Dec. 25, 1945. T. H. JOHNSTONE 2,391,834

CYLINDER LOCK

Filed Nov. 12, 1943 3 Sheets-Sheet 1

Fig. 1.

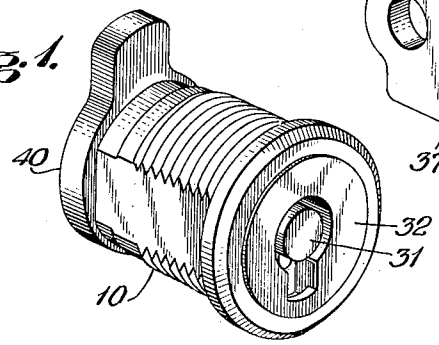


Fig. 2.

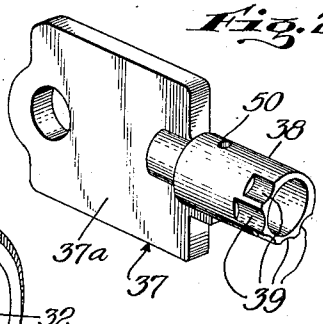
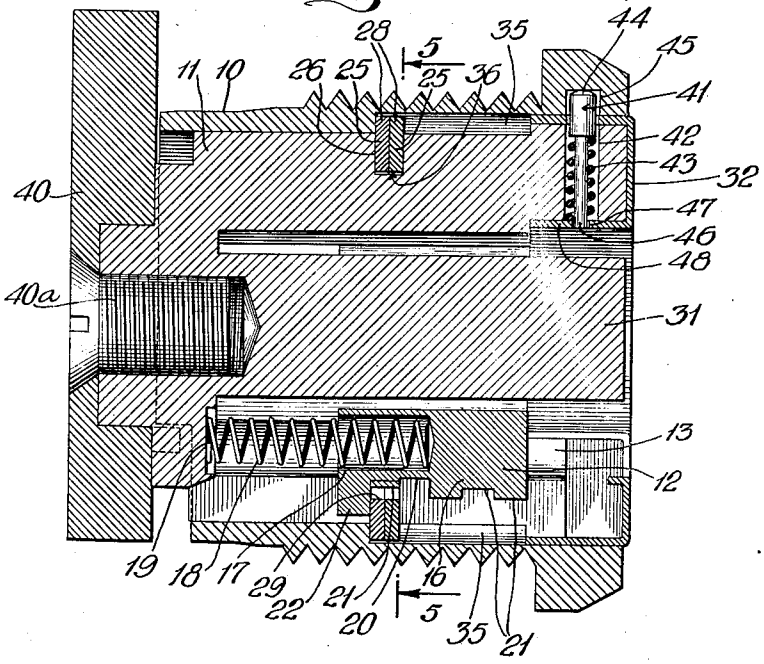


Fig. 3.



INVENTOR
T. H. Johnstone
BY
A. H. Golden
ATTORNEY

Dec. 25, 1945. T. H. JOHNSTONE 2,391,834

CYLINDER LOCK

Filed Nov. 12, 1943 3 Sheets-Sheet 2

Fig. 4.

