United States Patent

Nolin

[15] **3,702,553**

[45] **Nov. 14, 1972**

[54] CYLINDER LOCK PLUG

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[73] Assignee: **Tool Research & Engineering Corporation**, Beverly Hills, Calif.

[22] Filed: **May 10, 1971**

[21] Appl. No.: **141,875**

[52] **U.S. Cl.** **70/375**, 70/367, 70/385

[51] **Int. Cl.**.....**E05b 9/04**, E05b 15/08

[58] **Field of Search**.....70/375, 385, 367, 369, 382, 70/453, 454

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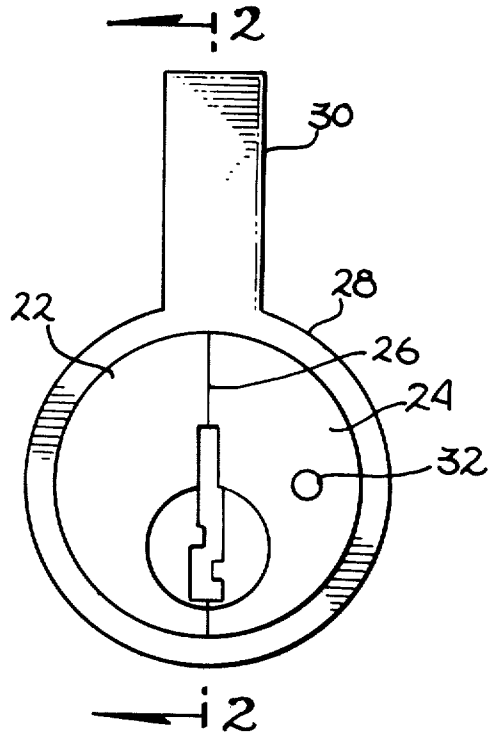
Primary Examiner—Robert L. Wolfe

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[57] **ABSTRACT**

A cylinder lock plug comprising two plug sections adapted to mate on facing surfaces defining a keyway, with the periphery of the sections adapted to slide into a cylindrical plug sleeve containing pin tumbler holes to complete the plug. Each plug section has an enlarged shoulder area adjacent one end and a threaded section adjacent the other end. When the plug is assembled with the cylindrical member into a cylinder, the enlarged shoulder areas mate to form the front face of the plug, and the threaded sections cooperate to define a threaded surface to receive a threaded retaining member. Each plug section defines the shape of one side of the keyway, so that plugs with a great variety of keyways may be made by using different combinations of a few plug sections.

