JOINT COMBINATION ACTUATED AND KEY ACTUATED PADLOCK

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Filed: Aug. 6, 1973
Appl. No.: 385,709

U.S. Cl. 70/21, 70/38 A, 70/52, 70/326, 70/425
Int. Cl. E05b 67/22
Field of Search 70/21, 22, 38 A, 52, 284, 70/312, 326, 425

References Cited
UNITED STATES PATENTS
140,377 7/1873 Kromer 70/129
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971,406 9/1910 Remlinger 70/425
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Primary Examiner—Albert G. Craig, Jr.
Attorney, Agent, or Firm—Fred Fisher

ABSTRACT
A principal feature of the joint combination-actuated and key-actuated padlock disclosed is that a customer can select a plurality (such as four) of a group (such as 10) of combination disks for use in the lock. The lock is sold basically in two parts: First, the main casing, including the shackles and key-operated mechanism, having a cut-away portion. Second, a group of 10 combination disks together with a housing and spring pin means for the assembly thereof. The customer selects any four of the 10 disks to provide his own unique permutation. The customer inserts the four disks into the housing, together with the spring pin, and inserts the assembled housing into the cut-away portion of the main casing. The spring pin means engage within suitable detents within the cut-away portion, thereby retaining the assembled housing in the padlock casing. Once performed, the housing cannot be simply removed, but is permanently engaged therewith.

By setting the proper combination with the selected disks, a reciprocating member can be disengaged from a first slidable plate which covers the keyhole of the padlock. After the combination is set, and the plate moved to uncover the keyhole, the customer can insert the key into the lock. A second slidable plate engages both the toe and heel ends of the padlock shackle in the manner of a bolt. The second slidable plate is activated by the insertion of a key into the keyhole, which operates against tumblers oriented in openings in the slidable plate. Other features include a unique configuration of two arms and a torsion spring, which, when operated upon by the toe end of the shackle, causes the second slidable plate to be urged against the shackle, so that, upon closing of the shackle, the slidable plate engages therewith and locks same.

7 Claims, 14 Drawing Figures
JOINT COMBINATION ACTUATED AND KEY ACTUATED PADLOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to padlocks and, in particular, relates to a joint operated combination-actuated and key-actuated padlock. Accordingly, it is a general object of this invention to provide new and useful devices of such character.

2. Background of the Prior Art
In accordance with novelty searches performed on behalf of the applicant, the following United States patents of interest are set forth below for their delineation of various features of prior art locks:

<table>
<thead>
<tr>
<th>Patentee</th>
<th>U.S. Pat. No.</th>
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<tbody>
<tr>
<td>Felter</td>
<td>41,211</td>
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<tr>
<td>McIntyre</td>
<td>109,922</td>
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<tr>
<td>Kromer</td>
<td>140,377</td>
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<tr>
<td>Wallmann</td>
<td>169,211</td>
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<tr>
<td>Sweeney</td>
<td>268,142</td>
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<tr>
<td>Jenkins</td>
<td>344,109</td>
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<tr>
<td>Richards</td>
<td>410,024</td>
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<tr>
<td>Mosley</td>
<td>426,734</td>
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<tr>
<td>Lucas</td>
<td>453,263</td>
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<tr>
<td>Carroll</td>
<td>1,092,474</td>
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<td>Carroll</td>
<td>1,113,193</td>
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<td>Nelson</td>
<td>1,193,412</td>
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<td>Casegilla</td>
<td>1,325,622</td>
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<tr>
<td>Stoeche</td>
<td>1,377,737</td>
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<tr>
<td>Tunison</td>
<td>1,577,939</td>
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<tr>
<td>Machinist</td>
<td>1,937,523</td>
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<tr>
<td>Karavia</td>
<td>2,231,536</td>
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Carroll, U.S. Pat. No. 1,092,474, discloses the use of a special key to allow removal of a combination portion of lock and resetting and is set forth as of interest.

Carroll, U.S. Pat. No. 1,113,193, and the foregoing Carroll patent, show the use of vertical posts which are positioned by the combination lock to control access to a key lock by internal blocking, but not by covering the keyhole as described by the applicant.

Karavia, U.S. Pat. No. 2,231,536, discloses disks which are rotated to a position of alignment to allow movement of bar covering the keyhole.

Felte, U.S. Pat. No. 41,211, and Stoeche, U.S. Pat. No. 1,377,737, show the use of a combination lock to release a plate covering a keyhole on a lock.

Machinist, U.S. Pat. No. 1,937,523, is included as of interest for combination and key use.

Kromer, U.S. Pat. No. 140,377, and Jenkins, U.S. Pat. No. 344,109, disclose use of keys having prongs thereon to align pins at their narrow portions to allow movement of a bar.

Casegilla, U.S. Pat. No. 1,325,622, disclosed movement of a bar when narrow portions of pins are aligned by a key, although the key is not of the pronged type.


Sweeney, U.S. Pat. No. 268,142, discloses use of a key which is pushed into the keyway to move a bar, thereby permitting sliding of a bolt to unlatch the shackle.

McIntyre, U.S. Pat. No. 109,922, discloses a U- or L-shaped member which is rotated upon contact with the shackle, upon closing, to move parts which move a bolt to engage a notch in the shackle. The members are in a locked position when the shackle is open, and, upon closing the shackle, members are caused to yield and close onto the shackle.

