

[54] CYLINDER LOCK

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[57] ABSTRACT

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A cylinder lock having tumblers movable within a key plug in response to the insertion of a bitted key whereby the tumblers both translate and rotate to present discretely located operating elements, or cavities, to cooperating elements, or projections, carried by a fence normally retaining the key plug from rotation in its cylinder shell to release the fence and permit the plug to be rotated; i.e., the projections of the fence normally bearing against the surfaces of the tumblers out of registration with the aforesaid discretely located elements until matching cavities are engaged to bring about release of the fence.

[52] U.S. Cl.....70/364 A, 70/378, 70/419

[51] Int. Cl.....E05b 15/14, E05b 27/04

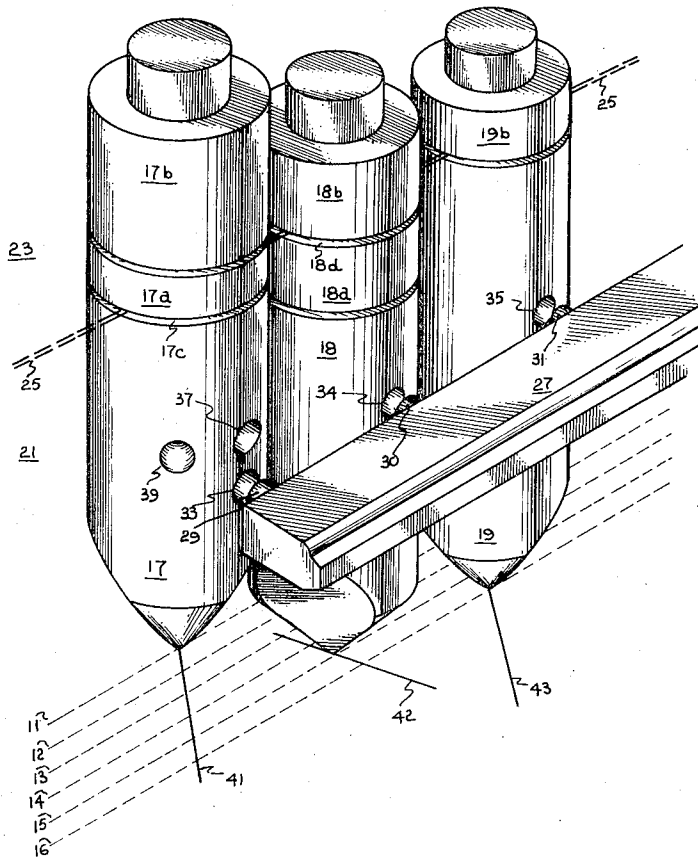
[58] Field of Search....70/364 A, 378, 406, 409, 419, 70/421

