally accomplished by a shift member having a manual actuator. Generally, the actuator has only been accessible from the back of the lock, i.e., from the interior of the article to which the lock is applied, and, in certain instances, this has proved to be cumbersome in operation. Further, the actuator has generally needed to be moved in the axial direction of movement of the sleeves relative to the dials in order to uncouple the sleeves from the dials. (See, for example, U.S. Patent No. 3,800,571 to Heine, issued April 2, 1974.)

It is an object of the present invention to provide a novel form of shift mechanism for a combination lock of the type in which a plurality of combination elements such as sleeves are moved axially in unison in order to effect a combination change.

Another object of the invention is to provide a combination lock of the type having a plurality of combination elements adapted to be moved axially in unison in order to effect a combination change, wherein an actuator for shifting the elements is moved in a direction other than the axial direction of movement of the elements.

A further object of the invention is to provide a combination lock suitable for use on articles of luggage and the like, wherein a shift mechanism for changing the combination of the lock is readily accessible from the exterior of an article to which the lock is applied.

It has previously been proposed in connection with combination padlocks, for example, which employ rotary dials and sleeves, to move the sleeves out of coupling engagement with the dials by utilizing the longer leg of the padlock shackle to provide axial movement of the sleeves by movement of the shackle in a direction other than the direction of axial movement of the sleeves, see, for example, U.S. Patent No. 3,766,758 to Heine et al, issued October 23, 1973, and U.S. Patent No. 4,048,821 to Bako et al, issued September 20, 1977. The present invention, however, is primarily concerned with providing alternative and simplified means for effecting axial movement of the combination elements, for combination changing purposes, by means of an actuator which is operated other than in the

direction of movement of the elements.

Summary of the Invention

In accordance with the invention, at least in a preferred embodiment thereof, axial movement of the combination elements of a combination lock in order to effect a change in combination, is provided by moving an actuator obliquely to the axis of the elements, such movement of the actuator being converted through camming means into axial movement of the combination elements.

In a preferred form, the combination elements, such as combination sleeves in a sleeve and dial type lock, are carried end-to-end on a shaft in a lock casing and the actuator is formed as a portion of a shift member mounted on one end of the shaft. The actuator extends through an opening, preferably in the face plate of the lock, which has a camming surface oblique to the axis of the shaft so that as the actuator is moved along this surface, the shift member, shaft and sleeves are moved axially in unison.

The invention may be applied to locks having different forms of locking members and the shift member can be designed so that the actuator can only be operated to move the combination elements axially for a combination change, when the locking member is in an unlocked condition.

Description of Drawings

Figure 1 is a plan view of a combination lock in accordance with the invention, with parts of the lock being cut away;

Figure 2 is a longitudinal section along line 2—2 of Figure 1;

Figure 3 is a cross section along line 3—3 of Figure 2;

Figure 4 is a cross section along line 4—4 of Figure 2;

Figure 5 is a view similar to Figure 2 but showing parts of the lock in a combination-changing condition;

Figure 6 is a plan view of a part of the lock with the face plate removed;

Figure 7 is a perspective view of a shift member used in the lock;

Figure 8 is a composite end view of a combination dial and a combination sleeve; and Figure 9 is a plan view of a pivotal bolt.

Description of Preferred Embodiment

The illustrated combination lock is of a generally known type employing a locking member in the form of a pivotal bolt adapted to engage a hasp, the bolt being movable between locking and unlocking positions under the control of a plurality of combination dials and sleeves. The arrangement is such that when the dials and sleeves are on-combination, the bolt automatically assumes its unlocked position in which the hasp can be inserted into or withdrawn from the lock and when the dials and sleeves are off-combination, the bolt automatically assumes its locking position in which it prevents an inserted hasp from being withdrawn from the lock.

Locks having the above type of locking and unlocking action are known, see for example, U.S. Patent No. 3,800,571 referred to above. It is to be understood that the present invention is not concerned with the locking and unlocking action per se and this form of lock is merely used for illustrative purposes as one type of lock to which the present invention may be applied. Thus, the present invention is concerned with a shift mechanism for moving combination elements such as sleeves axially out of coupling engagement with associated lock components in order to effect a combination change. The invention can be applied to locks having a locking and unlocking action different to the pivotal bolt type locking and unlocking action herein referred to.