Turnison, U.S. Pat. No. 1,577,939, discloses an L-shaped member which is contacted upon insertion of the shackle and, in turn, pushes a bolt to engage and lock the shackle in place. Spring action causes a bolt to be urged against the heel portion of the shackle so that the shackle locks when closed.

Nelson, U.S. Pat. No. 1,193,412, discloses an L-shaped member which moves a bolt into locking position. Although Nelson is not a padlock it is set forth for possible interest.

The field of search included the following: Class 70, subclasses 20, 21, 38, 39, 42, 43, 284, 345, 351, 387, 425, and 426. Class 206, Unofficial subclass 46 H and Dig. 31.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a novel joint combination-actuated and key-actuated padlock.

Yet another object of this invention is to provide a novel joint operated combination-actuated and key-actuated padlock, wherein the specific combination is selectively determined by the customer at the time of purchase and cannot be changed thereafter.

Still another object of this invention is to provide a new and useful joint combination-actuated and key-actuated padlock, wherein the combination is known solely to the customer and not to the manufacturer or distributor of the product.

Yet another object of this invention is to provide a novel joint combination-actuated and key-actuated padlock which is substantially burglar-proof.

In accordance with a specific embodiment of this invention, various features are disclosed and claimed.

One feature of the present invention includes a padlock having a generally U-shaped shackle having a central axis which separates the toe end from the heel end. The shackle has a cross-sectional diameter D1 at the toe end thereof. The shackle has a reduced cross-sectional diameter D2, a short distance from the toe end, along a plane P1 which is parallel to the cross-sectional diameter D1. The shackle has a cross-sectional diameter D3 at the heel end thereof and a reduced cross-sectional diameter D4 a short distance from the heel end along a plane P2 parallel to the cross-sectional diameter D3. The planes P1 and P2 are co-extensive and are perpendicular to the central axis. The dimensions are such that D1 is greater than D2 and D3 is greater than D4. A bolt means for the shackle has a generally flat, rectangular shape and has a first opening including a circular hole having the diameter D1 (with sufficient tolerance to allow free passage of the toe end of the shackle therethrough) and a radially extending slot having a width at least equal to the reduced cross-sectional diameter D2, but less than the diameter D1, so that the slot, upon engagement with the reduced cross-sectional diameter D2, restrains movement of the shackle in a direction perpendicular to the bolt means. The bolt means has a second opening, including a circular hole having the diameter D3 (with sufficient tolerance to allow the free passage of the heel end of the shackle therethrough) and a radially extending slot having a...
width at least equal to the reduced cross-sectional diameter $d_4$, but less than the diameter $d_3$, so that the slot, upon engagement with the reduced section diameter $d_4$, restrains movement of the shackle in a direction perpendicular to the bolt means. The first and second opening slots are parallel to each other and extend from their respective holes in the same direction. Additional holes are provided for the accommodation of tumblers therewithin and reciprocating means are provided for the bolt means to lock and unlock the shackle.

In accordance with certain features of the invention, the reciprocating means includes a casing for the padlock. A first arm, pivotally coupled to an axis in the casing, is adapted to be engaged by the toe end of the shackle when the shackle is in a closing position. A second arm, pivotally coupled to the casing axis, is adapted to engage an end of the bolt means. Torsion spring means are coupled to the casing axis. The torsion spring means has one end thereof engaged by the first arm and has an opposite end adapted to be engaged by the second arm. Upon closing the shackle, the toe end of the shackle rotates the first arm, causing the second arm to be urged against the bolt means, sliding the bolt means to restrain the shackle when the reduced cross-sectional diameters are aligned with the slots. Upon sliding the bolt means in the opposite direction, the shackle is unrestrained. Tumblers are provided in cooperating relationship with the additional holes for locking and unlocking the padlock.

In accordance with an embodiment of the invention, a joint combination and key-actuated padlock includes a casing having a keyhole. A slidable plate is adapted to selectively block and unblock the keyhole for actuation by a key. A plurality of circular disks each has indicia on a rim thereof. Each has a single unique hole oriented a fixed distance from the central axis of the respective disk. Means are provided for mounting the disks in the casing in a tiered fashion along a common central axis perpendicular to the plate. Bolt means are associated with the casing for engaging the slidable plate in a blocking condition. The bolt means includes a reciprocating bar perpendicular to the plate for engagement and disengagement with the plate, together with a like plurality of pins extending outwardly perpendicular to the bar along the length thereof in the same direction. Each extending pin has an upstanding lug formed at the end thereof so that the lugs can be received by the unique holes in the disks. When the circular disks are uniquely aligned with the selected permutations indicia on rims, the unique holes of the disks are aligned along a common axis. Each of the lugs, then, can enter the corresponding unique holes, so that the reciprocating bar is disengaged from the plate. When the circular disks are not uniquely aligned, one or more disks obstruct the movement of one or more lugs, thus restricting the movement of the reciprocating bar, so that the plate is kept engaged by the reciprocating bar in a blocking condition.