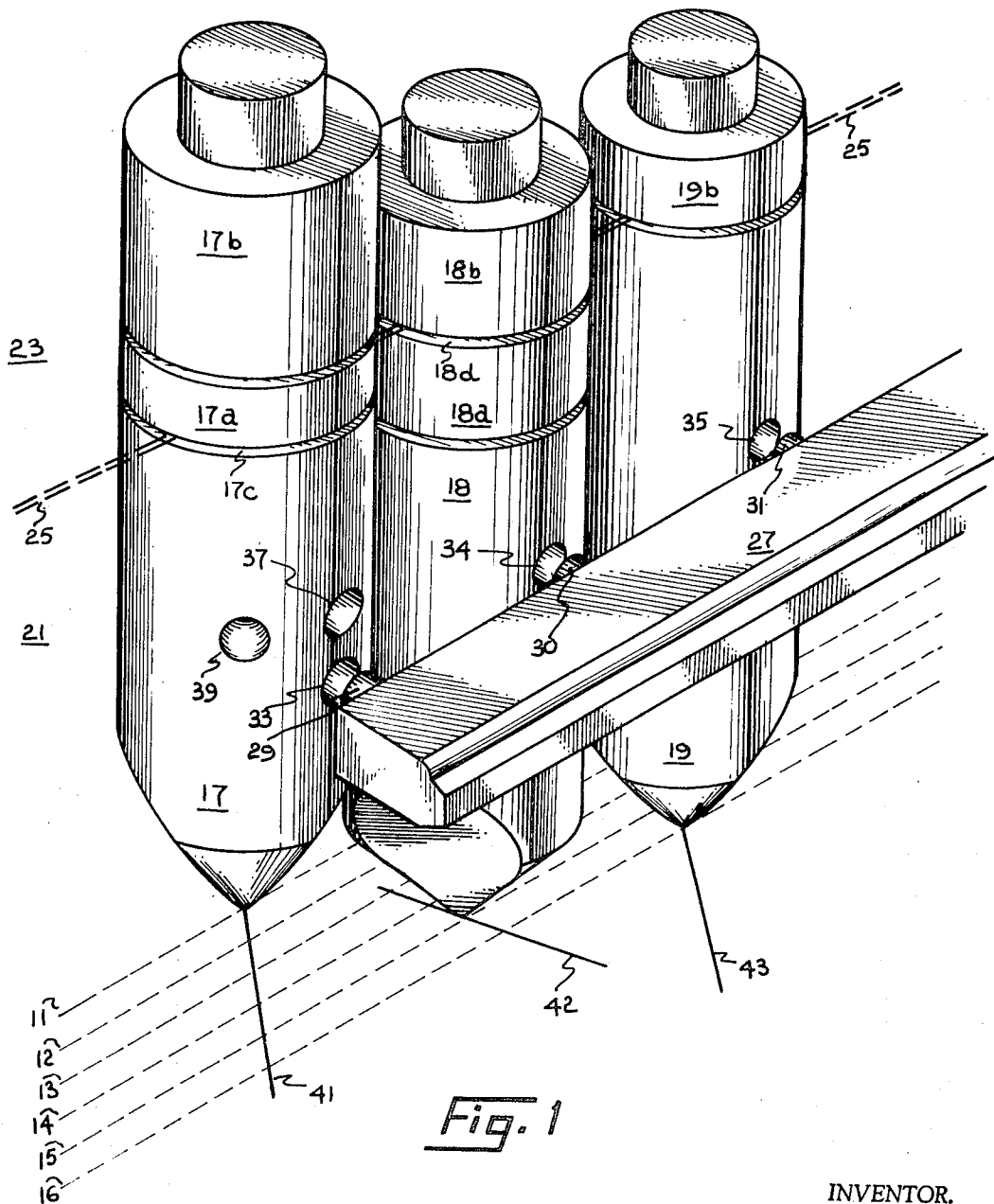
[56] References Cited

UNITED STATES PATENTS

3,499,302	3/1970	Spain.....	70/364 A
3,499,303	3/1970	Spain.....	70/364 A