16 Claims, 10 Drawing Figures



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SHEET 1 OF 2

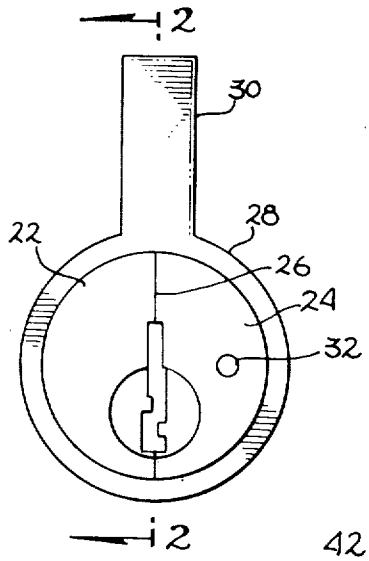


Fig. 1

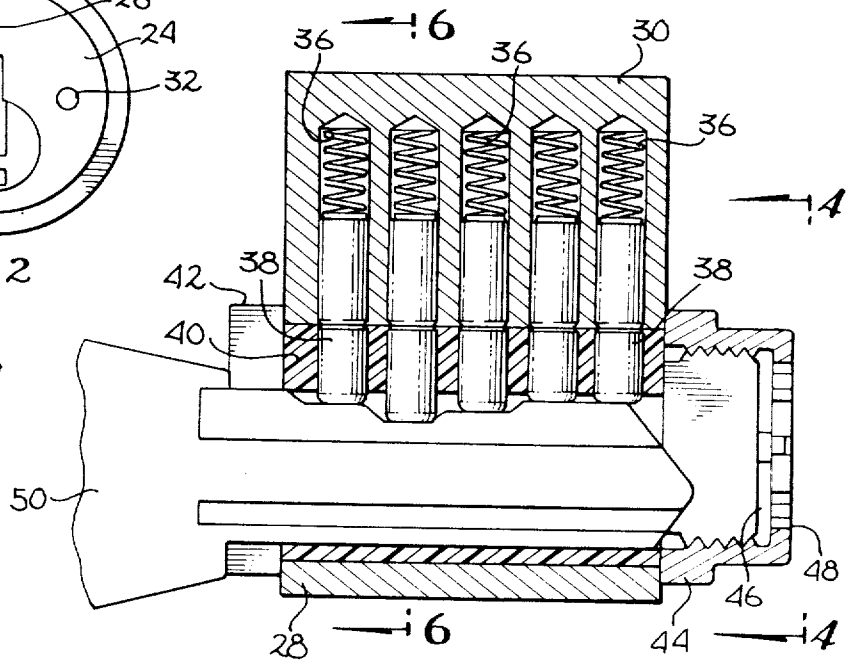


Fig. 2

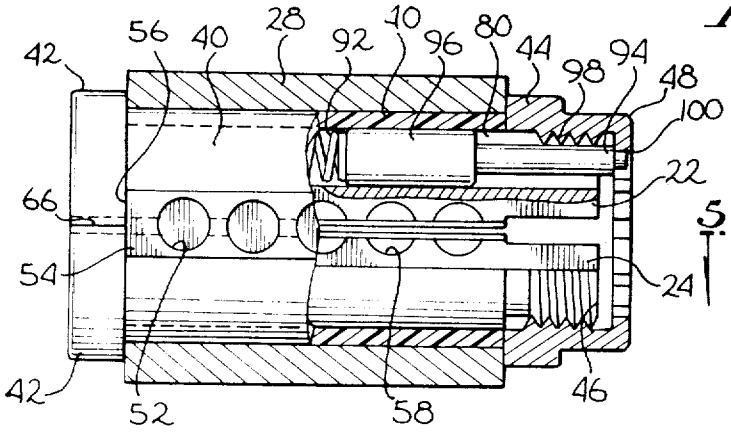


Fig. 3

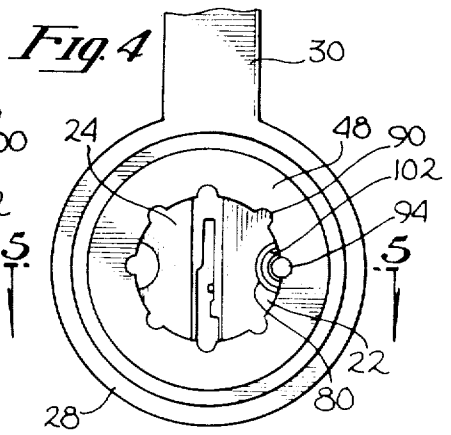


Fig. 4

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Fig. 5

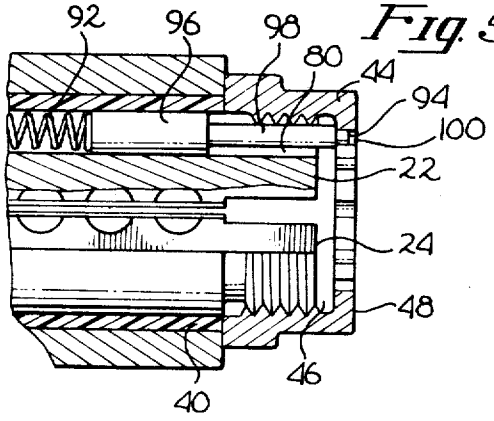


Fig. 6

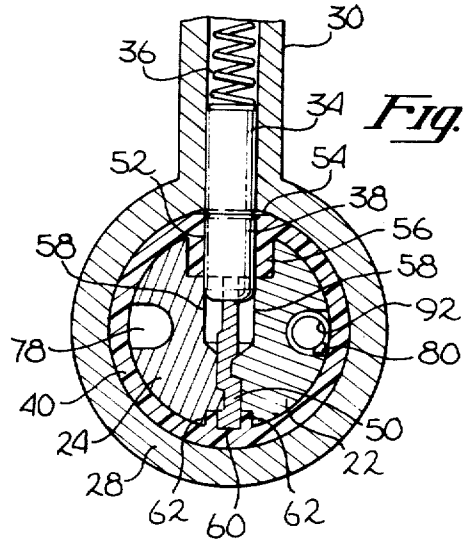


Fig. 8

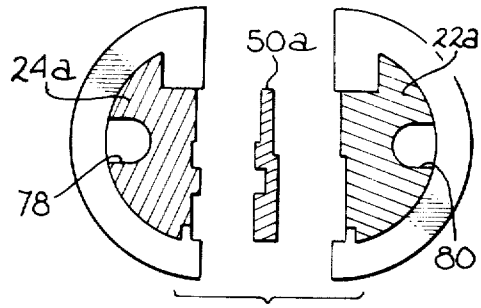
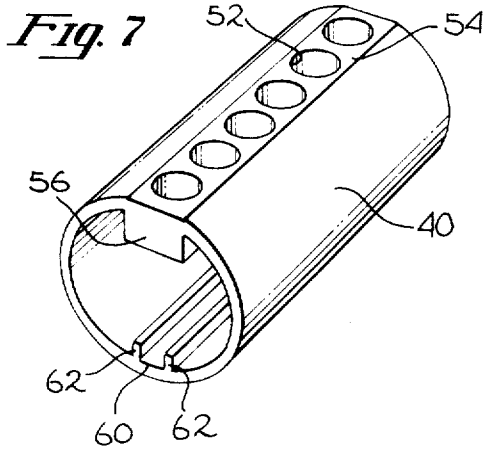


Fig. 7



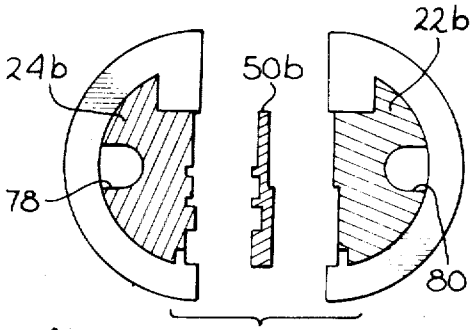
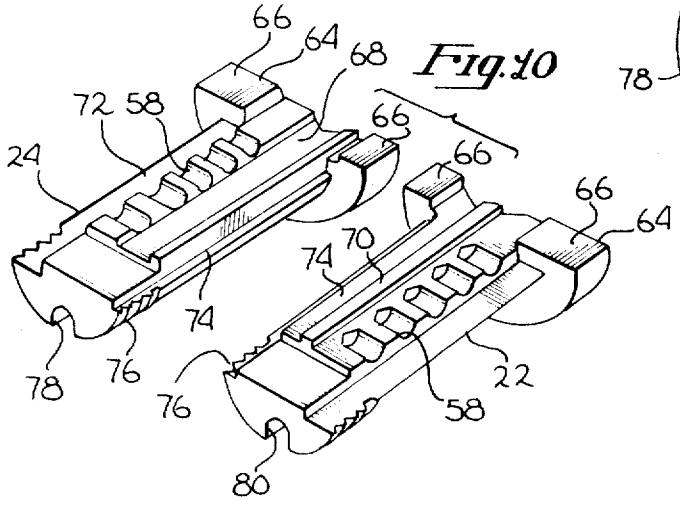


Fig. 9

Fig. 10



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CYLINDER LOCK PLUG

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of cylinder locks.

2. Prior Art

Prior art plugs for cylinder locks are generally fabricated by either of two methods. These methods are to machine the plug from a solid brass bar, or to use a zinc die casting for the plug.

Machining the plug from a solid brass bar yields an accurate and durable plug for use in locks. However, such plugs are relatively expensive because of the number of machining operations required to complete the plug and the specialized machine tools required to carry out these operations. By way of example, starting with a bar of sufficient diameter to define the front shoulder or face of the plug, the bar must be turned down on a screw machine to the inside diameter of the cylinder. The pin holes must be drilled, the keyway broached, and some provision made on the plug for locking the plug in the cylinder. In one prior art plug this locking provision required threading the end of the plug opposite the front face and drilling a hole adjacent the periphery of the plug so that a locking member could be screwed onto the plug to retain the plug in the cylinder, with the locking member being retained by a spring loaded pin inserted into the aforementioned hole. Further, for use in hotels where a visual indicator pin is to be provided, the visual indicator pin hole must be drilled the full length of the plug. These various operations are all relatively slow and costly operations requiring expensive and specialized equipment to assure adequate accuracy and dimensional control. Also, it is clear that a special broach must be used for each special keyway configuration.

The number of operations and cost associated with producing a finished plug from a zinc die casting is substantially less than machining the plug from a solid brass bar. However, not all machining operations are eliminated by the use of the zinc dye casting since, in general, the pi tumbler holes must be drilled in the dye casting to assure a sufficiently accurate location for such holes. Also, zinc itself has certain disadvantages making it undesirable or even unacceptable in certain applications. The major disadvantage is the characteristically low melting point of zinc and zinc alloys which make zinc lock parts unacceptable under certain federal specifications and for commercial and industrial applications. Also, it is difficult to maintain close tolerances in a zinc die casting, particularly to maintain a close tolerance keyway in the die cast plug.

