

Sept. 23, 1958

H. C. MILLER

2,852,928

COMBINATION LOCK ACTUATING MECHANISM

Filed Nov. 23, 1955

Fig. 1.

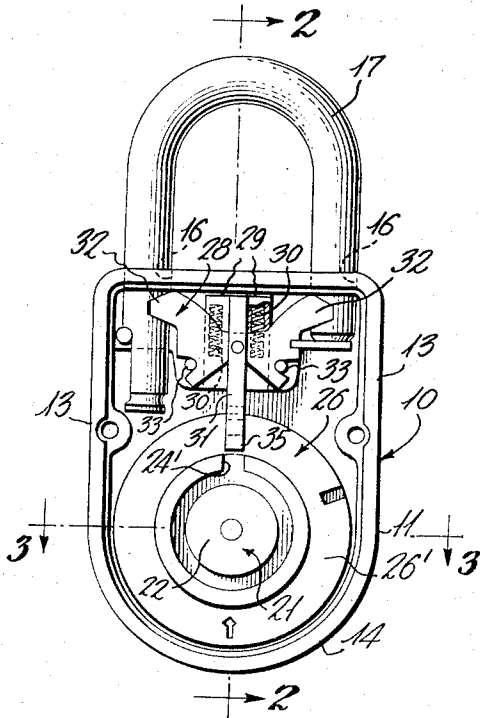


Fig. 2.

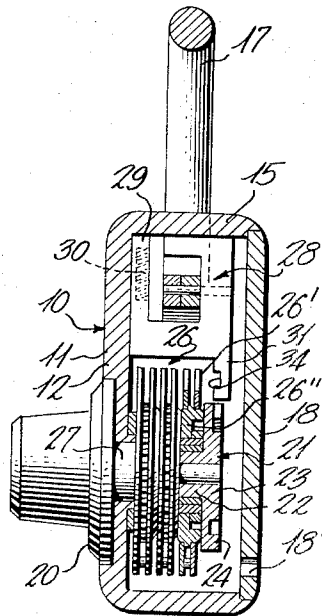


Fig. 3.

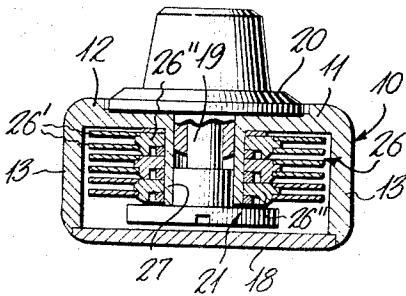
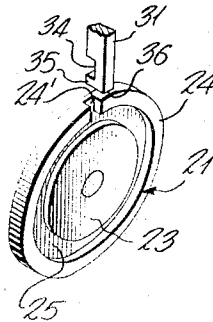


Fig. 4.



INVENTOR

Harry C. Miller

BY

Mason, Fenwick & Lawrence
ATTORNEYS

2,852,928

COMBINATION LOCK ACTUATING MECHANISM

Harry C. Miller, Rochester, N. Y.

Application November 23, 1955, Serial No. 548,699

4 Claims. (Cl. 70—303)

The present invention relates in general to exposed shackle padlocks, and more particularly to actuating mechanisms for padlocks of the combination type.

In combination locks of the general type herein involved having a plurality of rotary tumblers driven through a driving cam from an exposed dial, the combination can be reset at any time by inserting a combination changing key from externally of the lock 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.

In many locks of this type wherein a reciprocative fence or bolt is projectable into an accommodating peripheral recess or gate in the driving cam to effect unlocking of the lock, the lock must be returned to locked condition after the combination changing key is inserted into the tumblers to free the driving cam for rotation so that the driving cam can adjust the tumbler hub portion to establish the new combination, since the fence or bolt seated in or interlocked with the driving cam prevents rotary adjustment of the cam until withdrawn therefrom.

An object of the present invention is the provision of a novel exposed shackle padlock of the combination lock type having improved security and operation characteristics.