3 Claims, 5 Drawing Figures





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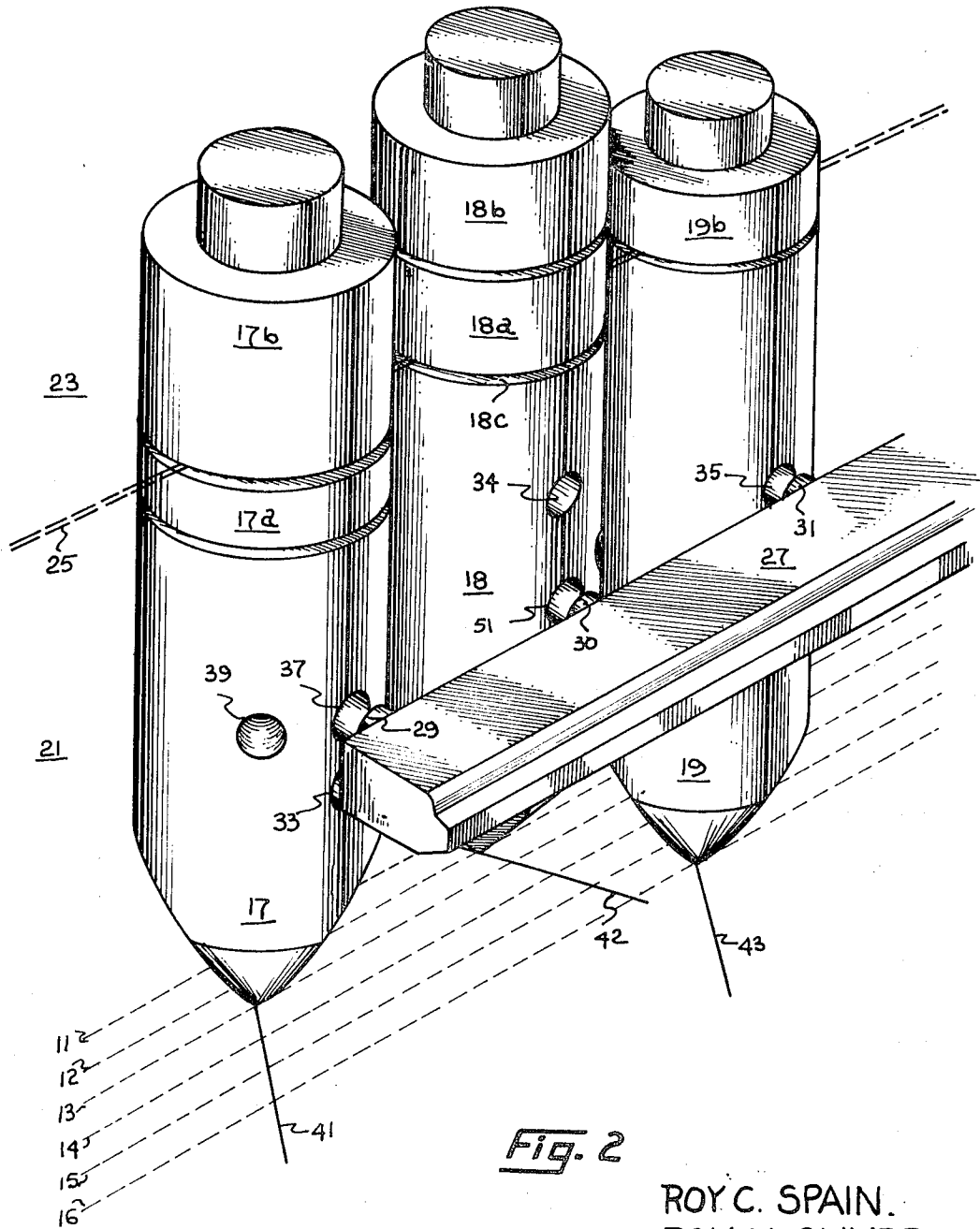


Fig. 2

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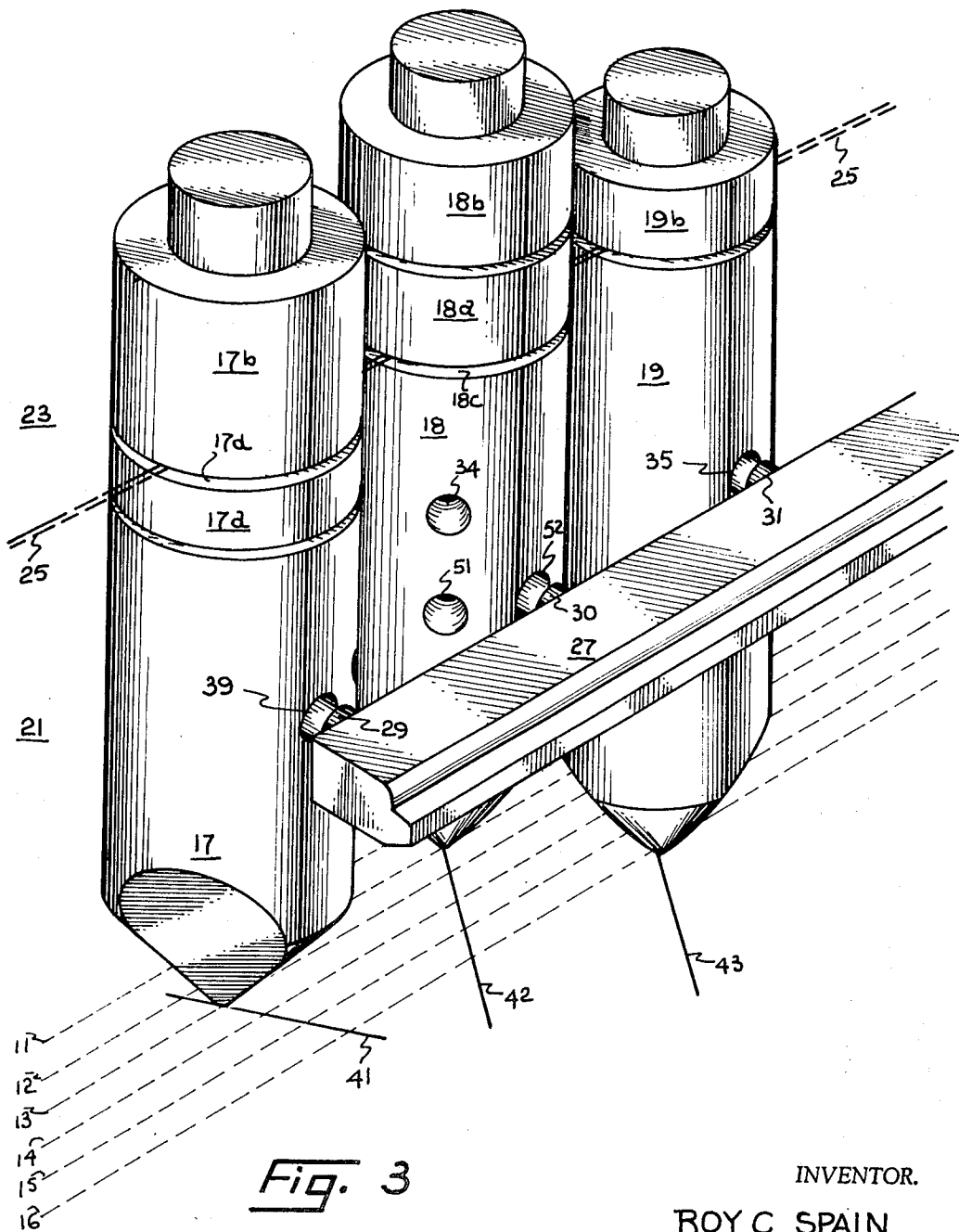


Fig. 3

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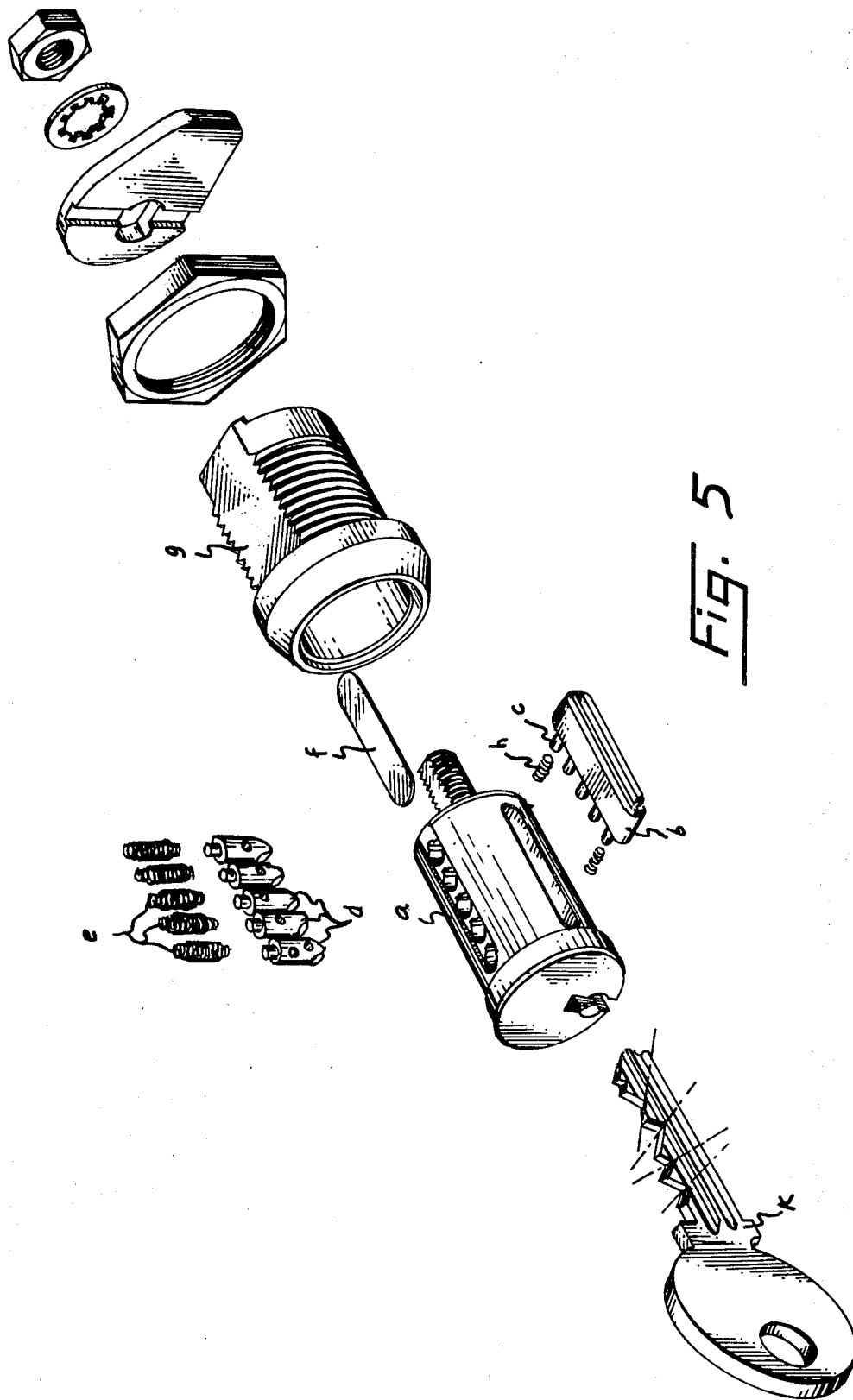


FIG. 5

CYLINDER LOCK

This invention is directed to a cylinder lock and more particularly to a cylinder lock of a master key system.

Conventional master key systems wherein a plurality of tumblers are reciprocally mounted in a key plug, the key plug being rotatable in the cylinder shell, make use of wafers to permit operation of one lock by more than one key. A system of this kind is described in U.S. Pat. No. 3,499,303 issued Mar. 10, 1970. Limitations in master key systems of this type arise in requiring the addition of wafers to a selected number of tumblers for each master key, thereby reducing the number of potential master keys per lock. The number of "change" keys which can be used with a master key in a lock of this type is also limited since the spline in the tumbler requires that the bitting in the master key be of the same angular displacement as that of the change key. Consequently, a master key used with two tumblers of a lock requires that the angular displacement of those two tumblers be the same throughout all the locks of the system.

This invention provides a solution and an improvement in cylinder locks wherein for each different key a discrete element is diametrically located on the tumbler for cooperation with a coacting element on the fence of the cylinder lock. The principal feature of this invention resides in the advantage that both the level of tumbler displacement and the angular displacement of the tumbler may vary from key to key for the same lock.

In the drawings:

FIG. 1 illustrates an arrangement of tumblers according to the invention showing in perspective the operation of a lock cylinder of a "change" key.

FIG. 2 is similar to FIG. 1 illustrating the operation of the lock under control of a master key.

FIG. 3 is a further illustration similar to FIG. 1 and FIG. 2 showing operation of the lock under a different master key, which may also be a master key for another system; i.e., a "grand" master key, for example.

FIG. 4 is a simplified version of the illustrations of FIGS. 1 - 3 showing operation of a so called "side bar" lock according to the invention.

FIG. 5 illustrates an exploded view of a cylinder lock into which the elements of FIGS 1 through 4 may be adapted wherein a key plug cooperating with a fence member *b* having a projection *c* and a spring *h* under control of tumblers *d* urged by springs *e* and confined in plug *a* by a spring cover *f* inserted into a shell *g*.

Referring to FIG. 1, a key (not shown) may have six V-bit levels as indicated by the dashed lines 11 - 16. Three tumblers 17, 18 and 19 rest on level lines 11, 15 and 16, respectively, corresponding to the first V-bit, the fifth V-bit and the sixth V-bit to allow operation of the lock by rotation of a key plug 21 within a cylinder shell 23. The lock illustrated is of the master key type wherein the normal tumblers 17 through 19 are augmented by wafers 17*a*, 17*b* and 17*c* for cooperation with three corresponding drivers 17*b*, 18*b* and 19*b*, as illustrated in previously mentioned U.S. Pat. No. 3,499,303.

In the present invention in order to operate the lock proper rotation of the tumblers, in addition to their translation to a proper level, is required. A fence 27 is urged by springs (not shown herein but illustrated in detail in U.S. Pat. No. 3,499,302) in a position

removed from the tumblers 17 through 19 into a groove (not shown) in the cylinder shell 23 so that the key plug cannot be rotated independently of the bit level of the tumblers. Under this condition any attempt to rotate the key plug 21 tends to urge the fence 27 into the tumblers. The fence 27 is provided with projections 29, 30 and 31 for cooperation with cavities, or holes, 33, 34 and 35, respectively, provided diametrically in the tumblers 17 through 19.

When alignment of the holes 33, 34 and 35 and projections 29, 30 and 31, respectively, is established, insertion of the projections into the holes is effected allowing the fence 27 to clear the shearline between the plug 21 and the shell 23. It is to be noted, however, that the tumblers must also be at the correct V-bit level, as explained in the previously mentioned U.S. Pat. No. 3,499,302. Specifically with reference to FIG. 1, V-bit rotations of the key are represented by lines 41, 42 and 43 and the levels of the tumblers are as initially stated above. In addition to the holes 33 through 35 additional holes may be provided in the tumblers for utilizing master key control of the lock. For example, tumbler 17 may include another hole 37 and at the same V-bit level still another hole 39, as illustrated in FIG. 2 of the drawings.

In FIG. 2 tumblers 17 through 19 are shown for master key operation, which has raised tumbler 17 to the third V bit level 13 causing the shearline 25 to be aligned with the separation 17*d* between driver 17*b* and wafer 17*a* and V-bit rotation is clockwise (see line 41). Similarly tumbler 18 is at the second V-bit level 12 causing the separation 18*c* between tumbler 18 and wafer 18*a* to be aligned with shearline 25 and V-bit rotation is counter clockwise (see line 42). Tumbler 19 is similarly positioned to the sixth V-bit level and rotated clockwise (see line 43).

Referring now to both FIGS. 1 and 2, it will be noted that tumbler 17 rests at a lower V-bit level for the master Key (FIG. 2) than for the regular, or change, key (FIG. 1). In other words, an alignment is obtained of the shearline 25 with a different separation.

Referring again to FIG. 2, in order to move fence 27 from the groove (not shown) in the cylinder shell 23 a hole 37 is provided in tumbler 17 to permit insertion of projection 29. Since the V-bit angle of both the change key (FIG. 1) and the master key (FIG. 2) is the same, the hole 37 is located directly above hole 33 at a distance equal to the difference in V-bit levels of tumbler 17. Similarly tumbler 18 has an additional hole 51 to be aligned with projection 30. Tumbler 19 is operative by both the change key and master key at the same V-bit level and angle.

Referring now to FIG. 3 tumbler 17 is at V-bit level 13 so that the separation 17*d* is aligned with shearline 25 and the V-bit rotation is counter clockwise causing hole 39 to be aligned with projection 29. Tumbler 18 is at the same V-bit level and is rotated clockwise causing a hole 52 to be aligned with projection 30. Tumbler 19 rests at the sixth V-bit level (level 16) and is rotated clockwise aligning projection 31 with hole 35. Consequently, with the holes 39, 51 and 35 now having projections 29, 30 and 31, respectively, inserted, the fence 27 is retracted from the groove (not shown) in the cylinder shell and the key plug is free to be rotated.

A practicable example of the utility of the invention may be understood by considering a two floor establishment where the locks of one floor are each operated by a change key, all locks of each floor being operated by a master key. The individual locks on the other floor are each operated by a change key also, all of these locks being operated by another master key — the master keys of each floor not being interchangeable. The change keys of each floor also use different V-bit levels.