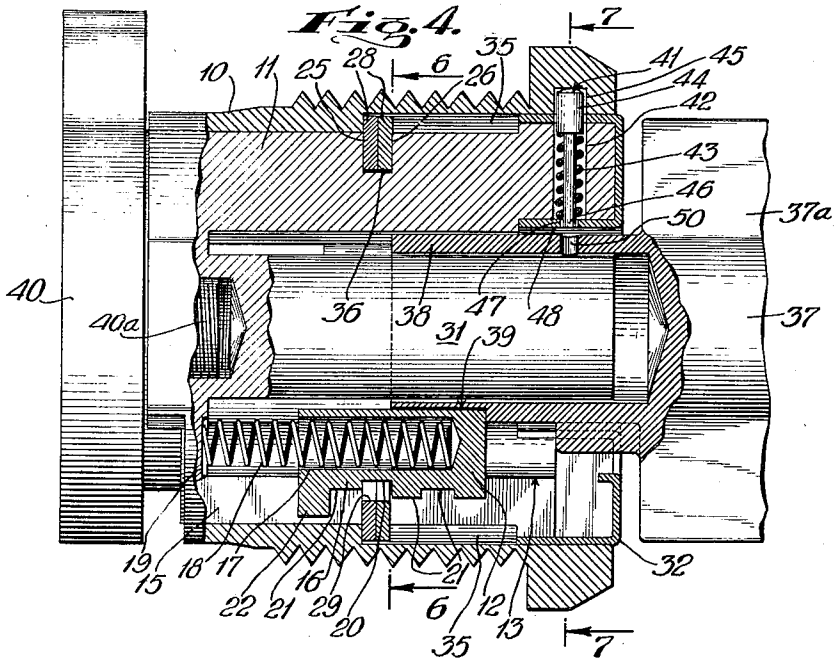


Fig. 5.

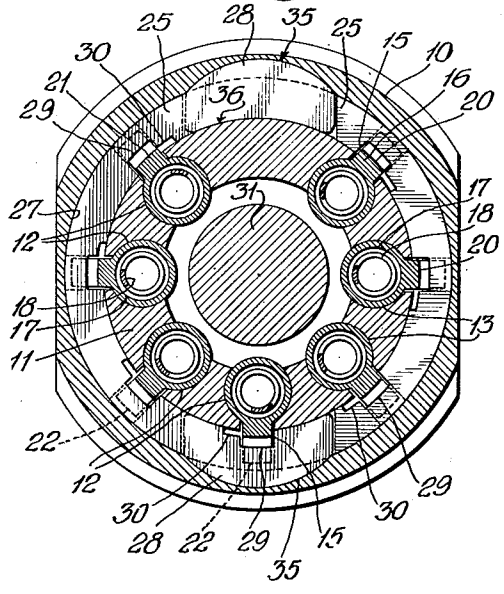
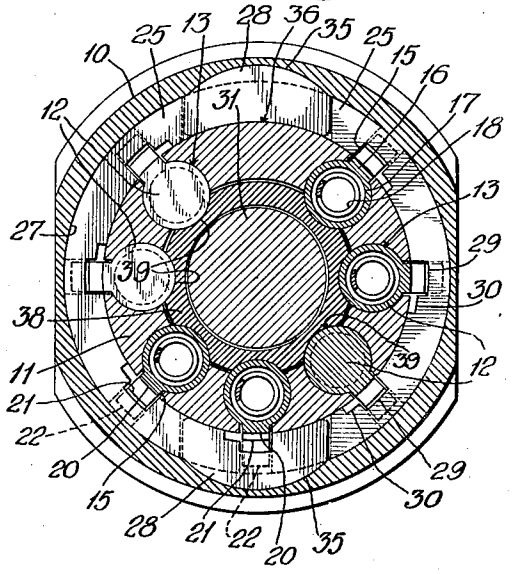


Fig. 6.



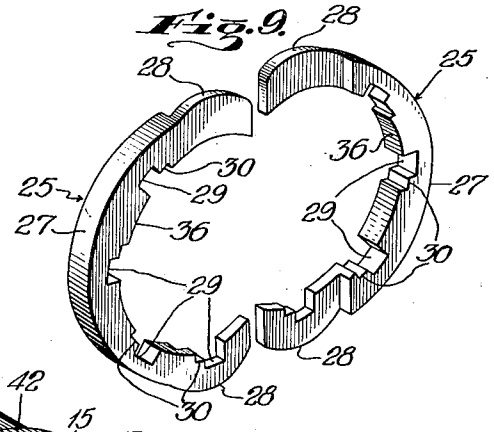
INVENTOR
T. H. Johnstone
BY
ATTORNEY

Dec. 25, 1945. T. H. JOHNSTONE 2,391,834

CYLINDER LOCK

Filed Nov. 12, 1943 3 Sheets-Sheet 3

Fig. 9.