In accordance with an embodiment of this invention, a combination type padlock includes a plurality of circular disks. Each of the disks has a central axial hole and each has indicia on the rim thereof. Each disk has a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another. A generally rectangular housing is provided for the disks. The housing has slots at one face for the rims of the disk to partially be exposed for manual manipulation. At two opposite faces of the disks, the two faces being adjacent to the aforesaid one face, a hole is provided for alignment with the central axial holes. Spring pin means are engaged with the holes of the housing and the central holes of the circular disks for holding the disks in the housing. The spring pin means, when retracted, are flush with the two opposite faces. The spring pin means, when normally extended, are extended from the two opposite faces. The padlock further includes a casing having a cut-away portion for receiving the housing. The cut-away portion further includes detent means so oriented as to receive the spring pin means when the housing is inserted thereinto. The housing, with the disks and the spring pin means, can be easily inserted into the cut-away portions of the casing, but cannot be easily removed therefrom.

In accordance with certain embodiments of the invention, a combination is provided including 10 circular disks. Each disk has a central axial hole, each has numerals from 0 through 9 designated on the rim thereof. Each has a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another. One disk has the unique hole associated with the numeral 1, another with the numeral 2, another with the numeral 3, and so forth. The combination includes a generally rectangular housing for a limited number (for example, four) of selected ones of the 10 disks. The housing has slots corresponding to the limited number at one face thereof for the rims of the selected disks to be partially exposed for manual manipulation. The selected disks are retained within the housing so that the selected disks are rotatable about a common axis. Padlock casing means are provided which are adapted to receive the housing so that the rims of the limited number of the disks are exposed through the slots to the user. The housing, when received by the casing means, is flush with the casing means.

In accordance with a preferred embodiment of this invention, a joint combination and key-actuated padlock includes a plurality of circular disks. Each disk has a central axial hole; each has indicia on the rim thereof. Each disk has a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another. A generally rectangular housing providing for the disk is provided; the housing having slots at one face thereof for the rims of the disks to be partially exposed for manual manipulation. The housing has two opposite faces thereof, each face adjacent to the aforesaid one face. The two opposite faces have holes for alignment with the central axial holes. Spring pin means are provided for the padlock for engagement with the holes of the housing and the central holes of the circular disks for holding the disks in the housing. The spring pin, when retracted, is flush with the two faces. The spring pin, when normally extended, is extended from the two opposite faces. A casing is provided for the padlock, the casing including, first, a keyhole, and second, a cut-away portion for receiving the housing. The cut-away portion further includes detent means so oriented as to receive the spring pin means when the housing is inserted therewithin. The housing, with the disks and the spring pin means, can be easily inserted into the cut-away portion of the casing, but cannot be easily removed therefrom. A slidable plate is adapted to selectively block and unblock the keyhole
from actuation by a key. A first bolt means is associated with the casing for engaging the slidable plate in a blocking condition. The first bolt means includes, first, a reciprocating bar which is perpendicular to the slidable plate for engagement with the plate. Second, the reciprocating bar includes a like plurality of pins extending outwardly perpendicular to the bar along the length thereof in the same direction. The pins each have an upstanding lug formed at the end thereof, so that the lugs can be received by the holes, whereby, when the circular disks are uniquely aligned with the unique indicia on their rims, the unique holes of the disks are aligned along a common axis so that each of the lugs can enter the corresponding unique hole so that the reciprocating bar is disengaged from the plate. A generally U-shaped shackel has a central axis separating the toe end thereof from the heel end thereof. The shackel has a cross-sectional diameter \( d_1 \) at the toe end thereof. The shackel has a reduced cross-sectional diameter \( d_2 \) a short distance from the toe end, along a plane \( p_1 \), parallel to the cross-sectional diameter \( d_1 \). The shackel has a cross-sectional diameter \( d_3 \) at the heel end thereof. The shackel has a reduced cross-sectional diameter \( d_4 \) a short distance from the heel end of the shackel along a plane \( p_2 \) parallel to the cross-sectional diameter \( d_3 \). The planes \( p_1 \) and \( p_2 \) are co-extensive and are perpendicular to the central axis. The diameter \( d_2 \) is less than the diameter \( d_1 \), and the diameter \( d_4 \) is less than the diameter \( d_3 \). A second bolt means is associated with the casing for engagement with the shackel. The second bolt means has a generally flat rectangular shape and has a first opening which includes a circular hole having a diameter \( d_1 \) (with sufficient tolerance to allow the free passage of the toe end of the shackel therethrough) and a radially extending slot having a width at least equal to the reduced cross-sectional diameter \( d_2 \), but less than the diameter \( d_1 \), so that the slot, upon engagement with the reduced cross-sectional diameter \( d_2 \) of the shackel, restrain movement of the shackel in a direction perpendicular to the second bolt means. A second opening includes a circular hole having a diameter \( d_3 \) (with sufficient tolerance to allow the free passage of the heel end of the shackel therethrough) and a radially extending slot with a width at least equal to the reduced cross-sectional diameter \( d_4 \) but less than the diameter \( d_3 \), so that the slot, upon engagement with the reduced cross-sectional diameter \( d_4 \) of the shackel, restrains movement of the shackel in a direction perpendicular to second bolt means. The first opening and second opening slots are parallel to each other and extend from their respective holes in the same direction. A second plurality of openings are oriented in a circle. Each opening includes a circular hole having a diameter \( d_5 \) and having a reduced radially extending slot having a width \( d_6 \). The second plurality of opening slots are parallel to and extend from their respective holes in a direction opposite to the aforesaid same direction. The second plurality of openings, when second bolt means is a locking engagement with the shackel, has its circle oriented in alignment with the keyhole. Each of a plurality (corresponding in number to the second plurality) of spring biased tumblers has enlarged diametrical portions not exceeding the diameter \( d_5 \) of the circular holes, but greater than the dimension \( d_6 \). Each tumbler has reduced diametrical portions not exceeding the diameter \( d_6 \). When all of the tumblers have their reduced dia-
mimetrical portions in association with the second bolt means, the second bolt means is in an unblocking condition for the shackel. When any one of the tumblers has its enlarged diametrical portion in association with the second bolt means, the second bolt means is in a locked condition for the shackel. A first arm is pivotally coupled to an axis of the casing and is adapted to be engaged by the toe end of the shackel, when the shackel is in a closed position. A second arm is pivotally coupled to the casing axis and is adapted to engage an end of the bolt means. Finally, a torsion spring means is coupled to the casing axis. The torsion spring means has one end thereof adapted to be engaged by the first arm and has an opposite end thereof adapted to be engaged by the second arm. Thus, upon closing the shackel, the toe end of the shackel rotates the first arm, causing the second arm to be urged against the bolt means, and sliding the bolt means to restrain the shackel when the reduced cross-sectional diameters of the shackel are aligned with the slots. Upon sliding the bolt means in the opposite direction, so that the shackel is unrestrained, the first arm is spring biased so as to urge the shackel in an open position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features, and advantages of this invention will become more apparent from a reading of the following specification, when read in conjunction with the accompanying drawing, in which:

FIG. 1 is perspective view of one embodiment of the invention showing a joint combination-actuated and key-actuated padlock with the combination portion thereof shown in an exploded format;

FIG. 2 is another perspective view of the padlock shown in FIG. 1 viewed in an opposite direction;

FIG. 3 is a sectional view of the embodiment shown in FIG. 1, taken along the line 3--3 with the shackle shown in a locked position;

FIG. 4 is a partially sectional view taken along the line 4--4 of FIG. 3;

FIG. 5 is a view taken along the line 5--5 of FIG. 3;

FIG. 6 is a view taken along the line 6--6 of FIG. 3;

FIG. 7 is a cross-sectional view taken along the line 3--3 of FIG. 1, similar to FIG. 3, but FIG. 7 shows the shackel in an open position with a key inserted into the lock;

FIG. 8 is a cross-sectional view taken along the line 8--8 of FIG. 7;

FIG. 9 is a view taken along the line 9--9 of FIG. 7;

FIG. 10 is a view taken along the line 10--10 of FIG. 7;

FIG. 11 is a partial sectional view taken along the line 11--11 of FIG. 5;

FIG. 12 is a partial cross-sectional view taken along the line 3--3 of FIG. 1, delineating portions of the mechanism when the shackel is in an intermediate position about to be locked;

FIG. 13 is a perspective view of a key for use with an embodiment of this invention; and

FIG. 14 is a perspective view of ten circular disks which are provided with the padlock so that selected ones may be used therewith.
DESCRIPTION OF A PREFERRED EMBODIMENT

A joint combination-actuated and key-actuated padlock 10 (shown in perspective in FIGS. 1 and 2) generally includes a casing 11 having a rectangular cut-away section portion 12, and the outline of which is depicted in FIG. 1. A housing 13, rectangular in configuration, has the same general shape as that of the cut-away section portion 12. The housing 13 has a plurality of slots 14—14 along one face 16 thereof, so that a like plurality of circular disks 17a, 17b, 17c, and 17d can have portions of their rims 18—18 exposed through the slots 14—14 for manual manipulation thereof.

Referring to FIG. 1, in conjunction with FIG. 14, the customer purchases the entire padlock 10 together with the housing 13 and associated hardware, together with ten circular disks, including disks 17a, 17b, 17c, 17d, and disks 19—19 (FIG. 14) which disks 19—19 are discarded. Referring to FIG. 14, it is noted that each of the disks includes a central axial hole 21. Each of the disks has an indicia on the rim 18 thereof. Each of the circular disks 17a, 17b, 17c, 17d, and 19—19 has a singular unique hole 22 oriented a fixed distance from the corresponding central axis 21 of the respective disks. For example, as shown in FIG. 14, the circular disk 19 (shown in the upper row, first column), the unique hole 22 is opposite from the indiciun “0”, the second disk shows a unique hole 22 located opposite the indiciun “1” for the disk 17d. The upper row, third column disk 19 has the unique hole 22 opposite from the numeral “2.” The fourth disk 17b has its unique hole located opposite from the numeral “3.” Likewise, upper row, right column disk 19 has its unique hole 22 located opposite from the number “4.” In similar fashion, the bottom row of disks 19, 17c, 19, 19, and 17a respectively, have their respective unique holes 22—22 located opposite the respective indicia, “5,” “6,” “7,” “8,” and “9.” The customer who purchases the lock, including the various components any one of the disks (as depicted in FIG. 14) for use in the casing 11. The remaining disks can be discarded. The four that are selected can be arranged in any determined pattern dependent upon the selection of the customer. As viewed in the drawings, the customer selected the disks 17a, 17b, 17c, 17d, and discarded the disks 19—19. As depicted in FIG. 1, the customer selected the numerical combination 9361 as his individual unique combination. The disks 17a, 17b, 17c, and 17d are inserted into the housing 13, so that the central axis 21 of each of the disks 17a, 17b, 17c, and 17d are so oriented that the central axes 21 of the disks 17a, 17b, 17c, and 17d are disposed to be engaged or disengaged the plate 36. The circular pin means, including optionally an axial sleeve 26, is inserted into the axial hole 23 and through the corresponding axial holes 21—21 of the said circular disks 17a, 17b, 17c, and 17d. Within the axial sleeve 26 is a spring pin 27. The spring pin 27 is similar to the spring pin found in both men’s and ladies’ wrist watch bands for connecting the wrist watch to a watch band. The spring pin, as is well known, includes a pair of projecting pins 28—28, which are spring biased so as to extend from a main body portion 29. The spring pin, when the projecting pins 28—28 are depressed, when inserted into the housing 13, is flush with the faces 24—24 of the housing. When released, the spring pin 27 has its projecting pins 28—28 extending therefrom.

