The present invention relates in general to combination resetting means for combination locks, and more particularly to a combination lock of the exposed shackle padlock type having a facility for preventing access to the tumblers for resetting the combination or observance of the movement of the tumblers to achieve unauthorized unlocking of the lock at all times except when the lock has been unlocked and specially adjusted by persons having knowledge of the combination.

In combination locks of the general type herein involved having a plurality of rotary tumblers driven from an exposed dial, the combination can be reset at any time by inserting a combination changing key from externally of the locking housing through an opening usually provided in the rear cover plate of the housing and into openings in the tumblers which are aligned with the key opening in the rear cover plate when the tumblers are in a predetermined position. The insertion of the combination changing key into the openings provided therefor in the tumblers effects a release of the outer annular disk portion of the tumblers of conventional construction from their inner hub portion by which the tumblers are driven, so that the position of the inner hub portions of the tumblers relative to their outer annular disk portions may be reset to any desired combination by turning the dial and driving cam. Since padlocks of the type having exposed shackles are designed to beUsually coupled through a hasp staple, the lock housing is exposed and freely available to persons having knowledge of the general structural features of this type of lock can fairly readily detect the combination of the lock by insertion of small pieces of material such as shim stock through the exposed combination changing key opening and thereby gain unauthorized admission to the locked enclosure.

It has herefore been proposed as an expedient to prevent such unauthorized admission to the interior of the lock housing and observance of the movement of the tumblers to provide a pivoted plate or similar member which is normally spring biased to a position covering the combination changing key opening, but this variation has proved generally unsatisfactory because the guard plate for the combination changing key opening which is usually pivoted to the lock housing cover plate adjacent one end of the guard plate can be readily punched out from covering relation with the combination changing key opening or shifted sufficiently to permit access of shim stock or other small instrumentalities through the combination changing key opening and into the interior of the lock housing.

An object of the present invention therefore is the provision of novel guard means for closing the rear cover plate opening of a combination lock housing through which the combination resetting key is inserted to prevent access to the resetting key opening or observation of the tumblers movement at all times except when the lock has been unlocked and expressly conditioned to permit changing of the combination.

Another object of the present invention is the provision of a novel guard means for the resetting key opening in combination padlocks for maintaining the opening covered against access except when the lock has been unlocked and expressly conditioned for combination resetting, which guard means is of simple construction of few parts which can be economically manufactured and which is so integrated with the rear cover plate of the padlock housing as to effectively resist forcing of the guard means from covering relation with the resetting key opening.

Another object of the present invention is the provision of a novel guard mechanism for the resetting key opening in combination padlocks wherein the location of the resetting key opening in the padlock cover plate is concealed by the guard means to further resist unauthorized access to the interior of the padlock housing.

Another object of the present invention is the provision of a novel guard mechanism for preventing key opening in combination padlocks to prevent access to the resetting key opening except when the padlock has been unlocked and expressly set for combination resetting, which mechanism requires no increase in the size of the padlock housing or in any way disturbs the relationship between the fence and tumbler mechanism or other parts of the lock assembly.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawing showing only a preferred embodiment of the invention.

In the drawing:
Figure 1 is a rear elevation of an exposed shackle combination padlock embodying the present invention, parts of the padlock housing being broken away to illustrate the internal construction thereof.
Figure 2 is a vertical longitudinal section view of the combination padlock, taken along the lines 2-2 of Figure 1.
Figure 3 is a horizontal transverse section view of the padlock taken along the lines 3-3 of Figure 1.
Figure 4 is an exploded perspective view of the two interconnected rotary elements forming the resetting opening guard means of the present invention.

Referring to the drawing wherein like reference characters designate corresponding parts throughout the several views, the structure embodying the preferred embodiment of the present invention comprises a combination padlock generally indicated at 10 having a lock housing 11 including a front wall 12, side walls 13, curved bottom wall 14 and top wall 15, all integrally formed with the front wall 12 to produce a rearwardly opening body. The top wall 15 is formed with a pair of laterally spaced circular openings 16 located adjacent the side walls 13 for receiving the legs of the usual U-shaped shackle 17 when the padlock is in locked condition. In accordance with conventional practice, one of the legs of the shackle 17 is slidably connected with the housing 11 so as to permit reciprocal movement of the shackle while the other leg always remains within the housing 11 while the end of the opposite leg of the shackle 17 when the shackle is shifted to its outermost position relative to the housing 11 clears the outer surface of the top wall 15 permitting the shackle to be rotated about the axis of the leg which is retained within the housing 11.

