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2,673,457

EXPOSED SHACKLE COMBINATION PADLOCK

Filed Feb. 19, 1953

2 Sheets-Sheet 1

Fig. 1.

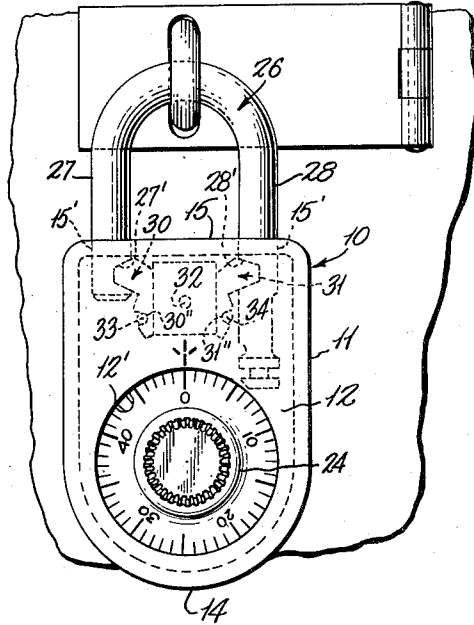


Fig. 2.

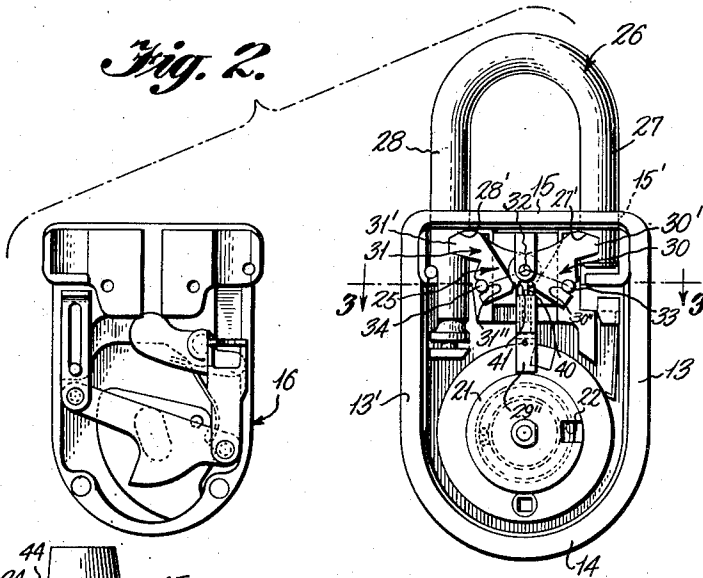
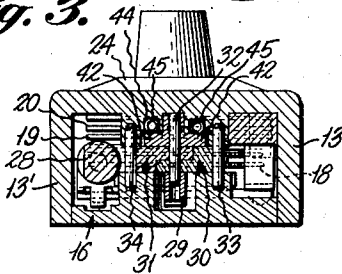


Fig. 3.



