

Aug. 19, 1947.

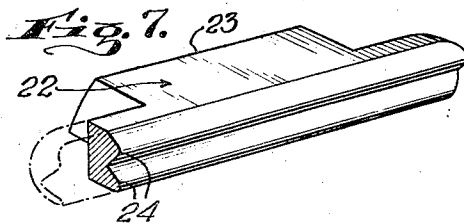
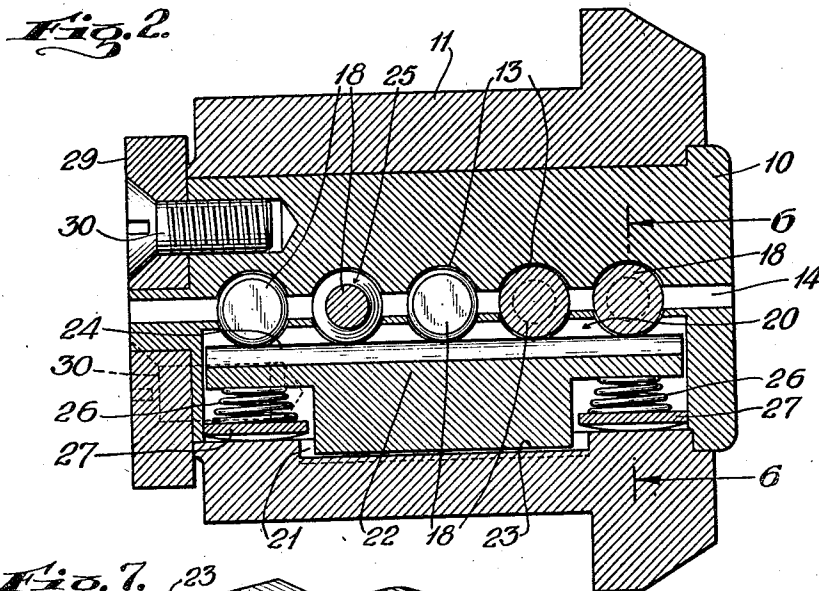
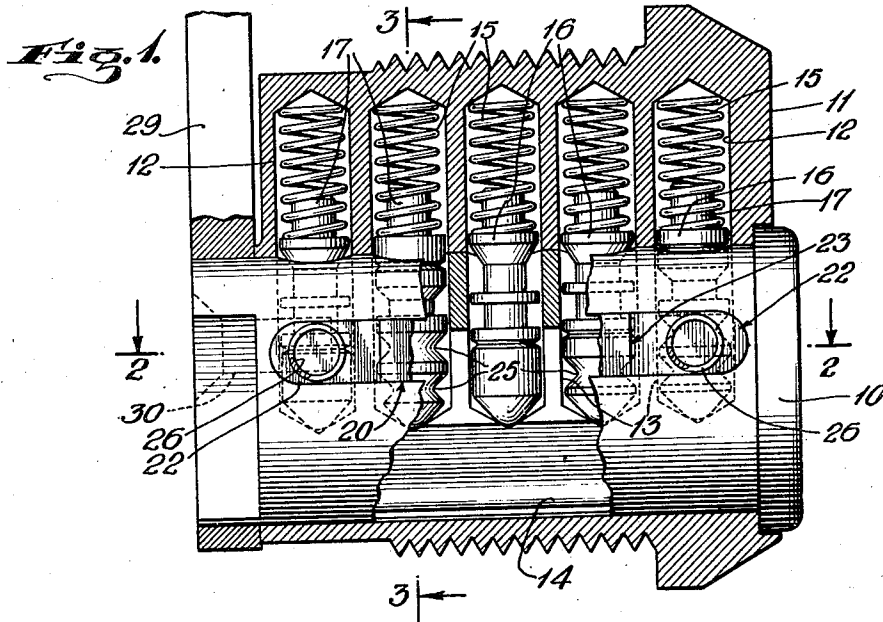
T. H. JOHNSTONE