One prior art lock plug having a split cylindrical section is disclosed in U.S. Pat No. 3,429,154 entitled "Lock Plug." The plug disclosed in that patent has a first section forming one-half of the plug and having the front face or shoulder integral therewith. A second member mates with the first member so as to define therebetween a continuation of the keyway in the front face of the plug integral with the first member, and to define a plurality of pin holes. That plug is intended to be fabricated from plastic, and though it contains certain advantages over other prior art plugs, primarily in regard to fabrication, it also has certain disadvantages in regard to utility which detract from its usefulness. By way of example, the front face contains a portion of the keyway and, therefore, defines the cross-section of the key. Consequently, the other section mated with this first section must match the same keyway and, therefore, different sections may not be assembled in a different manner so as to create a large combination of keyway shapes.

The prior art split plug is comprised of two half sections which are held in functional disposition to each other at least in part by the cylinder housing in which they operate. Thus, when a key is inserted into the keyway in the plug and rotated, the two half sections will be forced apart and pushed into firm rubber engagement with the cylinder. This may cause increased wear of the plug, particularly at the edges of the half sections, and may result in an increasing looseness in the fitting of the various parts of the assembly. In this regard, it should be noted that because of the looseness of the two half sections defining the keyway and the fact that the two half sections also define the pin holes, looseness of the sections or a tendency of the sections to move one with respect to the other will change the apparent geometry of the pin holes, possibly binding the pins between the two half sections and preventing the free operation of the lock.

These problems are aggravated when a bent key is inserted into the lock. In that case, the two sections are strongly forced apart by the mere pressure of the key, thereby causing increased wear or binding between the plug and the cylinder. Also, since the front face is integral with only one section of the plug, the other sections may tend to shift longitudinally when a bent key is inserted, thereby shifting one-half of each pin hole with respect to the other half and pinching the pins therein so as to prevent the free operation of the lock.

BRIEF SUMMARY OF THE INVENTION

The present invention utilizes a cylinder lock plug comprising two plug sections adapted to mate on facing surfaces defining a keyway, with the periphery of the sections adapted to slide into a cylindrical plug sleeve containing pin tumbler holes to complete the plug. Each plug section has an enlarged shoulder area adjacent one end and a threaded section adjacent the other end. When the plug is assembled with the cylindrical member into a cylinder, the enlarged shoulder areas mate to form the front face of the plug having a keyway therein, and the threaded sections cooperate to define a threaded surface to receive a threaded retaining member. Each plug section defines the shape of one side of the keyway so that plugs with a great variety of keyways can be made by using different combinations of a few plug sections.

The threaded retaining member has an outer diameter which is greater than the diameter of the plug sleeve. In assembly, it is threaded onto the two plug sections to position so as to retain the plug sections and plug sleeve in functional disposition with respect to the cylinder with a minimum of axial freedom. One plug section has a slot originating at the threaded end and terminating adjacent the large shoulder area for receiving a coil spring and a locking pin. The coil spring urges the locking pin against the retaining member, and a protrusion on the end of the locking pin engages the serration on an inward protruding lip on the back portion of the retaining member so as to lock the retaining

member against any substantial rotation. The other plug section also has a groove running from the threaded end up to the large shoulder area which, in applications requiring an indicator pin through the front face of the plug, may be extended by drilling a hole in the plug face and used to receive the indicator pin.

Both plug sections are simple members which may be formed to their finished dimensions by any of a number of processes. In the preferred embodiment, sintered brass is used for the plug section. The plug sleeve may also be formed to the finished dimensions either by molding out of a suitable plastic such as nylon or by forming the sleeve to the finished dimensions out of such material as sintered brass.

Brief Description of the Drawings

FIG. 1 is a front view of a cylinder assembly using the cylinder plug of the present invention.

FIG. 2 is a cross-section of the cylinder assembly of FIG. 1 taken along lines 2—2 of that figure.

FIG. 3 is a partial cross-section of the cylinder plug of FIG. 2.

FIG. 4 is a back view of the cylinder assembly of FIG. 1.

FIG. 5 is a cross-section of the cylinder assembly of FIG. 1 taken along lines 5—5 of FIG. 4.

FIG. 6 is a cross-sectional view of the cylinder assembly of FIG. 1 taken along lines 6—6 of FIG. 2.

FIG. 7 is a perspective view of the plug sleeve 40.

FIG. 8 is an exploded view of the cross-section of plug sleeve 40 with two plug sections 22*a* and 24*a* defining a specific key way shape.

FIG. 9 is a cross-section of plug sleeve 40 with plug section 24*a* of FIG. 8 and a new plug section 22*b* so as to define a different keyway shape over the assembly of FIG. 8.