Referring now specifically to the drawings, the illustrated lock generally indicated by reference A, may be attached to a valance B of one section of, say, a luggage article (see Figure 3), with the other section C of the article carrying a hasp 10 having projecting tongues 14a, 14b, (Figure 1) adapted to enter openings in the lock and engage a pivotal bolt 30 to releasably secure the sections of the luggage or like article together.

Lock A has a casing which may for example be formed by a channel-shaped base member 20, a face plate 22, side wall members 24 and 26 and end brackets 16 and 18. The design and assembly of the casing components is not critical and can follow established practice for locks of this type. As illustrated, base member 20 has openings 25 for attaching the lock, as by screws, rivets, or the like, to valance B and side wall member 24 has openings 27 aligned with similar openings 29 in the upright wall 31 of the base member 20 for admission of the hasp tongues 14a and 14b.

Brackets 16 and 18 which define opposite end walls of the casing, respectively, may, for example, be located in recesses 28 in the opposed upright walls of base member 20. The pivot bolt 30 (Figure 9) is mounted in brackets 12 and 18 by ears 32a, 32b of the bolt which fit in corresponding openings in the brackets, and coil compression springs 34 act between base member 20 and bosses 36 on the undersurface of the bolt, to urge the bolt upwardly into the position shown in Figure 2 and shown in solid lines in Figures 3 and 4. In this, the unlocked position of the bolt, the hasp tongues 14a and 14b are free to enter and be removed from the lock through openings 27 and 29. When bolt 30 is lowered, however, to the locking position, against springs 34, by means to be described, and as shown in phantom in Figures 3 and 4, bolt tongues 30a, 30b align vertically with the hasp tongues 14a, 14b to prevent disengagement of the hasp. Downward movement of bolt 30 is limited by a stop 39 on base member 20.

Brackets 16 and 18 also serve to mount a shaft 40 carrying a series of combination elements in the form of three abutting sleeves 42, each sleeve having an encircling combination dial 48. The dials and sleeves (see Figure 8) are of conventional type

insofar as the dials have internal teeth 56 or the like which mesh with complementary teeth 58 or the like on the exterior of the sleeves whereby the respective dials and sleeves are coupled for mutual rotation on the shaft 40. The dials also have a conventional series of circumferential combination indicia on their outer surfaces with locating detents 60 therebetween (see Figure 8), and a portion of the periphery of each dial protrudes from the lock casing through respective slots 62, in face plate 22. Similarly, the dials protrude through aligned slots 64 in bolt 30. A conventional dial spring 68 on base member 20 has limbs 70 engaging in the detents 60 of the respective dials.

Shaft 40 further has a fixed or integrally formed collar 72 adjacent the right-hand sleeve 42 (as seen in Figure 2), a coil spring 74 surrounding the shaft and acting between bracket 16 and the left-hand sleeve 42, and a shift member 76 journaled on the shaft between collar 72 and bracket 18. Spring 74 urges the assembly of sleeves, shaft and shift member to the right as seen in Figure 2, and holds the sleeves in coupling engagement with the respective dials.

Sleeves 42 have enlarged bosses 44 at the left-hand ends thereof defining circumferential cam surfaces. These cam surfaces have part-circular portions 46 and flattened portions 50, and the cam surfaces act on the upper surface of bolt 30 to control the position of the bolt. Thus, when all the sleeves are aligned by suitable manipulation of the dials, such that the flattened portions of the respective sleeves all engage the bolt (i.e., the on-combination condition), as shown in Figures 2 and 3, the bolt is free to rise to the unlocked position. If at least one of the sleeves is rotated from this position, the part-circular portion of the sleeve's cam surface cams the bolt down to the locked position. Thus, for the bolt to be unlocked, all the sleeves must have their flat portions in aligned engagement with the bolt and for the bolt to be locked any one, or more of the sleeves, must be rotated so that the part-circular cam portion engages the bolt. This form of locking and unlocking action, as indicated, is known and will be readily apparent to those skilled in the art.

To enable the combination of the lock to be changed, it is necessary to move the sleeves 42 axially out of coupling engagement with the respective dials 48 so that at least one of the dials can be rotated independently of its respective sleeve. This is accomplished by shift member 76 when the lock is on-combination as will now be described.

Shift member 76, as shown particularly in Figure 7, includes a body portion 78 having a boss 80 which abuts shaft collar 72, an upwardly projecting manual actuator portion 82 and a depending lobe portion 84. Actuator portion 82 projects from the lock casing through an opening 86 in face plate 22. Opening 86 defines a camming surface 88 (Figures 1 and 2), extending obliquely across the axis of shaft 40 and opposite end surfaces 90 and 92 extending substantially

transversely of the shaft axis.