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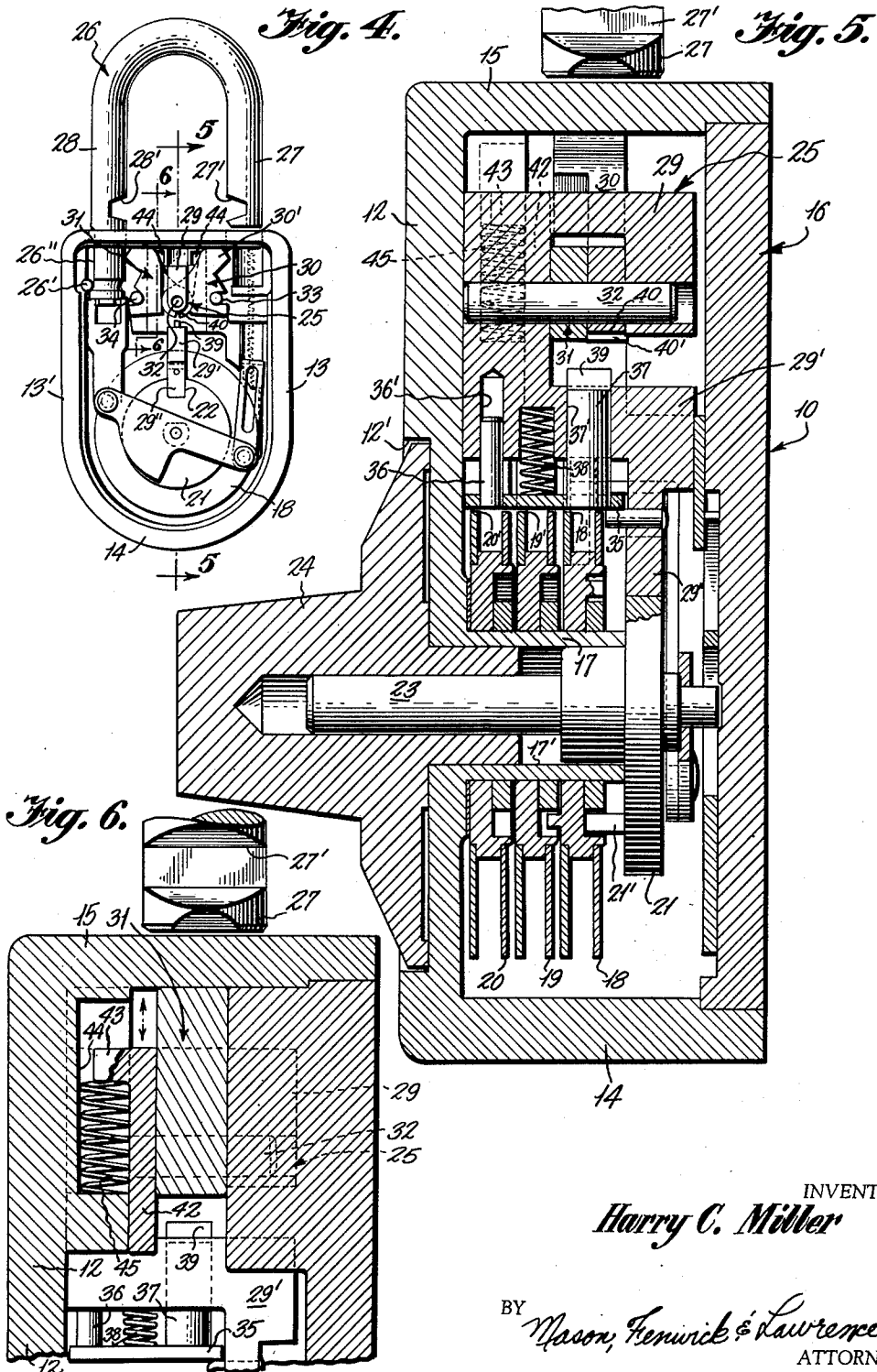
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EXPOSED SHACKLE COMBINATION PADLOCK

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8 Claims. (Cl. 70-25)

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The present invention relates in general to improvements in combination locks, and more particularly to exposed shackle padlocks of the combination lock type having means for improving the security thereof.

It is generally known that locks of the type commonly referred to as combination locks depend for their operation upon the alignment of a plurality of rotatable discs, commonly called tumblers, each of which is provided with a gating notch or recess. In conventional combination locks, the gating recesses of these tumblers must be aligned with a projecting element, called a fence, to permit the fence to seat in the gating recesses in order for the bolt or other locking element to be retracted into unlocking position. The peripheries of the tumblers when their gating recesses are out of alignment so limit movement of the fence that the bolt or locking element cannot be moved from locking position. It is common for these locks to be provided with three of such tumblers, and the security of the locks is dependent upon the fact that the number of orders or permutations of the possible relative positions of each tumbler before all the gating recesses come into register to give the correct combination is so large that the chance of the gating recesses being aligned by a person not familiar with the combination is so small as to be negligible.

The exposed shackle type padlocks have been modified to employ such combination lock operating mechanisms by providing a sliding carrier within the padlock casing which supports a pair of pivoted locking arms normally disposed in locking engagement with oppositely facing notches in opposite legs of the shackle. The locking arm carrier is normally so restricted in its sliding movement by the peripheries of the rotatable tumblers that the locking arms can not be withdrawn from locking engagement with the notches in the shackle. When, however, the gating recesses of the tumblers are aligned in registry with the fence portion of the locking arm carrier, the carrier may be projected into seating engagement with the gating recesses by exerting a withdrawing force on the shackle, the inward movement of the locking arm carrier toward the tumblers serving to withdraw the locking arms from seating engagement with the shackle notches to permit withdrawal of one end of the shackle from the padlock casing.