2,426,104

LOCK

Filed Sept. 25, 1943

2 Sheets-Sheet 1



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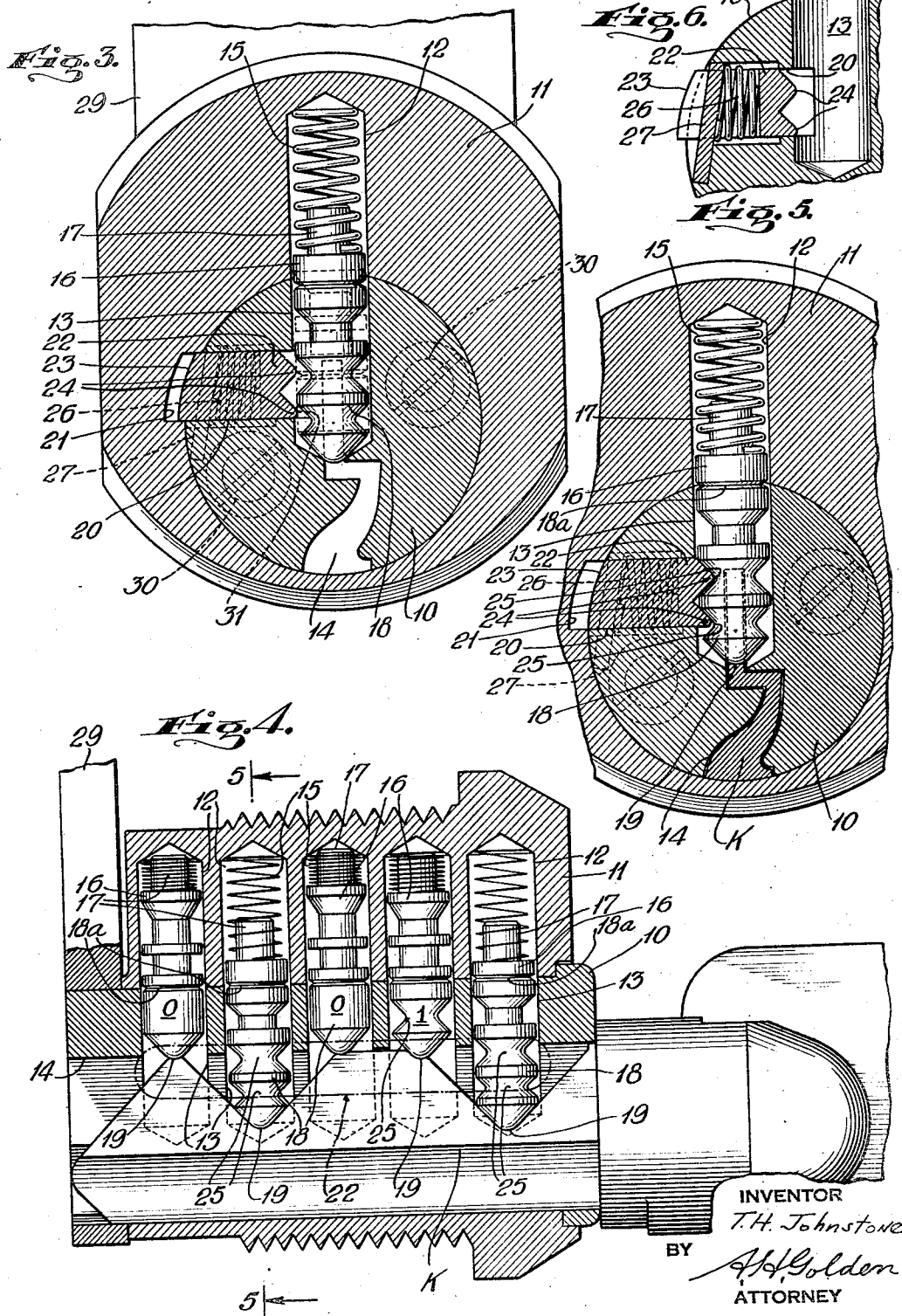
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,426,104

LOCK

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This invention relates to locks of the type in which a key plug is rotated within a cylinder. More particularly, my invention relates to cylinder locks in which a key plug is locked against rotation in the cylinder lock by a series of tumblers that must be key set in order to permit rotation of the key plug in the cylinder.

An object of my invention is the application to a lock of the class described of a locking bar to prevent the application of picking torque to the key plug and its tumblers. In its preferred form, the locking bar of my invention is adapted to move in a mounting slot in the key plug, and to be projected into an opening in the cylinder that is in the form of a locking slot. Springs urge the locking bar out of the slot in the cylinder and preferably entirely within the periphery of the key plug. The tumblers cooperating with the locking bar are formed with grooves for the entry of the locking bar whereby to permit the locking bar to move out of the slot in the cylinder.

