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REKEYABLE LOCK CYLINDER WITH ENHANCED TORQUE RESISTANCE

Abstract

A rekeyable lock cylinder with a cylinder body and a plug assembly. The lock cylinder includes a plurality of key followers and a corresponding plurality of racks disposed in the plug assembly. The lock cylinder includes, for example, a locking bar for blocking rotation of the plug assembly with respect to the cylinder body to prevent unlocking of the rekeyable lock cylinder with an unauthorized object. In some embodiments, the locking bar is configured such that torqueing the plug assembly with an unauthorized object applies force to the locking bar without translating such force to the plurality of racks. This type of arrangement enhances torque resistance of the lock cylinder against attempted forced entry.

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Background/Summary

RELATED APPLICATIONS [0001] This application is a continuation of U.S. patent application Ser. No. 18/616,508, filed Mar. 26, 2024, which is a continuation of U.S. patent application Ser. No. 16/825,817, filed Mar. 20, 2020, now U.S. Pat. No. 11,988,018, which is a continuation of U.S. patent application Ser. No. 15/172,206, now U.S. Pat. No. 10,612,271, filed Jun. 3, 2016, which claims the benefit of U.S. Provisional Application No. 62/180,339, filed Jun. 16, 2015, and which applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD
[0002] This disclosure relates generally to locks; in particular, this disclosure relates to a lock with a rekeyable lock cylinder having enhanced torque resistance.
BACKGROUND AND SUMMARY
[0003] Lock cylinders that can be rekeyed without removal of the cylinder plug are known. For example, U.S. Pat. No. 8,033,150 describes a rekeyable lock cylinder. These types of locks are highly beneficial to consumers because the locks can be easily rekeyed without use of a locksmith.
[0004] Although the plug cylinder should freely rotate when an authorized key is inserted into the keyway, the lock cylinder should be configured to resist rotation of the plug when torque is applied by an unauthorized key (or other object). A high amount of torque resistance for the lock cylinder is key to reducing forced entry. Therefore, there is a need for a rekeyable lock with enhanced torque resistance.
[0005] According to one aspect, this disclosure provides a rekeyable lock cylinder with a cylinder body and a plug assembly. The cylinder body defines a longitudinal axis and includes a groove. The plug assembly is disposed in the cylinder body and is rotatable about the longitudinal axis. The lock cylinder includes a plurality of key followers and a corresponding plurality of racks disposed in the plug assembly. At least one of the plurality of racks is selectively disengageable from at least one of the plurality of key followers responsive to application of a force by an object inserted into the rekeyable lock cylinder to facilitate rekeying to a new key. The lock cylinder includes means for blocking rotation of the plug assembly with respect to the cylinder body to prevent unlocking of the rekeyable lock cylinder with an unauthorized object. In some embodiments, the blocking means is configured such that torqueing the plug assembly with an unauthorized object applies force to the blocking means without translating such force to the plurality of racks. This type of arrangement enhances torque resistance of the lock cylinder.
[0006] In some embodiments, the blocking means includes a locking bar movable transversely with respect to the longitudinal axis between a locked position into the groove of the cylinder body and an unlocked position out of the groove of the cylinder body. For example, the locking bar could include a surface that engages a surface of the groove when in the locked position. In some illustrative embodiments, the respective surfaces of the locking bar and groove that engage when the locking bar is in the locked position are in approximately parallel planes. Depending on the

circumstances, the surface of the locking bar that engages the groove in the cylinder body when the locking bar is in the locked position is not a ramped surface. For example, the surfaces could be flat with respect to each other. In some cases, the edge of the locking bar is substantially squared off, such as having an approximately rectangular cross-section.

[0007] In some embodiments, there are one or more biasing members urging the locking bar towards the plurality of racks. With this arrangement, the biasing members urge the locking bar out of the groove in the cylinder body when an authorized key is inserted into the keyway. In some illustrative embodiments, a spring force of the biasing member is less than a spring force of the spring-loaded key followers. As such, the spring-loaded key followers will overcome the spring force of the biasing member to lock the lock cylinder when a key is not inserted into the keyway.

[0008] Additional features and advantages of the disclosure will become apparent to those skilled in the art upon consideration of the following detailed descriptions exemplifying the best mode of carrying out the disclosure as presently perceived.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present disclosure will be described hereafter with reference to the attached drawings which are given as non-limiting examples only, in which:

[0010] FIG. **1** is a perspective view of an example lock cylinder according to an embodiment of this disclosure;

[0011] FIG. **2** is an exploded view of the example lock cylinder shown in FIG. **1**;

[0012] FIG. **3** is a cross-sectional view of the example lock cylinder shown in FIG. **1** showing the springs urging the locking bar towards the racks;

[0013] FIG. **4** is a cross-sectional view of the example lock cylinder shown in FIG. **1** showing the interface between the locking bar and cylinder body with an authorized key in the keyway;

[0014] FIG. **5** is a cross-sectional view of the example lock cylinder shown in FIG. **1** showing the interface between the locking bar and cylinder body with an unauthorized key in the keyway; and

[0015] FIG. **6** is a cross-sectional view of the example lock cylinder shown in FIG. **1** showing the interface between the locking bar and cylinder body without a key in the keyway.

[0016] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates an embodiment of the invention in one form, and such exemplification is not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION

[0017] This disclosure relates to a rekeyable lock cylinder that can be rekeyed without removal of the cylinder plug. The operation for rekeying the lock cylinder is similar to that described in U.S. Pat. No. 8,033,150, which is hereby incorporated by reference. While the rekeying operation operates similarly, the present lock cylinder includes an enhanced torque resistance. In some embodiments, this enhanced torque resistance is configured in a manner that isolates torque on the plug cylinder from the racks, which increases durability of the lock cylinder.

[0018] An illustrative lock cylinder **10**, according to an embodiment of the present disclosure, is illustrated in FIGS. **1** and **2**. The lock cylinder **10** includes a longitudinal axis **12**, a cylinder body **14**, and a plug assembly **16**. A retainer clip **18** (FIG. **2**) couples together the cylinder body **14** with the plug assembly **16**.

[0019] The cylinder body **14**, as best seen in FIG. **2**, illustratively includes a generally cylindrical body **20** having a front end **22**, a back end **24** and a cylinder wall **26** defining an interior surface **28**. The cylinder wall **26** includes an interior, locking bar-engaging groove **30** (best seen in FIGS. **4**, **5**, **6**). In some embodiments, the locking bar-engaging groove **30** has a generally rectangular-shaped

cross-section and extends longitudinally along a portion of the cylinder body **14**, typically from the front end **22**.

[0020] The plug assembly **16** includes a plug body **32**, a carrier subassembly **34** and a plurality of spring-loaded pins **38** (also called key followers). The plug body **32** illustratively includes a plug face **36**, an intermediate portion **40** and a drive portion **42**. The plug face **36** defines a keyway opening **44**, a rekeying tool opening **46**, and a pair of channels **48** extending radially outwardly for receiving anti-drilling ball bearings **50**. The drive portion **42** is configured to drive a torque blade **51**, which could be coupled with a latch assembly (not shown). The drive portion **42** further includes a pair of slots **52** formed in its perimeter and a central groove **54** for receiving the retainer clip **18** to retain the plug body **32** in the cylinder body **14**.

[0021] The intermediate portion **40** includes a main portion **56** formed as a cylinder section and having a plurality of channels **58** for receiving the spring-loaded pins **38**. The channels **58** illustratively extend transversely to the longitudinal axis of the plug body **32**.

[0022] A planar surface **60** defines a recess **62** for receiving a retaining cap **64**. The channels **58** extend partially through the plug body **32**, with the sidewalls of the channels open to a planar surface **66**. The planar surface **66** illustratively includes a plurality of bullet-shaped, rack-engaging features **68**.

[0023] The carrier subassembly **34** includes a carrier **70**, a plurality of racks **72**, a spring catch **73**, a locking bar **74**, a pair of clips **76** for holding corresponding biasing members **78** against the locking bar **74** to urge the locking bar **74** against the racks **72**, and a return spring **80**. The carrier **70** includes a body **82** in the form of a cylinder section that is complementary to the main portion **56** of the plug body **32**, such that the carrier **70** and the main portion **56** combine to form a cylinder that fits inside the cylinder body **14**. The carrier **70** includes a curved surface **84** and a flat surface **86**. The curved surface **84** includes a locking bar slot **88**, a spring catch recess **90**, and a pair of clip receiving recesses **100** for receiving the clips **76**. The locking bar slot **88** illustratively includes a pair of biasing member-receiving bores **92** for receiving the biasing members **78**. In the embodiment shown, the locking bar **74** includes a corresponding pair of recessed areas **96** for receiving the biasing members **78**.

[0024] The spring-loaded locking bar **74** is sized and configured to fit in the locking bar slot **88** in the carrier **70**. The locking bar **74** illustratively includes a blocking portion **98** that is received in the locking bar engaging groove **30** in the cylinder body **14** when in the locked position (FIGS. **5** and **6**) and extends out of the locking bar engaging groove **30** when in an unlocked position (FIG. **4**). In some embodiments, as illustratively shown, the blocking portion **98** has a squared-off edge that forms a rectangular cross-section.

[0025] This squared-off surface stands in contrast to the triangular-shaped edge of the locking bar described in U.S. Pat. No. 8,033,150, which moves out of the groove in the cylinder body via a camming action. By using the urging of biasing members **78** to move the blocking portion **98** out of the groove **30** in the cylinder body **14**, a squared-off edge can be used with a corresponding flat surface in the locking bar engaging groove **30**, thereby increasing torque resistance of the lock cylinder **10** compared to the triangular-shaped edge and corresponding triangular-shaped locking bar engaging groove described in U.S. Pat. No. 8,033,150. Moreover, this relieves stress on the racks **72** because torque applied by an unauthorized key (or other object) will not be translated from the locking bar **74** to the racks **72** via a camming action; instead, the locking bar **74** interface with the locking bar engaging groove **30** will isolate the torque from the racks **72**. Opposite the squared-off edge of the blocking portion **98**, the locking bar **74** includes a flange **102** configured to engage locking bar-engaging grooves **104** formed in the racks **72** (FIGS. **4**, **5**, **6**). The flat surface **86** of the carrier **70** includes a plurality of parallel rack-receiving slots **94** extending perpendicular to the longitudinal axis of the carrier **70**.

[0026] FIG. **3** is an illustrative cross-sectional view of the lock cylinder **10** transversely cut through one of the clips **76**. In this view, it can be seen that the clips **76** extend around the carrier **70**. One

end of the biasing member **78** is fixed against a receiving portion **106** of the clip **76** and the other end is received in the recessed area **96** of the locking bar **74** and urges the locking bar **74** against the racks **72**. In this embodiment, the locking bar **74** is continuously urged by the biasing members **78** against the racks **72**.

[0027] FIGS. **4**, **5**, and **6** are illustrative cross-sectional views of the lock cylinder **10** transversely cut along the blocking portion **98** of the locking bar **74**. In FIG. **4**, which shows an authorized key **108** inserted into the keyway opening **44**, the key cut of the authorized key **108** is such to move the spring-loaded pins **38** and thereby the racks **72** to a position in which the flange **102** of the locking bar **74** is received into the respective locking bar engaging grooves **104** of the racks **72** via the urging of the biasing members **78**. This positions the blocking portion **98** of the locking bar **74** to its unlocking position out of the locking bar engaging groove **30**, thereby allowing free rotation of the plug assembly **16** with respect to the cylinder body **14** to unlock the lock cylinder **10**. This use of biasing members **78** to urge locking bar **74** out of locking bar engaging groove **30** stands in contrast to the camming action to move locking bar out of a groove in the cylinder body described in U.S. Pat. No. 8,033,150. FIG. **5** illustrates an example in which an unauthorized key **110** is inserted into the keyway opening **44**. Since the key cut of the unauthorized key **110** is "unauthorized," the locking bar engaging groove **104** of at least one of the racks **72** is not aligned with the flange **102** of the locking bar **74**. As such, the locking bar **104** cannot be urged out of the locking bar engaging groove **30** of the cylinder body **14**, which means the blocking portion **98** prevents rotation of the plug assembly **16** with respect to the cylinder body **14**. In the embodiment shown, the edge of the blocking portion **98** is squared-off and the locking bar engaging groove **30** of the cylinder body **14** has a corresponding shape. This means that the force caused by torqueing the plug assembly **16** with respect to the cylinder body **14** will be applied to a flat surface **112** of the blocking portion **98** with respect to a flat interior surface **114** of the locking bar engaging groove **30**. Since the surfaces **112**, **114** are flat with respect to each other, this enhances torque resistance compared to a ramped surface, such as the triangular edge of the locking bar and corresponding triangular groove in the cylinder body of U.S. Pat. No. 8,033,150. Moreover, unlike the flat surfaces **112**, **114**, the ramped surfaces described in U.S. Pat. No. 8,033,150 creates a camming action that applies force to the racks, which in some cases can deform the racks, or otherwise reduce durability of the racks. FIG. **6** illustrates an example in which there is no key in the lock cylinder **10**. The springs of the spring-loaded pins **38** have a higher spring force than the biasing members **78**. Accordingly, without a key in the keyway, the spring-loaded pins **38** drive the racks **72** downward, overcoming the force of biasing members **78**, so that the flange **102** of the locking bar **74** is not received in the locking bar engaging grooves **104** of the racks **74**. This forces the blocking portion **98** of the locking bar **74** into the locking bar engaging groove **30** of the cylinder body **14**, which prevents rotation of the plug assembly **16** with respect to the cylinder body **14**.

EXAMPLES

[0028] Illustrative examples of the rekeyable lock cylinder disclosed herein are provided below. An embodiment of the rekeyable lock cylinder may include any one or more, and any combination of, the examples described below.

[0029] Example 1 is a rekeyable lock cylinder with a cylinder body having a longitudinal axis and including a groove. The lock cylinder includes a plug assembly disposed in the cylinder body that is rotatable about the longitudinal axis. A plurality of key followers with a corresponding plurality of racks are disposed in the plug assembly. At least one of the plurality of racks is selectively disengageable from at least one of the plurality of key followers responsive to application of a force by an object inserted into the rekeyable lock cylinder to facilitate rekeying to a new key. The lock cylinder includes means for blocking rotation of the plug assembly with respect to the cylinder body to prevent unlocking of the rekeyable lock cylinder with an unauthorized object. The blocking means is configured such that force from torqueing the plug assembly with an unauthorized object

is primarily distributed between the cylinder body and blocking means compared with any force translated to the plurality of racks, thereby enhancing torque resistance of the rekeyable lock cylinder.

[0030] In Example 2, the subject matter of Example 1 is further configured such that the blocking means comprises at least one locking bar movable transversely with respect to the longitudinal axis between a locked position into the groove of the cylinder body and an unlocked position out of the groove of the cylinder body.

[0031] In Example 3, the subject matter of Example 2 is further configured such that the at least one locking bar includes a surface that engages a surface of the groove when in the locked position. The respective surfaces of the at least one locking bar and groove engage when the at least one locking bar is in the locked position are in approximately parallel planes.

[0032] In Example 4, the subject matter of Example 3 is further configured such that the surface of the at least one locking bar that engages the groove in the cylinder body when the at least one locking bar is in the locked position is not a ramped surface.

[0033] In Example 5, the subject matter of Example 3 is further configured such that the surface of the at least one locking bar that engages the groove in the cylinder body when the at least one locking bar is in the locked position is a flat surface.

[0034] In Example 6, the subject matter of Example 3 is further configured such that the surface of the at least one locking bar that engages the groove in the cylinder body is in a plane that is approximately parallel to an axis radial to the longitudinal axis.

[0035] In Example 7, the subject matter of Example 2 is further configured such that an edge of the at least one locking bar is received in the groove of the cylinder body when in the locked position.

[0036] In Example 8, the subject matter of Example 7 is further configured such that the edge of the at least one locking bar is substantially squared off.

[0037] In Example 9, the subject matter of Example 7 is further configured such that the edge of the at least one locking bar has an approximately rectangular cross-section.

[0038] In Example 10, the subject matter of Example 1 is further configured to include a biasing member urging the blocking means towards the plurality of racks.

[0039] In Example 11, the subject matter of Example 10 is further configured such that the plurality of key followers are spring-loaded and wherein a spring force of the biasing member is proportional to a spring force of the spring-loaded key followers to ensure any key follower will not be lifted by the at least one locking bar.

[0040] Example 12 is a rekeyable lock cylinder including a cylinder body with a longitudinal axis including a groove. The lock cylinder includes a plug assembly disposed in the cylinder body and being rotatable about the longitudinal axis. A carrier assembly is provided that includes a plurality of racks and at least one locking bar. The lock cylinder includes a plurality of key followers disposed in the plug assembly. At least one of the plurality of racks is selectively disengageable from at least one of the plurality of key followers responsive to application of a force by an object inserted into the rekeyable lock cylinder to facilitate rekeying to a new key. The at least one locking bar is movable transverse to, and rotationally about the longitudinal axis. At least a portion of the at least one locking bar is movable between a locked position in the groove of the cylinder body and an unlocked position out of the groove in the cylinder body. The at least one locking bar is configured to prevent unlocking of the rekeyable lock cylinder with an unauthorized object. The at least one locking bar is configured such that force from torqueing the plug assembly with an unauthorized object is primarily distributed between the cylinder body and carrier assembly compared to any force translated to the plurality of racks.

[0041] In Example 13, the subject matter of Example 12 is further configured such that a biasing member urges the at least one locking bar towards the plurality of racks.

[0042] In Example 14, the subject matter of Example 12 is further configured such that the plurality of key followers are spring-loaded and a spring force of the biasing member is less than a

spring force of the spring-loaded key followers.
[0043] Example 15 is a rekeyable lock cylinder that includes a cylinder body with a longitudinal axis including a groove. A plug assembly is disposed in the cylinder body and is rotatable about the longitudinal axis. The lock cylinder includes a plurality of key followers and a corresponding plurality of racks disposed in the plug assembly. At least one of the plurality of racks is selectively disengageable from at least one of the plurality of key followers responsive to application of a force by an object inserted into the rekeyable lock cylinder to facilitate rekeying to a new key. At least one locking bar is movable transverse to, and rotationally about the longitudinal axis. At least a portion of the at least one locking bar is movable between a locked position in the groove of the cylinder body and an unlocked position out of the groove in the cylinder body. The portion of the at least one locking bar is received into the groove has an approximately rectangular cross-section. The lock cylinder includes a biasing member that urges the at least one locking bar towards the plurality of racks.
[0044] In Example 16, the subject matter of Example 15 is further configured such that the plurality of key followers are spring-loaded and a spring force of the biasing member is less than a spring force of the spring-loaded key followers.
[0045] Although the present disclosure has been described with reference to particular means, materials, and embodiments, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics of the invention and various changes and modifications may be made to adapt the various uses and characteristics without departing from the spirit and scope of the invention.

Claims

1. (canceled)
2. A rekeyable lock cylinder comprising: a cylinder body extending along a longitudinal axis, the cylinder body defining an interior surface having a first engaging groove extending along the longitudinal axis; and a plug assembly at least partially disposed within the cylinder body and selectively rotatable around the longitudinal axis, the plug assembly comprising: a plug body; a plurality of spring-loaded key followers slidably mounted on the plug body, each of the plurality of spring-loaded key followers having at least one rack engagement feature; a carrier subassembly supported on the plug body, the carrier subassembly comprising: a carrier slidably supported on the plug body; a plurality of racks slidably mounted on the carrier, each of the plurality of racks having a plurality of key follower engagement features defined on a first side and configured to selectively engage the at least one rack engagement feature of a corresponding spring-loaded key follower, wherein each of the plurality of racks is selectively disengageable from the plurality of spring-loaded key followers via longitudinal movement of the carrier relative to the plug body to facilitate rekeying of the lock cylinder, each of the plurality of racks also having a second engaging groove recessed within a second side opposite the first side; and a locking bar supported on the carrier and movable between at least a locked position, whereby the plug assembly is blocked from rotating around the longitudinal axis, and an unlocked position whereby the plug assembly is allowed to rotate around the longitudinal axis, the locking bar having a first side and an opposite second side extending transversely relative to the longitudinal axis, the locking bar biased so that the second side is urged toward the plurality of racks and toward the unlocked position, wherein in the locked position, at least one of the second engaging grooves of the plurality of racks is not aligned with the locking bar and the first side of the locking bar is disposed at least partially within the first engaging groove of the cylinder body, wherein when the locking bar is in the locked position, engagement between the first side of the locking bar and the first engaging groove of the cylinder body substantially isolates rotational force applied to the plug assembly from the plurality of racks, and wherein when the locking bar is moved from the unlocked position toward the locked position,

one or more of the second engaging grooves cams the locking bar at least partially into the first engaging groove and into a position in which the locking bar blocks the rotation of the plug assembly around the longitudinal axis.

3. The rekeyable lock cylinder of claim 2, wherein the first engaging groove includes opposing parallel planar surfaces and the first side of the locking bar includes corresponding opposite parallel planar surfaces.

4. The rekeyable lock cylinder of claim 3, wherein when the locking bar is in the locked position, the opposing parallel planar surface of the first engaging groove and the opposite parallel planar surface of the first side of the locking bar restricts rotation of the locking bar relative to the plurality of racks when the rotational force is applied to the plug assembly.

5. The rekeyable lock cylinder of claim 3, wherein the first side of the locking bar includes a sidewall extending between the opposite parallel planar surfaces, and wherein edges connecting the sidewall to the opposite parallel planar surfaces are squared-off.

6. The rekeyable lock cylinder of claim 2, wherein the carrier subassembly further includes at least one biasing member biasing the locking bar towards the plurality of racks.

7. The rekeyable lock cylinder of claim 2, wherein the second side of the locking bar includes a flange and the second engaging groove of each of the plurality of racks has a corresponding flange shape, and wherein a size of the flange shape of the second engaging groove is larger than the flange of the second side of the locking bar.

8. The rekeyable lock cylinder of claim 7, wherein when the locking bar is in the unlocked position, the flange of the second side of the locking bar is completely disposed within the second engaging groove of each of the plurality of racks and with additional groove space above and below the flange.

9. The rekeyable lock cylinder of claim 7, wherein misalignment between the second engaging groove of at least one of the plurality of racks relative to the second side of the locking bar causes the second engaging groove to retain the flange of the locking bar in the locked position.

10. The rekeyable lock cylinder of claim 7, wherein the second side of the locking bar defines a first height of the locking bar, the flange tapering inwards from the first height of the locking bar, and wherein the second engaging groove has a second height defined at the second side of each of the plurality of racks, the second height of the second engaging groove greater than the first height of the locking bar.

11. The rekeyable lock cylinder of claim 10, wherein the flange has an extension length transverse to the first height of the locking bar and the second engaging groove has a recessed length transverse to the second height of the second engaging groove, and wherein the recessed length of the second engaging groove is greater than the extension length of the flange.

12. A rekeyable lock cylinder comprising: a cylinder body extending along a longitudinal axis, the cylinder body defining an interior surface having a first engaging groove extending along the longitudinal axis, the first engaging groove having opposing parallel planar surfaces; and a plug assembly at least partially disposed within the cylinder body and selectively rotatable around the longitudinal axis, the plug assembly comprising: a plug body; a plurality of key followers slidably mounted on the plug body, the plurality of key followers selectively movable in a first transverse direction that is orthogonal to the longitudinal axis, each of the plurality of key followers having at least one rack engagement feature; a plurality of springs corresponding to the plurality of key followers and biasing the plurality of key followers along the first transverse direction; a carrier subassembly supported on the plug body, the carrier subassembly comprising: a carrier slidably supported on the plug body; a plurality of racks supported on the carrier and slidable along the first transverse direction, each of the plurality of racks having a first side defining a plurality of key follower engagement features configured to selectively engage the at least one rack engagement feature of a corresponding key follower and a second side defining a second engaging groove, wherein each of the plurality of racks are selectively disengageable from the plurality of key

followers via longitudinal movement of the carrier relative to the plug body to facilitate rekeying of the lock cylinder; and a locking bar supported on the carrier and slidable relative to the carrier along a second transverse direction orthogonal to both the first transverse direction and the longitudinal axis between at least a locked position and an unlocked position, the locking bar having a first side and an opposite second side extending along the second transverse direction, the first side having opposite parallel planar surfaces, the second side defining a flange, and wherein when the locking bar is in the locked position, the first side of the locking bar is at least partially received within the first engaging groove of the cylinder body for engagement between corresponding planar surfaces, and wherein when the locking bar is in the unlocked position, the flange of the locking bar is received within the second engaging groove of the plurality of racks allowing rotation of the plug assembly around the longitudinal axis; and at least one biasing member biasing the locking bar towards the unlocked position.

13. The rekeyable lock cylinder of claim 12, wherein the opposite parallel planar surfaces of the first side of the locking bar define a first height of the locking bar along the first transverse direction, and the second engaging groove on each of the plurality of racks has a second height extending along the first transverse direction and on the second side of each of the plurality of racks, and wherein the second height is greater than the first height.

14. The rekeyable lock cylinder of claim 12, wherein the opposite parallel planar surfaces of the first side of the locking bar extend to the flange and the flange tapers inward from the opposite parallel planar surfaces, and wherein when the locking bar is in the unlocked position, a portion of the opposite parallel planar surfaces extend into the second engaging groove on each of the plurality of racks.

15. The rekeyable lock cylinder of claim 12, wherein the flange has a substantially triangular cross-sectional shape with opposite oblique surfaces, the second engaging groove on each of the plurality of racks has a corresponding triangular shape with opposing oblique surfaces, and wherein a length of the opposing oblique surfaces of the second engaging groove is greater than a length of the opposite oblique surfaces of the flange.

16. The rekeyable lock cylinder of claim 15, wherein the corresponding oblique surfaces of the second engaging groove and the flange cam so as to move the locking bar along the second transverse direction and into the locked position.

17. The rekeyable lock cylinder of claim 12, wherein the flange defines an extension length along the second transverse direction and the second engaging groove on each of the plurality of racks define a depth length along the second transverse direction, the extension length of the flange less than the depth length of the second engaging groove.

18. The rekeyable lock cylinder of claim 12, wherein the locking bar has a first longitudinal end and an opposite second longitudinal end defining a longitudinal length and extending along the longitudinal axis, and wherein the first side of the locking bar includes at least one recessed area for receiving the at least one biasing member, the at least one recessed area spaced apart from the first and second longitudinal ends of the locking bar.

19. The rekeyable lock cylinder of claim 18, wherein the flange of the locking bar extends uniformly between the first and second longitudinal ends of the locking bar.

20. The rekeyable lock cylinder of claim 12, wherein in the locked position of the locking bar, the engagement between corresponding planar surfaces restricts the flange from rotating the plurality of racks.

21. The rekeyable lock cylinder of claim 12, wherein in the locked position of the locking bar, a portion of the flange is partially disposed within the second engaging groove of at least one of the plurality of racks.