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CYLINDER LOCK

Filed June 28, 1967

2 Sheets-Sheet 1

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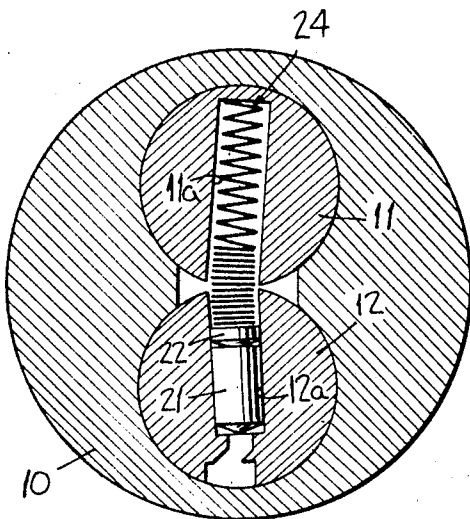


Fig. 4.

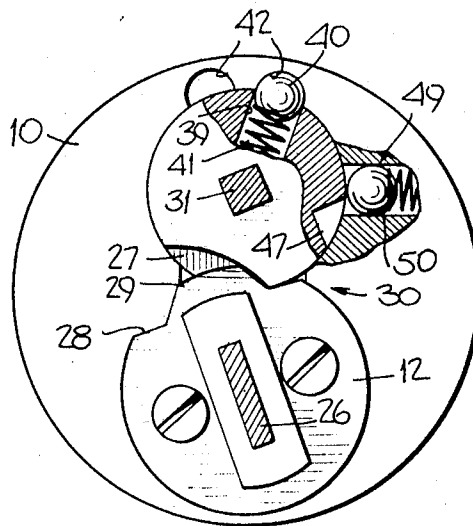


Fig. 6.

Fig. 5.

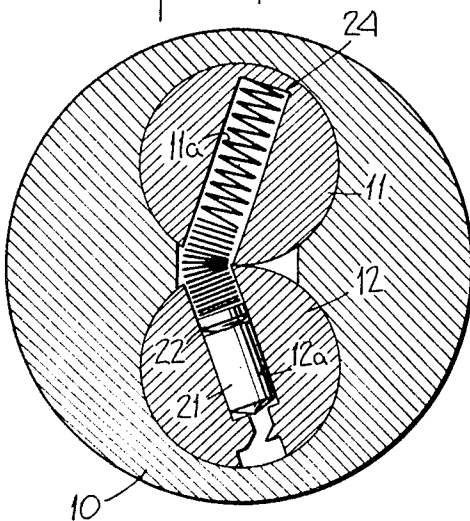
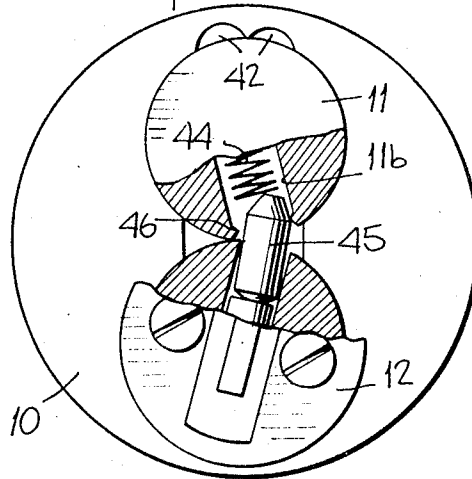


Fig. 7.



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CYLINDER LOCK

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19 Claims

ABSTRACT OF THE DISCLOSURE

Key operable tamper-proof cylinder lock with means affording limited rotation of bolt controlling plug insufficient to retract bolt upon attempted unauthorized manipulation; and cooperating means actuating alarm upon such limited rotation.

This invention relates to a lock mechanism, and more particularly, to a tamper-proof pin tumbler cylinder lock mechanism with which cooperating means for actuating an alarm upon attempted unauthorized manipulation of the mechanism may be associated.

Various types of alarm actuating mechanisms are known whereby unauthorized entry into a locked premises is sensed and indicated by the operation of an alarm. However, all too often mechanisms of this type have been able to be defeated so that the alarm is not actuated upon the occurrence of an unauthorized entry; and, even where the alarm is actuated, this usually occurs after the entry has taken place. As the security technology has advanced, the development of means to nullify the improvements has also advanced. Thus, there has been a long standing need for a tamper-proof lock mechanism which, while operable to permit authorized entry, resists unauthorized entry and may be combined with means to actuate an alarm upon attempted unauthorized entry. The invention disclosed in my copending application Ser. No. 623,333, filed Mar. 15, 1967 and entitled Lock Mechanism and Alarm provides a very satisfactory solution to this problem; and while the present invention attacks the same problem, it provides a solution based upon an entirely novel inventive concept.

