Dec. 2, 1969 E. M. BARNER 3,481,167

COMBINATION LOCK WITH UPSET MECHANISM

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FIG. 1

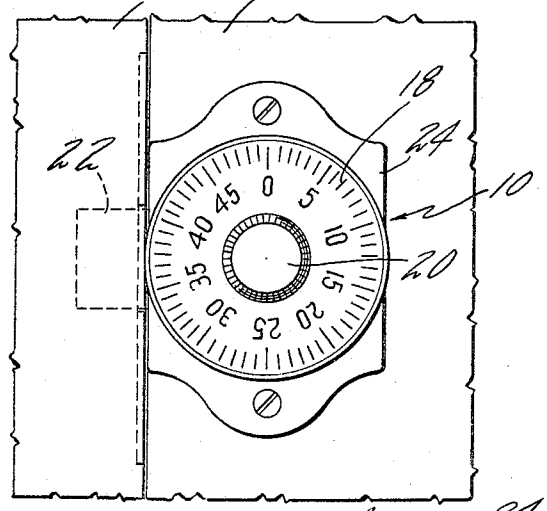


FIG. 2

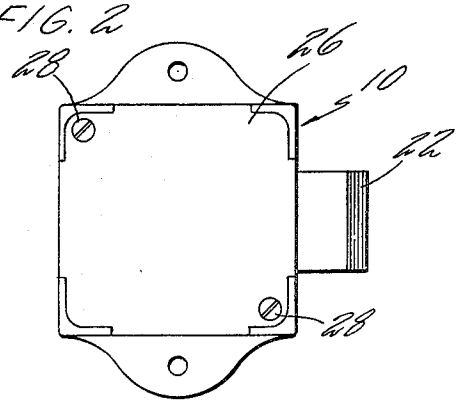


FIG. 3

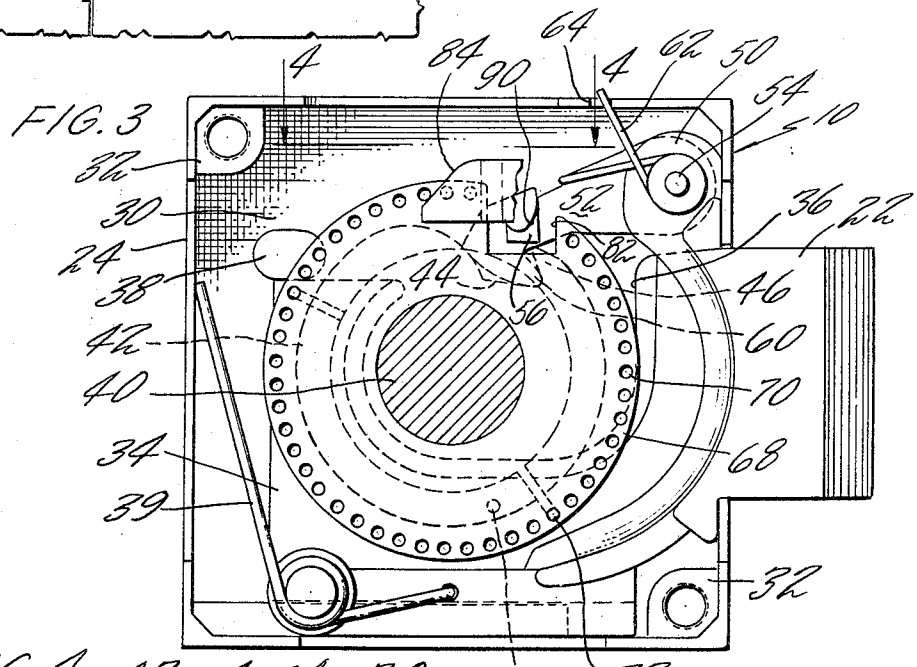
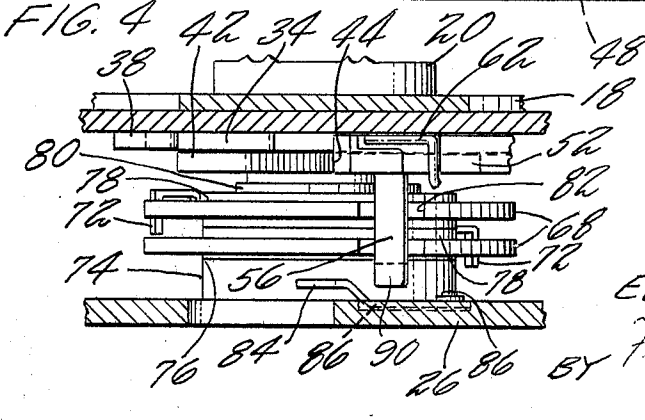


