

Dec. 2, 1947.

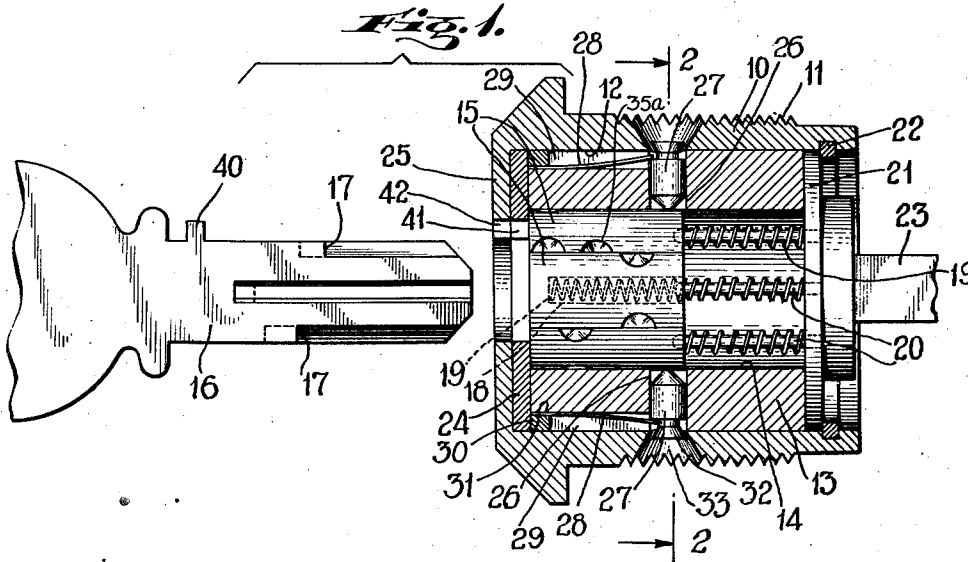
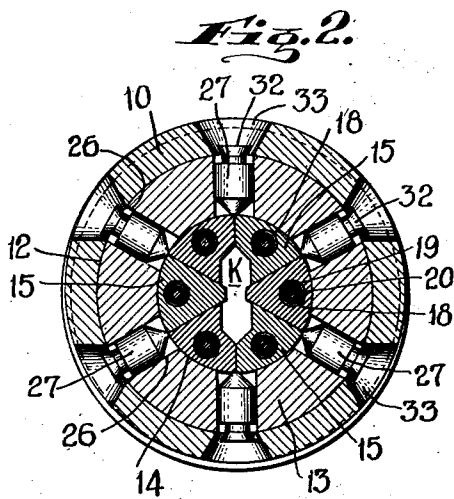
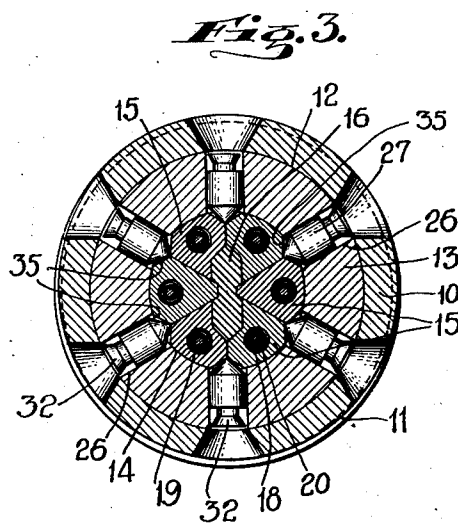
R. C. SPAIN