Conventionally the fence portion of the locking arm carrier is held in such position that it is slightly spaced from the outer peripheries of all of the tumblers. However, because of the difficulty in manufacture and slight inaccuracies resulting from mass production, it is almost impossible to manufacture all of the parts, including the tumblers, to such close tolerances that there will be the same slight difference in space between the

outer edges of the different tumblers and the fence portion. Accordingly, by very careful manipulation of the tumblers to a position such as the fence portion drops against the edge of the highest tumbler, a skilled person can detect when one of the gates is aligned with the fence by sense of touch or by the very minute sound or click produced. Then by continuing to manipulate the tumblers, the gate of the next highest tumbler can be aligned with the fence portion and, therefore, with the gate of the first tumbler, and so on, until the correct combination is found and the security of the lock is broken. Because of these defects, the security of the so-called combination locks against skilled persons has been limited.

A primary object of the present invention, therefore, is the provision of an exposed shackle padlock of the type having a combination lock actuating mechanism, which materially reduces the possibility of unauthorized persons detecting the combination for unlocking the lock.

Another object of the present invention is the provision of an exposed shackle padlock of the type having a combination lock operating mechanism, wherein novel means are provided for preventing detection by unauthorized persons of the location of the tumbler gating recesses thereof by sensing minute variations in the spacing between the tumbler peripheries and the fence portion of the lock.

Another object of the present invention is the provision of an exposed shackle padlock of the type having a combination lock actuating mechanism, in which manipulation of the dial for rotating the tumblers will not give any indication of the position of any of the tumbler gating notches.

Another object of the present invention is the provision of a novel exposed shackle padlock of the type having a combination lock actuating mechanism, wherein the pivoted locking arms are positively locked against withdrawal from the shackle locking notches when the tumbler gating notches are out of alignment and a withdrawing force is exerted on the shackle.

Other objects, advantages and capabilities of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings showing only one specific embodiment of the invention.

In the drawings:

Figure 1 is a front elevation of an exposed shackle padlock embodying the present invention, illustrating the same in locked condition in engagement with the locking hasp;

Figure 2 is an exploded rear elevation of an exposed shackle padlock embodying the present invention, showing the rear cover plate removed;

Figure 3 is a transverse horizontal section

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through the exposed shackle padlock, taken along the lines 3—3 of Figure 2;

Figure 4 is a rear elevation of the exposed shackle padlock with the rear cover plate removed, similar to the view of Figure 2, but showing the locking arms and carrier therefor in unlocked position;

Figure 5 is an enlarged vertical longitudinal section through the body of the exposed shackle padlock, taken along the lines 5—5 of Figure 4; and

Figure 6 is a section view taken along the lines 6—6 of Figure 4, illustrating further details of the mounting of the locking arm carrier in the padlock casing.

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, the exposed shackle padlock embodying the present invention is generally indicated by the reference character 10, and comprises a padlock casing 11 preferably formed of a body portion of a molded metallic material having a front wall 12, opposite side walls 13 and 13', and a curved bottom wall 14 and top wall 15, each forming continuous extensions of the side walls 13 and 13'. The casing is completed by a rear cover plate 16 which is adapted to be removably mounted on the back of the casing body by means of screws or other suitable connecting means.

Extending inwardly from the front wall 12 into a chamber defined by the front wall, the side walls 13, 13' and the top and bottom walls 14 and 15, is a hollow cylindrical boss 17, preferably formed integral with the front wall 12, about which are freely journaled a plurality of circular tumblers 18, 19 and 20 of conventional construction, each having a peripheral tumbler recess as indicated at 18', 19' and 20'. The tumblers 18, 19 and 20 are intercoupled in a conventional manner so that the forwardmost tumblers 20 and 19 are driven from the rearmost tumbler 18. A drive wheel 21 having a forwardly extending drive lug 21' for driving the rearmost tumbler 18, and having a peripheral gating recess 22, is fixedly mounted on a spindle 23 freely journaled for rotation within central bore 17' of the boss 17. The spindle 23 extends externally through the front face 12 of the padlock casing, and a dial 24 is fixedly mounted to the end of the spindle to permit the drive wheel 21 and the tumblers to be selectively positioned by rotation of the dial. Preferably a circular recess 12' is formed in the front face of the padlock casing to receive the circular dial portion of the dial 24.