In operation, the customer selects four of the desired 10 disks and inserts them into the housing 13, inserts the sleeve 26 thereof, and inserts the spring pin 27 within the sleeve 26. The entire housing package is then inserted into the cut-away portion 12 of the lock casing 11. Once inside, the spring pin projection portions 28—28 engage within corresponding detents 31—31 as depicted in FIGS. 3, 4, 7, and 8.

The casing 11 includes a keyhole 32. Adjacent to the bottom portion 33 of the casing 11, which bottom portion includes a hole 34 which is aligned with the keyhole 32, is a slidable plate 36 as shown in FIGS. 3, 6, 7, and 10. The slidable plate 36 has a projection 38 extending therefrom for manual manipulation from the exterior part of the lock 10. The casing 11 has a suitable slot 39 for the reciprocation of the projection 38. The slidable plate 36 is normally immovable and is locked in place. The projection 38 is slightly raised from the slot 39 so it can be easily grasped by a thumb in its movement, but it is not of such strength or rigidity so that the plate can be illegally forced by a hammer or the like.

The slidable plate, as depicted in FIGS. 3 and 6, is normally in a locked position. A hole 41 in the plate 36 is adapted to be aligned with the keyhole 32 (shown in dotted outline in FIG. 6) when the lock is in its position to be accepted by a key. Thus, FIG. 6 depicts the slide 36 in the locked position, whereas FIG. 10 depicts the slide 36 in a position suitable to accept a key. As shown in FIG. 10, the slide 36 has its hole 41 aligned with the keyhole 32.

The slidable plate 36 has a hole 42 along its side, so as to receive an end 43 of a reciprocating bar 44. The insertion of the end 43 into the aperture 42 of slidable plate 36, blocks the plate 36 from movement as depicted in FIG. 4. When the end 43 of the reciprocating bar 44 is free from the hole 42 of the slidable plate 36, as depicted in FIG. 8, the slidable plate 36 is free to be moved. Hence, the reciprocating bar 44 is adapted to be engaged and disengaged with the plate, the reciprocating bar being oriented in a direction perpendicular to the plate 36. The reciprocating bar has a plurality of pins 46—46 extending outwardly perpendicular to the bar along its length, all in the same direction. In the embodiment illustrated with four selected circular disks, the bolt means including the reciprocating bar has four extending pins. Each of the pins 46—46 has an upstanding lug 47—47 formed at its end. The lugs 47—47 are so formed so that, when the disks 17a, 17b, 17c, and 17d are properly oriented with their respective holes 22—22, each of the lugs 47—47 can enter its corresponding unique hole 22—22, as shown in FIG. 8, so that the reciprocating bar 44 is disengaged from the plate 36. However, when the circular disks 17a, 17b, 17c, 17d are not so aligned (see FIG. 4) so that one or more disks obstruct movement of one or more lugs 47—47, movement of reciprocating bar 44 is impeded. In such condition, the plate 36 is kept engaged by the reciprocating bar 44 in a blocking condition. The bolt means further includes a spring 48, as shown in FIGS. 4 and 8, which spring is adapted to urge the reciprocating bar 44 so that its projection 43 engages within the hole 42 of the plate 36. The reciprocating bar further includes a projection 49 which extends through a slot 51 on the rear face of the casing 11, as
shown in FIG. 2, so that by sliding with the thumb, the reciprocating bar 44 can be raised to disengage the reciprocating plate 46 when the proper combination has been set. When the proper combination is not set, the projection 49 cannot be moved and is locked in position. The projection 49 is relatively fragile so that the reciprocating bar 44 cannot be disengaged from the sliding plate 56 when struck by a hammer or the like.

The padlock 10 further includes a generally U-shaped shackle 52 as depicted generally in FIGS. 1, 2, and 3. The shackle 52 is shown partly broken away in FIGS. 4, 7, 8, 11, and 12 for simplicity of illustration.

As shown in FIGS. 3, 7, 8, and 12, the toe end 53 of the shackle 52 has a cross-sectional diameter $d_1$. Along a plane $p_1$, parallel to the cross-sectional diameter $d_1$, as shown for example in FIG. 7, a short distance from the toe end 53, the shackle 52 has a reduced cross-sectional diameter $d_2$.