2,431,894

LOCK

Filed Nov. 17, 1944

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

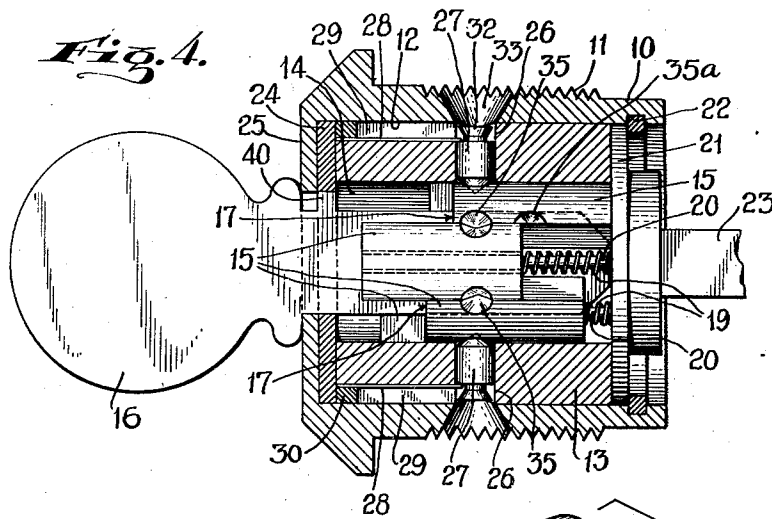
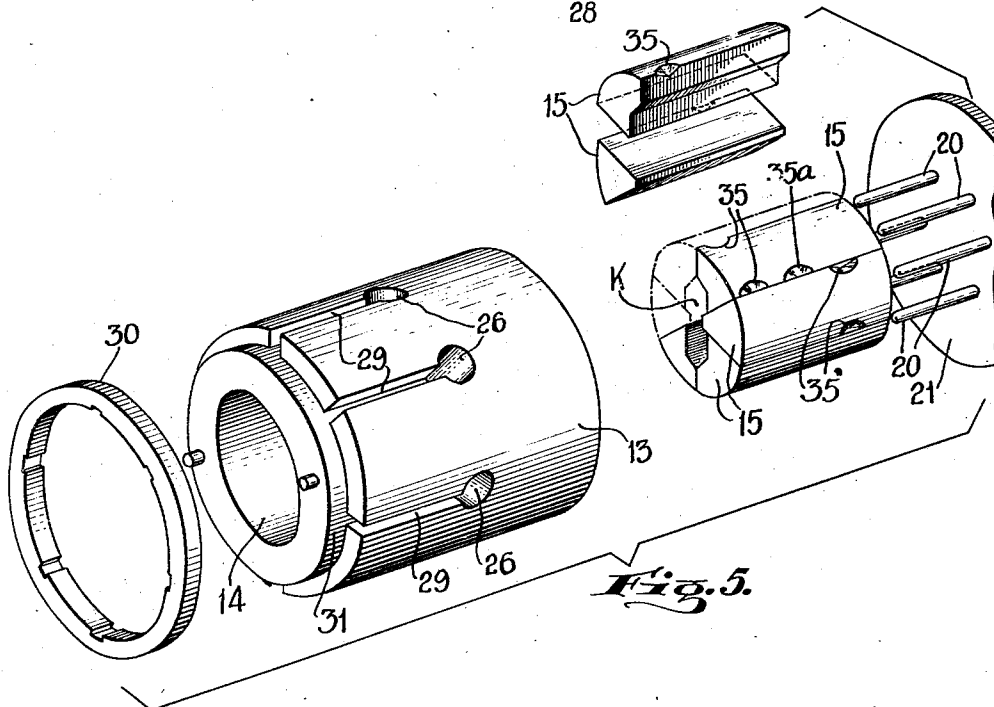


Fig. 5.

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LOCK

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This invention relates to a lock, and more particularly to a lock of the type in which a series of key set elements, or tumblers, are adapted to control the positioning of a series of locking elements or drivers. More particularly, my invention relates to locking mechanism of the class described adapted for embodiment in a cylinder lock with the key set elements or tumblers and the drivers preferably mounted for movement with a key plug and adapted to control the movement of the key plug.

An important feature of my invention resides in the utilization of key set elements or tumblers with each tumbler adapted to control the positioning of at least two locking elements or drivers. As a further feature of the invention each driver or locking element is adapted for positioning by a pair of tumblers or key set elements.

As a more detailed feature of my invention, I utilize a series of tumblers that are adapted for positioning by a key, there being a series of drivers adapted for movement into release position when the tumblers are properly positioned, the said drivers cooperating with composite depressions formed by the alignment of depressions in the tumblers. It is a further feature of this portion of my invention that each tumbler be equipped with a depression that may be at each side edge thereof so that there will be a composite depression between each pair of tumblers for a driver, there being one driver positioned between each pair of tumblers for coaction with each composite depression.