The lock of my invention departs from those locks of the prior art that employ tumblers and locking bars in that the locking bar of my invention is not relied upon as the locking member for locking the key plug against rotation. Rather, in my invention, the tumblers are the locking members and they must be key set to lie on the periphery of the key plug before the key plug may rotate in the cylinder. The locking bar of my invention is used merely to prevent the application of picking torque to the key plug through the arrangement of the parts so that the tumblers will hold the locking bar in the locking slot of the cylinder whenever the tumblers are moved from any one of a series of stepped positions. Thus, when the tumblers of my lock are positioned by a key with their ends aligned preferably with the outer peripheral surface of the key plug, the locking bar is entirely out of the locking slot in the cylinder. Similarly, whenever the tumblers are positioned not with their ends in alignment with the key plug periphery, but in predetermined spaced relation to that alignment, and with the spaces multiples of the biting spaces of the lock, then the locking bar will be within the grooves of the tumblers and entirely outside of the locking slot in the cylinder.

In brief therefore, the locking bar will not prevent rotation of the key plug from its locked position when the tumblers are in their normal locking positions, nor rotation of the key plug from its locked position after an improper setting of the tumblers with their grooves in alignment with the locking bar. Once the locking bar

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has been rotated with the key plug away from the locking slot in the cylinder, it will then of course inhibit movement of the tumblers because of its relation to the tumblers, and thereby effectively preventing picking.

One feature of my invention therefore resides in the utilization of a locking bar, and key set tumblers adapted to allow movement of the locking bar entirely out of its locking slot in the cylinder when the tumblers are in any one of a series of different positions.

A further feature of my invention resides in the utilization of the key set tumblers for locking the key plug, with the locking bar being employed merely as an anti-picking device. Because of this relationship of the parts, my new lock has the extreme accuracy and effectiveness of a pin tumbler lock with all its attendant advantageous features such as master keying, lack of interchange between keys, etc.

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 my invention should not be limited to the particular structure herein set forth. Also, while I have described generally 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 vertical elevation and partial section of a cylinder lock embodying my invention.

Fig. 2 is a section taken along lines 2-2 of Fig. 1.

Fig. 3 is a section taken along lines 3-3 of Fig. 1.

Fig. 4 is a vertical section similar to that of Fig. 1 but showing the key within the key plug and the tumblers all aligned for release of the key plug.

Fig. 5 is a section similar to that of Fig. 3 but taken along lines 5-5 of Fig. 4.

Fig. 6 is a section taken along lines 6-6 of Fig. 2.

Fig. 7 is a perspective view of the locking bar of my invention.

Referring now more particularly to the drawings, the key plug of my lock is designated by reference numeral 10, and is rotatable in a bore formed within a cylinder 11. Driver bores 12 are formed in the cylinder 11 and are in alignment

with tumbler bores 13 formed in the key plug 10. A keyway 14 is formed in the key plug and communicates with each of the tumbler bores 13. This construction is of course conventional.

A series of driver springs 15 are mounted in the driver bores 12 and press against drivers 16, being mounted about pins 17 formed as integral portions of the said drivers 16. Tumblers 18 lie in the bores 13 of the key plug 10 and are pressed through drivers 16 and springs 15 into the extreme downward position of Fig. 3. The lower ends of the tumblers 18 are shown in position in Fig. 3 for contact by a key to be inserted into the keyway 14. In Fig. 5 a key K is shown within the keyway 14 with its bitted edge 19 contacting the lower end of the tumbler 18 there illustrated. The upper end surface 18a of the tumbler 18 is shown in alignment with the periphery of the key plug 10 so that insofar as the tumbler 18 and the driver 16 are concerned, the key plug is free for rotation. Except for the rather different shape of the tumblers and drivers used by me, the structure that I have so far described is entirely conventional in this art.

A longitudinal slot 20 is formed in the key plug 10, and in the locked position of the key plug 10 this slot 20 is in alignment with a slot 21 in the cylinder 11. Mounted for sliding movement within the slot 20 of the key plug 10 is a locking bar 22 best illustrated in Fig. 7. Part 23 of the locking bar 22 is adapted for entry into the locking slot 21 of the cylinder 11 as illustrated in Fig. 3, while the cam surfaces 24 of the bar are adapted for entry into grooves 25 formed in the tumblers 18.

Springs 26 normally urge the locking bar 22 inwardly of the key plug so as to carry the cam surfaces 24 into the grooves 25 of the tumblers. The springs are held in place by discs 27 that are forced into slots in the key plug as is illustrated in Fig. 6 and are suitably retained as by staking. In order to complete the description of the lock, it may be well to indicate that a cam 29 is secured as by screws 30 to the inward end of the key plug 10 for rotation by the key plug.