Accordingly, an important feature of the present invention resides in apparatus of the class described comprising; a cylinder, a plug rotatably mounted in the cylinder, standard pin tumbler and driver means normally securing the plug against rotation relatively to the cylinder, a key slot in the plug for reception of means adjusting the pin tumbler and driver means to permit such relative rotation, and means allowing limited rotation only of the plug relatively to the cylinder upon unauthorized manipulation of the standard pin tumbler and driver means.

To this end, I prefer to employ a second plug also mounted for rotation in the cylinder and adjacent to the first plug, the plugs having normally opposed bores in which are positioned what I shall refer to as non-standard tumbler and driver assembly means. These assembly means include a pin tumbler, a driver and spring means, the latter urging the tumbler and driver into position to avoid establishment of an uninterrupted shear line between the plugs. The pin and driver assembly means may be so constructed and arranged relatively to the bores that the second plug is free to rotate a limited distance in either annular direction upon rotation of the first plug when the assembly means are in normal position, and, in fact, it is these non-standard assembly means that transmit the motion from the first to the second plug. Detent means such as a socket and spring loaded ball may act between the cylinder and plug tending to resist such annular movement. Moreover, similar detent means may

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be provided to resist return of the second plug to its normal position after a preselected amount of rotation. In this way, that plug may be utilized to operate an alarm upon attempted unauthorized manipulation of the lock, about which more will later be said.

A key slot is provided in the first plug so that the various standard and non-standard tumbler and driver assembly means may be set to establish an uninterrupted shear line between the plugs, and between the respective tumblers and drivers in the usual way, so that the key slotted plug is free to rotate independently of the other plug by the use of an authorized key. The key slotted plug may thus be arranged to operate a door bolt for instance.

According to one embodiment of the invention, the plugs are formed to interfere with one another when the extent of limited rotation is reached. Thus for example, one of the plugs may be formed with a recess and the other with a projection extending into the recess, the recess and projection being constructed and arranged to interfere at a preselected annular position of rotation thus to effect a positive limit of such rotation. In such cases, it is my preference that the parts comprising the tumbler and driver assemblies be of a size that the tumbler and driver, when bottomed under the influence of their respective spring, are both contained within their respective bore in one of the plugs and do not intersect the shear line between the plugs. The spring itself, in such case, does intersect the shear line and affords a toggle action when the plugs are rotated to the position of limited rotation.

On the other hand, the tumblers and drivers may be so dimensioned that, when bottomed, the drivers extend through the shear line. In this case, I prefer to form the bores of at least one of the plugs of a diameter slightly larger than that of the drivers to afford some degree of play therebetween so as to allow limited rotation of the plugs when the drivers intersect the shear line.

It will be appreciated by those persons skilled in the art that the foregoing arrangements permit authorized use of the lock mechanism by a key which positions the tumblers and drivers to afford an uninterrupted shear line between the plugs, such shear line also passing between the respective tumblers and drivers so that the key slotted plug may be rotated independently of the other plug to operate a door bolt retracting shaft, for example.

In addition to the foregoing structure, as mentioned, I provide at least one pin tumbler and driver assembly of the standard type, i.e., a pin, a driver and a spring disposed in cooperating bore means in the key slotted plug and in the cylinder. These bore means are dimensioned to afford the usual clearance to the pin and driver to obviate play in the key slotted plug. This standard assembly, or assemblies if more than one is used, is preferably in line with the tumbler and driver assembly means already described and is between them and the key slot opening and is operated by the same key which operates them.

However, if an attempt is made to pick the lock, it would be necessary to pick the standard assembly or assemblies first since the play in the nonstandard assembly means makes it exceedingly unlikely that the picked condition of the respective nonstandard assembly means could be maintained while others were being manipulated; instead any that had been picked would fall back into normal position since the standard assemblies would prevent sufficient rotation of the key slotted plug to afford a ledge at the top of that plug upon which to maintain a picked driver while others were being manipulated.

On the other hand, if the standard assemblies are picked successfully, then any torque applied to the key slotted plug sufficient to cause rotation thereof, will in turn cause counter rotation of the other plug until the limit

of such rotation is reached, and as this occurs after rotation of the order of 15° or less, the key slotted plug will be locked against further rotation before it has rotated sufficiently to effect retraction of a door bolt. In this connection, it will be understood that in the embodiment employing, in the tumbler and driver assembly means, springs that normally intersect the shear line, a toggle action is given to rotation of the plugs so that only a very slight movement off center will shift the plugs to their limit of rotation.

There has thus been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. Those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of the invention.

A specific embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings, forming a part of the specification where:

FIG. 1 is a vertical cross-sectional view of a cylinder lock in accordance with the present invention and illustrating a bolt operating shaft controlled by the first plug, a switch and switch operating mechanism controlled by the second plug and a key setting the various tumbler and driver assemblies to normal entry position;

FIG. 2 is an elevational view taken along the lines 2—2 of FIG. 1;

FIG. 3 is a partial elevational view illustrating a switch and switch operating elements;

FIG. 4 is a cross-sectional view taken along the lines 4—4 of FIG. 1;

FIG. 5 is a view similar to FIG. 4, but illustrating the parts in position of limited rotation;

FIG. 6 is a view similar to FIG. 2, but illustrating the parts in position of limited rotation; and

FIG. 7 is a view similar to FIG. 6, but illustrating another embodiment of the invention.

Referring now to the drawings in detail, and more specifically to FIG. 1, there is shown a cylinder 10 having a pair of plugs 11 and 12 mounted for rotation therein. The plugs are shown as being equal in diameter and mounted adjacent one another with their longitudinal axes parallel; but the uppermost plug 11 is shorter in length than is the plug 12 and does not extend to the front face of the cylinder 10.

A standard pin tumbler and driver assembly 14 is shown positioned in cooperating bores 15 and 15a in the cylinder 10 and plug 12, respectively. This assembly comprises a pin tumbler 16, a driver 17, both of drill-proof hardened steel, and a spring 19 normally urging the driver and tumbler into position to lock the plug 12 against rotation. This assembly is conventional and, although only one is shown, it will be understood that several may be used.

A series of nonstandard pin tumbler and driver assemblies such as that designated by the reference numeral 20 are shown behind and in line with the standard assembly 14, these nonstandard assemblies comprising tumblers 21, drivers 22 having inverted mushroom-like configurations, and spring means 24 urging the tumblers and drivers to bottom in the lowermost of corresponding bores 11a and 12a of the plugs 11 and 12, respectively.

Referring momentarily to FIGS. 4 and 5, it will be seen that the various parts of the nonstandard assemblies are so dimensioned that in normal position, the tumblers 21 and drivers 22 are contained within the bore 12a of plug 12 while the spring means 24 occupies the bore 11a of plug 11 and intersects the shear line between the plugs. It will be noted that the upper part of the spring means 24 is a compression spring while the lowermost portion,

and that which intersects the shear line, is closely coiled as a tension spring for a purpose later to be described.

Returning to FIG. 1, the plug 12 is a key slotted as at 25 for reception of a key 23 which adjusts the standard and nonstandard assemblies so that the shear line between the plugs also passes between the drivers and tumblers of all the assemblies whereupon the plug 12 is free to rotate independently of the plug 11. A shaft 26 rotates with the plug 12 to operate a conventional door bolt or the like.

As stated, in this embodiment of the invention, one plug is formed with a recess and the other with a projection extending into the recess, the recess and projection being constructed and arranged to interfere at a preselected annular position of rotation thus positively to limit the extent of such rotation. To this end, I extend the plugs somewhat beyond the inner end of the cylinder 10 (FIG. 1) and, as shown in FIG. 2, form an arcuate recess 27 in the lower marginal region of the upper plug 11. The lower plug 12 is milled out as at 28 and has an upstanding projection 29 in its corresponding region so arranged that it fits into the median area of the recess 27 when the plugs are in normal position. Additionally, the arcuate recess 27 is dimensioned so as not to interfere with rotation of the plug 12 when an uninterrupted shear line is effected between the plugs, so that the plug 12 can rotate independently of the plug 11. However, as shown in FIG. 6, if the shear line is interrupted as by one of the spring means 24, then a rotating force applied to the plug 12 will be transferred to the plug 11 through the spring and the latter plug will rotate in a direction counter to the direction of rotation of the plug 12; and as mentioned before, the closely coiled portion of the spring means interrupts the shear line thus giving a snap or toggle effect to the rotation. Such rotation is limited by interference between the outer surface of the plug 11 and the side of the milled portion of plug 12, as shown in FIG. 6 at 30. When this degree of rotation is reached, no further rotation is possible except back to normal position, and the limit of rotation can be preselected by appropriately shaping and sizing the milled portion and projection of plug 12, and the recess of plug 11.

Where it is desired to utilize an alarm with the present lock mechanism, the upper plug 11 is shown in FIGS. 1 and 3 equipped with a shaft 31 to which is attached for rotation therewith a cam 32 having a recess 34 in which a follower 35 sits when the plug 11 is in normal position. When the plug 11 is rotated in either direction, and before it reaches its limit of rotation, the shaft 31 and cam 32 also rotate sufficiently to lift the follower 35 out of the recess. This movement of the follower lifts a switch actuating arm 36 and operates a switch 37 to energize an alarm circuit. The plug 11 is also bored as at 39 (FIGS. 1, 2 and 6) for receipt of a ball 40 and spring 41, the latter normally urging the ball against the surface of the cylinder 10. The inner surface of the cylinder however has a pair of recesses 42, one on each side of the vertical center line through the plug 11 and located to seat the ball 40, upon completion of the limited rotation already discussed, to act as a detent restraining return of the plug 11 to its normal position.

In the embodiment of the invention illustrated in FIG. 7, bores 11b in plug 11 are of oversize diameter relatively to springs 44 and drivers 45, the latter being of a length normally to extend across the shear line between the plugs. In this way, a limited degree of rotation of the plugs is permitted upon attempted rotation of the plug 12 while the shear line is interrupted by at least one driver. Such rotation is limited due to eventual interference by the driver with the sides of the corresponding bores in the plugs 11 and 12 and, if desired, the lower portion of the bores 11b may be formed with annular ribs 46 for accurate control.

As shown in FIGS. 2 and 6, further detent means may be provided normally to maintain the plug 11 in neutral

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position. Thus, a conical recess 47 is formed in the side of the plug 11 and a ball and spring assembly 49 are positioned in a bore 50 in the cylinder 10, the spring urging the ball to seat in the recess 47 under a light force.

As shown in FIG. 1, a cup-shaped cap 51 is press fit or otherwise secured over the front portion of the cylinder 10 and is formed of drill-proof metal to prevent drilling through the cylinder for insertion of a shim to support the respective assemblies in picked condition as others are manipulated; and this cap covers the shear line at the front of the cylinder.

From the foregoing description it will be seen that I contribute a lock mechanism which is exceedingly pick resistant in that successful picking of the standard tumbler and drive assemblies will allow the plugs to rotate a limited extent only so that entry will not be effected, it being remembered that successful picking requires a torque to be applied to the plug being manipulated in order to maintain the picked tumblers in that condition. This same torque, necessary to maintain the standard assemblies picked, will also cause the limited rotation of the plugs. On the other hand, if it is attempted to pick the nonstandard assemblies first, the close fit of the standard assemblies in their respective bores prevent sufficient bearing being achieved to support any nonstandard drivers in picked condition; and even if this could be achieved in respect of one or two of them even the very faintest movement or vibration will cause them to drop back into locking condition.

I also provide means associated with the lock mechanism whereby an alarm is given when unauthorized entry is attempted and without such entry having been achieved.

I believe that the construction and operation of my invention will now be understood and that the several advantages thereof will be fully appreciated by those persons skilled in the art.

I claim:

1. Apparatus of the class described comprising: a cylinder, first and second plugs rotatably mounted in said cylinder in side by side relation, means defining pairs of normally opposed bores in said plugs, a pin tumbler and driver assembly disposed in each of said pairs of opposed bores normally to prevent establishment of an uninterrupted shear line between said plugs, a key slot in said first plug for reception of means adjusting said tumbler and driver assemblies to establish an uninterrupted shear line between said plugs whereby said first plug may be rotated independently of said second plug, at least one of said pin tumbler and driver assemblies cooperating with said plugs to transmit forces effecting rotation of said first plug to said second plug to effect counter-rotation thereof when said shear line is interrupted by said force transmitting assembly and means limiting said last-mentioned rotation and counter-rotation.

2. Apparatus according to claim 1, wherein said cylinder and one of said plugs are equipped with means tending to prevent relative movement therebetween.

3. Apparatus according to claim 2, wherein said last mentioned means includes a spring loaded ball and groove detent.

4. Apparatus according to claim 1, wherein said second plug is provided with switch operating means shiftable upon rotation of said second plug to effect actuation of a switch.

5. Apparatus according to claim 4, wherein said second plug and said cylinder are equipped with detent means to retain said second plug in switch actuating position.

6. Apparatus of the class described comprising: a cylinder, first and second plugs rotatably mounted in said cylinder in side by side relation, means defining pairs of normally opposed bores in said plugs, a nonstandard pin tumbler and driver assembly disposed in each of said pair of opposed bores normally to prevent establishment of an uninterrupted shear line between said plugs, a key slot in said first plug for reception of means adjusting

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said tumbler and driver assemblies to establish an uninterrupted shear line between said plugs whereby said first plug may be rotated independently of said second plug, at least one of said pin tumbler and driver assemblies cooperating with said plugs to transmit forces effecting rotation of said first plug to said second plug to effect counter-rotation thereof when said shear line is interrupted by said force transmitting assembly, means limiting said last-mentioned rotation and counter-rotation, and means defining normally opposed bores in said cylinder and said first plug, a standard pin tumbler and driver assembly in each such pair of opposed bores normally preventing establishment of an uninterrupted shear line between said cylinder and first plug, said means adjusting said nonstandard assemblies also adjusting said standard assemblies to provide an uninterrupted shear line between said cylinder and first plug.

7. Apparatus according to claim 6, wherein said pin and driver assembly means are so constructed and arranged relatively to the bores that said second plug is free to rotate a limited distance only in either annular direction upon rotation of the first plug when the nonstandard assembly means are in normal position and said standard tumbler and driver means are positioned to avoid interference with rotation of said first plug.

8. Apparatus according to claim 6, wherein said plugs each have a plurality of said bores and said nonstandard tumbler and driver assembly means comprise a tumbler, driver and spring means in each of said opposed bores, the diameter of the bores in said second plug being larger than that of the bores in said key slotted plug.

9. Apparatus according to claim 6, wherein detent means are provided tending to retain said second plug in normal position.

10. Apparatus of the class described comprising: a cylinder, first and second plugs rotatably mounted in said cylinder in side by side relation, means defining normally opposed bores in said plugs, a pin tumbler and driver assembly disposed in each pair of said opposed bores normally to prevent establishment of an uninterrupted shear line between said plugs, a key slot in said first plug for reception of means adjusting said tumbler and driver assemblies to establish an uninterrupted shear line between said plugs whereby said first plug may be rotated independently of said second plug, bolt operating means associated with said first plug, said tumbler and driver assemblies cooperating with said bores to permit limited rotation of said plugs when said shear line is interrupted by at least one of said assemblies, said plugs being formed to interfere with one another when the extent of such limited rotation is reached.

11. Apparatus according to claim 10, wherein said pin and tumbler assemblies comprise each a pin and a driver normally disposed in a respective bore of one of said plugs and a spring disposed in said bore and its opposed bore in the other of said plugs and urging the pin and tumbler to bottoming position whereby said spring normally intersects said shear line and afford a toggle action upon rotation of said second plug.

12. Apparatus according to claim 10, wherein one of said plugs is recessed and the other is formed with a projection extending into said recess, said recess and projection being constructed and arranged to interfere at a preselected annular position of rotation thus to effect a positive limit of such rotation.

13. Apparatus according to claim 10, wherein means define normally opposed bore means in said key slotted plug and said cylinder, a pin and driver are disposed in said bore means and a spring urges same into normal position wherein said driver intersects said shear line.

14. Apparatus according to claim 10, wherein switch operating means are associated with said second plug and operate to actuate an alarm switch when said second plug is rotated such limited amount.

15. Apparatus according to claim 14, wherein detent

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means are provided to retain said second plug in switch actuating position.

16. Apparatus of the class described comprising: a cylinder, first and second plugs rotatably mounted in said cylinder in side by side relation, means defining normally opposed bores in said plugs, a pin tumbler and driver assembly disposed in each pair of said opposed bores, said assemblies each including a pin tumbler and a driver, the latter normally seated on its respective pin tumbler in the respective bore in said first plug and extending into its respective bore in said second plug, said bores in said second plug being of a diameter larger than that of said drivers to permit limited relatively counter-rotation of said plugs, a key slot in said first plug for reception of means adjusting said tumbler and driver assemblies to establish an uninterrupted shear line between said plugs whereby said first plug may be rotated independently of said second plug, and bolt operating means associated with said first plug.

17. Apparatus according to claim 16, wherein means define normally opposed bore means in said cylinder and first plug, a pin and driver are disposed in said bore means, and a spring urges same into normal position wherein said driver extends into the bore means of both

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of said plugs, said bore means in both plugs affording a close fit for said driver.

18. Apparatus according to claim 16, wherein switch operating means are associated with said second plug and operate to actuate an alarm switch when said second plug is rotated such limited amount.

19. Apparatus according to claim 18, wherein detent means normally retain said second plug in normal position and in switch operating position.

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