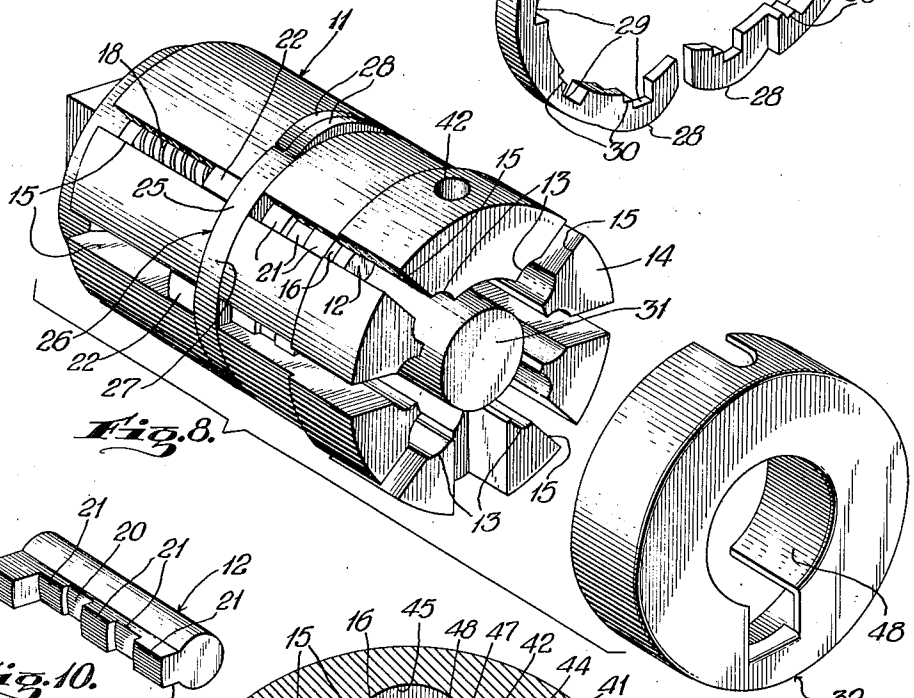


Fig. 8.

Fig. 10.

Fig. 7.

INVENTOR
T. H. Johnstone
BY
ATTORNEY

Patented Dec. 25, 1945

2,391,834

UNITED STATES PATENT OFFICE

2,391,834

CYLINDER LOCK

Theodore H. Johnstone, Detroit, Mich., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Application November 12, 1943, Serial No. 509,964

19 Claims. (Cl. 70—363)

This invention relates to tumbler locks of the type in which the tumblers are set by endwise movement imparted thereto by a key. More particularly, this invention relates to a lock of the particular type in which the tumblers are mounted for endwise movement in parallel bores formed in a cylindrical key plug, the tumblers being movable by a key in the bores so as to be set in predetermined release positions relatively to a barrier that is secured in the cylinder in which the plug is adapted for rotation. When the tumblers are positioned properly by the key so that slots therein are in alignment with the barrier, the key plug and key may rotate together relatively to the cylinder.

A feature of the lock of my invention resides in the manner in which the barrier is assembled relatively to the key plug and cylinder. More particularly, a feature of my invention resides in the mounting of the barrier on the key plug for insertion bodily with the key plug into assembled relation to the cylinder.

A further feature of my invention resides in the use of the barrier for retaining the tumblers in the key plug. Still a further feature of my invention resides in the manner of forming the barrier and tumblers so that they cooperate to prevent picking of the tumblers.

Still a further feature of my invention resides in the means for locking the key against endwise movement relatively to the key plug upon rotation of the key plug and key as a unit.