Another object of the present invention is the provision of a novel mechanism for interrelating control of a plurality of peripherally gated tumblers and a reciprocating shackle controlling fence in an exposed shackle combination padlock.

Another object of the present invention is the provision of a novel driving cam construction for exposed shackle combination padlocks cooperating with the fence in a novel manner to facilitate changing of the lock combination.

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

Figure 1 is a rear elevation of an exposed shackle combination padlock embodying the present invention, with the cover plate removed;

Figure 2 is a vertical longitudinal section view of the combination padlock, taken along the line 2—2 of Figure 1;

Figure 3 is a horizontal transverse section view of the padlock taken along the line 3—3 of Figure 1; and

Figure 4 is a perspective view of the driving cam and

a portion of the fence employed in the combination padlock.

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 one leg always remains within the housing 11. 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.

The padlock housing 11 is also provided with a removable rear cover plate 18 which is attached to the side, bottom and top walls of the lock housing in any suitable manner and has a combination change key opening 18' therein.

Journalled in the front wall 12 of the padlock housing is an arbor 19 which has fixed on the front end thereof the usual dial 20 which is disposed in accordance with conventional practice in overlying relation to the front wall 12 of the padlock housing, the dial 20 being rotatable to turn the arbor 19 and thereby control movement of the usual tumblers. The arbor 19 supports a unique driving cam 21 in fixed relation to the arbor at a point near the inner end of the arbor. The driving cam 21 is of unique form in that it is formed of a disk portion 22 keyed to the arbor 19 having an integral rearwardly projecting hub portion 23 centrally disposed thereon and an annular peripheral flange 24 projecting rearwardly from the margin of the disk portion and spaced from the hub portion 23 to define an annular groove 25 therebetween. A slot 24' is formed through the flange 24 at one circumferential point along the periphery of the driving cam 21 to form a guideway accommodating a fence, to be later described, for reciprocative movement radially of the cam 21.

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 19 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 21 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 20 and through the lost motion interconnection between the rearmost tumbler and the rest of the tumblers achieve rotation of all of the tumblers.

The tumblers 26 are mounted between the driving cam

21 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 leg 31 operatively associated with the driving cam 21 and carries a 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 to seat in the notches 17' of the shackle 17 and lock the shackle.

The downwardly projecting leg 31 of the fence member 28 is formed in the edge thereof facing the tumblers 26 with a recess 34 complementary to the cross section of the annular flange 24 on the driving cam 21 to slidably receive the flange 24 therein. This recess 34, spaced above the lower end of the fence leg 31, produces a hook formation 35 at this lower end having a nose 36 adapted to project into the annular groove 25 in the driving cam 21 and ride therein underlying the flange 24 when the slot 24' is out of alignment with the fence 28.

When the dial 20 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 slot 24' in the driving cam peripheral flange 24 is aligned with the downwardly projecting leg 31 on the fence 28, outward manual pressure on the shackle 17 pivots the locking portions of the locking arms 32 inwardly toward each other about the fixed pins 33. Since the tumbler and driving cam slot 24' are aligned with the fence 28 to receive the fence, the fence may be projected downwardly against the bias of the springs 30 to seat in the aligned recesses and slot and release 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 or tumblers 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 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 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 18' in the cover plate when the tumblers are all moved to a predetermined combination resetting position. An example of this type of tumbler construction, which is well-known in the prior art, wherein rotation of a cam provided in each of the outer annular disks 26' by insertion of the combination change key therein effects decoupling of a pivoted latch carried by the outer annular disk from interlocking engagement with the hub portion 26'' to permit adjustment of the hub portion relative to the outer annular disk, may be found in U. S. Patent No. 1,484,692 granted to E. R. Weber on February 26, 1924, to which reference is made for a more complete disclosure of this construction.

