United States Patent

Surko, Jr. et al.

[15] **3,667,264**

[45] **June 6, 1972**

[54] LOCK CORE

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[73] Assignee: **Emhart Corporation**, Bloomfield, Conn.

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[21] Appl. No.: **10,190**

[52] **U.S. Cl.** **70/369**

[51] **Int. Cl.** **E05b 27/00**

[58] **Field of Search** ..... 70/369, 340, 367–368, 70/364 A, 419, 373

[56] **References Cited**

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[57] **ABSTRACT**

A removable or interchangeable figure-8 pin tumbler lock core adapted to be received and locked in a housing and for operating an associated lock mechanism. The core has a body supporting a key plug and a locking element arranged for limited angular movement relative to the body and the key plug to lock the core in or release it from the housing when a control key is inserted in the plug. The lock mechanism is operated by inserting an operating key to rotate the plug relative to the body without effecting movement of the locking element. A line of shear between the locking element and the body is formed by a planar surface of the body and an arcuate surface of the locking element generally tangent thereto. Lugs on the locking element cooperate with grooves in the body to prevent escape of pin tumblers from the locking element or the body when the locking element is rotated between its locking and releasing positions.

14 Claims, 12 Drawing Figures

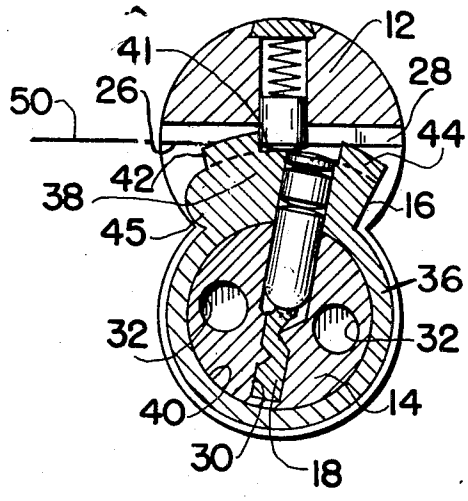


FIG. 1

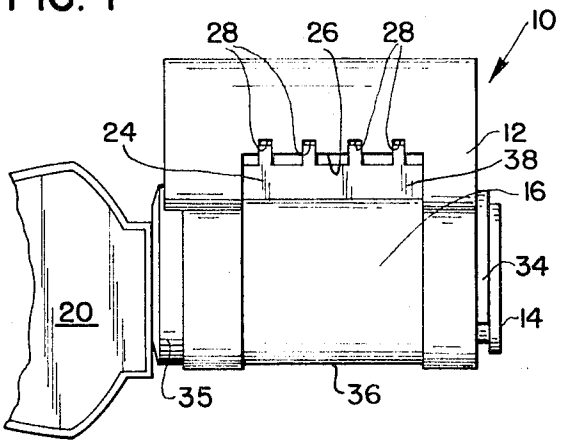


FIG. 2

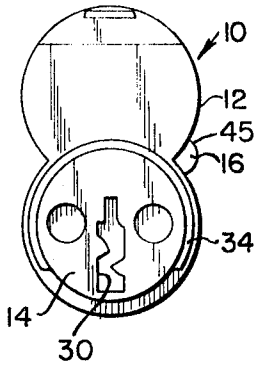


FIG. 3

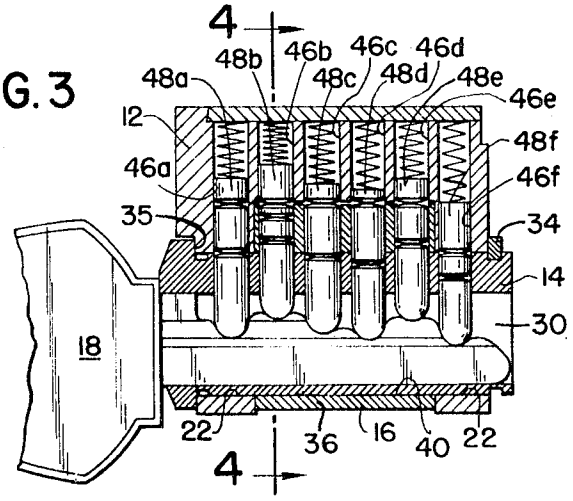


FIG. 4

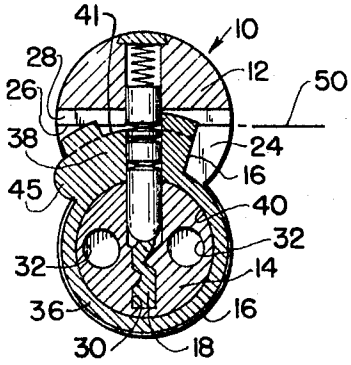


FIG. 5

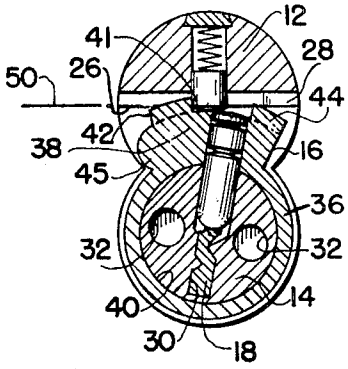
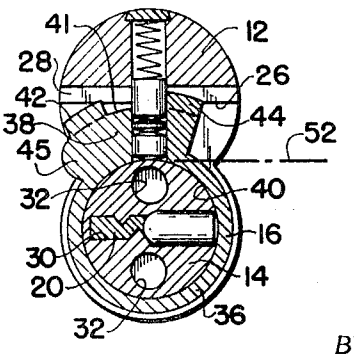


FIG. 6



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FIG. 7

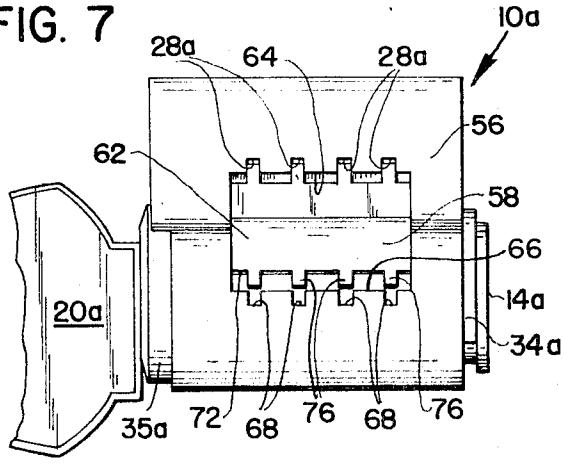


FIG. 8

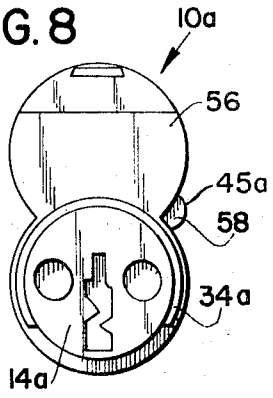


FIG. 9

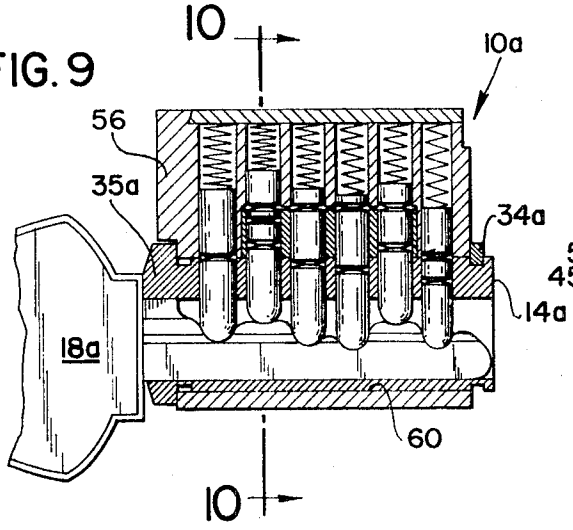


FIG. 10

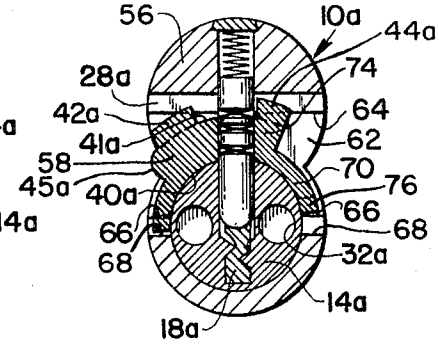


FIG. 11

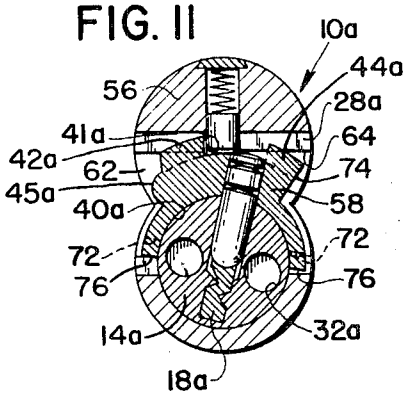
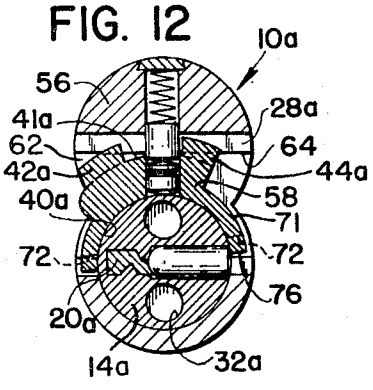


FIG. 12



LOCK CORE

BACKGROUND OF THE INVENTION

This invention relates in general to improvements in lock cores and deals more particularly with an improved removable or interchangeable key-operated pin tumbler lock core having a lock-controlled assembly feature in which the assembly of the lock core in a core receptacle or housing is controlled by the lock core.

The invention relates more specifically to improvements in interchangeable pin tumbler lock cores of figure-8 type such as illustrated and described in U.S. Pat. No. 2,814,941 to Best, entitled "Lock Core," issued Dec. 7, 1957. A lock core of the aforesaid type usually includes a body, a key plug supported for rotation relative to the body for operating an associated lock mechanism, and a locking element arranged for limited angular movement with the key plug and relative to the body to lock the core in or release it from an associated core receptacle. As illustrated in the patent to Best, it is usual in a lock core of this type to provide the body and locking element with arcuate mating surfaces which form control shears at locations where the pin tumbler holes intersect the arcuate surfaces. When a series of lock cores of this type are provided having a relatively large number of key combinations, some of the pin tumblers will, if necessary, take the form of relatively thin wafers to permit relatively slight differences in key biting. In such a structure it is essential that close concentricity tolerances be maintained between the mating arcuate surfaces to prevent pin tumblers from escaping or jamming when the locking element is rotated relative to the body. If the core body is to be made from a single piece of material relatively difficult machine operations may be required to attain desired concentricity between the arcuate surfaces on the body, the locking element and the key plug in the associated structure so that it will operate smoothly without risk of the pin tumblers escaping or jamming. Best overcomes this problem by providing a body built up from stampings or laminations and riveted together in assembly. However, this approach necessitates formation of a plurality of parts which differ in shape and requires accurate assembly.

Accordingly, it is the general aim of the present invention to provide an improved lock core of the aforedescribed general type which eliminates part or simplifies machining operations with resulting savings in manufacturing cost.

SUMMARY OF THE INVENTION

In accordance with the present invention, an improved removable or interchangeable lock core is provided which includes a body and a locking element having a line of shear therebetween formed by a substantially planar surface and an arcuate surface generally tangent to the planar surface. Means are provided to prevent escape of pin tumblers from the body or locking element when the locking element is rotated between locking and releasing positions relative to the body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a lock core embodying the present invention shown with an operating key therein.

FIG. **2** is an end elevational view of the lock core of FIG. **1** as viewed from the right in FIG. **1**.

FIG. **3** is a sectional view taken along the line **3—3** of FIG. **2** and shows the core with a control key therein.

FIG. **4** is a sectional view taken along the line **4—4** of FIG. **3**, and shows the locking element in its locked position.

FIG. **5** is similar to FIG. **3** but shows the locking element in its releasing position.

FIG. **6** similar to FIG. **3** but shows the core with an operating key therein and the key plug rotated to an operating position.

FIG. **7** is a side elevational view of another lock core embodying the present invention, shown with a control key therein.

FIG. **8** is an end elevational view of the lock core of FIG. **7**.

FIG. **9** is a sectional view taken generally along the line **9—9** of FIG. **8**.

FIG. **10** is a sectional view taken along the line **10—10** of FIG. **9** and shows the locking element in its locked position.

FIG. **11** is similar to FIG. **10** but shows the locking element in its releasing position.

FIG. **12** is similar to FIG. **9** but shows the core with an operating key therein and the key plug rotated to an operating position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the drawings and referring particularly to FIGS. **1–3**, a lock core embodying the present invention and indicated generally by the numeral **10** comprises a body **12** supporting a key plug **14** and a locking element **16**. The core **10** has a figure-8 shaped profile as best shown in FIG. **2** and is adapted to be received and locked in a complementary core receptacle or housing (not shown) for operating a locking mechanism associated with the housing. The locking element **16** is arranged for limited angular movement relative to the body **12** and with the key plug **14** between a locking position shown in FIGS. **2** and **6** and a releasing position illustrated in FIG. **5** when a control key such as indicated at **18** is inserted in the plug. When an operating key **20** is inserted therein the plug is freely rotatable relative to the body **12** and the locking element **16** for operating an associated lock mechanism in a manner well known in the art.

Considering now the mechanism in further detail, the body **12** is preferably formed from an elongated piece of solid material and has a figure-8 shaped cross section or profile and a bore **22** extending longitudinally through the lower portion thereof. A recess or notch **24** formed in the underside of the body for receiving the locking element **16** is partially defined by a substantially planar upper surface **26** parallel to the bore axis. A plurality of axially spaced grooves **28, 28** extend transversely of the body **12** and open downwardly through the planar surface **26** for a purpose which will be hereinafter evident.

The key plug **14** is of a generally conventional type and has a cylindrical body and a paracentric fluted keyway **30** formed therein. A pair of cylindrical holes **32, 32** extend axially into the key plug on opposite sides of the keyway and open through the rear face thereof for receiving drive pins associated with the lock mechanism to establish driving connection therewith. A retaining washer **34** received on the rear end of the key plug **14** cooperates with an annular shoulder **35** formed at the forward end thereof to retain the plug in assembly with the body **12**.

The locking element **16** has a generally cylindrical body portion **36** which surrounds the key plug **14** within the recess **24** and includes an upwardly extending portion **38** received in the upper portion of the recess. The locking element **16** has concentric inner and outer surface portions respectively indicated at **40** and **41**, the inner surface being in mating engagement with the surface of the key plug and the outer surface portion being tangent to the planar surface **26**. A plurality of circumaxially spaced radially outwardly projecting pairs of lugs **42** and **44** are formed on the upper portion **38**. Each pair of lugs extend into an associated one of the grooves **28, 28**. It will be noted that a locking shoulder **45** is also formed on one side of the upper portion **38** and extends therealong in an axial direction.

The key plug **14** and the locking member **16** are locked against rotation by conventional stacks of pin tumblers indicated at **48*a–f*** received in a plurality of pin tumbler holes **46*a–f***. The tumblers in each stack have breaks between the individual tumblers thereof. The number of tumbler stacks provided may vary, but in the illustrated case, six stacks of tumblers are employed. The endmost tumblers **48*a*** and **48*f*** are respectively received in holes **46*a*** and **46*f*** which extend downwardly through the body **12** and into the key plug **14**.

The four stacks of tumblers indicated at **48***b*–**48***e* are associated with the recess **24** and extend downwardly into and through the body **12** and the locking element **16** and into the key plug **14**. It will be noted that each of the latter four pin tumbler holes is aligned with an associated groove **28** and opens through the planar surface **26** and extends through the locking element **16** between an associated pair of lugs **42** and **44**. A control line of shear indicated at **50** is formed between the locking element **16** and the body **12** at the point of tangency therebetween where the various pin tumbler holes intersect the planar surface **26** and the outer surface **41**. An operating line of shear **52** is formed between the locking element **16** and the key plug **14** where the various pin tumbler holes intersect the inner surface **40** and the surface of the key plug **14**.

When there is no key in the plug **14** or when an improper key is inserted therein, the divisions or breaks between the various pin tumblers are not aligned on either of the shear lines and the key plug **14** and the locking element **16** are prevented from turning relative to the body **12**. In either case, when the core **10** is in its locked position, as it appears in FIG. **6**, the shoulder **45** is disposed outside of the recess and projects beyond the profile of the body **12** for engagement with an associated core housing to prevent removal of the core therefrom. When the control key **18** is inserted in the plug, the various pin tumblers move to a position wherein breaks therebetween are aligned with the control line of shear **50** as shown in FIGS. **3** and **4**. The control key **18** may then be turned in a clockwise direction through an angle of approximately 15° so that the key plug **14** and the locking element **16** rotate together to retract the locking shoulder **45** to a position wherein it is wholly disposed within the recess **24** as it appears in FIG. **5**. The core **10** may then be freely removed from its associated housing.

It should be noted that the lugs **42** and **44** cooperate with the grooves **28, 28** to prevent the escape of pin tumblers from the locking element and the body when the locking element is rotated between its locking and releasing positions. The lugs **42** and **44** also cooperate with the pin tumblers to limit rotation of the locking element between its locking and releasing positions.

When a proper operating key **20** such as the key is inserted in the key plug **14** the divisions or breaks between the various pin tumblers are aligned on the operating shear line **52** and the key plug **14** is freely rotatable relative to the body **12** to operate an associated lock mechanism without effecting movement of the locking element **16**.

Referring now to FIGS. **7–9** another lock core embodying the present invention is illustrated and designated generally by the reference numeral **10***a*. The core **10***a* is similar in many respects to the core **10** and parts substantially identical to parts previously described bear the same reference numeral and a letter *a* suffix and will not be hereinafter further discussed.

The core **10***a* also has a generally figure-8 shaped profile and includes a body **56**, a locking element **58**, and a key plug **14***a*. The body **56** has a bore **60** which extends longitudinally therethrough and a recess **62** which extends transversely therethrough and intersects the bore **60**. The upper wall of the recess is defined by a downwardly facing substantially planar surface **64** parallel to the axis of the bore. The lower extent of the recess is defined by a pair of upwardly facing edge surfaces **66, 66** adjacent opposite sides of the bore **60**. As in the previously described core a plurality of axially spaced grooves **28***a*, **28***a* extend transversely of the body and open downwardly through the planar surface **64**. The body **56** also has a plurality of axially spaced notches **68, 68** formed at opposite sides of the bore therein and opening upwardly through the edge surfaces **66, 66**. Each notch **68** is radially aligned with an associated groove **28***a*.

The locking element **58** comprises a parti-cylindrical or segmental part received in the recess **62**. It has an arcuate segmental portion **71** which engages an associated portion of the key plug surface and terminates in generally downwardly facing edge surfaces **72, 72**. The element **58** also includes an integral upwardly extending portion **74** and has concentric inner and outer surfaces **40***a* and **41***a*, the outer surface **41***a* being generally tangent to the planar surface **64**. A plurality of pairs of lugs **42***a*, **42***a* and **44***a*, **44***a* are formed on the portion **74** and extend outwardly therefrom. Each pair of lugs extends into an associated groove **28***a*, the lugs which comprise the pair being disposed to opposite sides of the pin tumbler stack associated with the groove. A locking shoulder **45***a* is also formed on the element **58** and extends in an axial direction along one side of the portion **74**. A plurality of fingers **76, 76** extend generally downwardly and in a circumferential direction from each edge surface **72**. Each finger **76** is radially aligned with an associated notch **68** and adapted to be received therein when the locking element **58** is moved between its locking and releasing positions.

The core **10***a* operates generally as aforedescribed. However, when the core **10***a* is in its locked position, as it appears in FIGS. **10** and **12**, the fingers **76, 76** along the left edge surface **72** are disposed in associated notches **68, 68** and the fingers at the opposite or right hand side of the element **58** are disposed immediately adjacent associated notch openings. The fingers **76, 76** on the locking element cooperate with the notches **68, 68** formed in the body to prevent the various pin tumblers from escaping from the key plug **14***a* when an operating key such as indicated at **20***a* is inserted in the plug and the plug is rotated relative to the body **12** and the locking member **58** as best shown in FIG. **12**.

When the locking element **58** is rotated to its locked position the edge surface **72** on the left side of the locking element, as it appears in FIG. **10**, engages the right edge surface **66** on the body, thereby preventing each lug **44***a* from engaging an associated pin tumbler. The opposite condition is obtained when the locking element is rotated to its releasing position, that is the surface **72** on the right side of the locking element **58** engages the associated surface **66** on the right side of the body to prevent each lug **42***a* from engaging an associated pin tumbler. Thus, each surface **72** and associated surface **66** comprise a pair of coengagable abutment surfaces for limiting rotation of the locking element relative to the body and for preventing the lugs on the locking element from engaging the pin tumblers to impair free movement thereof.

We claim:

1. A lock core adapted to be received and locked in a housing and for operating an associated lock mechanism comprising a body having a cylindrical bore extending longitudinally therein and including a recess communicating with said bore and partially defined by a generally planar surface parallel to the axis of said bore, a generally cylindrical key plug received in said bore, means for retaining said plug in assembly with said body for rotation therein, a locking element received in said recess and having an outwardly projecting locking shoulder and arcuate inner and outer surface portions generally concentric with the surface of said plug, said arcuate inner surface portion in mating engagement with the surface of said plug, said arcuate outer surface portion generally tangent to said planar surface, pin tumbler holes extending through said locking element and into said body at general points of tangency between said planar surface and said arcuate outer surface portion and extending into said key plug, said planar surface and said arcuate outer surface portion forming one line of shear between said body and said locking element where said tumbler holes intersect said planar surface and said arcuate outer surface portion, said inner surface portion and said plug surface forming another line of shear between said plug and said locking element where said pin tumbler holes intersect said inner surface portion and said plug surface, a stack of pin tumblers received in each of said pin tumbler holes and having breaks between the individual tumblers thereof, said pin tumblers being adapted for movement to one position wherein one of said breaks is aligned with said one line of shear by insertion of one key in said plug to permit rotation of said locking element with said plug and

relative to said body between a locking position wherein said shoulder is disposed in one location relative to said body and engagable with the housing to prevent removal of the core therefrom and a releasing position wherein said shoulder is disposed in another location relative to said body to permit insertion of said core into said housing and removal of said core therefrom, said pin tumblers being adapted for movement to another position wherein one of said breaks is aligned with said other line of shear by insertion of another key in said plug to permit rotation of said plug relative to said locking element and said body for operating the lock mechanism, and means for preventing escape of said pin tumblers from said locking element and said body when said locking element is rotated between its locking and releasing positions.

2. A lock core as set forth in claim 1 wherein said body has grooves formed therein and said locking element has outwardly projecting lugs thereon extending into said grooves, said lugs and said grooves comprising said means for preventing escape of said pin tumblers.

3. A lock core as set forth in claim 2 wherein said grooves extend transversely of said body in axially spaced relation and open through said planar surface, each of said grooves intersecting an associated one of said pin tumbler holes, and said locking element has a plurality of pairs of axially spaced lugs, each of said pairs including two circumaxially spaced radially outwardly extending lugs, said lugs comprising each of said pairs extending into an associated one of said grooves at opposite sides of an associated one of said pin tumblers.

4. A lock core as set forth in claim 1 including means for limiting rotation of said element between said locking and releasing position.

5. A lock core as set forth in claim 2 wherein said lugs cooperate with said pin tumblers and comprise means for limiting rotation of said locking element.

6. A lock core as set forth in claim 4 wherein said body and said locking element have coengageable abutment surfaces thereon, said abutment surfaces comprising said means for limiting rotation.

7. A lock core as set forth in claim 1 wherein said recess comprises a downwardly opening notch, said planar surface defines the upper surface of said notch, and said locking element comprises a generally cylindrical part surrounding an associated portion of said key plug.

8. A lock core as set forth in claim 1 wherein said shoulder in said locking position is disposed outside of said recess and projects outwardly beyond the peripheral surface of said body and said shoulder in said releasing position is disposed wholly within said recess.

9. A lock core as set forth in claim 1 wherein said recess comprises a generally rectangular opening extending transversely through said body and opening through opposite sides thereof and said locking element comprises a parti-cylindrical part.

10. A lock core as set forth in claim 9 including means for preventing escape of pin tumblers from said plug when said plug is rotated relative to said locking element and said body.

11. A lock core as set forth in claim 10 wherein said locking element has a plurality of axially spaced apart circumaxially extending fingers and said body has a plurality of notches formed therein, each of said notches being adapted to receive an associated one of said fingers when said locking element is rotated to said locking position, said fingers and said notches comprising said means for preventing escape of pin tumblers from said plug when said plug is rotated relative to said locking element and said body.

12. A lock core as set forth in claim 3 including means for limiting rotation of said locking element between said locking and releasing position and for preventing said lugs from engaging said pin tumblers.

13. A lock core as set forth in claim 12 wherein said body and said locking element have coengageable abutment surfaces thereon, said abutment surfaces comprising said means for limiting rotation of said locking element and preventing said lugs from engaging said pin tumblers.

14. A lock core as set forth in claim 13 wherein said planar surface comprises the upper surface of said recess and said coengageable abutment surfaces are defined by generally upwardly facing surfaces on said body and generally downwardly facing surfaces on said locking element.

* * * * *