I have thus outlined the more important features of my invention in order that my contribution to the art may be better understood and in order that the relation of my contribution to the prior art may be better comprehended. I do believe that my contribution is a broad and valuable one and that it should not be limited by the particular mechanical structure hereinafter set forth in detail. Also, while I have described several important features of my invention, there are other important features that will be described particularly in the specification and will be claimed in the claims appended hereto.

Referring now to the drawings,

Fig. 1 is a perspective view of a cylinder lock embodying my invention.

Fig. 2 is a perspective view of the key used for operating the lock.

Fig. 3 is a vertical section through the lock of Fig. 1.

Fig. 4 is a section similar to that of Fig. 3 but with the key inserted in the lock and with one of the tumblers shown positioned thereby.

Figs. 5 and 6 are respectively sections taken along lines 5—5 of Fig. 3 and 6—6 of Fig. 4.

Fig. 7 is a section taken along lines 7—7 of Fig. 4.

Fig. 8 is a perspective exploded view of the key plug and scalp at the front end thereof.

Fig. 9 is a perspective view of the two barrier segments.

Fig. 10 is a perspective view of one of the tumblers.

Referring now more particularly to the drawings, the cylinder of my invention is designated by reference numeral 10 and is probably best shown in Fig. 1. The key plug is designated by reference numeral 11 and is best shown in Fig. 8. The tumblers of the key plug are designated by reference numeral 12, one of the tumblers being best shown in Fig. 10. As illustrated in Fig. 8 the key plug has a series of tumbler bores 13 formed longitudinally thereof and terminating at the front end 14 of the key plug. The tumbler bores 13 include grooves 15 communicating therewith, it being appreciated that the cylindrical portion of each tumbler 12 is mounted in a bore 13 while the rectangular portion 16 of each tumbler 12 is mounted in one of the grooves 15. The tumblers 12 are thus adapted for sliding movement longitudinally relatively to the key plug 11 and are maintained against rotation in the key plug by their rectangular portions 16.

The tumblers 12 are each formed with an internal bore 17 in which is mounted a spring 18 as best shown in Figs. 3 and 4. One end of each spring 18 presses of course against the end of the bore 17 in one of the tumblers and at its other end against a surface 19 of the key plug. It is thus seen that it is the function of the springs 18 to urge the tumblers outwardly of the key plug and toward the front end 14 thereof. The rectangular portion 16 of each of the tumblers 12 is formed with a deep release slot 20 and a series of arbitrarily stepped surfaces 21 that function to prevent picking of the lock as will hereinafter be set forth. The end of the rectangular portion 16 of each tumbler 12 is designated by reference numeral 22 and is termed by me a retaining lug, it being the function of the lugs 22 to retain the tumblers 12 within the key plug 11, as I shall presently indicate in detail.

Cooperating with the several tumblers 12 are a pair of barrier segments, each designated by reference numeral 25 and best shown in Fig. 9. While I prefer to use two barrier segments because of ease of assembly, it is obvious that I may use a greater or lesser number should I so

desire. The barrier segments 25 are adapted to be inserted into a transverse slot 26 formed in the key plug, this slot extending inwardly to intersect the grooves 15 in which the portions 16 of tumblers 12 are slidably mounted. When the barrier segments 25 are assembled relatively to the key plug as best shown in Fig. 8, the outer periphery 27 of each of the segments will lie generally so as to form an extension of the surface of the key plug 11. If desired, the barrier segments 25 may lie with their peripheries 27 somewhat inwardly of the outer surface of the key plug 11. Rounded lugs 28 extend from each of the segments 25 and are adapted to lie beyond the periphery of the key plug 11 for the purpose hereinafter set forth.

Each barrier segment 25 is formed with a series of deep slots 29 and shallow slots 30 extending therefrom. The deep slots 29 are adapted to allow free sliding of the tumblers 12 because the slots 29 will coincide with the grooves 15 of the tumbler bores at those points where the segments 25 extend into the said grooves. The slots 29 are not sufficiently deep however to accommodate the retaining lugs 22 of the tumblers 12 as is probably best illustrated in Fig. 3. Therefore, the barrier segments 25 will act, as is illustrated in Figs. 3 and 8, to prevent outward movement of the tumblers by the springs 18 beyond the position of Figs. 3 and 8.