As a further feature of my invention, the tumblers and drivers are adapted for mounting within a key plug, the tumblers moving axially relatively to the key plug and the drivers radially thereof. As still a further feature of my invention, the tumblers are segmental in form and lie within a bore in the key plug so that if force is applied thereto for rotating the tumblers in a manner to destroy their mounting means, the tumblers will rotate in said bore while leaving the key plug locked.

As still a further feature of my invention, the tumblers are adapted to be spring pressed outwardly toward the front end of the key plug by a series of springs, while the drivers are pressed radially inwardly of the key plug and against the tumblers so as to move into the composite depressions formed by the proper positioning of the tumblers.

Still a further feature of my invention resides in the provision of false depressions in certain

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of the tumblers for the purpose of making the lock even more pickproof than otherwise.

A further feature of my invention resides in a new form of key.

I have thus described the more important features of my invention in order that those skilled in the art may better appreciate the relation of my invention to the prior art and the importance of the contribution represented by my invention. Naturally, those skilled in the art will readily understand how to develop mechanical structures, other than that by me preferred and herein illustrated, for achieving the purposes and contributing the features of my invention. It is, therefore, important that the claims to be granted me be not limited by the specific structure that I shall hereinafter describe in detail.

Referring now to the drawings, Fig. 1 is a vertical section through a cylinder lock embodying my invention and showing the key outside the cylinder lock. Figs. 2 and 3 are sections taken along lines 2—2 of Fig. 1, Fig. 2 showing the key set elements or tumblers, and the locking elements or drivers, in a locking position while Fig. 3 illustrates the parts of Figs. 1 and 2 when the key is inserted and the tumblers are properly positioned. Fig. 4 is a view similar to Fig. 1 but showing the tumblers and drivers in release position. Fig. 5 is an exploded view of my key plug showing certain parts thereof.

Referring now more particularly to the drawings, one form of the lock body in which my invention may be embodied, is a cylinder lock designated by reference numeral 10. Its outer periphery is threaded as at 11 so that it may be mounted in a lock in the conventional manner understood by those skilled in the art. It is important to appreciate that the lock body of my invention may take many forms; thus, this lock body may be a padlock or handle, all as those skilled in the art will appreciate.

The cylinder 10 is formed with a bore 12, and rotatable within this bore is a key plug 13 best illustrated in Fig. 5. The key plug is, in turn, bored at 14 for the mounting of a series of segments 15. These segments are termed by me key set elements or tumblers and are adapted to be moved axially within the bore 14 by a key 16. For this purpose the blade of the key is formed with grooves terminating in shoulders adapted to impinge upon a part of each segment or tumbler 15, the several shoulders of the key being designated by reference numeral 17.

Each tumbler 15 is formed with a bore 18 within which is housed a spring 19 fitting about a

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post 20. A plate 21 is formed with six posts 20, there being one post for each tumbler 15. It is, of course, obvious that when the key presses the tumblers axially from the position of Fig. 1 to the position of Fig. 4, the springs 19 will resist this movement of the tumblers 15, the posts 20 maintaining the springs in proper alignment for this operation.

The plate 21 carrying the posts 20 is retained within cylinder 10 by a retaining ring 22 as is apparent from Figs. 1 and 4. The plate 21 is suitably secured for rotation with the key plug 13, so that the posts 20, the several tumblers 15, and the key plug 13 will rotate as a unit upon release of the key plug in a manner hereinafter set forth. A suitable connecting bar 23 may be formed integrally with the plate 21 for operating lock mechanism upon rotation of the plate 21 with the key plug 13.

The forward end of the key plug 13 is covered by an armored plate 24 so as to protect the key plug against attack, this armored plate lying retained between the key plug 13 and the front plate surface 25 of the cylinder 10. It is, of course, obvious that this arrangement also limits the forward axial projection of the tumblers 15 relatively to the key plug 13.

