Oct. 21, 1969 TOSHIZUMI SAITO 3,473,355

TWO-KEY LOCK

Filed Sept. 19, 1967 2 Sheets-Sheet 1

FIG. 1.

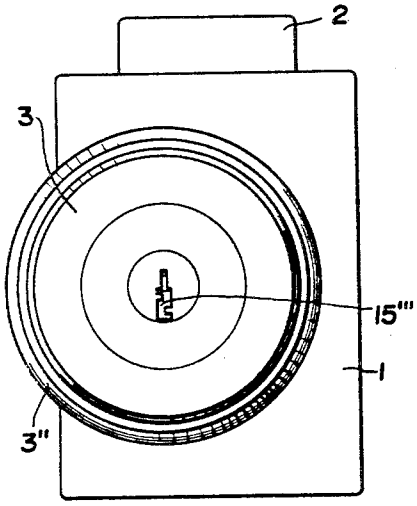


FIG. 2.

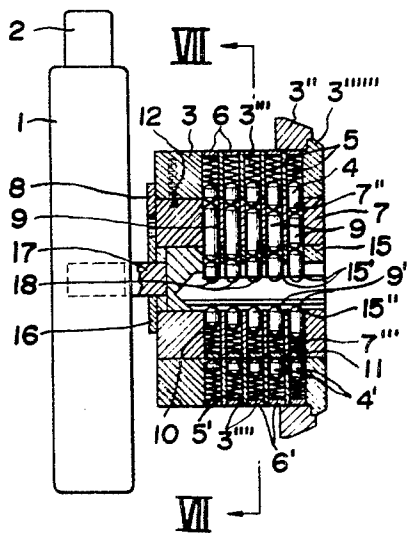


FIG. 3.

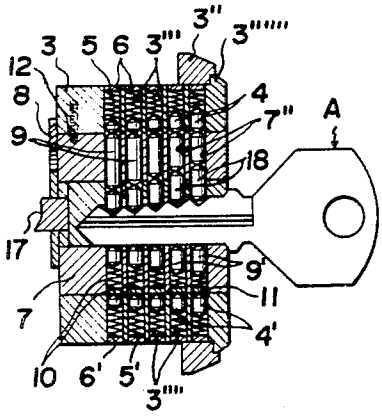
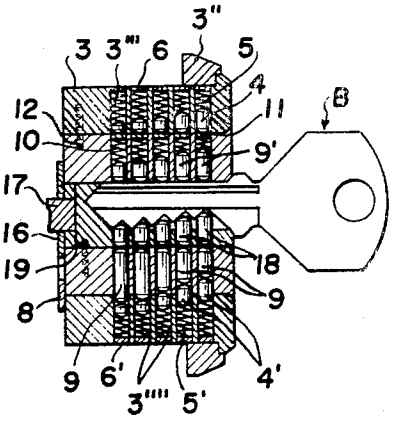


FIG. 4.



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FIG. 5.

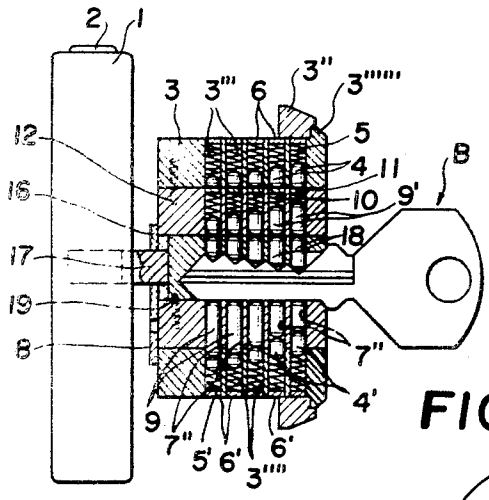


FIG. 6.

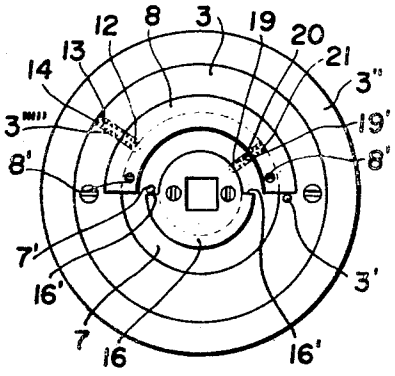


FIG. 8.

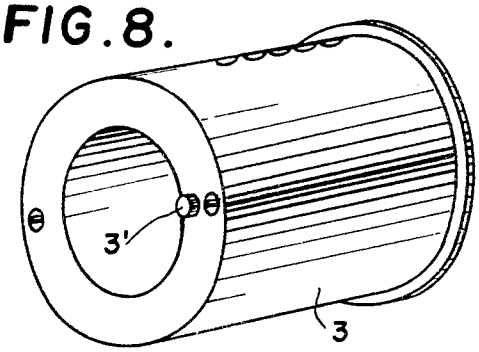


FIG. 7.

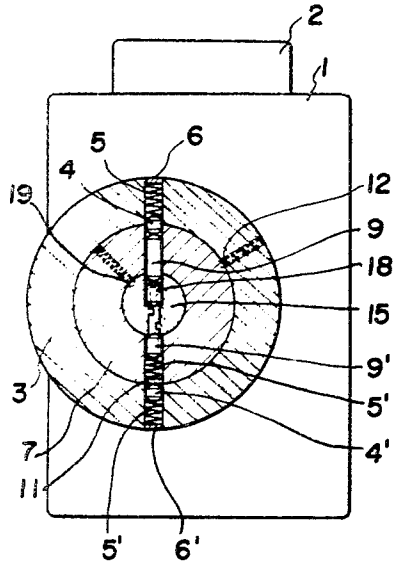


FIG. 9.

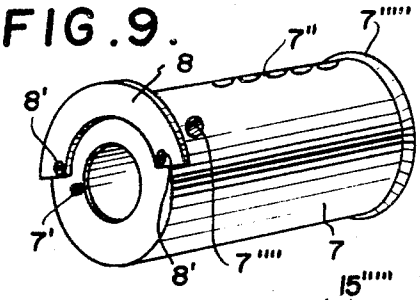
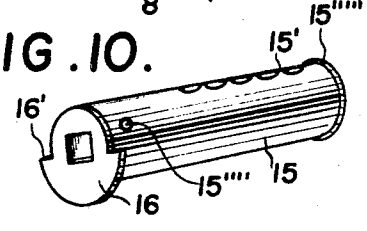


FIG. 10.



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TWO-KEY LOCK

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Int. Cl. E05b 35/12, 25/00
U.S. Cl. 70—339 4 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to a two-key cylinder lock whose bolt can be opened and closed only by using two different keys in succession, the lock comprising three concentric cylinders, pin tumblers arranged in the cylinders so that when one of the keys is inserted into a keyway in the innermost cylinder the two inner cylinders rotate together 180°, and when the first key is replaced by the second key only the innermost cylinder will rotate for 180°. The lock includes stop means for selectively preventing rotation of the cylinders after 180° rotation.

The present invention relates to a two-key lock for vaults, strong rooms and the like, more particularly, to a cylindrical lock for vaults and the like which can be locked and unlocked only by two different keys to be inserted, the one after the other.

The object of this invention is to provide a cylindrical lock for the security of vaults and the like which comprises a middle revolving cylinder and a central revolving cylinder attached with a shaft connectable with the bolt, both cylinders being revolvably fitted telescopically to each other within another fixed cylinder, to be operated in relation with each other through springs, pins and pin tumblers and, especially, by two different keys to be used in succession the one after the other.

Another object of this invention is to provide a cylindrical lock particularly as a higher improvement in the security phase which can be locked and unlocked only by two different keys, No. 1 and No. 2, through their relative operation against the cylinders, each of which keys is retained by a different official in order that the security may be guaranteed even though one official were deprived of his key in such a case as of a bank robbery.

The objects and advantages of this invention will become apparent from the following description taken in connection with the appended drawings in which:

FIG. 1 is a frontal view of a two-key lock according to this invention;

FIG. 2 is a vertically sectional side view of this invention;

FIG. 3 is a vertically sectional side view of this invention showing the state in which the first key is inserted into the lock;

FIG. 4 is also a view showing the state in which the second key is inserted into the lock;

FIG. 5 is a cross sectional view in which the lock is shown as unlocked by the second key;

FIG. 6 is a back view of this invention from which the bolt case has been removed;

FIG. 7 is a vertically sectional view taken on the line VII—VII of FIG. 2;

FIG. 8 is a perspective view of the outer lock cylinder;

FIG. 9 is a perspective view of the middle revolving cylinder; and

FIG. 10 is a perspective view of the central revolving cylinder.

Referring to the drawings, now, a detailed description will be made in the following: Numeral 1 denotes a bolt case; 2, a bolt; 3, a fixed outer lock cylinder having an edge 3'''''' on the front and a projection 3' on the back and furthermore a washer 3'' fitted on the front, said outer lock cylinder 3 having two longitudinal series of radially disposed holes or tumbler bores 3''', 3'''' for inserting pins open on the surfaces upper and lower. Several pins 4, 4' of different length are arranged in a manner such that the longer ones of them are provided internally and vertically slidably on the front side of the lock; springs 5, 5' of different length are inserted into said holes and arranged in a manner such that the shorter ones are internally put on the front side of the lock; the springs thus inserted from the holes and arranged are brought into contact with the pins 4, 4' while the holes are blocked by stops 6, 6'. Numeral 7 denotes a middle revolving cylinder rotatably fitted into the central longitudinal bore of the outer lock cylinder 3 and having an edge 7'''''' on the front and a projection 7' on the back of the lock, an arcuate check plate 8 being screw-fitted 8' on said back. Several pin tumblers 9 of different length are inserted into a longitudinal series of radially disposed holes, or tumbler bores 7'' opened on the upper side of the cylinder body of the middle revolving cylinder, and arranged in a manner such that the shorter ones of them are provided vertically slidably on the front side of the lock, while, on the other hand, several pin tumblers 9' of different length are inserted into another longitudinal series of radially disposed holes, or tumbler bores 7''' and arranged in a manner such that the longer ones of them are put also vertically slidably on the front side of the lock.

Further, springs 10 are arranged so as to be in contact with said pin tumblers 9' in a way such that the shorter ones of them are placed therein on the front side of the lock and that they are blocked up by stops 11. Numeral 12 denotes a checking ball inserted from a guide hole 3'''''' of the lock proper 3 which ball is pressed by a spring 13 and blocked up by a stop 14; said ball is so adapted that it may be fitted into a concave 7'''' of the middle revolving cylinder 7 when it, 7, turns and the one end of the check plate 8 comes into, and stops at, the projection 3'. Numeral 15 denotes a central revolving cylinder which has an edge 15'''''' on the front and engaging parts 16' of an engaging plate 16 on the back thereof, being rotatably fitted in the central longitudinal bore in the middle revolving cylinder 7 and also being attached with a square shaft 17 connectable with the bolt 2; several pin tumblers 18 are inserted into the upper holes 15' of a proper number of longitudinal series of radially disposed holes, or tumbler bores 15', 15'' opened on the cylinder surface of said central cylinder 15 and are arranged in a manner such that the longer ones of them are vertically slidably set on the front side of the lock. Numeral 19 denotes a checking ball inserted into a guide hole 19' provided in the middle revolving cylinder 7 and is fitted so as to be pressed by a spring 20 and blocked by a stop 21; said ball 19 is so adapted as to be fitted into a concave 15'''' of the central revolving cylinder 15 when said central cylinder turns half a rotation so that the engaging part 16' of the engaging plate 16 comes to, and stops at, the projection 7'.

Now the operation of the two-key cylinder lock of this invention having the construction as afore-mentioned will be illustrated taking the example in which this lock is mounted for use, for example, onto a paneled board of a vault.

As there are holes 3''', 3'''' open on both sides, upper and lower, of the outer lock cylinder 3, pins 4, 4' and springs 5, 5' are inserted into these holes 3''', 3'''' which are closed up with the stops 6, 6', and as there are holes 7'', 7'''' open on both surfaces, upper and lower, of the middle revolving cylinder 7, pin tumblers 9, 9' are inserted into these holes 7'', 7'''' while the springs 10 are provided in the holes to be blocked up with the stops 11. Said outer

lock cylinder 3 that is a fixed cylinder is then fitted telescopically onto the middle revolving cylinder. Said central revolving cylinder has the square shaft 17 connectable with the bolt 2 within the case 1, and said central cylinder 15 which is internally installed with pin tumblers 18 in the upper holes 15' out of the holes 15', 15'' all lying on the upper and lower sides thereof is telescoped into said middle revolving cylinder 7.

Now that the construction of the lock of this invention is such as above-mentioned, the unlocking operation of the fastened lock will be carried out in the following way: First, No. 1 key A is inserted into the key hole 15''' of the central revolving cylinder 15, when the pin tumblers 18 in the holes of said cylinder 15 will be lifted upward by virtue of the serration of the key A as shown in FIG. 3. The heads of the longer ones of the pin tumblers 18 of different length in a proper number will thence be thrown into the holes of said middle revolving cylinder 7 from the holes of said central revolving cylinder 7 so as to connect said both cylinders. The tumbling action of the pin tumblers 18 will thereupon bring the upper ends of the pin tumblers 9 arranged in succession on the surface of the middle revolving cylinder to be in line with the upper surface of the holes of said middle revolving cylinder and therefore bring the lower ends of the pins 4 in the holes of the outer lock cylinder 3 also to be in line with the lower surfaces of the holes 3''' thereof. As the lower side holes of the middle revolving cylinder 7, on the other hand, are closed up with the stops 11, the upper ends of the pins 4' in the holes of the outer lock cylinder 3 will be in line with the upper faces of the holes. When No. 1 key A is turned clockwise under this condition, both the central revolving cylinder 15 and the middle revolving cylinder 7 will turn half a cycle together, at which position the one end of the arcuate check plate 8 screw-fitted onto the back of the middle revolving cylinder 7 will be brought into contact with the projection 3' of the outer lock cylinder 3 so as to bring the middle revolving cylinder 7 to a halt. Under this halted condition the check ball 12 set in the guide hole will come to be fitted into the concave 7'''' of the middle revolving cylinder 7 because of the resiliency of the spring 13, so that the shift or play of the lock proper 3 with the middle revolving cylinder 7 can be checked so as to make the halted condition of said middle revolving cylinder satisfactory.

Now, after No. 1 key A has been revolved halfway, said key A is withdrawn, and thereafter, No. 2 key B of different serration is inserted into the key hole with its serration facing downward. The serration of the key B when inserted into the key hole will, as is shown in FIG. 4, cause the bottoms of the pin tumblers 18 to be in line along the lower side of the holes of the central revolving cylinder 15. Further, the pin tumblers 9 will be also in line with the upper side of the holes of the middle revolving cylinder 7, while, on the other hand, the lower parts of several longer pin tumblers out of said pin tumblers 9 on the back of the middle revolving cylinder 7 will be thrown into the holes of the outer lock cylinder 3, thereby connecting said middle revolving cylinder 7 and the outer lock cylinder 3 together. Therefore, when No. 2 key B is turned clockwise, the central revolving cylinder 15 alone will turn halfway and the square shaft 17 provided on the back of said central revolving cylinder will turn following the rotation of the central revolving cylinder and thus the bolt 2 can be lowered so as to open the lock. In the position where the central revolving cylinder 15 has just turned half a cycle, the one engaging part 16' of the engaging plate 16 provided on the back thereof will touch the projection 7' of the middle revolving cylinder 7 and will halt thereat while meantime the checking ball 19 set in the guide hole of said middle revolving cylinder 7 will fit into the concave 15'''' of the central revolving cylinder 15 because of the resiliency of the spring 20 so as to prevent it from shifting or playing with the middle revolving cylinder 7 and further to make the halted condition of said central revolving cylinder satisfactory.

Secondly, the operation of locking the two-key lock of this invention will follow: No. 2 key B in the first place is inserted into the key hole 15''' of the central revolving cylinder 15 with its serration facing upward; said serration of the key B will thereupon cause the upper ends of the pin tumblers 18 to be in line with the upper surfaces of the holes of the central revolving cylinder 15 while also the lower ends of the pin tumblers 9' of said middle revolving cylinder 7 willl be in line with the lower surfaces of the holes of said middle revolving cylinder 7. On the other hand, the upper parts of the longer pins 4' out of a proper number of the pins 4' in the lock proper 3 will be thrown into the holes 7'' of the middle revolving cylinder 7 on account of the resiliency of the springs 3'''' so as to bring the outer lock cylinder 3 to be connected with said middle revolving cylinder 7. Therefore, when the central revolving cylinder alone is revolved by said No. 2 Key B contrariwise from the case of unlocking, the other end 16' of the engaging plate on the back of the central revolving cylinder 15 will come into contact with the projection 7' of the middle revolving cylinder 7 in the position where said central revolving cylinder has turned halfway, so that the shaft 17 will turn following the semi-rotation of said central revolving cylinder so as to make the head of the bolt project out of its case, thereby effectuating the locking.