To prevent tampering with the internal mechanism of the padlock by insertion of shim stock or other very thin instrumentalities through the shackle-receiving openings
in the top wall 15, an integral shelf member 18 projects inwardly from one of the side walls 13 to underlie the shackle-receiving opening 16 for the shackle leg which can be completely withdrawn from the housing 11, and integral arcuately curved walls 19 project inwardly from both side walls 13 along a circular path concentric with the axis of the rotary lock mechanism to be described, to a point near the medial longitudinal plane of the lock housing so as to provide a narrow opening between the inner ends of the walls 19 lying in the medial longitudinal plane of the housing. The walls 19 thereby provide a substantially complete protective enclosure about the cylindrical tumblers chamber 20 in the lock housing 11.

The padlock housing 11 is also provided with a removable rear cover plate 21 which is attached to the side, bottom and top walls of the lock housing in any suitable manner.

Journalled in the front wall 12 of the padlock housing is an arbor 22 which has fixed on the front end thereof of the usual dial 23 which is disposed in accordance with conventional practice in overlying relation to the front wall 12 of the padlock housing, the dial 23 being rotatable to turn the arbor 22 and thereby control movement of the usual tumblers. The arbor 22 supports the usual driving cam 24 in fixed relation to the arbor at a point near the inner end of the arbor, the driving cam 24 being provided with the usual peripheral notch 25 for cooperation with the fence to be referred to hereinafter. The reference character 26 designates several tumblers which are constructed in the usual manner with outer annular disks 26′ and inner annular hubs 26″ rotatably supported on a tubular boss 27 integral with and projecting rearwardly from the front wall 12 of the padlock housing. The tubular boss 27 also serves as the bearing in which the arbor 22 rotates. The outer annular disk portions 26′ of the tumblers 26 are provided with the usual peripheral recesses for receiving the fence 28 for operation in the usual fashion of tumbler combination locks in which the dial is turned in opposite directions alternately for predetermined numbers of turns until the peripheral recesses of all the tumblers are in alignment to release the fence and permit movement thereof to unlock the shackle. The tumblers 26 are therefore provided with the usual lost motion connection and the driving cam 24 has a conventional inwardly extending driving pin which engages a stop member on the rearmost tumbler 26 to drive the rearmost tumbler on rotation of the dial 23 and through the lost motion interconnection between the rearmost tumblers of all the tumblers achieve rotation of all of the tumblers.

The tumblers 26 are mounted between the driving cam 24 and the front wall 12 of the padlock housing with their circular edges adjacent to the curved bottom wall 14 of the housing so that the parts can be arranged compactly and occupy a minimum of space. The tumblers cooperate with the fence member 28 which is mounted above the tumblers and is reciprocally slidable in suitable guideways 29 in the direction of the longitudinal medial axis of the housing to bring the lower leg of the fence member which extends laterally over the width of all of the tumblers 26 into contact with the tumblers. A plurality of coil springs 30 are disposed in the guideways 29 and bear upon projecting shoulders of the fence member 28 to urge the fence toward the top wall 15 out of contact with the tumblers 26. The fence member 28 is likewise provided with a downwardly projecting nose 31 operatively associated with the driving cam 24 and carries pivotally supported pair of locking arms 32 having outwardly directed locking portions positioned by the fixed pins 33 on the front housing wall 12 received in suitable notches in the locking arms 32 seated in the notches 17′ of the shackle 17 and lock the shackle.

When the dial 23 has been rotated in accordance with a preselected combination to align the peripheral recesses of the tumblers 26 with the fence member 28 and the driving cam notch 25 is aligned with the downwardly projecting nose 31 on the fence, the downwardly directed pressure on the shackle 17 pivots the locking portions of the locking arms 32 inwardly toward each other about the fixed pins 33, and since the tumbler and driving cam recesses are aligned with the fence to receive the fence, the fence may be projected downwardly against the bias of the coil springs 30 to seat in the notches 17′ to lock the shackle 17 for sliding movement outwardly of the lock housing. If the tumbler recesses are not aligned with the fence member 28, the periphery of the non-aligned tumbler will intercept downward movement of the fence 28 and prevent sufficient movement of the fence to permit the locking arms 32 to pivot free of the shackle notches 17′.