Extending centrally of the key plug 11 is a key guiding post 31 as best illustrated in Figs. 3 and 8. For assisting the key post 31 in guiding the key to be hereinafter described, and for protecting the front end of the key plug, I employ a scalp member 32 best illustrated in Fig. 8. The scalp 32 is adapted to be applied over the front end 14 of the key plug 11 as is well illustrated in the several drawings and may be retained relatively to the head of the key plug 11 in several ways. The retaining means that are preferred by me function not only as a retainer but also as a key retaining means and will be described presently.

From the description so far given, it is apparent that I have a key plug 11 equipped with a series of tumblers 12 that are spring pressed outwardly of the key plug but are retained by a pair of barrier segments 25. The barrier segments 25 allow free sliding motion of the several tumblers 12 while acting to retain the tumblers. It is also apparent that the barrier segments form a part of the key plug once they are assembled relatively thereto.

The cylinder 10 in which the key plug of my invention is adapted to be mounted is formed with a bore that is of a size adapted to mount the key plug for free rotation therein once the key plug is inserted endwise into the cylinder 10. In order that the key plug and the barrier segments may be inserted as a unit endwise into the cylinder 10, the cylinder is formed with retaining grooves 35 adapted to accommodate those rounded lugs 28 of the barrier segments 25 protruding beyond the surface of the key plug 11. Once the key plug is inserted within the cylinder 10 it is obvious that the barrier segments 25 are held against rotation in the cylinder. It is further obvious of course, that the several tumblers 12 will prevent rotation of the key plug and tumblers relatively the barrier segments 25 unless the deep slots 20 of the tumblers are placed in alignment relatively to the barrier segments 25 as illustrated in Figs. 4 and 6. In that position of the parts, the deep slots 20 lie inwardly of the inner periphery 36 of each of the barrier segments 25 and the tumblers and key plug may rotate as a unit.

The tumblers are set into the release position of Figs. 4 and 6 by the key 37 best illustrated in Fig. 2 and comprising a key bow 37a and a sleeve-like portion 38 that is bitted at 39 for cooperation with the tumblers. I claim no novel cooperation between the key 37 and the push-in tumblers 12, the particular parts per se coacting as is well known in the prior art to move the tumblers inwardly against the springs 18 until the deep slots 20 are in alignment with the barrier segments 25. It may be well at this point to indicate that the rounded lugs 28 of the barrier segments 25 overlap and are sufficiently thin so that together they occupy the same space as does the full thickness of each barrier segment 25. This is fully illustrated in Fig. 4. For holding the key plug 11 within the cylinder 10 I may utilize various means known in the art but I show herein the simple combination of a cam 40 secured to the end of the key plug 11 by a screw 40a.

I shall now describe the means for locking the key within the key plug as rotary movement is imparted to the key plug by the key. Because the sleeve portion 38 of the key 37 is entirely within the key plug when operating the lock, as illustrated in Fig. 4, I cannot utilize those key retaining means that are illustrated in the prior art. Thus, in the prior art it is general for a lug on the key to operate within a slot in the cylinder for retaining the key as the key rotates with the plug, the cylinder overhanging the key for the particular purpose. In my invention, I utilize a retaining pin 41 that slides within a bore 42 of the key plug and is spring pressed outwardly of the key plug by a spring 43. The head 44 of the retaining pin 41 is mounted within a groove 45 in the head of the cylinder 10 while the lower end 46 of the pin portion lies within a bore 47 in the flange 48 of the scalp 32. The spring 43 also rests against the flange 48 of scalp 32.

In the position of the parts in Fig. 3, the key plug is of course held locked against rotation and the retaining pin 41 extends into the groove 45 and does not obstruct the insertion of the key over the key guide post 31. When the key is inserted over post 31 as shown in Fig. 4, a bore 50 therein is placed in alignment with the retaining pin 41. Upon rotation of the key plug to the position of Fig. 7, the head 44 of the retaining pin 41 will be carried beyond the groove 45 and the lower end 46 of pin 41 will be cammed into the bore 50 of the sleeve 38 of the key 37, thereby locking the key against outward movement. This locking will continue until the key plug is brought back to its position of Figs. 3 and 4. It is therefore seen that not only does the retaining pin 41 act to retain the scalp on the key plug, if that function thereof is desired, but it acts to carry out the main function of retaining the key within the key plug during rotation of the key and key plug from the initial locking position of the parts. It is of course obvious that a pivoted or other type of detent member may be used instead of the retaining pin 41 for cooperation with a slot or other means in the key, such variations being within the teachings of my invention.

I shall now describe the function of the shallow slots 30 of the barrier segments 25, and the stepped surfaces 21 of the several tumblers 12.

With the key plug in its locked position of Fig. 5, and the tumblers positioned as illustrated, it is obvious that a limited rotation of the key plug and the tumblers 12 is possible because of the shallow slots 30 in the barrier segments 25. Therefore, if picking torque is applied to the key plug in the usual manner known in the art, the stepped surfaces 21 will move into the shallow slots 30 in the barrier segments. Once this is accomplished, it will be impossible thereafter to move the tumblers freely to align the deep release slots 20 thereof relatively to the barrier segments 25. This is true because at least some of the stepped surfaces 21 will extend outwardly beyond the shallow slots 30 and will prevent endwise movement of the tumblers for that reason. Therefore, the application of picking torque serves merely to lock at least certain of the tumblers against endwise movement. It will be quite apparent at this point that the mere provision of the deep slots 20 and stepped surfaces 21 in the tumblers will not in itself provide that resistance to picking that is desirable. It is necessary to utilize the shallow slots 30 of the barrier segments as I have described in detail, and the provision of those slots 30 is therefore a very important contribution of my invention.

I believe that the operation and function of my invention will now be quite apparent.

I now claim:

1. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment mounted in a peripheral opening in said key plug formed therein transversely of said tumbler bores, the outer periphery of said barrier segment lying within the cylindrical surface of the key plug and having a holding portion extending beyond the said cylindrical surface, a cylinder having a bore in which said key plug is adapted for rotation, and a groove in said cylinder bore for accommodating the holding portion of said barrier segment as said key plug and barrier are inserted endwise into said cylinder bore for thereafter holding said barrier segment against rotation.

2. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment mounted in a slot in said key plug formed therein transversely of said tumbler bores, said barrier segment being formed at its inner periphery to allow free endwise movement of said tumblers in said bores while cooperable with said tumblers to prevent rotation of said key plug and tumblers until a slot in each of said tumblers is placed in alignment with said barrier segment, the outer periphery of said barrier segment lying within the cylindrical surface of the key plug and having a holding portion extending beyond the said cylindrical surface, a cylinder having a bore in which in said cylinder bore for accommodating the holdsaid key plug is adapted for rotation, and a groove in said cylinder bore for accommodating the holding portion of said barrier segment as said key plug and barrier segment are inserted endwise into said cylinder bore for thereafter holding said barrier segment against rotation.

3. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment mounted in a slot in said key plug formed therein transversely of said tumbler bores, said barrier segment being formed at its inner periphery to allow for endwise movement of said tumblers in said bores while cooperable with said tumblers to prevent rotation of said key plug and tumblers until a slot in each of said tumblers is placed in alignment with said barrier segment, the outer periphery of said barrier segment lying within the cylindrical surface of the key plug and having a holding portion extending beyond the said cylindrical surface, a cylinder having a bore in which said key plug is adapted for rotation, and a groove in said cylinder bore for accommodating the holding portion of said barrier segment as said key plug and barrier segment are inserted endwise into said cylinder bore for thereafter holding said barrier segment against rotation, the ends of said tumblers extending beyond the inner periphery of said barrier segment so as to limit outward movement of said tumblers by said springs.

4. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment, said key plug having a peripheral opening formed therein transversely of said tumbler bores and leading inwardly from the periphery thereof, said barrier being insertible into said opening inwardly from the periphery of said key plug, the outer periphery of said barrier segment lying within the cylindrical surface of the key plug whereby to be insertible with said key plug into a bore of a lock, a lock having a bore into which said key plug is adapted for insertion and rotation, and means for locking said barrier segment against rotation in said bore.

5. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment mounted in a slot in said key plug formed at its inner periphery to allow free endwise movement of said tumblers in said bores while cooperable with said tumblers to prevent rotation of said key plug and tumblers relative to said barrier segment until a slot in each of said tumblers is placed in alignment with said barrier segment, the said barrier segment being insertible with said key plug into a bore in a lock, a lock formed with a bore for the insertion and rotation of said key plug, and means engageable through the insertion of said key plug in said bore for locking said barrier segment against rotation in said bore.

6. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier

segment mounted in a slot in said key plug formed therein transversely of said tumbler bores, being insertible with said key plug into a lock bore, the ends of said tumblers extending beyond the inner periphery of said barrier segment whereby to limit outward movement of said tumblers from the tumbler bores by said springs, a lock formed with a bore for the insertion of said key plug, and means for locking said barrier segment against rotation in said lock bore.

7. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surfaces thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, said key plug having a transverse slot formed therein and communicating with the bores in which said tumblers slide, a barrier segment mounted in said slot and having a notch therein at each tumbler bore to allow for free sliding of said tumblers in said bores while preventing rotation of said key plug and tumblers relatively to said barrier segment until release slots in said tumblers are aligned with said barrier through accurate positioning of said tumblers by a key, a lock having a bore in which said key plug and barrier are inserted as a unit, and means formed on said barrier and lock engaged by the insertion of said key plug in said lock for locking said barrier against rotation in said lock bore.

8. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surfaces, said key plug having a transverse slot formed therein and communicating with the bores in which said tumblers slide, a barrier segment mounted in said slot and having notches therein at each tumbler bore to allow for free sliding of said tumblers in said bores while preventing rotation of said key plug and tumblers relatively to said barrier segment until release slots in said tumblers are aligned with said barrier through accurate positioning of said tumblers by a key, a lock having a bore in which said key plug and barrier are inserted as a unit, means for locking said barrier against rotation in said bore, said barrier segment having shallow notches communicating with said first notches and said tumblers having stepped surfaces in addition to said release slots so that when said stepped surfaces are opposite said shallow notches said key plug may rotate a slight amount relatively to said barrier to move said tumblers opposite said shallow notches where they are held by said barrier segment against free endwise movement in their bores.

9. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, said key plug having a transverse slot formed therein and communicating with the bores in which said tumblers slide, a barrier segment mounted in said slot and having notches therein at each tumbler bore to allow for free sliding of said tumblers in said bores while preventing rotation of said key plug and tumblers relatively to said barrier segment until release slots in said tumblers are aligned with said barrier segment through accurate positioning of said tumblers, by a key, said barrier segment having shallow notches communicating with said first notches and said tumblers having stepped surfaces in addition to said release slots so that when said stepped surfaces are opposite said shallow notches said key plug may rotate a slight amount relatively to said barrier to move said tumblers opposite said shallow notches where they are held by said barrier segment against free endwise movement in their bores.

10. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a cylinder in which said plug rotates, a barrier segment in said cylinder fixed against rotation relatively to said cylinder, said barrier segment having notches therein at each tumbler bore to allow for free sliding of said tumblers in said bores while preventing rotation of said key plug and tumblers relatively to said barrier segment until release slots in said tumblers are aligned with said barrier segment through accurate positioning of said tumblers by a key, said barrier segment having shallow notches communicating with said first notches and said tumblers having stepped surfaces in addition to said release slots so that when said stepped surfaces are opposite said shallow notches said key plug may rotate a slight amount relatively to said barrier to move said tumblers opposite said shallow notches where they are held by said barrier segment against free endwise movement in their bores.

11. In a lock of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, whereby to tend to project outwardly the key that positions said tumblers against the force of said springs, and movable means for locking said key to said key plug in a predetermined position against endwise movement out of said key plug as said key and key plug rotate after the setting of said tumblers.

12. In a lock of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, whereby to tend to project outwardly the key that positions said tumblers against the force of said springs, and a detent mounted in said key plug and movable into an opening in said key upon rotation of said key and key plug for locking said key in a predetermined position against endwise movement out of said key plug.

13. In a lock of the class described, a cylindrical key plug having a front end surface formed with a circular slot for the endwise insertion of a sleeve like key, said key plug having a series of parallel bores extending longitudinally thereof and terminating at said circular slot, tumblers in said bores adapted to be set by a sleeve like key inserted into said circular slot to a predetermined limit position, and movable means for

locking said key at said limit position actuated by rotation of said key with said key plug.

14. In a lock of the class described, a cylindrical key plug having a front end surface formed with a circular slot for the endwise insertion of a sleeve like key, said key plug having a series of parallel bores extending longitudinally thereof and terminating at said circular slot, tumblers in said bores adapted to be set by a sleeve like key inserted into said circular slot to a predetermined limit position, and a detent mounted in said key plug and movable into an opening in said key upon rotation of said key and key plug.

15. In a lock of the class described, a key having a sleeve portion bitted for contact with a series of tumblers, said key having a bore transversely therethrough for cooperation with a detent of said lock adapted to move diametrically of said sleeve portion into said bore for holding said key against endwise movement out of said lock.

16. In a combination of the class described, a cylindrical key plug, said key plug having a peripheral opening formed therein, a barrier segment mounted in said opening, a lock having a bore in which said key plug and barrier are inserted as a unit, and means formed on said barrier and lock engaged by the insertion of said key plug in said lock for locking said barirer against rotation in said lock bore.

17. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in said key plug, a barrier segment for said tumblers mounted in said key plug, the outer periphery of said barrier segment lying within the cylindrical surface of the key plug and having a holding portion extending beyond the said cylindrical surface, a cylinder having a bore in which said key plug is adapted for rotation, and a groove in said cylinder bore for accommodating the holding portion of said barrier segment as said key plug and barrier are inserted endwise into said cylinder bore for thereafter holding said barrier segment against rotation.

18. In a combination of the class described, a cylindrical key plug, a series of tumblers mounted in bores formed in said key plug parallel to the axis thereof and terminating on the outer end surface thereof whereby said tumblers may be positioned by a key, springs pressing said tumblers toward the said outer end surface, a barrier segment. said key plug having a peripheral opening formed therein transversely of said tumbler bores and leading inwardly from the periphery thereof, said barrier segment being insertible into said opening inwardly from the periphery of said key plug, the said barier being insertible with said key plug into a bore of a lock, a lock having a bore into which said key plug is adapted for insertion and rotation, and means for locking said barrier segment against rotation in said bore.

19. In a combination of the class described, a cylindrical key plug, said key plug having a peripheral opening formed therein, a barrier segment mounted in said opening and lying substantially within the periphery of said key plug with but a small holding portion thereof extending beyond the key plug periphery, a cylinder having a bore in which said key plug is adapted for rotation, and a groove in said cylinder bore for accommodating the holding portion of said barrier segment as said key plug and barrier are inserted endwise into said cylinder bore for thereafter holding said barrier segment against rotation.

THEODORE H. JOHNSTONE.