The above described driving cam construction may be employed in combination locks either of the type wherein a perpetually open combination change key

opening 18' is provided in the rear cover plate through which the combination change key is inserted into the combination change key openings in the outer annular disks 26' of the tumblers 26 to release the outer disks 25' from their associated hub portions 26'', or with combination change key opening guard mechanisms which normally bar admission through the combination change key opening to the interior of the lock and are selectively manipulatable to condition the combination change key opening to permit insertion of the change key into the tumbler change key openings such as those disclosed in my copending application Serial No. 423,719 filed April 16, 1954, now Patent No. 2,780,087, or in the copending application of James L. Taylor, Serial No. 525,130 filed July 29, 1955, now Patent No. 2,775,112. In each instance, the special construction of the above described driving cam 21 and fence 28 permit the manipulation of the tumbler hub portions 26' and the driving cam 12 while the fence 28 is in unlocked position seated in the peripheral gates of the tumblers 26 and the fence-accommodating guideway 24' of the driving cam.

The operation of the combination padlock embodying the present invention is as follows:

Assuming the components to be in the relative positions illustrated in Figures 1 and 2 with the padlock in locked condition, the padlock is manipulated to release the shackle 17 for withdrawal from locked condition in the padlock casing by manipulating the dial knob 20 to rotate the driving cam 21 in clockwise and counterclockwise directions alternately for preselected numbers of revolutions, in accordance with conventional practice in this art, to adjust the tumblers 26 so as to dispose the peripheral gates of the tumblers in alignment with the axis of movement of the fence member 28 to receive the fence member when it is rectilinearly shifted toward the axis of the tumblers. The particular combination which must be manipulated by the operator is determined, of course, by the relative positions of the peripheral and hub portions 26' and 26'' of the tumblers, as established by the previous adjustment of the combination. When the tumbler gates have been thus aligned in registry with the fence member 28, the driving cam is then shifted by rotation of the dial knob 20 to align the slot 24' in the peripheral flange 24 of the driving cam 21 so as to receive the depending leg 31 of the fence member 28. If the operator then manually grasps the shackle 17 and applies a force thereto in a direction tending to withdraw the shackle from the padlock casing 13, the locking arms 32 will be rotated about their fixed pivot pins 33 by the camming force on the noses of the locking arms 32 produced by the inclined edges of the notches 17' on the shackle 17 upon attempted withdrawal of the shackle. This movement of the locking arms 32 shifts the fence member 28 to which the locking arms are pivoted toward the tumblers and driving cam and against the resilient upward force exerted on the fence member 28 by the springs 30. It will be understood that the fence member 28 will not be permitted to slide toward the tumbler axis a sufficient distance to enable the noses of the locking arms 32 to be withdrawn clear of the shackle notches 17' if any of the tumbler gates or driving cam gate are out of registry with the fence member.

To change the combination, the combination change key may then be inserted through the opening 18' in the rear cover plate and into the conventional openings provided therefor in the outer annular disks 26' of the tumblers 26 and aligned with the opening 18' to rotate the conventional cam or other facility in the tumbler for disconnecting the annular disks 26' from the hub portions 26''. By the construction herein described, the dial 20 may thereupon be adjusted to set up the desired combination without returning the fence member 28 to shackle-locking position, thereby eliminating this procedural step from conventional combination lock-charging procedure.

Because of the particular construction of the driving cam 21 and fence member 28, the driving cam is free to rotate when the depending leg 33 of the fence member 28 is fully projected toward the axis of the driving cam by virtue of the alignment of the transverse recess 34 in the hook portion 35 of the fence member leg 31 with the peripheral flange 24 on the rear face of the driving cam and the accommodation of the nose 36 of the hook portion 35 in the driving cam annular recess 25. The driving cam 21 may thereupon be rotated by manipulation of the dial 20 to shift the hub portions 26'' of the tumblers 26 relative to their annular disks 26' in accordance with conventional combination-changing procedure to set up the desired relative positioning between the annular disks 26' and the hub portions 26'' and therefore, the combination of the padlock.

The combination change key is then withdrawn from the opening 18' and the padlock may then be returned to locked condition by forcing the shackle 17 toward the padlock casing, whereupon the noses of the locking arms 32 are projected into locking engagement with the shackle sockets 17' under the influence of the springs 30 when the same come into registry.