FIG. 4



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COMBINATION LOCK WITH UPSET MECHANISM

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FIG. 5

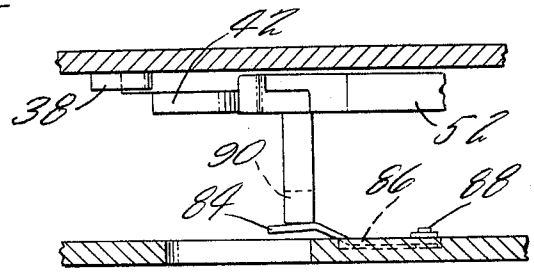


FIG. 6

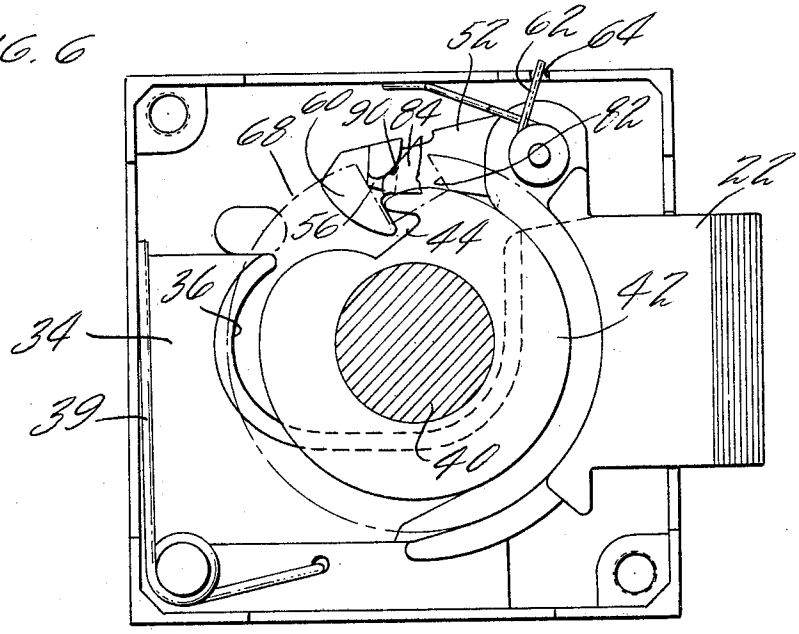


FIG. 7

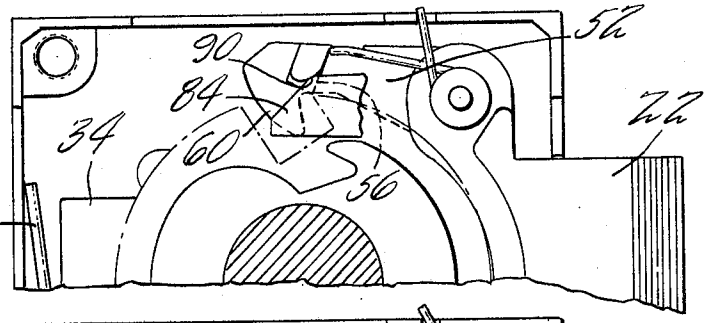
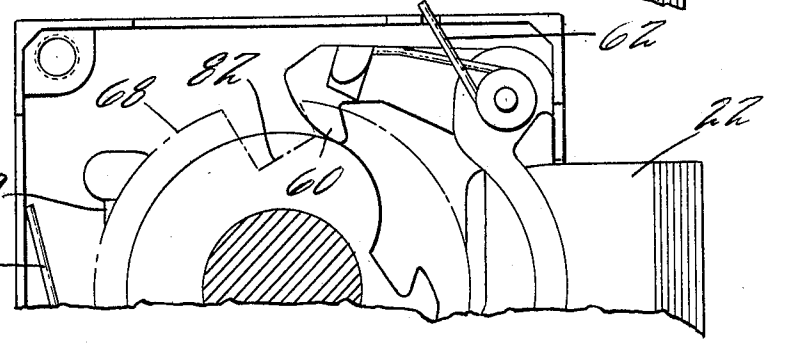


FIG. 8



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COMBINATION LOCK WITH UPSET MECHANISM

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Int. Cl. E05b 37/00, 37/08
U.S. Cl. 70—314 10 Claims

ABSTRACT OF THE DISCLOSURE

A rotatable tumbler combination lock having a resiliently mounted cam which interacts with a cam surface on the dog lever to disengage the dog mechanism upon movement of the bolt to the unlocked position and return the dog mechanism to the locked position. A spring normally urges the dog mechanism toward the position of engagement so that engagement for unlocking is accomplished when the tumblers and driving disc are properly aligned. Movement of the bolt plate toward the unlocked position removes the spring bias from the dog mechanism and the resiliently mounted cam disengages the dog mechanism for return to the locked position when the dial is released.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to combination locks. More particularly, this invention relates to combination locks with an automatic upsetting mechanism whereby the operating mechanism of the lock is disengaged or scrambled upon release of the actuating dial to automatically upset the unlocking alignment of the operating mechanism of the lock eliminating the need of manual scrambling by the person operating the lock.

Background of the invention

A persistent problem in the combination lock art has been the danger of a lock being opened by an unauthorized person if the unlocking mechanism has not been completely upset. The problem arises when an authorized person dials the proper combination, opens the lock, and then closes the lock without disturbing the final setting. Since the final setting of the lock has placed the lock mechanism in proper alignment to accomplish the unlocking movement, it is possible in many locks for an unauthorized person to open a lock thus left undisturbed at its final dial setting.

Suggestions have been made in the past for tumbler upset mechanisms. However, these mechanisms proposed in the past have usually been relatively involved, complicated compared to the remainder of the lock structure, and not completely reliable.

SUMMARY OF THE INVENTION

The present invention provides tumbler type combination locks with a positive action upset mechanism without adding undue complications to the lock structure. A resiliently mounted cam element is positioned for cooperation with the dog mechanism of the lock structure, and the dog mechanism is spring biased toward the position of engagement for unlocking. When the tumblers and drive disc have been properly positioned in accordance with the right combination, the spring loading on the dog mechanism drives the dog mechanism into engagement with notches in the tumblers and drive disc, and the bolt plate is then free to move to the unlocked position with further movement of the dial. The dog mechanism rides over the resiliently mounted cam during

movement of the bolt plate toward the open position, and a camming surface on the dog mechanism then comes into contact with the cam when the bolt plate reaches the unlocked position. Movement of the bolt plate to the unlocked position also relieves the spring loading normally biasing the dog mechanism, and thus the dog mechanism is free to respond to the interaction between the cam and the camming surface. The bolt plate is spring loaded toward the closed position, and thus when the operator releases the dial plate, the spring loading on the bolt plate causes a reaction between the cam and the camming surface whereby the dog mechanism is cammed out of engagement with the tumblers and drive disc. The spring loading on the bolt plate then returns the bolt and dog mechanism to the locked position so that the unlocking alignment between the dog mechanism and the tumblers and disc mechanism is upset. Once the dog mechanism has been returned to its locked position, the bolt can only be reopened by a complete recycling of the lock combination.

Accordingly, one object of the present invention is to provide a novel and improved combination lock and upset mechanism.

Still another object of the present invention is to provide a novel and improved combination lock and upset mechanism wherein the lock structure is not significantly increased in complexity by the presence of the upset mechanism.

Still another object of the present invention is to provide a novel and improved combination lock and upset mechanism wherein the upset mechanism employs a resiliently mounted cam element that is fool-proof.

Other objects and advantages of the present invention will be apparent and understood from the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like elements are numbered alike in the several figures,

FIGURE 1 is an elevation view showing the combination lock of the present invention mounted in a structure to be locked.

FIGURE 2 is a rear view of the lock shown in FIGURE 1.

FIGURE 3 is an enlarged view taken in the direction of FIGURE 2 with the back plate removed.

FIGURE 4 is a view taken along line 4—4 of FIGURE 3 showing the dog mechanism in alignment with the tumbler grooves for opening, but prior to opening of the lock.

FIGURE 5 is a view similar to FIGURE 4, with some of the parts removed for purposes of illustration, and showing the dog in an intermediate position moving from the locked position to the unlocked position.

FIGURE 6 is a view similar to FIGURE 3 showing the bolt structure in the unlocked position with maximum bolt retraction.

FIGURE 7 is a partial view of the mechanism shown in FIGURE 6 showing the relative position of the mechanism with the bolt partly returned to the locked position.

FIGURE 8 is a view similar to FIGURE 7 showing the relative position of the lock mechanism with the bolt fully extended to the locked position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGURE 1, a combination lock indicated generally at **10** is shown mounted in structure with which it might be associated such as, for example, a Post Office Box 12 having a door **14** in which the lock is mounted and a casing **16** into which the bolt extends

for locking. As viewed externally, lock **10** has a dial plate **18** on which the combination numbers are displayed, a knurled operating post **20** connected to drive dial plate **18**, and a bolt **22** connected to the operating mechanism mounted in the interior of lock casing **24**.

Referring now to FIGURE 2, lock **10** is shown from the rear. A part of casing **24** is in the form of a backing plate **26** which is removable to expose the mechanism within the casing. Backing plate **26** is secured to the rest of the casing by a pair of screws **28**.

Referring now to FIGURE 3, lock is shown minus backing plate **26**. Some of the structure shown in FIGURE 3 is actually attached to or mounted on the interior of backing plate **26**, and thus it should be understood that the showing of FIGURE 3 is literally minus backing plate **26** as distinguished from the state wherein backing plate **26** is removed. The interior side **30** of the front part of casing **24** can be seen along with screw posts **32** into which screws **28** fasten. A bolt plate **34** is positioned immediately adjacent interior surface **30**, bolt **22** being an integral part and an extension of bolt plate **34**. Bolt plate **34** is movable laterally with respect to interior surface **30**. As shown in FIGURE 3, bolt plate **34** and bolt **22** are in the locked position with maximum bolt extension, and unlocking movement would involve the sliding of bolt plate **34** and bolt **22** left with respect to the position shown. Bolt plate **34** has an open central section defined by edge **36** so that the bolt plate can slide without interference with other parts of the mechanism. The bottom part of bolt plate **34** is guided along the lower part of casing **24**, and the upper part of the bolt plate is guided by a guidepost **38** mounted on interior surface **30** so that straight movement of bolt plate **34** and bolt **22** are accomplished without canting.

A torsion spring **39** is wrapped around a post on bolt plate **34**, and one end of spring **39** bears against the side of casing **34** while the other end is positioned in a hole in bolt plate **34**. The action of torsion spring **39** imparts a force to the bolt plate urging or biasing the bolt plate to the locked position.

An arbor **40** is rotatably mounted and extends into the interior of casing **24**. A drive plate **42** is connected to arbor **40** so that drive plate **42** is rotated by arbor **40**. Drive plate **42** may be permanently fixed to arbor **40**, and arbor **40** is connected to be driven by operating post **20**. Thus, rotation of operating post **20** causes rotation of arbor **40** and drive plate **42**. Drive plate **42** has a section which is formed into the shape of a hook **46** having a notch **44**. Drive plate **42** also carries a projection **48** perpendicular to its surface and facing toward the interior of the lock.

A mounting post **50** extends from bolt plate **34**, mounting post **50** being integral with bolt plate **34** but recessed from interior surface **30** to define a space between post **50** and interior surface **30**. A dog lever **52** is positioned adjacent interior surface **30** above bolt plate **34**, and one end of dog leg **52** extends into the space between post **50** and surface **30**, and this end of the dog lever is pivotally connected to bolt plate **34** by pin **54**. Thus, dog lever **52** is connected to bolt plate **34** but can move pivotally with respect to the bolt plate. A fence **56** extends from dog lever **52** toward the interior of the lock structure for tumbler engagement. A dog **60** at the end of dog lever **52** removed from the pivoted connection is adapted for engagement with notch **44**.

A torsion spring **62** is mounted on pin **54**, and torsion spring **62** imparts a force to dog lever **52** urging the dog lever counterclockwise against the periphery of drive plate **42**. One end of torsion spring **62** normally bears against the right hand surface of an opening **64** in the top of casing **24**, and the other end of spring **62** bears against a flat surface on the top of dog lever **52** so that the dog lever is urged in a counterclockwise direction (as viewed in FIGURE 3) toward the periphery of drive plate **42**. The arrangement of the lock mechanism in FIGURE 3 shows the parts in their relative position when the dog has dropped into the notch in drive plate **42** upon completion of the dialing of the combination and just prior to unlocking the bolt. Ordinarily, dog **60** would ride against the outer periphery of drive plate **42** rather than be positioned in the notch as shown in FIGURE 3.

As previously pointed out, some of the structure depicted in FIGURE 3 is actually attached to backing plate **26**; however, none of the structure described to this point with respect to FIGURE 3 is attached to the backing plate. The structure attached to the backing plate includes a pair of tumblers **68** (only one of which can be seen in FIGURE 3). The tumblers have a series of evenly spaced holes **70** around their periphery corresponding to the numbers on dial plate **18**, and each tumbler has associated therewith a finger **72** which is positioned in a selected hole to set the combination for the lock.

Referring now to FIGURE 4, the tumblers **68** and the fingers **72** can be seen more clearly. The tumblers are mounted on a shaft **74** which is fixed to backing plate **26** and which is stepped to provide a shoulder **76** to position the tumblers with respect to the backing plate. Each of the fingers **72** extends from a ring **78** which both supports the finger and acts as a separator between the tumblers. As can be seen, each finger **72** passes through the combination holes with which it is associated and projects beyond the rear surface of the tumbler so that it can drivingly engage the finger on the next tumbler. A snap ring **80** mounted on a reduced diameter portion of shaft **74** secures the tumbler assembly to the shaft while leaving the tumblers free to rotate about the axis of the shaft. Each of the tumblers has a notch **82** directed radially inward from its surface (see also FIGURE 3), and when the notches **82** in the tumblers and notch **44** in drive plate **42** are in proper alignment, as a result of proper dialing of the combination, the fence **56** and the dog **60** drop into the notches to allow opening of the lock.

The structure described to this point has been a standard prior art combination lock mechanism without an upset feature. As previously stated, upset mechanisms heretofore available have not been satisfactory for a number of reasons.

The upset mechanism of the present invention include a cam **84** which is connected to a strip of resilient spring material **86** which is in turn fastened at one end by rivet **88** to backing plate **26** in a recessed portion thereof. Spring **86** is spaced from the surface of backing plate **26** a sufficient distance to allow it to be flexed and thus allow some movement of cam **84** toward the backing plate.

An extension at the free end of fence **56** froms a camming surface **90** which also forms part of the upset mechanism. Camming surface **90** is adapted for engagement with cam **84** when the lock is in the unlocked position, and the interaction between cam **84** and camming surface **90** leads to the upsetting operation.

The upset mechanism and operation can best be illustrated by a description of the operation of the lock. Assuming that the lock is in a locked position and is to be unlocked, dial plate **18** is turned by manipulation of operating post **20** in the usual fashion to select the proper combination numbers. Movement of the dial plate acts through arbor **40** to turn drive plate **42**. Drive plate **42** drives the tumblers in a manner well known in the art by contact between the fingers **72** and projection **48**. The dialing of the proper combination results in the alignment of plate notch **44** and the tumbler notches **82** as shown in FIGURES 3 and 4 so that fence **56** is aligned with the tumbler notches and dog **60** is aligned with drive plate notch **44**. The force of spring **62** then drives dog levers **52** downward and causes dog **60** to engage notch **44**. The lock mechanism is then in the position shown in FIGURES 3 and 4 ready for opening, and the bolt can be moved to the open position. Movement of the bolt to the open position is accomplished by additional rotation of drive plate **42** in the counterclockwise direction as viewed

in FIGURE 3, whereby dog lever 52 is pulled to the left and pulls with it bolt plate 44 to which it is pivotally connected and thus bolt 22.

Referring now to FIGURE 5, a view similar to FIGURE 4 is shown, with some of the parts removed, with the dog in an intermediate position moving from the locked position to the unlocked position. As previously stated, movement to the unlocked position is accomplished by additional rotation of drive plate 42 after dog 60 has engaged notch 44 in the drive plate. This additional rotation of the drive plate pulls dog lever 52 leftward thereby moving with it bolt plate 34 to which it is attached and thus bolt 22. As clearly shown in FIGURE 5, movement to the unlocked position causes the free end of fence 56 (i.e. the end adjacent to camming surface 90) to ride across the face of cam 84. The contact between the end of fence 56 and the face of cam 84 causes a flexing of spring 86 and results in cam 84 being moved rearwardly from its position shown in FIGURE 4 toward backing plate 26 as shown in FIGURE 5. As can be seen from both FIGURES 4 and 5, the contact between the end of camming surface 90 and the face of cam 84 occurs because the distance from the free end of fence 56 to backing plate 26 is less than the distance from the face of cam 84 to the packing plate.

Referring now to FIGURE 6, bolt 22 is shown in the unlocked position with spring 39 being fully flexed to provide a biasing force urging the bolt back toward the locked position. As can be seen, the opening defined by edge 36 of bolt plate 34 has allowed full movement of the bolt plate to the left without inerference of arbor 40. The counterclockwise movement of drive plate 42 has resulted in a counterclockwise movement of notch 44, and the contact between fence 56 and the back wall of notches 82 causes a similar counterclockwise rotation of the tumblers 68 so that the notches 82 also move counterclockwise. Thus, drive plate 42, tumblers 68, and the associated notches in each of these elements are moved from the previous position, wherein they were aligned in the one proper position to allow unlocking, to a new position. During movement to the unlocked position of FIGURE 6, the end of spring 62 in opening 64 engages the left face of opening 64 and is rotated in a clockwise direction out of contact with dog lever 52. Thus, movement of the bolt to the unlocked position removes the force normally biasing the dog lever toward the tumblers and drive disc.

Still referring to FIGURE 6, when the full unlocked position has been reached fence 56 has been moved leftward to a position where camming surface 90 clears the inclined surface of cam 84. Thus, spring 86 unflexes and returns cam 84 to its normal position with respect to the backing plate. The inclined surface of cam 84 and camming surface 90 are now in bearing contact with each other.

When the operator of the lock releases post 20, the force from spring 39 starts to move bolt plate 34 to the right. The rightward movement of the bolt plate imposes a rightward force on dog lever 52, and, as can be seen in FIGURE 7, dog lever 52 is caused to rotate in a clockwise direction by the interaction between the inclined surface of cam 84 and camming surface 90. Dog 60 and fence 56 are thus cammed up and rotated out of their respective notches in the drive plate and tumblers, and spring 39 drives bolt plate 34 and bolt 22 to the closed position as shown in FIGURE 8. The reaction between dog 60 and drive plate 42 as the dog is being rotated out of engagement causes a clockwise rotation of the drive plate to approximately the position shown in FIGURE 8 and the dog is again bearing on the outer periphery of the drive plate with the force of spring 62 having been withstored. The fact that the force of spring 62 is removed in the unlocked position eliminates wear between the cam 84 and camming surface 90.

As can be seen from the position of the elements in FIGURE 8, an automatic upsetting of the locking alignment has occurred. The tumblers 68 and tumbler notches 82 are no longer in the position wherein unlocking can take place because the tumblers have been rotated from the unlocking position and the fence has been withdrawn. Similarly, the dog has been withdrawn from the notch in drive plate 42 after rotation away from the unlocking position, and the drive disc has been further upset by the rotation imparted to its by the reaction of the withdrawal of the dog. Thus, the lock has automatically been upset, and a reopening can be accomplished only by complete redialing of the proper combination.

While a preferred embodiment has been shown and described, various modifications and substitutions may be made without departing from the spirit and scope of this invention. Accordingly, it is to be understood that this invention has been described by way of illustration rather than limitation.

What is claimed is:

1. In a combination lock having notched rotatably mounted tumblers, a notched rotatably mounted drive plate, a bolt plate and bolt movable between locked and unlocked positions, a lever pivotably mounted to said bolt plate and having a fence for engagement with said tumbler notches and a dog for engagement with said drive plate notch to allow movement of said bolt to said unlocked position, an upset mechanism including:
   - a cam;
   - resilient means positioning said cam in a first position;
   - projection means extending from said lever and extending beyond said cam in the first position of said cam, said projection means coacting with said cam to displace said cam from said first position during movement of said bolt to said unolcked position, said cam returning to said first position upon said bolt reaching said unlocked position;
   - a camming surface on said projection means, said camming surface engaging said cam in said unlocked position of said bolt; and
   - bolt return means for driving said camming surface along said cam to pivot said lever and upset the engagement of said dog with said drive plate notch and said fence with said tumbler notches, said bolt return means including a spring biasing said bolt plate and bolt toward said locked position.

2. An upset mechanism for a combination lock as in claim 1 wherein said projection means comprises:
   - an extension of said fence.

3. An upset mechanism for a combination lock as in claim 1 further comprising:
   - spring means biasing said lever toward said drive plate.

4. An upset mechanism for a combination lock as in claim 3 including:
   - means for removing the bias of said spring means during movement of said bolt to said unlocked position.

5. An upset mechanism for a combination lock as in claim 1 wherein said upsetting includes:
   - rotating said lever to disengage said dog from said drive plate notch and said fence from said tumbler notches, said dog and said fence being returned to a locked position, and said drive plate being rotated away from said unlocked position.

6. A combination lock comprising:
   - a lock casing;
   - a plurality of tumbler discs rotatably mounted within said casing, each of said discs having a notch;
   - a drive plate rotatably mounted within said casing, said drive plate having a notch;
   - means for transmitting selective movement of said drive plate to said tumblers;
   - an operating post connected to drive said drive plate;
   - a bolt plate within said casing having a bolt extending therefrom;
   - a lever pivotably connected to said bolt plate;
   - a fence extending from said lever, said fence being adapted for engagement with the notches in said tum-

blers when said tumblers have been driven to a position for unlocking by movement of said operating post;

a dog on said lever, said dog normally engaging the periphery of said drive plate, and said dog being adapted for engagement with the notch in said drive plate when said drive plate has been driven to a position for unlocking by movement of said operating post; said lever, bolt plate and bolt thereby being connected to said drive plate for movement to an unlocked position upon further movement of said operating post;

cam means resiliently mounted within said casing;

a projection extending from said lever and having a camming surface thereon, said projection displacing said cam means during said further movement to said unlocked position, and said cam engaging said camming surface in said unlocked position;

and bolt return means for driving said camming surface along said cam to pivot said lever and upset the engagement of said dog with said drive plate notch and said fence with said tumbler notches upon release of said operating post, said bolt return means including a spring biasing said bolt plate and bolt toward said locked position.

7. A combination lock as in claim 6 wherein;

said projection is an extension of said fence.

8. A combination lock as in claim 6 including:

spring means biasing said lever toward said drive plate.

9. A combination lock as in claim 8 including:

means for removing the bias of said spring means upon said further movement to said unlocked position.

10. A combination lock as in claim 6 wherein said upset includes:

rotating said lever to disengage said dog from said drive plate notch and said fence from said tumbler notches, said dog and said fence being returned to a locked position, and said drive plate being rotated away from said unlocked position.

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U.S. Cl. X.R.

70—303