Let it be assumed that the locks of each floor each include 5 tumblers and that the tumblers are arranged for operation by a master key and also by a grand master key having the same V-bit levels, as for example in FIGS. 2 and 3 wherein the rotation of the tumblers is the only difference between the master key and the grand master key. Let it be assumed further that the master key for the first floor has V-bit angles as follows:

Tumbler Number	1	2	3	4	5
Key Angle	CW	CW	CCW	CW	CW
Tumbler Angle	both	both	CCW	CW	CW

Also the master key for the second floor has V bit angles as follows:

Tumbler Number	1	2	3	4	5
Key Angle	CW	CCW	CW	CW	CW
Tumbler Angle	CW	CCW	both	CW	CW

(CW is indicative of clockwise rotation of the tumbler, and CCW is indicative of counter clockwise rotation of the tumbler).

Obviously the master key for the second floor can not operate locks of the first floor since the third tumbler of the first floor locks requires counter clockwise rotation whereas the second floor master key is bitted for clockwise rotation of the third tumbler. Similarly the master key for the first floor can not operate locks of the second floor since the first and second tumblers, respectively, require clockwise and counter clockwise rotation whereas the first floor master key is bitted oppositely.

A grand master key, however, may have V bit arrangements as follows:

Tumbler Number	1	2	3	4	5
Key Angle	CW	CCW	CCW	CW	CW

This grand master key will be capable of operating the locks of each floor since tumbler No. 1 of the first floor locks operates with either counter clockwise or clockwise and tumbler No. 1 of the second floor locks operates with clockwise rotation, and since tumbler No. 2 of the first floor locks operates with either clockwise or counter clockwise rotation and tumbler No. 2 of the second floor locks operates with counter clockwise rotation, and since tumbler No. 3 of the first floor locks operates with counter clockwise rotation and tumbler No. 3 of the second floor locks operates with either clockwise or counter clockwise rotation, the tumblers No. 4 and No. 5 on all locks operating with clockwise rotation.

From the above example it is quite obvious that further master, grand master, etcetera, keys can be utilized in the manner illustrated.

Attention is directed also to FIG. 4 which illustrates the invention as applied to a so called "side bar" lock. Here a tumbler 71 is shown resting on a V-bit level 12 of several levels 11 through 16. The side bar type of lock requires no wafers or drivers, the tumblers being urged downward (as in FIG. 4) within a key plug 73 by a spring, or springs, (not shown). A fence, or side bar, 75 normally is urged by springs (not shown) into a groove in the cylinder shell 77, only clearing the groove to permit rotation of the key plug when the fence clears the shearline 79. Such clearance is brought about by a projection 81 on the fence becoming aligned with a diametrically located hole 83 in the tumbler 71, the V-bit level of the key being such as to raise the tumbler to a predetermined level (see FIG. 4), and the V-bit angle of the key being such as to rotate the tumbler to a predetermined angle (see FIG. 4 as indicated by line 82); i.e., the key must translate and rotate the tumbler to the required level and angle. Under such conditions the fence 75 (FIG. 4) will cause projection 81 to become inserted into hole 83, clearing the fence from shearline 79 and permitting the key plug to be rotated.

Master key control may be obtained in a similar manner; i.e., by providing as shown in FIG. 4 a V-bit level, fifth level (see dashed line 15) and counter clockwise rotation (see line 84) for the master key and a hole 85 in tumbler 71 whereby projection 81 of the fence becomes inserted in hole 85. If a higher order master key is required an additional hole 87 may be located in the tumbler 71, the key being V-bitted for the fifth level (see line 15) and clockwise rotation, similar procedure may be followed to secure higher orders of master keys accordingly.

What is claimed is:

1. A cylinder lock having a cylindrical shell, a key plug rotatably operable in said shell to form a shear line therewith, a spring urged fence normally extending into said shell across said shear line from said plug to prevent its rotation, a plurality of tumblers in said plug, said tumblers being translatable and rotatable under control of a key having its bits formed therein at different levels and angles, at least one of said tumblers having a hole in its lateral surface at a preselected location, and a projection on said fence extendable into said hole to release said fence to permit said plug to be rotated in said shell when said key translates and rotates said tumbler to present said hole to said projection.

2. The invention of claim 1 wherein an additional hole is provided in said tumbler's lateral surface at another preselected location at the same translation level but at a different angle of rotation of said tumbler for releasing said fence by said key.

3. The invention of claim 1 wherein an additional hole is provided in said tumbler's lateral surface at another preselected location at the same angle of rotation but at a different translation level of said tumbler for releasing said fence by said key.

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