While the majority of the tumblers are grooved as at 25 for cooperation with the cam surfaces 24 of the locking bar 22, the shortest tumbler, called the No. 0 tumbler in the trade, and so designated in Fig. 4 of the drawings, is not formed with grooves 25. Therefore, as is seen in dotted lines in Fig. 3 the No. 0 tumbler surface 31 contacts the lowermost cam surface 24 of the locking bar 22 and maintains the bar with its locking part 23 in the locking slot 21. In those few key plugs that will use one or more No. 0 tumblers, this will be the condition of the parts when the key is not within the plug. However, the No. 1 tumbler that is next in length to the No. 0 and is best shown in Fig. 4, is formed with one groove 25. Tumbler No. 1 will, in the locked position of the parts, allow the locking bar 22 to move under the influence of the springs 26 out of the locking slot 21 and entirely within the key plug. This will be the condition even when there is no key within the key plug, and therefore the locking bar 22 will not prevent rotation of the key plug from its locked position. Rotation of the key plug will of course be prevented by the arrangement of the tumblers 18 and drivers 16.

As is clearly apparent from the drawings, there is considerably greater clearance or tolerance between the tumblers and drivers relatively to their bores 12 and 13 than there is clearance or tolerance between the locking bar 22 and the locking

slot 21. Therefore, with the bar 22 within the key plug, a very slight rotation of the key plug will bring the locking bar portion 23 beyond the locking slot 21. Thereafter it will be impossible for the locking bar to move outwardly of the key plug away and from interlocking relation to the several tumblers. In other words, the locking bar will be held as shown in Fig. 5 through contact of the end surface thereof with the cylinder bore in which the key plug rotates. It will then be impossible to move the tumblers 18 as by a picking tool.

The grooves 25 are formed in the tumblers at distances corresponding to the distances between the bittings of the keys used to set the tumblers. Thus, the distance between two grooves 25 in a tumbler is the distance between sequential bittings of a key. Therefore, any key inserted into the lock, if that key is bitted in accordance with the biting depths for which the lock is designed, will position the tumblers 18 so that their grooves 25 lie in alignment with the cam surfaces 24 of the locking bar 22. Therefore, the locking bar 22 will be able to move out of the locking slot 21 in the cylinder into locking relation to the tumblers. This will be the condition also if a picking tool sets the tumblers with their grooves 25 aligned properly relatively to bar 22. If torque is not applied to the key plug until the tumblers have been moved vertically as by a special key or picking tool, then immediately upon application of torque the locking bar, if it is within the grooves 25 of the tumblers when the plug is rotated, will remain within those grooves to lock the tumblers against movement. If, on the other hand, the locking bar 22 is pressed outwardly into slot 21 by any one of the tumblers 18 because of the positioning of that tumbler by a picking tool, then the locking bar 22 will make it impossible to apply rotation to the key plug as is necessary in order to pick the several tumblers. This is true because the tolerance between the locking bar 22 and slot 21 is smaller than between the tumblers and drivers and their bores, all as earlier outlined.

I have found through the building of a model lock of my invention that that lock is extremely secure against picking and that because of the extreme accuracy possible through the use of pin tumblers, it is safe against interchange; that is against operation by keys of approximately the same biting as the key for which the lock is intended. I have also found that my lock is capable of master keying in the approved manner of the art.

I believe that the operation and construction of my invention will now be quite apparent to those skilled in the art.

I now claim:

1. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, tumblers for physically locking said key plug to said cylinder, and grooves in certain of said tumblers into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening.

2. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a

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locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder adapted to be positioned by a key in a key way formed in said key plug in communication with said aligned bores, and grooves in said tumblers spaced in a predetermined manner and into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening upon the alignment of said grooves.

3. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder adapted to be positioned by a key in a key way formed in said key plug in communication with said aligned bores, grooves in said tumblers spaced in a predetermined manner and into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening upon the alignment of said grooves through positioning of said tumblers by a key or otherwise, the biting steps of said tumblers being so determined relatively to the positions of said grooves that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key.

4. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder adapted to be positioned by a key in a key way formed in said key plug in communication with said aligned bores, grooves in said tumblers spaced in a predetermined manner and into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening upon the alignment of said grooves through positioning of said tumblers by a key or otherwise, the biting steps of said tumblers being so determined relatively to the positions of said grooves that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, one of the tumblers of said lock being short enough so that when raised to release position by a key it is positioned above obstructing relation to said locking bar.

5. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said

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cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder adapted to be positioned by a key in a key way formed in said key plug in communication with said aligned bores, grooves in said tumblers spaced in a predetermined manner and into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening upon the alignment of said grooves through positioning of said tumblers by a key or otherwise, the biting steps of said tumblers being so determined relatively to the positions of said grooves that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, one of the tumblers of said lock being without a groove and short enough so that when raised to release position by a key it is positioned above obstructing relation to said locking bar, while when it is in its lowered position it obstructs movement of said locking bar out of said locking slot.

6. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, tumblers in said key plug, grooves in said tumblers into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening, the clearance between said tumblers and the cylinder and key plug bores in which they move being considerably greater than the clearance between said locking bar and the opening in said cylinder, substantially for the purpose set forth.

7. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder adapted to be positioned by a key in a keyway formed in said key plug in communication with said aligned bores, grooves in said tumblers into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening, the clearance between said drivers and tumblers and the cylinder and key plug bores in which they move being considerably greater than the clearance between the locking bar and the opening in said cylinder, substantially for the purpose set forth.

8. In a combination of the class described, a cylinder, a key plug rotatable in said cylinder, a locking bar slidable on said key plug and movable into a position in which a part thereof extends outwardly of said key plug into an opening in said cylinder, means pressing said locking bar into a position in which said part is withdrawn from said cylinder opening, spring pressed drivers and tumblers in aligned bores of said key plug and cylinder

der adapted to be positioned by a key in a key way formed in said key plug in communication with said aligned bores, grooves in said tumblers into any one of which said locking bar enters depending upon the position of said tumblers in said key plug when said locking bar is entirely withdrawn from said cylinder opening, the biting steps of said tumblers being so determined relatively to the positions of said grooves that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, the clearance between said drivers and tumblers and the cylinder and key plug bores in which they move being considerably greater than the clearance between said locking bar and the opening in said cylinder, substantially for the purpose set forth.

9. In a lock, a cylinder, a key plug rotatable in said cylinder, tumblers interlocking said key plug and cylinder and having portions thereof in said key plug extending into a keyway formed in said key plug whereby to be set by a key in said key plug, a locking bar in said key plug having a locking part thereof adapted to enter a slot in said cylinder for interlocking said cylinder and key plug, a spring pressing said locking bar toward said tumblers to bring said locking part out of said cylinder slot, grooves in said tumblers into any of which said locking bar may enter under the influence of said spring to bring said locking part out of said cylinder slot, the grooves in each of said tumblers being so positioned relatively to the biting depths of said tumblers that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, the clearance between said tumblers and the cylinder and key plug opening in which they move being considerably greater than the clearance between said locking bar and the opening in said cylinder, substantially for the purpose set forth.

10. In a lock, a cylinder, a key plug rotatable in said cylinder, tumblers interlocking said key plug and cylinder and having portions thereof in said key plug extending into a keyway formed in said key plug whereby to be set by a key in said key plug, a locking bar in said key plug having a locking part thereof adapted to enter a slot in said cylinder for interlocking said cylinder and key plug, a spring pressing said locking bar toward said tumblers to bring said locking part out of said cylinder slot, grooves in said tumblers into any of which said locking bar may enter under the influence of said spring to bring said locking part out of said cylinder slot, the said grooves in each of said tumblers being so positioned relatively to the biting depths of said tumblers that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key.

11. In a lock, a cylinder, a key plug rotatable

in said cylinder, tumblers interlocking said key plug and cylinder and having portions thereof in said key plug extending into a keyway formed in said key plug whereby to be set by a key in said key plug, a locking bar in said key plug having a locking part thereof adapted to enter a slot in said cylinder for interlocking said cylinder and key plug, a spring pressing said locking bar toward said tumblers to bring said locking part out of said cylinder slot, grooves in said tumblers into any of which said locking bar may enter under the influence of said spring to bring said locking part out of said cylinder slot, the said grooves in each of said tumblers being so positioned relatively to the biting depths of said tumblers that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, one of the tumblers of said lock being without a groove and short enough so that when raised to release position by a key it is positioned above obstructing relation to said locking bar.

12. In a lock, a cylinder, a key plug rotatable in said cylinder, tumblers interlocking said key plug and cylinder and having portions thereof in said key plug extending into a keyway formed in said key plug whereby to be set by a key in said key plug, a locking bar in said key plug having a locking part thereof adapted to enter a slot in said cylinder for interlocking said cylinder and key plug, a spring pressing said locking bar toward said tumblers to bring said locking part out of said cylinder slot, grooves in said tumblers into any of which said locking bar may enter under the influence of said spring to bring said locking part out of said cylinder slot, the said grooves in each of said tumblers being so positioned relatively to the biting depths of said tumblers that a groove in each of said tumblers will be in alignment with said locking bar in each of the possible stepped positions to which said tumblers are set by a bitted key, one of the tumblers of said lock being without a groove and short enough so that when raised to release position by a key it is positioned above obstructing relation to said locking bar, while when it is in its lowered locking position it obstructs movement of said locking bar out of said locking slot.

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