FIG. 10 is a perspective view of plug sections 22 and 24 showing the details of the plug sections, and particularly the normally facingly disposed surfaces of the plug sections.

DETAILED DESCRIPTION OF THE INVENTION

First referring to FIG. 1, a front view of the plug of the present invention in a prior art cylinder may be seen. In this figure, the front face and keyhole are formed by plug section 22 and plug section 24 which abut each other at the front face on a vertical plane 26. Also visible in this figure is the cylinder 28 and pin tumbler chamber 30, well-known in the prior art, and a visual indicator pin 32 which is used in locks for hotel and motel rooms to indicate that the room is occupied. Such indicator pins are also well-known in the prior art and are mentioned herein only to indicate the ease with which an indicator pin may be used in conjunction with the plug of the present invention.

Now referring to FIG. 2, a cross-section of the cylinder assembly of FIG. 1 taken along lines 2—2 of that figure may be seen. Cylinder 28 forms a cylindrical cavity surrounding the plug, with pin tumbler chamber 30 integral therewith. The pin tumbler chamber contains a plurality of holes having pin tumblers 34 and tumbler springs 36 urging the pin tumblers toward the plug. Pins 38 are located in cooperatively disposed holes in plug sleeve 40, which forms a portion of the plug of the present invention. The bore of cylinder 28 is smaller in diameter than the front face of sections 22 and 24 so that shoulder 42 defined by the front face of the two sections locates the sections with respect to cylinder 28. The two sections 22 and 24, as well as plug sleeve 40, are retained in the cylinder by a internally threaded cap 44 which screws onto a threaded area defined in part by an extension of each of sections 22 and 24. The cap 44 is retained against rotation by a pin in section 22 (to be subsequently described in greater detail) at a proper axial position to minimize the axial freedom between sections 22 and 24 and cylinder 28, but allow the free rotation of the plug with respect to the cylinder. Not shown in FIG. 2 is a drive member for operating a bolt, well-known in the prior art, which is captured between the surface 46 defined by the ends of sections 22 and 24 and shoulder 48 on cup 44, and driven in rotation by the same pin which retains cap 44 with respect to sections 22 and 24.

When a proper key 50 is inserted into the plug, pins 38 take the positions in plug sleeve 40 shown in FIG. 2, thereby allowing the free rotation of the plug.

Further details of the plug sleeve 40 may be seen in FIG. 6, which is a cross-section of the cylinder assembly taken along lines 6—6 of FIG. 2, and in FIG. 7 which is a perspective view of the plug sleeve 40. Plug sleeve 40 is generally cylindrical sleeve of substantially the same length as cylinder 28. The plug sleeve has a uniform cross-section, except for pin holes 52, and has an outer diameter adapted to provide a slip fit between the plug sleeve 40 and cylinder 28. As with prior art plugs, plug sleeve 40 has a flattened surface 54 in the region of pin holes 52 so as to form a flattened surface cooperative with the flat ends of the pins and pin tumblers to allow the initial rotation of the plug upon insertion of the proper key.

Plug sleeve 40 has an enlarged, substantially rectangular section 56 in the vicinity of pin holes 52. Though the plug sections 22 and 24 have cooperatively disposed surfaces 58 to define a continuation of pin holes 52 (FIGS. 6 and 10), the major guidance for pins 38 is provided by the holes 52 in regions 56 of the plug sleeve, particularly as the pins approach their respective positions allowing operation of the lock. This is to be compared with the prior art split plug where the pin holes were totally defined by the two plug halves, thereby allowing either looseness of the pins on the separation of the two halves, or the binding of the pins by the longitudinal shift of one part with respect to the other.

Diametrically opposite the pin holes 52 in the plug sleeve 40 is a groove 60 defined by the inward protruding members 62 which are integral with the plug sleeve. The groove 60 provides a guide for the lower edge of key 50 so as to guide the key and maintain the proper key position with respect to the pin tumbler chamber as the key is being inserted into the plug.

Plug sections 22 and 24, and particularly the facingly disposed surfaces thereof, may be best seen in FIG. 10. Each plug section has an enlarged frontal area 64 adapted to mate with the frontal area of the other plug section on the surfaces 66 to define the front face or shoulder 42. The surfaces 66 and the two plug sections are the only surfaces on the plug sections which mate or substantially mate with each other in the preferred embodiment.