The parts thus far described are substantially conventional except for the protective shelf 18 and walls 19 of the lock housing and correspond to the conventional padlock structure exclusive of the security interlock features described in my earlier Patent No. 2,673,658 granted March 30, 1954. This application has to do specifically with mechanism which prevents observance of the movement of the tumbler mechanism or gaining access to the tumbler chamber for resetting the tumbler combination except when the lock has been unlocked and reset to a special combination resetting position so that the combination ca be reset by either of two persons designated by someone who does not know the existing combination.

The construction of the tumblers 26 and the manner in which the outer annular disks 26′ of each tumbler are disconnected from the hub portion 26″ to permit resetting of the combination forms no part of this invention, it being understood that the outer annular disks 26′ are disconnected from the hubs 26″ for resetting the combination by inserting a key through an opening 34 in the rear cover plate 21 and through corresponding openings in the outer annular disks 26′ of the tumblers which are aligned with the key opening in the cover plate when the tumblers are all moved to a predetermined combination resetting position. To prevent access to the resetting key opening 34 in the rear cover plate 21 and to prevent resetting the combination by unauthorized persons, there is provided a movable guard mechanism indicated generally by the reference character 35 having components located over the inner and outer faces of the rear cover plate 21 in the path of the resetting key which must be inserted through the key opening 34 to change the combination so as to completely block the key opening 34 and prevent access to the tumbler chamber and the outer annular disks 26′ of the tumblers indicated by the key opening. This guard mechanism comprises an outer circular disk 36 and an inner circular disk 37 disposed over the outer and inner faces, respectively, of the rear cover plate 21 in concentric relation with the axis of the arbor 22. The innermost end of the arbor 22 is provided with an integral portion 39 of reduced diameter which is received in a central aperture 39 in the innermost guard disk 37 and in a complementary aperture in the rear cover plate 21 journauling the inner end of the arbor. The outer and inner guard disks 36 and 37 are rigidly held together for rotation as a unit by a pair of rivets 40 interconnecting the two disks and extending through arcuate slots 41 in the rear cover plate 21. The outer guard disk 36 is provided with an annular peripheral flange 42 projecting inwardly of the disk and the rear cover plate 21 is provided with an annular recess 43 to accommodate the outer guard disk 36 so that the outer surface therein 44 and carries pivotally supported pair of locking arms 32 having outwardly directed locking portions positioned by the fixed pins 33 on the front housing wall 12 received in suitable notches in the locking arms 32 seated in the notches 17′ of the shackle 17 and lock the shackle.

When the dial 23 has been rotated in accordance with a preselected combination to align the peripheral recesses
edge portion of the fence when the guard mechanism is within its normal position preventing access to the resetting key opening 34. The flange 44 is also provided with a combination resetting gate 46 which is spaced from the gate 45 and may be selectively brought into alignment with the fence 28 and permit reciprocation of the fence when the combination is to be reset. The fence, as will be observed in Figure 2, is provided with a recess 47 in the rearmost portion of the fence which is forced into alignment with the flange 44 when the fence is seated in the aligned recesses of the tumblers and driving cam in unlocked condition. This recess 47 is of sufficient depth to receive the flange 44 and thereby permit rotation of the gate therefrom, a rectilinearly reciprocable fence operatively associated with said tumblers and driving cam, and

means holding said driving cam against rotation when said fence is out of locking position, of a guard mechanism comprising a pair of relatively fixed circular disks disposed over the inner and outer surfaces of said driving cam, and in relation with said wall opening for normally blocking said wall opening, said disks having inwardly projecting annular peripheral flanges and aligned resetting key openings therein disposed out of registry with said wall openings when said disks are in a guard position, means pivotally supporting said disks on said wall for rotation about their axes from said guard position to a combination resetting position, the peripheral flange on the innermost of said disks having gates therein receiving said fence to permit reciprocation thereof between locking and unlocking positions only when said disks are in said guard position and said reseting position, means bounding said gates for engaging said fence to prevent rotation of said disks when said fence is in locking position, and said fence having a recess therein disposed to receive the flange of said innermost disk and permit rotation of said disks only when said fence is in unlocking position.

2. In a combination lock, the combination with a lock housing including a wall having a combination resetting key opening therein, rotatable tumblers, a driving cam therefrom, and a fence operatively associated with said tumblers and driving cam, of a guard mechanism comprising a pair of cover plates held together against relative movement and rotatably mounted on said wall, said cover plates being disposed over the inner and outer surfaces of said wall in covering relation with the wall opening for normally blocking both the entrance and exit of said wall opening, said plates having aligned resetting key openings therein normally spaced out of alignment with said wall opening, means projecting from one of said plates for engaging said fence upon attempted rotation of said cover plates from said blocking position when said fence is in locking position to prevent rotation of said plates, said fence having a relieved portion for receiving said projecting means when said fence is in unlocking position to permit rotation of said plates to align the openings therein with said wall opening, and said pair of cover plates having means releasing said fence for return to locking position when said cover plates are positioned with their openings in alignment with said wall opening.