In similar fashion, the heel end 54 of the shackle 52 has a cross-sectional diameter $d_3$. Likewise, along a plane $p_2$ parallel to the cross-sectional diameter $d_3$, a short distance from the heel end 54, the shackle has a reduced cross-sectional diameter $d_4$. The planes $p_1$, $p_2$, as depicted in FIG. 7, are co-extensive and are perpendicular to a central axis 56 of the shackle 52. The reduced cross-sectional diameter $d_2$ is smaller than the cross-sectional diameter $d_1$ of the toe end 53 of the shackle 52. In like fashion, the reduced cross-sectional diameter $d_4$ is smaller than the cross-sectional diameter $d_3$ of the heel end 54 of the shackle 52.

A bolt means is provided for the shackle 52, including a generally flat rectangular plate 57—best shown in FIGS. 5 and 9. The bolt means 57 includes a first opening 58, including a circular hole 59 which has substantially the diameter $d_1$ with sufficient tolerance to allow the free passage of the toe end 53 of the shackle 52 into the hole 59. The opening 58 further includes a radially extending slot 61 which has a width at least equal to the reduced cross-sectional diameter $d_2$, but less than the diameter $d_1$, so that the slot 61, upon engagement with the reduced cross-sectional diameter $d_2$ portion of the shackle 52, restrains movement of the shackle 52 in a direction perpendicular to the plate 57.

The plate 57 includes a second opening 62, having a circular hole 63 having a diameter $d_3$ which has sufficient tolerance to allow the free passage of the heel end 54 of the shackle 52 therethrough. The second opening 62 further includes a radially extending slot 64 having a width at least equal to the reduced cross-sectional diameter $d_4$ but less than the diameter $d_3$. The slot 64, upon engagement with the reduced cross-sectional diameter $d_4$ of the shackle 52, restrains movement of the shackle 52 in a direction perpendicular to the plate 57. The first opening slot 61 and the second opening slot 62, as shown in FIGS. 5 and 9, are parallel to each other and each slot extends from its respective hole 59, 63 in the same direction.

The bolt means plate 57 includes additional holes 66—66, best shown in FIG. 5, for accommodation of tumblers 67—67 therewith.

The plate 57 has a projection 68 extending therefrom through a corresponding slot 69 (see FIG. 2) of the casing 11. The projection 68 forms a reciprocating means for the bolt plate 57.

Referring specifically to FIGS. 3, 7, and 12, there is shown a first arm 72 which is pivotally coupled about an axis 73 of the casing 11. The arm 72 is adapted to be engaged by the toe end 53 of the shackle 52 when the shackle 52 is in a closed position as shown in FIG. 3. FIG. 12 depicts the shackle 52 in an intermediate position as the shackle is about to be closed, where the toe end 53 of the shackle 52 comes into initial engagement with the arm 72.

A second arm 74 is pivotally coupled to the axis 73 of the casing 11 and is adapted to engage an end 76 of the bolt plate 57.

A torsion spring 77 is coupled to the casing axis 73, and has one end 78 thereof adapted to be engaged by the first arm 72. The opposite end 79 of the torsion spring 77 is adapted to be engaged by the second arm 74.

FIG. 7, as stated above, depicts the open view, or unlocked condition, of the shackle 52. Upon closing the shackle 52, immediately shown in FIG. 12, and upon the locked condition shown in FIG. 3, the toe end 53 of the shackle 52 rotates the first arm 72, causing the second arm 74, as shown in FIG. 12, to be urged against the bolt plate 57. When the shackle 52 assumes the position shown in FIG. 3, the arm 74, being spring biased and being urged against the bolt plate 57, slides the bolt means 57 to restrain the shackle 52 by causing the reduced cross-sectional diameter $d_3$ of the shackle to be aligned with the slot 61 and the reduced cross-sectional diameter $d_4$ of the shackle to be aligned with the slot 64, as shown in FIG. 5.

When the bolt means 57 is slid from the locked condition depicted in FIGS. 3 and 5, into the condition shown in FIGS. 7 and 9, the shackle is unrestricted. A spring 81 is maintained in the casing 11 to be urged against the heel portion 54 of the shackle 52 to raise the shackle.

Referring to FIG. 5, the additional holes are oriented in a circle. Each opening 66 includes a circular hole 82. The circular holes 82—82 each has a diameter $d_5$ and each circular hole 82 has a corresponding reduced radial extending slot 83. The slots 83—83 each has a width $d_6$. The slots 83—83, as depicted in FIG. 5, are parallel to each other and extend from their respective circular holes 82—82 in a direction opposite to that of the slots 61, 64. The openings 66—66 when the bolt plate 57 is in locking engagement with the shackle, as shown in FIG. 5, has its circle oriented in alignment with the keyhole 52, as best shown in FIG. 3.

The plurality of tumblers 67—67, which correspond in number to the plurality of openings 66—66, each has an enlarged diametrical portion 84 which do not exceed the diameter $d_5$, but is greater than the diameter $d_6$. The tumblers 67—67 have reduced diametrical portions 86 which do not exceed the diameter $d_5$. Thus, when all the tumblers 67—67 have their diametrical portions 86 in association with the bolt means 57, the bolt plate 57 is in an unlocking condition for the shackle 52. The bolt plate 57 can be slid into the open position as shown in FIGS. 7 and 9. When any one of the tumblers 67—67 has its enlarged diametrical portion 84, in association with the bolt plate 57, the bolt plate 57 is in a locked position for the shackle 52. A suitable key 87, for actuating the tumblers 67—67, can be inserted into the keyhole 32 for actuation of the tumblers 67—67, only when the combination has been properly set to release the reciprocating bar 44, so that
the slidable plate 36 can uncover the keyhole 32. The key 87 has an axial spine 88 for engaging within a corresponding keyway 89 in the plate 36. The key 87 has prongs 91—91 at its extension thereof so as to actuate the tumblers.