The key plug 13 is formed with a series of driver bores 26 for the mounting of locking elements or drivers 27. Each driver 27 is adapted for coaction with a leaf spring 28 mounted in a slot 29 of the key plug 13, there being one such slot for each driver bore 26. A ring 30 fits over the part 31 of the key plug 13 for holding the several springs 28 assembled to the plug. The drivers 27 are formed with truncated ends 32 that, in the locking position of the drivers 27, lie within truncated bores 33 formed in the cylinder 10. It is, of course, obvious that so long as the drivers 27 are in their positions of Figs. 1 and 2, the key plug 13 will be held against rotation. It is obvious, moreover, that any slight rotation of the key plug will bring the truncated ends 32 of the drivers into interlocking relation with the surfaces of the bores 33 so as to interlock very effectively the key plug 13 and the cylinder 10. This interlock prevents picking of the lock through the application of picking torque, a feature that will be quite apparent to those skilled in the art.

For allowing release movement of the drivers 27 by the leaf springs 28, each of the tumblers 15 is formed with at least one depression at each side edge thereof. These depressions are designated by reference numeral 35. It is obvious that a pair of tumblers 15 must be placed in proper relation to form a composite depression for the release of any one driver 27 and that each tumbler, therefore, controls the positioning of two drivers. In Fig. 4 there is illustrated the positioning of the several tumblers 15 by the key 16 so that composite depressions are formed by the proper alignment of depressions 35 to allow for release movement of the drivers 27 by the springs 28.

It is well to indicate at this point that should a screw driver or other tool be used to attempt forceful rotation of the key plug by entry of the tool into the keyway K formed by the shaping of the tumblers 15, the entire force that may be imparted by the screw driver or other tool will merely tend to shear the several posts 20. Since those posts are much weaker than the drivers 27, they will shear while leaving the drivers 27 effective to maintain interlocking engagement between the key plug 13 and the cylinder 10, the tumblers 15 merely rotating freely in bore 14 thereafter.

In order that the key 16 shall rotate 360° before being removed, thereby contributing proper alignment of the tumblers and key plug relatively to the cylinder 10, the key is formed with a retaining lug 40. This retaining lug enters into coaction with a slot 41 in the armored plate 24 after traversing a slot 42 in the plate portion 25 of the cylinder 10. This positioning of the key is best shown in Fig. 4. Rotation of the key 16 together with the key plug 13 and armored plate 24 thereafter, will carry the key away from the slot 42. The key will, of course, be now retained in the lock because its retaining lug 40 will be held against a solid portion of the rear of the plate portion 25 of the cylinder 10. Only upon return of the key to its entry position, may it be removed.

It is well to note further that when the key 16 is withdrawn from the key plug 13, as from its position of Fig. 4 to its position of Fig. 1, the several springs 19 will push the tumblers 15 to the forward end of the cylinder and key plug, forcing the several drivers 27 outwardly from their position shown in Fig. 4 to their locking position illustrated in Fig. 1. The parts are, of course, now ready for setting once again by the insertion of the key 16.

In order to hinder picking of the lock even beyond the degree that is possible by the construction already set forth, certain of the tumblers 15 may be formed with an additional or false depression 35a, as best illustrated in Fig. 5. It will now be readily seen that the particular tumbler 15 having two depressions at one edge, may be set into either one of two positions to form a composite depression for the release of one of the drivers 27. One of these positions will be false, however, because the tumbler will be ineffective to release the second driver 27 which it controls at its opposite edge. Thus, by forming a series of extra or false depressions 35a, picking resistance of my lock is effectively and greatly increased.

It may be well to emphasize that the pick resistance of the lock is relatively great also, because of the particular cooperation of the truncated ends 32 of the drivers or locking elements 27, and the truncated bores 33 in cylinder 10. Thus, any attempt to apply picking torque to the key plug will effect an interlock between the truncated ends 32 of the drivers 27 and the truncated bores 33 to prevent the drivers from movement toward the key set elements.

I believe that my invention and its operation will now be clearly understood by those skilled in this art.

I now claim:

1. In a lock of the class described, a cylinder, a key plug, a series of key set elements movable axially in said key plug, a series of locking elements moving radially of said cylinder and key plug, and each of said key set elements having surfaces for release cooperation with at least two of said locking elements.