A locking assembly 25 is slidably mounted within the padlock casing 11 in operative association with the tumblers 18, 19 and 20 and drive wheel 21, and with the exposed shackle 26. The shackle 26 is preferably in the form of a U-shaped rod formed of hardened steel having legs 27 and 28 extending into the chamber formed within the padlock casing 11 through circular openings 15' in the top wall 15 of the casing. The shackle 26 is mounted for rectilinear and rotatable movement relative to the casing and about the leg 28 by means of a fixed pin 25' in the casing interfitted with a longitudinal slot 26'' terminating at its lower end in a transverse peripheral slot portion. By this construction, the shorter leg 27 of the shackle can be withdrawn from the casing 11 and tilted relative to the leg 28 to an exposed position.

The locking assembly 25 comprises a locking arm carrier frame 29, preferably having a C-

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shaped form, slidably mounted for rectilinear movement within the padlock casing toward and away from the tumblers and drive wheel. A pair of locking arms 30 and 31 are pivotally mounted on a pivot pin 32 having its ends supported in opposite frame members of the carrier frame 29. The locking arms 30 and 31 are provided with dogging elements 30' and 31' at their ends remote from the pivot pin 32 adapted to fit into complementary notches 27' and 28' of the legs 27 and 28 of the shackle to lock the shackle with the ends of both legs thereof within the padlock casing 11. The position of the locking arms 30 and 31 for a given location of the carrier frame 29 is controlled by fixed camming pins 33 and 34 supported in the front wall 12 of the casing 11 and seated in semi-circular recesses 31'' and 32'' in the locking arms 30 and 31. The pins 33 and 34 are so located that when the carrier frame 29 is in its uppermost position as illustrated in Figure 2, the locking arms are canted outwardly by the pivot pin 32 and fixed pins 33 and 34 into seating engagement with the notches 27', 28'.

The lowermost horizontal arm 29' of the carrier frame 29, as viewed in Figure 5, serves as the fence portion of the carrier frame, and is provided with an integral downwardly extending finger 29'' disposed rearwardly of the rearmost tumbler 18 to be selectively brought into seating relation within the gating recess 22 of the drive wheel 21. The fence portion 29' of the carrier frame 29 carries interlock means for preventing pivotal movement of the locking arms 30 and 31 out of engagement with the shackle notches 27', 28' when the tumbler recesses 18', 19' and 20' are out of alignment with the fence portion 29'. This interlock means comprises a contact bar 35 slidably supported for rectilinear movement toward and away from the fence portion 29' of the carrier frame 29 by means of a pair of guide pins 36 and 37, the end of the guide pin 36 being disposed within a complementary circular recess 36' extending into the carrier frame 29 and the guide pin 37 which also serves as an interlocking pin being disposed in a circular aperture 37' extending entirely through the lower arm 29' of the carrier frame.

A coil spring 38 is also fixedly mounted to the contact bar 35 between the two guide pins 36 and 37, and extends into a recess 38' in the carrier frame 29. The spring 38 serves to resiliently maintain the contact bar 35 a selected distance below the fence portion 29' of the carrier frame at a position spaced slightly above the peripheries of the tumblers 18, 19 and 20 when the carrier frame 29 is at the uppermost limits of its sliding movement. An interlocking key portion 39 is formed at the upper end of the guide pin 37 in the portion extending into the hollow of the C-shaped carrier frame 29. The key portion 39 of the pin 37 is designed to be projected into notches 40 and 41 in the locking arms 30 and 31 located adjacent the pivot pin 32, when the contact bar 35 is urged toward the fence portion 29' against the resilient bias of the coil spring 38. Shoulders 40' and 41' forming one terminal wall of each of the notches 40 and 41 are so positioned as to engage the sides of the key portion 39 of pin 37 when the same is projected in the notches and the locking arms 30 and 31 are in locking position, to prevent rotation of the dogging elements 30', 31' of the locking arms toward each other when a manual withdrawing force is applied to the shackle 26.

The finger 29'' of the carrier frame 29 is also

of such a length in respect to the position of the drive wheel periphery that the end of the finger 29' engages the outer periphery of the drive wheel 21 when the carrier frame is urged in that direction before the contact plate 35 comes into contact with the peripheries of tumblers 18, 19 and 20. Therefore the dial 24 must be rotated to the preselected position to dispose the drive wheel gate 22 in registry with the finger 29' before the contact bar 35 can be brought into contact with the tumbler peripheries.

A supporting panel 42 is formed in the forward portion of the carrier frame 29, and is provided with a pair of lugs 43 extending into vertical guideways 44 formed in the front wall 12 of the padlock casing 11, to guide the carrier frame 29 along a radial axis relative to the center of the tumblers and drive wheel, and a pair of compression springs 45 are disposed below the guide lugs 43 within the guideways 44 to resiliently urge the carrier frame 29 toward its uppermost limit of travel.