Advantageously, with this invention, a customer can purchase a padlock with the confident knowledge that only he, and he alone, can determine the combination for the padlock. The customer is also confident that he has the dual security of a padlock which requires both the knowledge of the combination and a specific key for the padlock itself.

Various modifications may be performed in the embodiment shown in the drawings and described hereinabove without departing from the spirit and scope of the invention. For example, the customer can be supplied with more than ten unique combinational disks. A padlock can be provided which requires other than four different disks for its operation. The disks, though shown with numerical indicia ranging from 0 through 9, can have other indicia on their rims such as letters and the like, or for that matter, numbers ranging in more than or less than 10 different numerals.

One variation, which can be performed with minor modification, is to change the number of tumblers required for the lock. Though five are illustrated in the embodiment shown in FIG. 9, fewer (for example three, or more) can be used without departing from the invention.

Other modifications, well within the scope of those skilled in the art, may involve the elimination of one or more of the projections 38, 49, and 68 and their corresponding slots 39, 51, and 69, or the corresponding elimination of the spring 48. The projections and spring, in certain instances, have redundant purposes. Both may be provided for convenience, but one or the other may be eliminated for economical or security purposes.

In one form of the invention, the spring pin sleeve can be eliminated, the spring pin being inserted directly into the housing so as to hold the disks and housing together as an integral assembly.

What is claimed is:

1. A joint combination and key actuated padlock comprising:
   A. a plurality of circular disks, each having a central axial hole, each having indicia on the rim thereof, and each having a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another;
   B. a generally rectangular housing for said disks, having slots at one face thereof for the rims of said disks to be partially exposed for manual manipulation thereof, and having at two opposite faces thereof, adjacent to said one face, a hole for alignment with said central axial holes;
   C. spring pin means for engagement with said holes of said housing and said central holes of said circular disks, for holding said disks in said housing, said spring pin when retracted being flush with said two opposite faces, and said spring pin when normally extended being extended from said two opposite faces;
   D. a casing for said padlock including:
      1. a keyhole, and
      2. a cutaway portion for receiving said housing, said cut-away portion further including detent means so oriented as to receive said spring pin means when said housing is inserted therewithin, whereby said housing, with said disks and said spring means can be easily inserted into the cutaway portion of said casing, but cannot be easily removed therefrom;
   E. a slidable plate adapted to selectively block and unblock said keyhole from and for, respectively, actuation by a key;
   F. first bolt means associated with said casing for engaging said slidable plate in a blocking condition comprising
      1. a reciprocating bar, perpendicular to said slidable plate, for engagement and disengagement with said plate, and
      2. a like plurality of pins, extending outwardly perpendicular to said bar along the length thereof in the same direction, having an upstanding formed at the end of the respective pin, whereby the lugs can be received by said unique holes, and whereby when said circular disks are uniquely aligned with unique indicia on their rims, the unique holes of said disks are aligned along a common axis, whereby each of said lugs can enter the corresponding unique hole so that the reciprocating bar is disengaged from said plate,
   G. a generally U-shaped shackle having a central axis separating the toe end thereof from the heel end thereof, and having at the toe end thereof, a cross-sectional diameter (d1), along a plane (p1) parallel to said cross-sectional diameter (d1), a short distance from said toe end, a reduced cross-sectional diameter (d2), at the heel end thereof, a cross-sectional diameter (d3), and along a plane (p2) parallel to said cross-sectional diameter (d3), a short distance from said heel end, a reduced cross-sectional diameter (d4), and wherein said planes (p1) and (p2) are co-extensive and are perpendicular to said central axis, and wherein (d2)<(d1) and (d4)<(d3);
   H. second bolt means associated with said casing, for engagement with said shackle, said second bolt means having a generally flat rectangular shape and having a first opening including a circular hole having a diameter (d1) with sufficient tolerance to allow the free passage of the toe end of said shackle therethrough, and a radially extending slot having a width at least equal to the reduced cross-sectional diameter (d2), but less than the diameter (d1), so that said slot, upon engagement with said reduced cross-sectional diameter (d2), restrains movement of said shackle in a direction perpendicular to said second bolt means,
   a second opening including a circular hole having a diameter (d3) with sufficient tolerance to allow the free passage of the heel end of said shackle therethrough, and a radially extending slot having a width at least equal to the reduced cross-sectional diameter d4, but less than the diameter (d3), so that said slot, upon engagement with said reduced cross-sectional diameter (d4), restrains movement of said shackle in a direction perpen-
a first opening including a circular hole having a diameter \((d1)\) with sufficient tolerance to allow the free passage of the toe end of said shackle therethrough, and a radially extending slot having a width at least equal to the reduced cross-sectional diameter \((d2)\) (but less than the diameter \(d1\)) so that said slot, upon engagement with said reduced cross-sectional diameter \((d2)\), restrains movement of said shackle in a direction perpendicular to said bolt means, a second opening including a circular hole having a diameter \((d3)\) with sufficient tolerance to allow the free passage of the heel end of said shackle therethrough, and a radially extending slot having a width at least equal to the reduced cross-sectional diameter \((d4)\) (but less than the diameter \(d3\)) so that said slot, upon engagement with said reduced cross-sectional diameter \((d4)\), restrains movement of said shackle in a direction perpendicular to said bolt means, and whereby the first opening slot and the second opening slot are parallel to each other and extend from their respective holes in the same direction, and additional holes for the accommodation of the tumblers therewithin; and C. means for reciprocating said bolt means to lock and unlock said shackle.