While only one preferred embodiment of the invention has been particularly shown and described, it is apparent that other 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.

I claim:

1. A combination lock comprising a plurality of coaxially aligned, peripherally recessed, rotatable tumblers each having an inner hub portion and an annular peripheral portion adjustable relative thereto and combination control means selectively interlocking said portions against relative movement, the hub portions of said tumblers being interconnected by lost motion driving connections, a rotatable cylindrical driving cam having a lost motion driving connection with the hub portion of one of said tumblers for adjusting said plurality of tumblers, a dial having a spindle affixed thereto and to said driving cam for adjusting said driving cam, a reciprocative fence having an edge adjacent said tumblers extending transversely of the driving cam and tumblers shiftable radially of said driving cam and tumblers between a locking position projected from the axes of said tumblers wherein said adjacent edge is spaced from the peripheries of the tumblers and a retracted position releasing the lock from said locked condition wherein said adjacent edge is seated in said tumbler peripheries, said fence having a leg thereon projecting toward the axis of said driving cam beyond said adjacent edge of said fence having a terminal projection thereon extending toward the driving cam along an axis perpendicular to the reciprocative axis of said fence, said driving cam having a radial guideway in one circular face thereof opening through the periphery of the driving cam to accommodate said fence leg and terminal projection at one angular position of said driving cam and permit displacement of said adjacent edge of said fence from the projected position to said retracted position when the tumbler recesses are aligned therewith, and said driving cam having an annular concentric groove in said circular face communicating with said guideway, spaced from the periphery of said driving cam, and complementary in cross-section to said terminal projection to accommodate said terminal projection and permit full rotation of said driving cam when said adjacent edge of said fence is seated in said tumbler peripheries whereby said tumbler hub portions may be adjusted by rotation of said driving cam when the lock is in unlocked condition and said interlocking means are adjusted to permit relative rotation of said hub portions and said annular peripheral portions of said tumblers.

2. In a combination lock of the type having a plurality of coaxially aligned, peripherally recessed, rotatable tumblers each having an inner hub portion and an annular

peripheral portion adjustable relative thereto and combination control means selectively interlocking said portions against relative movement, the hub portions of said tumblers being interconnected by lost motion driving connections, a rotatable cylindrical driving cam having a lost motion driving connection with the hub portion of one of said tumblers for adjusting said plurality of tumblers, a dial having a spindle affixed thereto and to said driving cam for adjusting said driving cam, a reciprocative fence having an edge adjacent said tumblers extending transversely of the driving cam and tumblers shiftable radially of said driving cam and tumblers between a locking position projected from the axes of said tumblers wherein said adjacent edge is spaced from the peripheries of the tumblers and a retracted position releasing the lock from said locked condition wherein said adjacent edge is seated in said tumbler peripheries; the improvement comprising a leg on said fence projecting toward the axis of said driving cam beyond said adjacent edge of said fence having a terminal projection thereon extending toward the driving cam along an axis perpendicular to the reciprocative axis of said fence, said driving cam having a radial guideway in one circular face thereof opening through the periphery of the driving cam to accommodate said fence leg and terminal projection at one angular position of said driving cam and permit displacement of said adjacent edge of said fence from the projected position to said retracted position when the tumbler recesses are aligned therewith, and said driving cam having an annular concentric groove in said circular face communicating with said guideway, spaced from the periphery of said driving cam, and complementary in cross-section to said terminal projection to accommodate said terminal projection and permit full rotation of said driving cam when said adjacent edge of said fence is seated in said tumbler peripheries whereby said tumbler hub portions may be adjusted by rotation of said driving cam when the lock is in unlocked condition and said interlocking means are adjusted to permit relative rotation of said hub portions and said annular peripheral portions of said tumblers.

3. In a combination lock of the type having a lock casing, a dial, a dial spindle affixed to said dial and projecting inwardly of said lock casing, a plurality of coaxially aligned, rotatable tumblers disposed concentric with said spindle each having an inner hub portion and a peripherally recessed, annular peripheral portion adjustable relative to said hub portion and combination control means selectively interlocking said portions against relative movement and releasing said hub portion for movement independently of said peripheral portion, the hub portions of said tumblers being interconnected by lost motion driving connections, a rotatable cylindrical driving cam affixed to said spindle disposed adjacent one of said tumblers and having a lost motion driving connection with the hub portion of the adjacent tumbler for driving the same to adjust said plurality of tumblers, a rectilinearly reciprocative fence member lying in a radial plane of the axis of said spindle supported for movement between a locking position projected from the axis of said tumblers and an unlocking position retracted toward the axis of said tumblers, said fence member having an edge adjacent said tumblers extending transversely of the tumblers and spaced from the peripheries thereof when said fence is in said locking position; the improvement comprising a leg on said fence member projecting toward the axis of said driving cam from said adjacent fence edge having a terminal projection thereon extending toward the driving cam along an axis paralleling the axis of said spindle, said driving cam having a radial guideway in one circular face thereof opening through the periphery of the driving cam to accommodate said terminal projection at one angular position of said driving cam to permit displacement of said adjacent fence edge from said projected position to the retracted position wherein the same is received in the tumbler recesses

in alignment therewith, and said driving cam having an annular concentric groove in said circular face communicating with said guideway and spaced from said driving cam for accommodating said terminal projection and permitting full rotation of the driving cam when said adjacent fence edge is seated in the tumbler peripheries whereby said tumbler hub portions may be adjusted by rotation of said driving cam when said fence is in unlocking position and said interlock means are adjusted to release said hub portions from said peripheral portions of said tumblers.

4. In a combination padlock of the exposed shackle type including a shackle, a dial, a dial spindle affixed to said dial and rotatable about the axis thereof, a plurality of coaxially aligned rotatable tumblers disposed concentric with said spindle each having an inner hub portion and a peripherally recessed annular peripheral portion adjustable relative to the hub portion and combination control means selectively interlocking said portions against relative movement and releasing them for relative movement to adjust the combination, the hub portions of said tumblers being interconnected by lost motion driving connections, a rotatable cylindrical driving cam affixed to said spindle having a lost motion driving connection with the hub portion of one of said tumblers for adjusting said plurality of tumblers, a reciprocative fence having locking arms thereon for selectively locking said shackle, means supporting said fence for rectilinear reciprocative movement radially of the axis of said spindle from a projected position wherein said locking arms lock the shackle to a retracted position wherein the locking arms are released from said shackle, said fence member having an edge adjacent and lying transversely of said tumblers which is spaced from said tumblers when said fence member is in locking position and is received within

the tumbler peripheral recesses in registry therewith when said fence member is in unlocking position; the improvement comprising means for permitting rotation of said driving cam to adjust said tumbler hub portions for altering the combination when said fence is in said retracted unlocking position and said combination control means are actuated to release said hub portions from their associated peripheral portions including a leg on said fence member projecting from said adjacent fence edge toward the axis of said spindle along an axis adjacent one circular face of said driving cam, said leg terminating in a terminal formation extending toward said driving cam along an axis paralleling said spindle, and said driving cam having a radial guideway in said one circular face thereof opening through the periphery of the driving cam to accommodate said terminal formation at one angular portion of said driving cam to permit displacement of said fence leg and adjacent edge from said projected locking position to said retracted unlocking position when said tumbler recesses are aligned with said adjacent edge, and said driving cam having an annular concentric groove in said circular face thereof communicating with said guideway inwardly of the periphery of said driving cam and complementing in cross-section said terminal formation to accommodate said terminal formation and permit full rotation of said driving cam when said fence is in said retracted unlocking position.

References Cited in the file of this patent

UNITED STATES PATENTS

177,054	Gross	May 2, 1876
864,395	Tobias	Aug. 27, 1907
1,263,062	Ikeda	Apr. 16, 1918
1,301,846	Hick	Apr. 29, 1919
2,673,457	Miller	Mar. 30, 1954