Surfaces **68** and **70** define the two sides of the keyway and are held in separation in part by faces **66** on the enlarged frontal area **64**, and in part by location of each section between the rectangular section **56** and the inward protruding members **62** in the plug sleeve (FIG. **6**). Surfaces **72** are flat surfaces adapted to slide along rectangular section **56**, and surfaces **74** are adapted to slide along inward protruding members **62**. Located at one end of the plug sections is a threaded surface **76** which, when the sections are assembled into the plug sleeve, are disposed so as to be engageable by internally threaded cap **44**. Also, visible in FIG. **10**, are the slots **78** and **80** originating at the threaded end of the plug sections and running longitudinally along the sections. Groove **80** in plug section **22** is for receiving the locking pin and coil spring, to be subsequently described, and projects from the threaded end of the plug section up to the enlarged frontal area **64**. Groove **78** in plug section **22** is for receiving the indicator pin **32** (FIG. **1**) and also projects from the threaded end of the plug section up to the enlarged frontal area **64**. In those applications using the indicator pin **32**, the hole in the front face **64** of section **24** for the pin is drilled in a subsequent operation. This is to be compared with the prior art plugs, where the hole for the indicator pin must be drilled the full length of the plug, a time consuming and costly operation.

The mating of plug sections **22** and **24** may be best seen in FIG. **3**, which is a top view of the plug of the present invention in a cylinder with the cylinder **28**, retaining nut **44** and a portion of the plug sleeve **40** shown in cross-section. The two plug sections mate on surfaces **66** as hereinbefore described and are held in separation by engagement with rectangular section **56** and inward protruding members **62**. The region between plug sections **22** and **24** within cylinder **28** define both sides of the keyway and since, as may be seen in FIG. **2**, the higher lobes on the key extend upward to a position just below the inner surface of the rectangular section **56** and the lower edge of the key rides in the groove **60** in the plug sleeve **40**, the two plug sections must be held in separation in this region to allow free passage of the key. Also, as may be seen in FIG. **3**, the two plug sections **22** and **24** do not mate in the region within cap **44**. This however, is not a requirement as the key **50** (FIG. **1**) projects only into a portion of that area, and cylinder plug sections **22** and **24** could have a configuration which included inwardly disposed mating surfaces in the region under cap **44**. Also, while in the preferred embodiment of the present invention plug, the key **50** substantially extends from rectangular section **56** to groove **60** in cylinder plug **40** so as to prevent any facingly disposed surfaces in the region of the keyway from mating, plugs could be designed using the principles of the present invention in which the plug sections had facingly disposed mating surfaces above or below the key. By way of example, the plug sections **22** and **24** might be made to extend below the lower edge of key **50** so as to mate in that region and define a groove or guide for the lower edge of the key.

Now referring to FIGS. **4** and **5**, details of the manner of locking cap **44** in the desired position along the threads **76** on the plug sections may be seen. FIG. **4** is a rear view of the cylinder assembly of FIG. **1**, and FIG. **5** is a cross-section taken along lines **5—5** of FIG. **4**. The inner surface of shoulder **48** has a series of serrations **90** which are generally in the shape of semicylindrical reliefs on the inner diameter of the shoulder. Groove **80** in plug section **22** houses a coil spring **92** and a locking pin **94**. The locking pin **94** has a first section **96** having a loose slip fit in groove **80** between plug section **22** and the adjacent wall of plug sleeve **40**. A second section **98** of reduced diameter extends below the minor diameter of the thread **76** on the end of plug section **22**, and in cooperation with the end **100** of further reduced diameter defines shoulder **102** which abuts the interface of shoulder **48** so as to retain locking member **94** and prevent its further expulsion by coil spring **92**. End section **100** engages one of the serrations **90** in the inner surface of shoulder **48** so as to prevent the rotation of the cup is desired, such as upon assembly or any subsequent disassembly, the locking member **94** may be pushed in against coil spring **92** so that end section **100** no longer engages the serrations in retaining nut **44**, thereby allowing the free rotation of the retaining nut.

Now referring to FIGS. **8** and **9**, one advantages of the present invention cylinder plug may be seen. These figures are cross-sections of typical plug sections and keys. In FIG. **8**, plug section **22***2* and **24***a* are shown which together define a keyway for use with a key having the cross-section of key **50***a*. In FIG. **9**, the plug section **24***a* of FIG. **8** has been replaced with plug section **24***b* so as to define a new keyway for use with a key **50***b* having a different cross-section than key **50***a*. It is thus apparent that if plug section **22***a* were replaced with a new plug section having a different face defining one side of the keyway, plugs defining two additional keyway shapes could be assembled therefrom. By having a number of plug sections, each defining a different shape for one side of the keyway, assemblies of the plug sections may be made to define a great variety of keyway shapes. By way of example, if plug section **22** and **24** were each made having five different shapes on the surfaces defining the respective sides of the keyway, a total of 25 plugs, each having a different keyway shape, could be assembled from these plug sections. This is to be compared to the prior art split plug in which the number of combinatiosn is limited to the number of pairs of matched parts (five pairs of parts produced only five combinations, rather than 25 combinations as in the present invention).

The parts for the present invention plug may be fabricated in a number of ways and out of a number of different materials depending upon requirements for the specific application. In the preferred embodiment, the plug sections **22** and **24** are sintered metal sections and are sintered to their finished dimensions. It is to be noted that because of the designs of the plug sections the plugs may be molded with molds having simple cavities since there are no holes, keyways, etc. which would require removable pieces in the mold. This is also be compared with the prior art split plug wherein one part of the plug had the entire plug face, with a keyway molded into the face integral therewith, which necessarily requires a much more complex mold to mold the part to the finished dimensions.

The plug sleeve **40** of the present invention plug in the preferred embodiment is molded to its finished dimensions out of nylon. Of course, any plastic materi-

al, preferably one having self-lubricating characteristics, could be used for the sleeve. The use of nylon or a similar plastic provides adequate strength for holding the plug sections in proper disposition and results in a smoothly operating plug within the cylinder. However, in certain applications a plastic material for plug sleeve **40** will not be acceptable because of the temperature limitations of the material. In those applications a metal such as sintered brass, sintered to the finished dimensions, would be used. In this regard, it should be noted that except for the pin holes in the plug sleeve, the plug sleeve has a uniform cross-section so that the plug sleeves could be made from an extruded member such as a brass extrusion by simple cutting the extrusion into the desired length and drilling the pin holes. Of course, other materials such as stainless steel, zinc, etc. may also be used for any or all of the parts of the present invention plug.

The present invention plug results in a substantial cost reduction and greater flexibility in the selection of key shapes by grossly reducing the operations required to produce a finished plug and by providing flexibility in the matter of assembly of various plug sections to create a large variety of keyways. While the plug has been shown in assembly with a conventional cylinder, it should be noted that the plug may also be used with the cylinder of my co-pending applications entitled "-Cylinder Housing for Locks" filed Oct. 7, 1970 wherein a cylinder is disclosed which may be assembled from parts which also may be sintered to their finished dimension. Consequently, these two inventions, when used in conjunction with each other, result in a cylinder and cylinder plug combination which may be assembled directly from molded and/or sintered parts without any required machining, thereby resulting in a very substantial cost reduction over the equivalent prior art parts, while at the same time providing greater flexibility and lower costs associated with the selection of new and different keyway shapes. Also, the present invention lends itself readily to improved "grand master keyway" applications which are standard in the art, without the requirement of expensive tooling. Of course, these results may also be obtained by making variations in the design and configuration of the component parts making up the assembly. Thus, while the invention has been particularly shown and described with reference to a preferred embodiment, therefore, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

I claim:

1. For use in the cylinder of a cylinder lock a plug comprised of first and second plug sections, a plug sleeve and a retaining means, said plug sleeve having an inner surface for receiving said first and second plug sections and a substantially cylindrical outer surface with a plurality of radially oriented pin holes disposed therein, said first and second plug sections having an enlarged first end section, a second end section and a center section therebetween, said first and second plug sections being retained in adjacent cooperative relationship with facingly disposed surfaces by said plug sleeve, said facingly disposed surfaces being contoured to define a keyway and a plurality of pin cavities aligned with the respective pin holes in said plug sleeve, said enlarged first end of said first and second plug sections together defining a front face having a diameter greater than the diameter of said outer surface of said plug sleeve, said retaining means engaging said first and second plug sections on said second end sections and defining a surface extending outward beyond the diameter of said outer surface of said plug sleeve to retain said first and second plug sections and said plug sleeve in functional disposition with respect to each other and with respect to said cylinder.

2. The plug of claim **1** wherein said plug sleeve is of substantially uniform cross-section, except for said pin holes, having a thickness in the region of said pin holes sufficient to dispose the inner surface of said last named region adjacent the top of said keyway.

3. The plug of claim **2** wherein said plug sleeve has a longitudinal groove on the inner surface of said plug sleeve diametrically opposite said pin holes for receiving and guiding the lower edge of a key.

4. The plug of claim **3** wherein the inner surface of said plug sleeve is a substantially cylindrical surface interrupted by an inward projecting longitudinal region containing said pin holes and by inwardly disposed, substantially parallel projections defining, at least in part, said longitudinal groove, and said center sections of said plug sections locate on said last named cylindrical surface and being maintained in substantially fixed separation by surface abutting the sides of said inward projecting longitudinal region and said parallel projections.

5. The plug of claim **1** wherein said plug sleeve is a plastic member.

6. The plug of claim **1** wherein said first and second plug sections are sintered metal sections.

7. The plug of claim **1** wherein said retaining means is comprised of a cap having internal threads adjacent one end thereof, said second end section of said first and second plug sections having threads forming a portion of a threaded cylindrical surface and said cap engaging said threads on said first and second plug sections.

8. The plug of claim **7** wherein said cap is locked against rotation at a position on said threads so as to limit the axial motion of said plug sections and said plug sleeve with respect to the cylinder by a cylindrical locking member and a coil spring, said first plug section having a groove in its outer surface extending from said second end section and terminating part way along said plug, said cap having an inwardly directed shoulder, with an inwardly directed serrated surface, projecting over the end of said first and second plug sections, and partially covering said groove to retain said locking member in said groove, said locking member and said coil spring being located in said groove so that said coil spring urges said locking member toward said inwardly projecting shoulder, said locking member having an area of reduced diameter adjacent the outer end thereof engaging said serrated surface to prevent substantial rotation of said internally threaded cap.

9. The plug of claim **8** wherein said second plug section has a groove in its outer surface extending from said second end section and terminating adjacent said first end section.

10. In a cylinder lock, a cylinder assembly comprised of a cylinder having a substantially cylindrical inner surface and a pin tumbler chamber with a plurality of pin tumbler holes containing pin tumblers and pin tumbler springs, and a cylinder plug having first and second plug sections, a plug sleeve having a length substantially equal to the length of said cylinder and a retaining means, said plug sleeve having an inner surface for receiving said first and second plug sections and a substantially cylindrical outer surface slidably fitting within said cylinder, with a plurality of radially oriented pin holes cooperatively disposed therein with respect to said pin tumbler holes in said cylinder, said first and second plug sections having an enlarged first end section, a second end section and a center section therebetween, said first and second plug sections being retained in adjacent cooperative relationship with facingly disposed surfaces by said plug sleeve, said facingly disposed surfaces being contoured to define a keyway and a plurality of pin cavities aligned with the respective pin holes in said plug sleeve, said enlarged first end of said first and second plug sections together defining a front face having a diameter greater than the diameter of said outer surface of said plug sleeve, said retaining means engaging said first and second plug sections on said second end sections and defining a surface extending outward beyond the diameter of said outer surface of said plug sleeve to retain said first and second plug sections and said plug sleeve in functional disposition with respect to each other and with respect to said cylinder.

11. The plug of claim 10 wherein said plug sleeve is of substantially uniform cross-section, except for said pin holes, having a thickness in the region of said pin holes sufficient to dispose the inner surface of said last named region adjacent the top of said keyway.

12. The plug of claim 11 wherein said plug sleeve has a longitudinal groove on the inner surface of said plug sleeve diametrically opposite said pin holes for receiving and guiding the lower edge of a key.

13. The plug of claim 12 wherein the inner surface of said plug sleeve is a substantially cylindrical surface interrupted by an inward projecting longitudinal region containing said pin holes and by inwardly disposed, substantially parallel projections defining, at least in part, said longitudinal groove, and said center sections of said plug sections located on said last named cylindrical surface and being maintained in substantially fixed separation by surfaces abutting the sides of said inward projecting longitudinal region and said parallel projections.

14. The plug of claim 10 wherein said retaining means is comprised of a cap having internal threads adjacent one end thereof, said second end section of said first and second plug sections having threads forming a portion of a threaded cylindrical surface and said cap engaging said threads on said first and second plug sections.

15. The plug of claim 14 wherein said cap is locked against rotation at a position on said threads so as to limit the axial motion of said plug sections and said plug sleeve with respect to the cylinder by a cylindrical locking member and a coil spring, said first plug section having a groove in its outer surface extending from said second end section and terminating part way along said plug, said cap having an inwardly directed shoulder, with an inwardly directed serrated surface, projecting over the end of said first and second plug sections, and partially covering said groove to retain said locking member in said groove, said locking member and said coil spring being located in said groove so that said coil spring urges said locking member toward said inwardly projecting shoulder, said locking member having an area of reduced diameter adjacent the outer end thereof engaging said serrated surface to prevent substantial rotation of said internally threaded cap.

16. The plug of claim 15 wherein said second plug section has a groove in its outer surface extending from said second end section and terminating adjacent said first end section and said first end section has a hole therethrough cooperatively disposed with said groove for receiving and guiding an indicator pin therein.

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