3. The padlock as claimed in claim 2 wherein said reciprocating means C comprises
1. a casing for said padlock;
2. a first arm pivotally coupled to an axis of said casing, and adapted to be engaged by the toe end of said shackle when said shackle is in a closed position;
3. a second arm pivotally coupled to said casing axis, and adapted to engage an end of said bolt means; and
4. a torsion spring means coupled to said casing axis, having one end thereof adapted to be engaged by said first arm and having an opposite end thereof adapted to be engaged by said second arm, so that, upon closing said shackle: the toe end of said shackle rotates said first arm causing said second arm to be urged against said bolt means, and sliding said bolt means to restrain said shackle when said reduced cross-sectional diameters are aligned with said slots, and, so that, upon sliding said bolt means in the opposite direction, said shackle is unrestrained.

2. A padlock comprising
A. a generally U-shaped shackle having a central axis separating the toe end from the heel end thereof, and having at the toe end thereof, a cross-sectional diameter \((d1)\), along a plane \((p1)\) parallel to said cross-sectional diameter \((d1)\), a short distance from said toe end, a reduced cross-sectional diameter \((d2)\), at the heel end thereof, a cross-sectional diameter \((d3)\), and along a plane \((p2)\) parallel to said cross-sectional diameter \((d3)\), a short distance from said heel end, a reduced cross-sectional diameter \((d4)\), and wherein said planes \((p1)\) and \((p2)\) are co-extensive and are perpendicular to said central axis, and wherein \((d2)<(d1)\) and \((d4)<(d3)\).
B. bolt means for said shackle having a generally flat rectangular shape, said bolt means having
E. bolt means associated with said casing for engaging said slidable plate in a blocking condition comprising
1. a reciprocating bar, perpendicular to said plate, for engagement and disengagement with said plate, and
2. a like plurality of pins, extending outwardly perpendicular to said bar along the length thereof in the same direction, having an upstanding lug formed at the end of the respective pin, whereby the lugs can be received by said unique holes, and whereby when said circular disks are uniquely aligned with unique indicia on their rims, the unique holes of said disks are aligned along a common axis, whereby each of said lugs can enter the corresponding unique hole so that the reciprocating bar is disengaged from said plate, and when said circular disks are not uniquely aligned, one or more disks obstruct movement of one or more lugs, and, hence restrain movement of said reciprocating bar so that said plate is kept engaged by said reciprocating bar in a blocking condition.

5. A combination type padlock comprising
A. a plurality of circular disks, each having a central axial hole, each having indicia on the rim thereof, and each having a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another;
B. a generally rectangular housing for said disks, having slots at one face thereof for the rims of said disks to partially be exposed for manual manipulation thereof, and having at two opposite faces thereof, adjacent to said one face, a hole for alignment with said central axial holes;
C. spring pin means for engagement with said holes of said housing and said central holes of said circular disks, for holding said disks in said housing, said spring pin when retracted being flush with said two opposite faces, and said spring pin when normally extended being extended from said two opposite faces;
D. a casing for said padlock, including a cut-away portion for receiving said housing, said cut-away portion further including detent means so oriented as to receive said spring pin means when said housing is inserted therewithin, whereby said housing, with said disks and said spring pin means can be easily inserted into the cut-away portion of said casing, but cannot be easily removed therefrom.

6. In combination,
A. 10 circular disks, each having a central axial hole, and each having numerals from 0 through 9 designated on the rim thereof, and each having a single unique hole oriented a fixed distance from the respective axial hole so that each disk is unique from another, one disk having a unique hole associated with the numeral 2, another disk having a unique hole associated with the numeral 3, and so forth;
B. a generally rectangular housing for a limited number of selected ones of said ten disks, having slots corresponding to said limited number at one face thereof for the rims of said selected disks to be partially exposed for manual manipulations thereof;
C. means for retaining said selected disks within said housing so that said selected disks are rotatable about a common axis;
D. padlock casing means adapted to receive said housing so that said slots and the exposed rims of said limited number of disks are exposed to the user, and so that said housing, when received by said casing means, is flush with said casing means.

7. The invention as claimed in claim 6 wherein said limited number is four.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,823,584 Dated July 16, 1974

Inventor(s) Robert E. Gill

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 58, change "onr" to read --one--.
Column 12, line 4, after "means" insert a comma (,).
Column 13, line 15, the numeral "1" should read the letter --I--; line 65, the period (.) should read a semi-colon (;).
Column 14, lines 51-53, change "C" to --5.-- and indent the recited element so that it is aligned with the preceding elements 1 through 4; line 66, after "plate;" insert --and--.
Column 16, line 4, after "faces;" insert --and--: line 29, after "axis;" insert --and--.

Signed and sealed this 8th day of October 1974.

(SEAL)

Attest:

McCoy M. Gibson Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents