

Dec. 3, 1968

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3,413,831

ROTARY CYLINDER LOCK

Filed Dec. 18, 1967

2 Sheets-Sheet 1

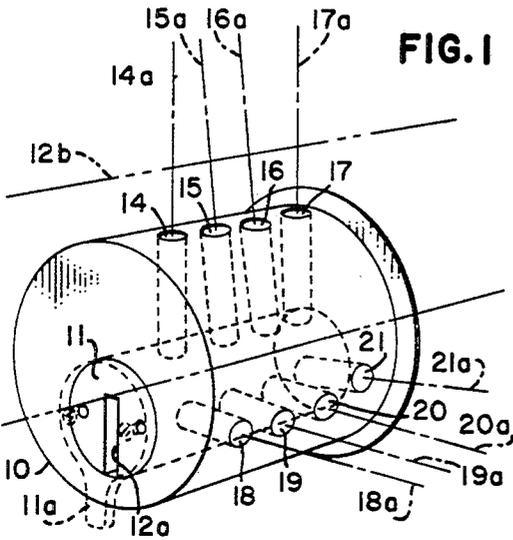


FIG. 1

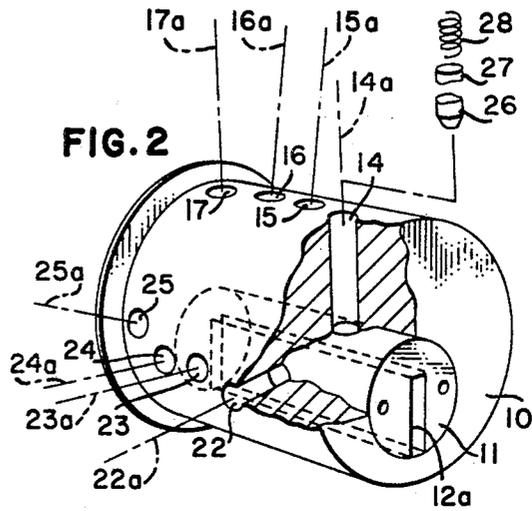


FIG. 2

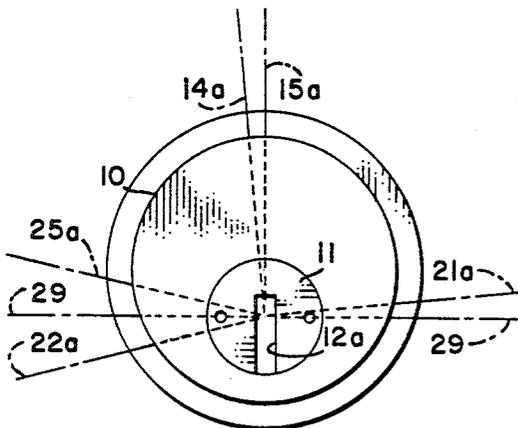


FIG. 3

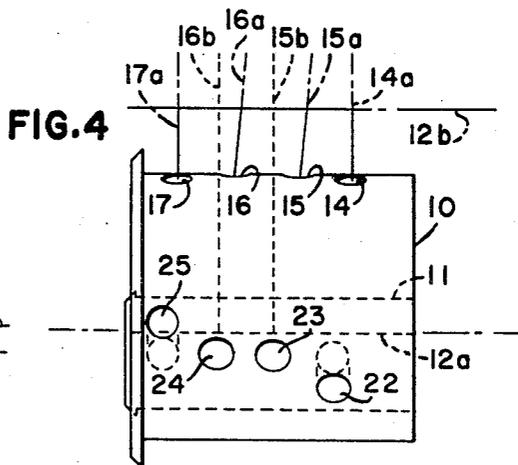


FIG. 4

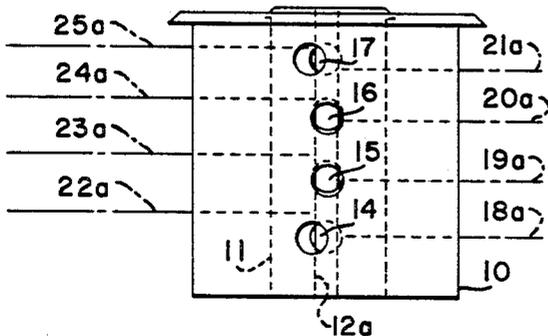


FIG. 5

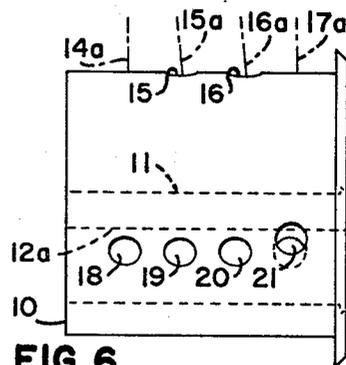


FIG. 6

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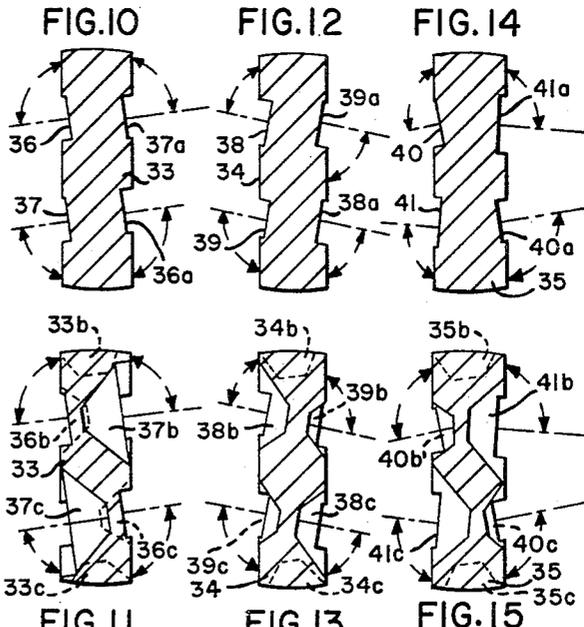
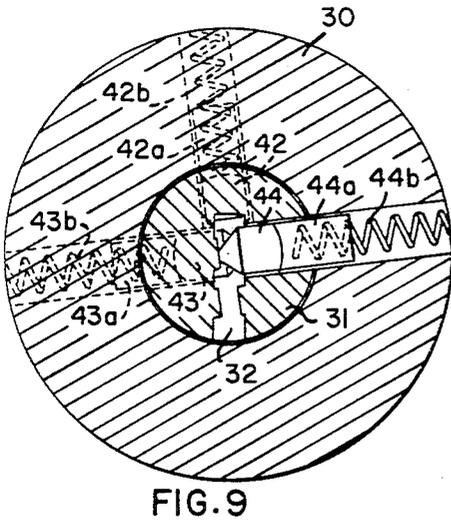
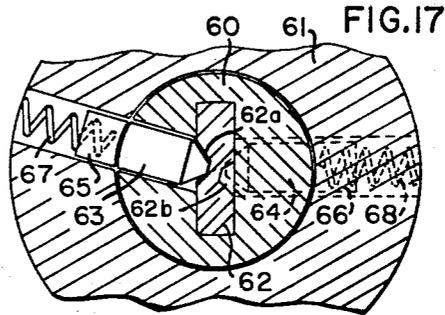
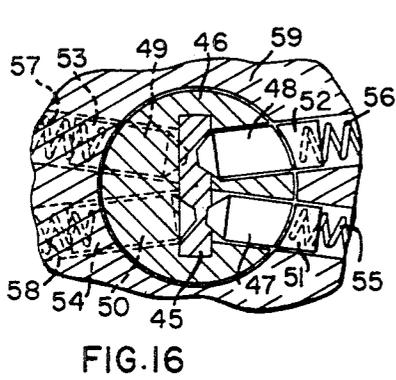
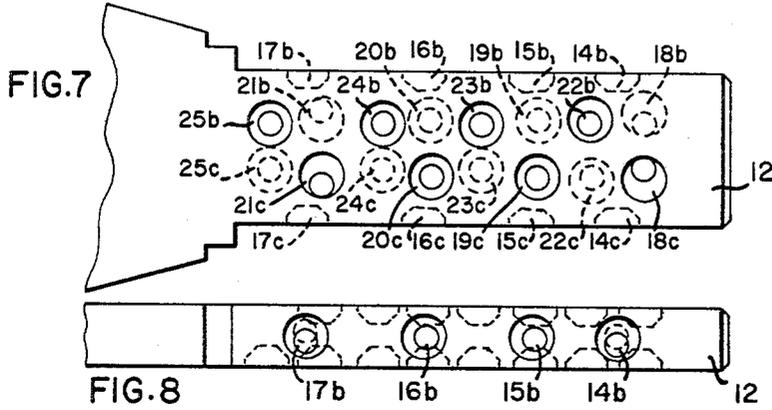
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ROTARY CYLINDER LOCK

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Continuation-in-part of application Ser. No. 459,644, May 28, 1965. This application Dec. 18, 1967, Ser. No. 691,419

9 Claims. (Cl. 70—358)

ABSTRACT OF THE DISCLOSURE

A key operated rotatable plug and cylinder lock in which the plug and cylinder are provided with pin-receiving holes that are disposed at one or more different angles with respect to the sides of the key inserted into the plug. Various angles may be provided to the pin-receiving holes so that the number of combinations possible with the lock mechanism is greatly increased, and also making it much more difficult for unauthorized duplication of the key.

This application is a continuation-in-part of my application Ser. No. 459,644 filed May 28, 1965 for Rotary Cylinder Lock.

This invention relates to a key operated cylinder lock.

An object of this invention is to provide an improved key and cylinder lock assembly which provides greater security than conventional type locks.

Another object of this invention is to provide an improved plug and cylinder assembly of high security which can be interchangeably used with previously manufactured conventional types of cylinder lock assemblies.

Still another object of this invention is to provide an improved key and cylinder lock which has a greater number of possible combination variations than conventional type cylinder lock assemblies, and which is no larger than the conventional type assembly.

Still another object of this invention is to provide an improved flat key for use with a cylinder lock, said key being provided with pin-receiving recesses which are shaped so that it is more difficult to copy the key than in the case of conventional type keys.

Another object of this invention is to provide an improved plug and cylinder lock assembly with key-engaging pins which are arranged to engage the key at different predetermined angles so that the number of possible combinations that may be provided to a simple plug and cylinder lock is greatly increased and also the security is substantially improved since it is more difficult to duplicate the key than in conventional locks.

Still another object of this invention is to provide an improved lock employing rows of key-engaging pins adapted to engage the key on opposite sides thereof, selected rows of the pins being positioned at different angles with respect to the key, said key having longitudinally extending planar recess with the planes thereof being at right angles to the axes of the pins on the corresponding side of the key.

Other and further objects of this invention will be apparent to those skilled in the art to which it relates from the following specification, claims and drawing in which, briefly:

FIG. 1 is a perspective view showing one side of a plug and cylinder lock embodying features of this invention;

FIG. 2 is a perspective view with parts thereof broken away showing the other side of the plug and cylinder lock;

FIG. 3 is an end view of the rear of the plug and cylinder lock shown in FIGS. 1 and 2;

FIG. 4 is a view showing the left hand side of the cylindrical housing illustrating the angular position of the pin-receiving holes formed therein;

FIG. 5 is a top view of the cylinder showing the angular position of the pin-receiving holes;

FIG. 6 is a side view showing the right hand side of the cylinder and illustrating the angular position of the pin-receiving holes;

FIG. 7 is a view showing one side of the key adapted to be used with this lock;

FIG. 8 is a view of the key showing the narrow top side thereof;

FIG. 9 is a sectional view of another embodiment of the lock of this invention;

FIGS. 10, 12 and 14, are sectional views of key blanks adapted to be used with a lock such as shown in FIG. 9, and FIGS. 11, 13 and 15 illustrate keys corresponding to the blanks shown in FIGS. 10, 12 and 14, respectively, after the pin-receiving recesses have been provided to the blanks;

FIG. 16 is a sectional view of another embodiment of the lock of this invention; and

FIG. 17 is a sectional view of still another embodiment of the lock of this invention.

Referring to the drawing in detail, reference numeral 10 designates the cylindrical housing of the lock having a hole bored therethrough for receiving the rotatable plug 11, which is provided with a key-receiving slot 12 extending longitudinally therethrough. The plug 11 is held assembled with the housing 10 by the bolt-actuating member 11a which is attached to the plug by suitable screws threaded thereto. The housing 10 and plug 11 are provided with three rows of pin-receiving holes 14 to 25, inclusive, as shown in FIGS. 1 and 2, different ones of which are oriented at different angles with respect to the faces of the key 12. These different angles are shown by way of example only as numerous other angles may be used and will be used in practical embodiments of this invention.

Four pin-receiving holes are provided to each row. The holes in the top row are designated by reference numerals 14, 15, 16 and 17, as shown in FIGS. 1 and 2, and the holes in the right hand row are designated by reference numerals 18, 19, 20 and 21, as shown in FIG. 1. The holes in the left hand row are designated by reference numerals 22, 23, 24 and 25, as shown in FIG. 2. Each of these holes extends through the housing 10 and into the plug 11 to communicate with the key-receiving slot 12a, into which the key 12 shown in FIGS. 6 and 7 is adapted to be inserted.

Each of these holes is provided with pins such as the pins 26 and 27, shown in FIG. 2, and the innermost key-engaging pin, such as the pin 26, is adapted to be positioned in the hole formed in the plug 11, whereas, the outer pin 27 is adapted to be positioned in the hole formed in the housing 10. The pins are provided with a spring, such as the spring 28, which urges the pins inward. The assembly of the pins and spring is held in the respective hole by a member (not shown) on the outside of the housing 10, which may be in the form of a sleeve surrounding the housing 10, or it may be a retaining plate recessed into the housing, and both arrangements are conventional in the art.

The axes 14a to 25a, inclusive, of the pins positioned in the holes 14 to 25, inclusive, respectively, are shown in FIGS. 1 and 2 by broken lines which extend away from the housing 10 so as to illustrate more clearly the fact that the axes of the pins positioned in the holes are disposed at different predetermined angles with respect to the face of the key with which these pins are adapted to cooperate.

The top row including the holes 14, 15, 16 and 17 is shown in the plan view FIG. 5, and from this view it will be seen that the holes 14 and 17 are tilted to the left at a predetermined angle, while the holes 15 and 16 are tilted downward. Thus, the axes of the pins positioned in holes 14 and 17 lie in planes cutting the axis of the cylinder at right angles, whereas, the axes of the pins positioned in holes 15 and 16 lie in a plane passing through the axis of the key 12 when it is positioned in the key slot 12a.

It is, of course, also possible to tilt the holes 14 and 17 downward so that the axes of the pins positioned therein no longer lie in planes cutting the axis of the cylinder at right angles. Likewise, it is also possible to tilt the holes 15 and 16 laterally so that the axes of the pins positioned in these holes do not lie in the plane passing through the axis of the key 12 positioned in the key slot 12a.

Thus, while the axes of the pins positioned in holes 14 and 17 lie in planes cutting the axis of the cylinder at right angles, they are disposed at an angle corresponding to that between the lines 14a and 15a shown in FIG. 3 where the line 15a is at right angles to the narrow top face of the key and the line 14a corresponds to the axis of the pins in these holes. At the same time the inclinations of the pins positioned in holes 15 and 16 correspond respectively to the angle between the axis 15a and vertical line 15b and to the angle between the axis 16a and vertical line 16b, as shown in FIG. 4.

The holes 18, 19 and 20 shown in FIG. 1 on the right hand side of the cylinder are oriented so that the axes of the pins positioned therein are at right angles to one of the wide faces of the key 12 inserted in slot 12a. Hole 21 is oriented so that it is tilted upward and the axes of the pins positioned therein. The axis 21a of the pins positioned in this hole is disposed as at the angle shown in FIG. 3 between this axis 21a and the line 29 which is disposed at right angles to the face of the key 12 positioned in the slot 12a.

The holes 22, 23, 24 and 25 in the left hand side of the cylinder 10, shown in FIG. 2, are all oriented so that the axes of the pins positioned therein lie in the planes cutting the axis of the cylinder at right angles. Holes 23 and 24 are also oriented so that the axes of the pins positioned therein are at right angles to the face of the key 12 positioned in the slot 12a cooperating therewith. Hole 22, on the other hand, is oriented so that the axis of the pins positioned therein is tilted downward at an angle shown in FIG. 3 between the axis 22a of the hole and the horizontal line 29 which is at right angles to the face of the key 12 positioned in slot 12a. The hole 25 is, on the other hand, tilted upward so that the axis of the pins positioned therein are oriented at the angle shown in FIG. 3 between this axis 25a and the horizontal line 29.

The holes 18 to 25, inclusive, shown in FIG. 5, are oriented so that the axes 18a to 25a, inclusive, respectively, of the pins positioned in these holes lie in planes cutting the axis of the cylinder at right angles. However, it is possible to orient these holes so that the axes of the pins positioned therein will lie at various angles outside of such planes, if desired, and such an arrangement would make it still more difficult for unauthorized duplication of the key used with such a lock.

The pins in the various rows of holes may be parallel or they may depart from parallelism with respect to each other to different extents, by providing different angles of tilt thereto with respect to the associated face of the key. By selecting various predetermined angles of tilt of the pins, the number of different combinations possible with the lock of the plug and cylinder type is greatly increased. At the same time, the problem of duplicating the key to be used with this type of lock is rendered difficult unless a fixture such as disclosed in my copending application Ser. No. 678,339 filed October 26, 1967 is provided. In this fixture the predetermined angles of the pins provided to a given lock are fixed so that the recesses may be cut into the key blank at these precise predetermined angles.

The key adapted to be employed with the lock mechanism shown in FIGS. 1 to 5, inclusive, is illustrated in FIGS. 7 and 8 in which FIG. 7 shows one wide side of the key and FIG. 8 shows the narrow top of the key. The recesses adapted to cooperate with the pins located in holes 14 to 25, inclusive, when the key 12 is inserted into the slot 12a in one orientation are designated by reference numerals 14b to 25b, inclusive. When the key 12 is rotated 180 degrees and inserted into the key-receiving slot 12a, then recesses designated by reference numerals 14c to 25c, inclusive, are adapted to cooperate with pins located in holes 14 to 25, inclusive, respectively. It will be noted that the recesses are angled to receive the inner end parts of the pins which are disposed at angles as previously described.

In FIG. 9 there is shown a sectional view of a lock mechanism employing a cylindrical housing 30 and a rotatable plug 31 positioned therein which the pin-receiving holes are tilted with respect to the key-receiving slot 32 formed in the plug 31. The lock mechanism shown in FIG. 9 is adapted to be employed with keys having the cross-sectional shapes shown in FIG. 11, 13 and 15, inclusive. The key blanks shown in FIGS. 10, 12 and 14 illustrate the shape of the key blank before the pin-receiving recesses are provided thereto, whereas, the FIGS. 11, 13 and 15 show sectional views corresponding to key blanks 10, 12 and 14, respectively, after the pin-receiving recesses have been bored into the sides thereof. The key blank shown in FIG. 10 is provided with longitudinally extending recesses 36 and 37 on one side thereof and similar recesses 36a and 37a on the other side thereof which correspond to recesses 36 and 37, respectively, and the key slot 32 of the plug 31 is provided with internal longitudinally extending projections that fit into these recesses when the key is placed into the slot. Longitudinally extending recesses 38 and 39 are provided to one side of the key blank shown in FIG. 12 are corresponding recesses 38a and 39a are provided to the other side. It will be noted that these longitudinally extending recesses are parallel in key blanks shown in FIGS. 10 and 12 so that the axes of the tumbler pins which are to cooperate with the pin-receiving recesses shown in FIGS. 11 and 13 are tilted as indicated with respect to the sides of the key. These axes are at right angles to the faces of the longitudinally extending recesses, as shown in FIGS. 10 and 12.

The key shown in FIG. 11 is adapted for use with the lock mechanism shown in FIG. 9. When the key is inserted into the slot 32 in one orientation, the tumbler pins 42, 43 and 44 are adapted to enter the recesses 33b, 36b and 37b, respectively, and when the key is rotated 180 degrees, these pins will enter recesses 33c, 36c and 37c, respectively, and position the pins so that plug 31 may be rotated in cylinder 30. The lock mechanism shown in FIG. 9 is of course provided with rows of pins and only one pin from each row is shown. Thus, the side view of the key 33 employed with this mechanism appears similar to the key shown in FIG. 7 except that the longitudinally extending recesses are not shown in this figure.

Suitable driver pins 42a, 43a and 44a are provided to this lock mechanism and the inner faces of these driver pins engage the outer faces of the tumbler pins 42, 43 and 44, respectively. Springs 42b, 43b and 44b are provided for urging the driver pins toward the pins in the plug 31 and a suitable sleeve (not shown) may be provided on the outside of the housing 30 to retain the springs and pins therein.

In the lock mechanism shown in FIG. 9, the pins 43 and 44 are parallel and keys such as shown in FIGS. 11 and 13 may be employed therewith. However, if the pins 43 and 44 are not parallel but are angularly disposed with respect to each other, then a key such as shown in FIG. 15 may be employed therewith.

The key shown in FIG. 15 is made from the blank shown in FIG. 14 which is provided with longitudinally extending recesses 40 and 41 on one side thereof, and cor-

responding longitudinal recesses 40a and 41a on the other side thereof. The planes of the recesses are disposed at predetermined angles with respect to the sides of the key blank, and pin-receiving recesses are bored into these sides, as shown in FIG. 15. The axes of the pin-receiving holes 40b, 40c, 41b and 41c are at right angles to the planes of the longitudinal recesses 40, 41, 41a and 40a, respectively, as shown in FIG. 15.

By providing key blanks such as shown in FIGS. 10, 12 and 14 with longitudinal recesses, the planes of which are disposed at different angles with respect to the sides of the key, the number of combinations may accordingly be increased, and unauthorized duplication of the keys is made more difficult.

In FIGS. 16 and 17 there are illustrated modified forms of plug and cylinder locks in which the pins in each of the rows may also be disposed at predetermined angles with respect to each other and with respect to the cooperating key face. The lock shown in FIG. 16 is provided with a plug 46 rotatably supported in the cylindrical housing 59. This lock employs four rows of pins (one pin in each row being shown in this figure). The key 45, which is positioned in the key slot in plug 46, is provided with recesses for receiving the inner ends of pins 47, 48, 49 and 50 so that these pins may be pushed into the recesses in the key 45 by the driver pins 51, 52, 53 and 54, respectively, and springs 55, 56, 57 and 58, respectively, until the outer faces of pins 47, 48, 49 and 50 are flush with the outer cylindrical surface of the plug 46 and the plug may be rotated in the housing 59.

FIG. 17 shows a further modified form of a plug and cylinder lock which is provided with a plug 60 rotatably supported in the cylindrical housing 61. The plug 60 is adapted to receive the key 62 which is provided with two sets of pin-receiving recesses on each side thereof so that the key may be inserted into the plug in any one of two orientations. Two rows of pins are provided to this lock and only one pin of each row is shown. Pins 63 and 64 are positioned in holes formed in the plug 60 and driver pins 65 and 66 are urged against the outer surfaces of pins 63 and 64, respectively, by the springs 67 and 68, respectively. The pins in the two rows are staggered so that the pins in one row are not directly opposed to the pins in the other row. Thus, it is possible to provide two sets of recesses on each side of the key so that one set of recesses will be engaged by the pins of one row when the key is inserted in one orientation, and the other set of recesses on this same side will be engaged by the pins in the other row when the key is inserted in the other orientation.

While I have shown a preferred embodiment of this invention, it will be understood that the invention is capable of variation and modification from the form shown so that the scope thereof should be limited only by the proper scope of the claims appended hereto.