In the normal rest position of shift member 76, actuator portion 82 is in the position in opening 86 shown in full line in Figures 1 and 4. When the lock is off-combination, the bolt being in its locked lowered position, shown in phantom in Figure 4, tongue 30b of the bolt is in a blocking position with respect to lobe portion 84 of the shift member and actuator portion 82 of the shift member cannot therefore be effectively moved along surface 88 of opening 86. When the lock is on-combination, however, with the bolt in its raised, unlocked position, tongue 30b clears lobe portion 84 and frees actuator portion 82 for movement in opening 86. In this condition, actuator portion 82 can be moved along surface 88 which acts as a camming surface with which the actuator portion reacts. The shift member 76 thus moves to the left as shown in Figure 2, and, through collar 72, also moves the shaft 40 and sleeves 42 axially to the left against spring 74 into the position shown in Figure 5. The sleeves are thus uncoupled from their respective dials, the axial movement of the sleeves and shaft being effected by linear movement of actuator portion 82 obliquely to the direction of movement of the sleeves, through cam surface 88.

Actuator portion 82 can be released when in engagement with surface 92, with spring 74 acting to hold the actuator portion against surface 92. Surface 92 may, as shown in Figure 1, be slightly offset to aid in the retention of actuator portion 82. In this position (the position of the shift lever shown in phantom in Figure 4), lobe portion 84 engages under bolt tongue 30b (see also Figure 6) to hold the bolt in its raised position and prevent sleeves 42 from rotating and thereby losing the combination. After the combination has been changed, actuator portion 82 can be returned along surface 88 to its rest position allowing spring 74 to return the sleeves axially into coupling engagement with the respective dials, thereby setting the new combination and returning the lock components to the position shown in Figure 2.

It will be seen from the foregoing that the invention provides a convenient form of shift mechanism for use with combination locks suitable for application to articles of luggage or the like, which shift mechanism can be operated from the top of the lock casing, i.e., from externally of the article to which the lock is applied. Further, the shift mechanism is operated by moving a manual actuator other than in the direction of movement of the combination elements that are moved.

While only a single preferred embodiment of the invention has been described herein in detail, it is to be understood that the invention is not limited thereby and modifications can be made within the scope of the attached claims.

CLAIMS

1. A combination lock including a plurality of combination elements disposed on a common axis in a casing for axial movement in unison out of coupling engagement with cooperating combination components in order to change the combination of the lock, a shift member for moving said elements axially, said shift member including an actuator portion extending through an opening in said casing and means providing a camming action between said shift member and said casing for causing said shift member to move said elements axially responsive to movement of said actuator portion in said opening in a direction oblique to said axis.

2. A lock as defined in claim 1, wherein said means for providing a camming action includes a surface of said casing defining said opening, said surface extending obliquely to the common axis of said elements and said actuator portion being movable along said surface to provide said camming action.

3. A lock as defined in claim 1 or claim 2, wherein said combination elements comprise sleeves mounted axially in abutting relation on a shaft defining said axis and said cooperating combination components comprise dials encircling said sleeves, said dials having peripheral portions extending through slots in a face plate of the lock, and said opening being formed in said face plate.

4. A lock as defined in claim 3, wherein said shift member is mounted on said shaft adjacent a terminal one of said sleeves.

5. A lock as defined in claim 4, including a collar of said shaft between said terminal one of said sleeves and said shift member engaging said collar to move said shaft and said sleeves axially responsive to movement of said actuator portion in said opening.

6. A lock as defined in claim 1, including a locking member in said casing controlled by said combination elements for movement between locking and unlocked positions, said shift member including a lobe portion adapted to engage said locking member when said locking member is in locking position, for inhibiting movement of said actuator portion in said opening, said lobe portion clearing said locking member when said locking member is in unlocked position.

7. A lock as defined in claim 6, wherein said actuator portion has a terminal position in said opening for holding said combination elements in combination changing position, said lobe portion engaging said locking member in said terminal position of the actuator portion to retain said locking member in unlocked position.

8. A lock as defined in claim 6, wherein said locking member is a pivotal bolt and said sleeves each include a flange having a cam surface engaging said bolt for controlling movement of



transversely of the shaft axis.