The operation of the exposed shackle combination padlock is as follows. The carrier frame 29, when the padlock is in locked condition as illustrated in Figures 1 and 2, is maintained by the upward pressure of the springs 45 on the carrier guide lugs 43 at the uppermost limit of its movement, with the dogging elements 30', 31' of the locking arms 30, 31 spread outwardly into seating engagement with the shackle notches 27', 28' by camming interaction of the camming pins 33, 34 and pivot pin 32. The contact bar 35 is held by the coil spring 38 out of contact with the peripheries of the tumblers 18, 19 and 20, and the lower end of the finger 29' on the carrier frame 29 is spaced slightly above the periphery of the drive wheel 21.

The dial 24 is then rotated in a selected manner to the positions making up the combination of the padlock, to position the recesses 18', 19' and 20' of the tumblers 18, 19 and 20 in registry with the fence portion 29' and contact bar 35 of the carrier frame 29. The dial is then rotated through less than one revolution in a preselected direction to a position disposing the gate 22 of the drive wheel 21 in alignment with the finger 29' on the carrier frame 29. Manual pressure on the shackle 26 tending to withdraw the same, through camming interaction between the divergent walls of the notches 27', 28' and the locking arms 30 and 31, forces the carrier frame 29 downwardly against the bias of the springs 45 to seat the contact bar 35 and fence portions 29' and 29'' in the tumbler and drive wheel recesses. During this movement, the movement of the locking arm pivot pin 32 with respect to the fixed camming pins 33 and 34 effects complete withdrawal of the dogging elements 30', 31' from the notches of the shackle 26. Since the tumbler recesses are in alignment with the contact bar 35, the contact bar is not shifted inwardly toward the frame 27 so that the key portion 39 of the interlock pin 37 remains below the locking arms 30 and 31 and out of contact with the shoulders 40', 41' of the locking arm.

If the tumbler recess of any of the tumblers 18, 19 or 20 is out of alignment with the contact bar 35 and carrier frame fence portion 29' when withdrawing pressure is exerted against the shackle 26, the contact bar 35 engages the periphery of the misaligned tumbler, so that further downward movement of the contact frame 29 forces the contact bar 35 upwardly against the bias of the spring 38 to project the interlock key 39 on

the pin 37 into the notches 40, 41 of the locking arms. In this position, withdrawing pressure on the shackle can not cam the locking arm dogging elements 30', 31' out of the shackle notches 27', 28', since slight rotary movement of the locking arms brings the shoulders 40', 41' on the notches 40, 41 thereof into engagement with opposite sides of the interlock key 39 preventing further rotation of the locking arms toward each other.

The provision of the intermediate contact bar 35 and guide pins therefor, together with the interlocking shoulders 40', 41' of the locking arms, prevents detection by sense of touch or sound of imperfections in the tumbler recesses and tumbler peripheries, since the contact bar 35 can only move on a radial axis of the tumblers, and the drive wheel is locked against rotation of the dial before the contact bar 35 engages the tumbler peripheries by prior seating of the finger 29' in the drive wheel recess 21', and markedly improves the security of such exposed shackle padlocks against unauthorized opening.

While but one particular embodiment of the invention has been particularly shown and described, it is distinctly understood that the invention is not limited thereto but that various modifications may be made in the invention without departing from the spirit and scope thereof, and it is desired, therefore, that only such limitations shall be placed thereon as are set forth in the appended claims.

What is claimed is:

1. In an exposed shackle combination padlock including fence means having locking members carried thereby, said fence means being reciprocally movable to shift the locking members into and out of locking engagement with the shackle, and combination tumblers having peripheral recesses to receive said fence means and permit retraction of said locking members from locking position, interlock means associated with said fence means comprising stop means on said locking members and a slidable member resiliently carried by said fence means to contact the tumbler peripheries in advance of said fence means and be projected by such contact toward said locking members into interlocking engagement with said stop means to prevent unlocking movement of said locking members.

2. In an exposed shackle combination padlock including fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with the shackle, and combination tumblers having peripheral recesses to receive said fence means and permit retraction of said locking arms from locking position, interlock means associated with said fence means comprising stop means on said locking arms, a slidable member carried by said fence means, and means resiliently supporting said slidable member to contact the tumbler peripheries in advance of said fence means during movement thereof toward said tumblers and project said sliding member by such contact into interlocking engagement with said stop means to prevent unlocking movement of said locking arms.