3. In a combination lock, the combination with a lock housing including a wall having a combination resetting key opening therein, rotatable tumblers, a driving cam therefrom, and a fence operatively associated with said tumblers and driving cam, of a guard mechanism comprising a pair of relatively fixed circular disks disposed over the inner and outer surfaces of said wall in covering relation with said wall opening for normally blocking said wall opening, said disks each having inwardly projecting annular peripheral flanges and aligned resetting key openings therein disposed out of registry with said wall openings when said disks are in a guard position, the outer surface of said wall having an annular recess therein complementary to said annular peripheral flanges to receive the flange of the outermost one of said disks seated therein, means pivotally supporting said disks on said wall for rotation about their axes from said guard position to a combination resetting position wherein the openings in said disks are aligned with said wall opening, the flange of said innermost disk having spaced radial grooves for receiving said fence to permit movement of said fence relative to said disks between locking and unlocking positions when said disks are in said guard position and said reseting position, means interlocking said flange of said innermost disk with said fence to restrain the latter against movement relative to said disks at all times of said disks between said guard position and said reseting position when said fence is in unlocking position, said flange of said innermost disk having means bounding said guides to engage said fence for preventing rotation.
of said disks when said fence is in locking position, and said fence having means permitting rotation of said disks about their axes when said fence is in unlocking position.

4. In a combination padlock, the combination with a padlock housing including a wall having a combination resetting key opening therein, rotatable tumblers, a driving cam therefor, a rectilinearly reciprocable fence operatively associated with said tumblers and driving cam, and means holding said driving cam against rotation when said fence is out of locking position, of a guard mechanism comprising a pair of aligned parallel relatively fixed circular disks disposed over the inner and outer surfaces of said wall in covering relation with said wall opening for normally blocking said wall opening, said disks having aligned resetting key openings therein disposed out of registry with said wall opening when said disks are in a guard position, means pivotally supporting said disks on said wall for rotation about their axes from said guard position to a combination resetting position, the axes of said disks being disposed in the plane of movement of said fence perpendicular to the direction of movement thereof, the innermost disk having peripheral radial guideways therein for receiving said fence to permit reciprocation thereof between locking and unlocking positions only when said disks are in said guard position and said resetting position, said innermost disk having means on the periphery thereof adapted to interlock with said fence at all positions of said disks between said guard position and said resetting position when said fence is in unlocking position to hold said fence against movement from said unlocking position, means bounding said guideways for engaging said fence to prevent rotation of said disks when said fence is in locking position, and said fence having means to permit rotation of said disks when said fence is in unlocking position.

5. In a combination shackle padlock, a lock housing including a wall having a combination resetting opening therein, rotatable tumblers, a driving cam therefor, and a fence operatively associated with said tumblers and driving cam for rectilinear reciprocal movement along a radial axis of said tumblers and having an elongated rearwardly projecting rib extending along said radial axis, said fence locking said driving cam against rotation when said fence is in unlocking position, a guard mechanism rotatably mounted on said wall having covering means blocking both the entrance and exit of said wall opening when said mechanism is in guard position, said guard mechanism having aligned resetting key openings therein disposed out of alignment with said wall opening, means for rotating said guard mechanism to a combination resetting position disposed said openings therein in registry with said wall opening, inwardly projecting means on said guard mechanism preventing reciprocation of said fence between shackle locking and unlocking positions at all positions of said guard mechanism except said guard and resetting positions and having guideways interfitting with said rib of said fence for permitting reciprocation of said fence between said shackle locking and unlocking positions when said guard mechanism is in said guard and resetting positions, said inwardly projecting means having shoulders disposed adjacent the lateral surfaces of said rib when said rib is interfitted with said guideways for barring rotation of said guard mechanism when said fence is in shackle locking position, and said fence rib having a rearwardly opening recess disposed to receive said inwardly projecting means when said fence is in shackle unlocking position for releasing said guard mechanism for rotation, whereby said guard mechanism may be rotated to align all of said resetting key openings when said lock is unlocked and said lock may be relocked when said openings are disposed in alignment to free said driving cam for rotation to reset the tumbler combination.

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