What I claim is:

1. A rotatable plug and cylinder lock of the type having a cylindrical housing with a rotatable plug therein, an elongated substantially flat key having recesses on opposite sides thereof for receiving the inner ends of tumbler pins that are positioned in the rotatable plug, said plug being rotatable in said cylindrical housing when the key is inserted into a longitudinally extending slot in said plug so that the key recesses receive the inner ends of said tumbler pins, the improvement comprising at least one row of tumbler pins in said rotatable plug and at least one row of pins in said cylindrical housing which are adapted to be aligned with said tumbler pins to hold said rotatable plug in locked position when said key is removed therefrom, said key having longitudinally extending planar recesses in sides thereof, the planes of said planar recesses being oriented at a predetermined angle with respect to the planes of said sides, said planar recesses being provided with recesses for receiving the inner ends of said tumbler pins, said rotatable plug having elongated

projections in the key slot thereof adapted to fit closely into the planar recesses of said key, said tumbler pins in said plug and corresponding aligned pins in said housing being disposed at said predetermined angle with respect to the side of said key with which they cooperate in unlocking said plug.

2. A rotatable plug and cylinder lock of the type having a cylindrical housing with a rotatable plug therein, an elongated substantially flat key having depressions on opposite sides thereof for receiving the inner ends of tumbler pins that are positioned in the rotatable plug, said plug being rotatable in said cylindrical housing when the key is inserted into a longitudinally extending slot in said plug so that the key depressions receive the inner ends of said tumbler pins, the improvement comprising a plurality of rows of tumbler pins in said rotatable plug and a plurality of rows of pins in said cylindrical housing, the pins in the rows in said plug being adapted to be aligned with said pins in said housing to hold said rotatable plug in locked position when said key is removed therefrom, at least some of said tumbler pins in said plug and corresponding aligned pins in said housing being disposed at different predetermined angles other than 90 degrees with respect to one side of said key with which they cooperate in unlocking said plug, said pins disposed at said different predetermined angles with respect to the cooperating side of said key also being disposed out of parallelism with respect to each other.

3. A rotatable plug and cylinder lock of the type having a cylindrical housing with a rotatable plug therein, an elongated substantially flat key having depressions on opposite sides thereof for receiving the inner ends of tumbler pins that are positioned in the rotatable plug, said plug being rotatable in said cylindrical housing when the key is inserted into a longitudinally extending slot in said plug so that the key depressions receive the inner ends of said tumbler pins, the improvement comprising at least one longitudinally extending row of tumbler pins in said rotatable plug and at least one longitudinally extending row of pins in said cylindrical housing which are adapted to be aligned with said tumbler pins to hold said rotatable plug in locked position when said key is removed therefrom, selected ones of said tumbler pins of said at least one row in said plug and corresponding aligned pins in said housing being disposed at predetermined angles other than 90 degrees with respect to the side of said key with which they cooperate in unlocking said plug, one of said selected pins having a different predetermined angle from another one of said selected pins.

4. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 3, further characterized in that said key is provided with major faces disposed parallel to each other and said selected pins are disposed at predetermined angles other than 90 degrees with respect to said major faces.

5. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 4, further characterized in that said predetermined angles of said selected pins are such that said selected pins are not parallel.

6. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 4, further characterized in that each of said major faces of said key is provided with a row of said pin-receiving depressions on each of said major faces, and each of said major faces is provided with a longitudinally extending recess aligned with said pin-receiving depressions and said key-receiving slot of said rotatable plug is provided with longitudinally extending projections adapted to fit into said longitudinally extending recesses of said key.

7. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 6, further characterized in that said different predetermined angles of said selected pins corre-

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spond to angles of 90 degrees with respect to the planes of said longitudinally extending recesses.

8. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 6, further characterized in that each of said major faces of said key is provided with two rows of pin-receiving depressions arranged so that said key may be inserted into the key slot in said rotatable plug in either one of two orientations which are disposed at angles of 180 degrees with respect to each other.

9. A rotatable plug and cylinder lock of the type having a cylindrical housing and a rotatable plug therein as set forth in claim 6, further characterized in that each of said major faces of said key is provided with two rows of pin-receiving depressions aligned with said longitudinally ex-

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tending recesses and diagonally disposed ones of said recesses having outwardly facing plane thereof parallel.

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