3. In an exposed shackle combination padlock including fence means having locking arms pivotally supported thereon, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with the shackle, and combination tumblers having peripheral recesses to receive said

fence means and permit retraction of said locking arms from locking position, interlock means for prevention of detection of the combination comprising stop means on said locking arms, a slidable locking member resiliently carried by said fence means, and means supporting said locking member to contact the tumbler peripheries in advance of said fence means and be projected by such contact into position to intercept said stop means on rotation of said locking arms and prevent further unlocking movement thereof.

4. In a combination padlock of the exposed shackle type including a shackle, fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with said shackle, and a plurality of peripherally recessed tumblers normally disposed to prevent locking arm retracting movement of said fence means and having peripheral recesses alignable with said fence means to receive the same and permit sufficient movement of the fence means to retract said locking arms, interlock means associated with said fence means to prevent unlocking movement of said locking arms when the tumbler recesses are in non-registry with said fence means comprising stop means on said locking arms, a slidable member carried by said fence means in overlying relation to said tumblers, and means resiliently supporting said slidable member to contact the tumbler peripheries in advance of said fence means during movement thereof toward said tumblers and project said sliding member by forward contact into interlocking engagement with said stop means to prevent unlocking movement of said locking arms.

5. In a combination padlock of the exposed shackle type including a shackle, fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with said shackle, and a plurality of peripherally recessed tumblers normally disposed to prevent locking arm retracting movement of said fence means and having peripheral recesses alignable with said fence means to receive the same and permit sufficient movement of the fence means to retract said locking arms, means associated with said fence means to prevent unlocking movement of said locking arms when said tumbler recesses are in non-registry with said fence means comprising stop means on said locking arms, a slidable interlock member resiliently carried by said fence means in overlying relation to said tumblers, and means supporting said interlock member to contact the tumbler peripheries in advance of said fence means and be projected by such contact into position to intercept said stop means of said locking arms on rotation thereof and prevent further unlocking movement of said locking arms.

6. In a combination padlock of the exposed shackle type including a shackle, fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with said shackle, and a plurality of peripherally recessed tumblers normally disposed to prevent locking arm retracting movement of said fence means and having peripheral recesses alignable with said fence means to receive the same and permit sufficient movement of the fence means to retract said locking arms,

means associated with said fence means to prevent unlocking movement of said locking arms when said tumbler recesses are in non-registry with said fence means comprising stop means on said locking arms located adjacent the pivotal support therefor, a slidable interlock member carried by said fence means and having a contact element overlying said plurality of tumblers and a projecting element juxtaposed to said stop means, and means supporting said interlock member to dispose said contact element in contact with the tumbler peripheries in advance of said fence means on movement of said fence means toward said tumblers and advance said projecting element into intercepting relation with said stop means on said locking arms to prevent further unlocking rotation thereof.

7. In a combination padlock of the exposed shackle type including a shackle, fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with said shackle, and a plurality of peripherally recessed tumblers normally disposed to prevent locking arm retracting movement of said fence means and having peripheral recesses alignable with said fence means to receive the same and permit sufficient movement of the fence means to retract said locking arms, interlock means associated with said fence means comprising contact means resiliently carried by said fence means and overlying said tumblers to engage the same in advance of said fence means, projecting means advanced toward said locking element by engagement of said contact means with a tumbler periphery on movement of said fence means toward said tumblers, and means on said locking arms to be interlocked with said projecting means on projection of the same toward said locking arms to prevent unlocking movement of said arms.

8. In a combination padlock of the exposed shackle type including a shackle, fence means having a pair of locking arms pivotally carried thereby, said fence means being reciprocally movable to shift the locking arms into and out of locking engagement with said shackle, and a plurality of peripherally recessed tumblers normally disposed to prevent locking arm retracting movement of said fence means and having peripheral recesses alignable with said fence means to receive the same and permit sufficient movement of the fence means to retract said locking arms, means associated with said fence means to prevent unlocking movement of said locking arms when said tumbler recesses are in non-registry with said fence means comprising contact means slidably mounted on said fence means and overlying said plurality of tumblers, means resiliently supporting said contact means to engage said tumbler peripheries before said fence means are disposed to contact said tumblers, a projecting key carried by said contact means to be advanced toward said locking arms when said fence means is moved toward said tumblers and said contact means engages a tumbler periphery, and each of said pivoted locking arms having notches facing said key to receive said key when the same is advanced toward said notches and prevent further unlocking rotation of said locking arms.

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No references cited.