In the normal rest position of shift member 76, actuator portion 82 is in the position in opening 86 shown in full line in Figures 1 and 4. When the lock is off-combination, the bolt being in its locked lowered position, shown in phantom in Figure 4, tongue 30b of the bolt is in a blocking position with respect to lobe portion 84 of the shift member and actuator portion 82 of the shift member cannot therefore be effectively moved along surface 88 of opening 86. When the lock is on-combination, however, with the bolt in its raised, unlocked position, tongue 30b clears lobe portion 84 and frees actuator portion 82 for movement in opening 86. In this condition, actuator portion 82 can be moved along surface 88 which acts as a camming surface with which the actuator portion reacts. The shift member 76 thus moves to the left as shown in Figure 2, and, through collar 72, also moves the shaft 40 and sleeves 42 axially to the left against spring 74 into the position shown in Figure 5. The sleeves are thus uncoupled from their respective dials, the axial movement of the sleeves and shaft being effected by linear movement of actuator portion 82 obliquely to the direction of movement of the sleeves, through cam surface 88.

Actuator portion 82 can be released when in engagement with surface 92, with spring 74 acting to hold the actuator portion against surface 92. Surface 92 may, as shown in Figure 1, be slightly offset to aid in the retention of actuator portion 82. In this position (the position of the shift lever shown in phantom in Figure 4), lobe portion 84 engages under bolt tongue 30b (see also Figure 6) to hold the bolt in its raised position and prevent sleeves 42 from rotating and thereby losing the combination. After the combination has been changed, actuator portion 82 can be returned along surface 88 to its rest position allowing spring 74 to return the sleeves axially into coupling engagement with the respective dials, thereby setting the new combination and returning the lock components to the position shown in Figure 2.

It will be seen from the foregoing that the invention provides a convenient form of shift mechanism for use with combination locks suitable for application to articles of luggage or the like, which shift mechanism can be operated from the top of the lock casing, i.e., from externally of the article to which the lock is applied. Further, the shift mechanism is operated by moving a manual actuator other than in the direction of movement of the combination elements that are moved.

While only a single preferred embodiment of the invention has been described herein in detail, it is to be understood that the invention is not limited thereby and modifications can be made within the scope of the attached claims.

CLAIMS

1. A combination lock including a plurality of combination elements disposed on a common axis in a casing for axial movement in unison out of coupling engagement with cooperating combination components in order to change the combination of the lock, a shift member for moving said elements axially, said shift member including an actuator portion extending through an opening in said casing and means providing a camming action between said shift member and said casing for causing said shift member to move said elements axially responsive to movement of said actuator portion in said opening in a direction oblique to said axis.

2. A lock as defined in claim 1, wherein said means for providing a camming action includes a surface of said casing defining said opening, said surface extending obliquely to the common axis of said elements and said actuator portion being movable along said surface to provide said camming action.

3. A lock as defined in claim 1 or claim 2, wherein said combination elements comprise sleeves mounted axially in abutting relation on a shaft defining said axis and said cooperating combination components comprise dials encircling said sleeves, said dials having peripheral portions extending through slots in a face plate of the lock, and said opening being formed in said face plate.

4. A lock as defined in claim 3, wherein said shift member is mounted on said shaft adjacent a terminal one of said sleeves.

5. A lock as defined in claim 4, including a collar of said shaft between said terminal one of said sleeves and said shift member engaging said collar to move said shaft and said sleeves axially responsive to movement of said actuator portion in said opening.

6. A lock as defined in claim 1, including a locking member in said casing controlled by said combination elements for movement between locking and unlocked positions, said shift member including a lobe portion adapted to engage said locking member when said locking member is in locking position, for inhibiting movement of said actuator portion in said opening, said lobe portion clearing said locking member when said locking member is in unlocked position.

7. A lock as defined in claim 6, wherein said actuator portion has a terminal position in said opening for holding said combination elements in combination changing position, said lobe portion engaging said locking member in said terminal position of the actuator portion to retain said locking member in unlocked position.

8. A lock as defined in claim 6, wherein said locking member is a pivotal bolt and said sleeves each include a flange having a cam surface engaging said bolt for controlling movement of



said bolt between said locking and unlocked positions dependent upon the alignment of the respective cam surfaces.

9. A combination lock substantially as
5 hereinbefore described with reference to and as illustrated in the accompanying drawings.

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