2. In a lock of the class described, a series of key set elements, at least three locking elements, each of said key set elements having two spaced and independent surfaces for release cooperation with at least two of said locking elements, and each of said locking elements requiring the alignment of only two of said key set elements for releasing each of said locking elements.

3. In a lock of the class described, a series of key set elements, at least three locking elements, each of said key set elements having a pair of depressions, and one depression of each pair co-operating with a depression of another pair for

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forming a composite depression allowing release movement of one of said locking elements when said key set elements are properly positioned with said cooperating depressions in alignment each of said locking elements requiring the alignment of only two of said key set elements for releasing each of said locking elements.

4. In a lock of the class described, a series of key set elements, a series of locking elements, said key set elements being juxtaposed at their side edges, depressions formed at each edge of each key set element, whereby when said key set elements are properly aligned the depressions of two key set elements at juxtaposed edges mate to form a depression for the entry of one of said locking elements.

5. In a lock of the class described, a series of axially movable key set elements, a series of locking elements movably mounted for movement transversely of said key set elements, said key set elements being juxtaposed at their side edges, a depression formed in each key set element at each edge for mating with a like depression in the edge of the juxtaposed key set element, one of said locking elements being movable into each composite depression formed by the mating of said individual depressions.

6. In a lock of the class described, a series of key set elements, a series of locking elements, said key set elements being juxtaposed at their side edges, depressions formed at each side edge of each key set element whereby when said key set elements are properly aligned the depressions at juxtaposed edges mate to form depressions for the entry of said locking elements, and a false depression at one edge of at least certain of said key set elements to resist picking.

7. In a lock of the class described, a series of axially movable key set elements, a series of locking elements mounted for movement transversely of said key set elements, said key set elements being juxtaposed at their side edges, a depression formed in each key set element at each edge for mating with a like depression in the edge of the juxtaposed key set element, one of said locking elements being movable into each composite depression formed by the mating of said individual depressions, and a false depression at one edge of at least certain of said key set elements to resist picking.

8. In a lock of the class described, a series of key set elements having parallel sides and mounted side by side for movement parallel to said sides with the edges of said sides juxtaposed, a series of locking elements mounted for movement transversely of said key set elements, a depression formed in each key set element at each edge for mating with a like depression in the edge of the juxtaposed key set element, one of said locking elements being movable into each composite depression formed by the mating of said individual depressions.

9. In a lock of the class described, a lock body, a key plug rotatably mounted in a bore of said lock body, a series of key set elements mounted for axial endwise movement in said key plug and adapted for positioning by a key, a series of locking elements mounted for radial movement in said key plug and adapted to effect the locking of said key plug against rotation in said bore, and each of said key set elements having surfaces for release cooperation with at least two of said key set elements, and each of said locking elements in turn coacting with two of said key set elements whereby said locking elements may be moved to

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release said key plug for movement when said key set elements are properly aligned.

10. In a lock of the class described, a lock body, a key plug movably mounted in a bore of said lock body, a series of key set elements mounted for axial movement in said key plug, a series of locking elements mounted in said key plug for radial movement and adapted to effect an interlock between said key plug and lock body, and each of said key set elements having surfaces for release cooperation with at least two of said key set elements whereby said locking elements may be moved to release said key plug for movement when said key set elements are properly positioned.

11. In a lock of the class described, a lock body, a key plug rotatably mounted in a bore of said lock body, a series of key set elements mounted for axial movement in said key plug, a series of locking elements mounted in said key plug for radial movement and adapted to effect an interlock between said key plug and lock body, said key set elements being juxtaposed at their side edges, depressions formed at each edge of each key set element, whereby when said key set elements are properly aligned the depressions at juxtaposed edges mate to form composite depressions for the entry of said locking elements whereby to release said key plug for rotation in said bore.

12. In a lock of the class described, a lock body, a key plug rotatably mounted in a bore of said lock body, a series of key set elements mounted for axial movement in said key plug, a series of locking elements mounted in said key plug for radial movement and adapted to effect an interlock between said key plug and lock body, said key set elements being juxtaposed at their side edges, a depression formed in each key set element at each edge for mating with a like depression in the edge of the juxtaposed key set element, one of said locking elements being movable into each composite depression formed by the mating of said individual depressions whereby to release said key plug for rotation in said bore.

13. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, a series of key set elements axially slidable in said key plug and mounted with their side edges juxtaposed, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, spring means pressing said key set elements toward the forward end of the key plug, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements effect the locking of said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements.

14. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, a series of key set elements axially slidable in said key plug and mounted with their side edges juxtaposed, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial

movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements effect the locking of said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements.

15. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, a series of key set elements axially slidable in said key plug and mounted with their side edges juxtaposed, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, spring means pressing said key set elements toward the forward end of the key plug, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements, and spring means pressing said locking elements toward said composite depressions.

16. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments mounted in said bore of said key plug, means maintaining said key set elements against rotation in said key plug bore and for sliding axial movement therein, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements.

17. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments mounted for axial sliding movement in said bore of said key plug, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements.

18. In a lock of the class described, a lock body,

a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments mounted for axial sliding movement in said bore of said key plug, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements.

19. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments mounted for axial sliding movement in said bore, said segments being formed to define a substantially central internal opening for the insertion of a key, said key set elements having surfaces exposed at said internal opening for contact with a key, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements.

20. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments mounted in said bore, means maintaining said key set elements against rotation in said key plug bore and for sliding axial movement therein, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements, said locking elements being stronger than said means maintaining said key set elements against rotation whereby torque applied to said key set elements will rotate said elements relatively to said key plug.

21. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a bore, a series of key set segments in said bore, means maintaining said key set elements against rotation in said key plug bore and for sliding axial movement therein, each of said segments having a pair of depressions

with one depression adapted for cooperation with one depression of another key set element to form in effect cooperative depressions, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said cooperative depressions, in effect, whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements.

22. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a circular bore, a series of key set segments in said circular bore of said key plug with the outer surfaces of said segments in contact with the surface of said key plug bore and their side edges juxtaposed, a series of pins in said key plug on which said key set elements are mounted for sliding movement in said key plug bore axially of said key plug, springs pressing said key set elements toward one end of the key plug for setting by a key, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, and means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements.

23. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a circular bore, a series of key set segments in said circular bore of said key plug with the outer surfaces of said segments in contact with the surface of said key plug bore and their side edges juxtaposed, a series of pins in said key plug on which said key set elements are mounted for sliding movement in said key plug bore axially of said key plug, springs pressing said elements toward one end of the key plug for setting by a key, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements, and relatively weak spring means pressing said locking elements into said composite depressions.

24. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body,

a series of key set elements axially slidable in said key plug and mounted with their side edges juxtaposed, each side edge of each key set element having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, spring means pressing said key set elements toward the forward end of the key plug, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form said composite depressions for the entry of said locking elements, and a false depression at one edge of at least certain of said key set elements to resist picking.

25. In a lock of the class described, a lock body, a key plug movable in a bore of said lock body, said key plug having a circular bore, a series of key set segments in said circular bore of said key plug with the outer surfaces thereof in contact with the surface of said key plug bore, means maintaining said key set elements against rotation in said key plug bore and for sliding axial movement therein, the side edges of said segments being juxtaposed and each side edge having a depression with the said depressions adapted for alignment to form a composite depression at each side edge of each key set element, a series of locking elements mounted for radial movement in said key plug, there being one locking element for each of said composite depressions whereby each key set element controls two locking elements and each locking element is controlled by two key set elements, means whereby said locking elements lock said key plug against movement in said lock body bore except when said key set elements are properly key set to form composite depressions for the entry of said locking elements, and a false depression at one edge of at least certain of said key set elements to resist picking.

26. In a lock of the class described, a cylinder, a key plug, a series of key set elements movable axially in said key plug, a series of locking elements moving radially of said cylinder and key plug, and each of said key set elements having surfaces for release cooperation with at least two of said locking elements, each of said locking elements in turn coacting with two of said key set elements.

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