Under this condition, next, No. 2 key B is withdrawn and No. 1 key A is instead inserted into the key hole 15''' of the central revolving cylinder 15; the serration of said key will thereupon cause the pin tumblers 18 of said central revolving cylinder 15 to be pushed down and further will bring the lower parts thereof to be thrown into the holes of the middle revolving cylinder 7, so that said middle revolving cylinder and said central revolving cylinder will be connected with each other. Subsequently, the compression of the pin tumblers 18 will bring the lower ends of the pin tumblers 9 to be in line with the lower surfaces of the holes of the middle revolving cylinder 7, and therefore, the key is turned counterclockwise, which will thence cause the checking plate 8 provided on the back of the middle revolving cylinder 7 to come into contact with, and halt at, the projection 3' protruding on the back of the outer lock cylinder 3 in the position where the middle revolving cylinder 7 and the central revolving cylinder 15 have completed one half turn together. In this position, No. 1 key is withdrawn, when the spring 5 of the lock proper 3 will bring the lower parts of the longer pins 4 provided on the front side of the lock proper out of a proper number of said pins 4 in the holes of the outer lock cylinder to be put into the holes of the middle revolving cylinder so as to have said middle revolving cylinder connected with the outer lock cylinder. Further, as the longer pin tumblers 9 on the back side of the middle revolving cylinder are pushed out by the pins 4 and the lower parts of said pin tumblers 9 are thereby thrown into the holes of the central revolving cylinder 15, the outer lock cylinder 3 and the middle revolving cylinder 7 and further the central revolving cylinder 15 will be connected with each other, so that the locking will be made perfect.

It will be appreciated that arcuate plate 8 and projection 3' constitute cooperating interengaging stop means, the radial edges of plate 8 defining stop surfaces approximately 180° apart. One of the stop surfaces contacts projection 3' to prevent further relative rotation between cylinders 3 and 7 when cylinder 7 is rotated in one direction and the other stop surface contacts projection 3' to prevent further rotation when cylinder 8 rotates in the other direction. The two stop positions are 180° apart. In a similar manner plate 16 and projection 7' constitute interengaging stop means, the radial edges of plate 18 defining stop surfaces approximately 180° apart. The respective stop surfaces of plate 16 prevent further relative rotation between cylinders 15 and 7 in different directions 180° apart.

When the present invention. having such working and effect as described in the foregoing, is applied to vaults or the like for use, the security may be warranted during nights and closed office hours as well as during office hours by virtue of the interrelated actions of the two keys, No. 1 and No. 2, of different shape, the operation of which only can open and fasten the lock. Therefore, even if such a case as robbery or threat occur during office hours and one of the two officials who hold the two different keys individually be robbed of the one key, the security of a vault or the like may not be threatened to be lost. Consequently, this invention is very advantageous and valuable in comparison to conventional cylinder locks.

What I claim is:

1. A two-key lock whose bolt can be opened and closed only by using two different keys in succession, comprising an outer lock cylinder having a central longitudinal bore, a first longitudinal series of radially disposed tumbler bores communicating with said central bore and a second longitudinal series of radially disposed tumbler bores communicating with said central bore and opposed to said first series;

a middle cylinder rotatably mounted in said central bore of said outer lock cylinder and having a central longitudinal bore, a first longitudinal series of radially disposed tumbler bores communicating with said central bore and a second longitudinal series of radially dsiposed tumbler bores communicating with said central bore and opposed to said first series;

a central cylinder rotatably mounted in said central bore of said middle cylinder, said central cylinder having an outer surface, a keyway, and a series of radially disposed tumbler bores communicating with said keyway and said outer surface;

means mounted on said central cylinder and rotatable therewith for actuating the bolt of the lock;

first cooperating interengaging stop means on said outer lock cylinder and middle cylinder to prevent further rotation of said middle cylinder relative to said outer lock cylinder when said middle cylinder is rotated from a position wherein one of said series of bores of said middle cylinder is aligned with one of said series of bores of said outer lock cylinder to a position where one of said series of bores of said middle cylinder is aligned with the other of said series of said outer lock cylinder;

second coperating interengaging stop means on said middle cylinder and central cylinder to prevent further rotation of said central cylinder relative to said middle cylinder when said central cylinder is rotated from a position wherein one of said series of bores of said central cylinder is aligned with one of said series of bores of said middle cylinder to a position where one of said series of bores of said central cylinder is aligned with the other of said series of said middle cylinder;

and pin tumblers in said tumbler bores so arranged and constructed that, when one of said keys is inserted into said keyway and rotated, said pin tumblers will permit said middle cylinder to rotate relative to said outer lock cylinder but will interconnect said central cylinder and said middle cylinder for joint rotation, and, when the second of said keys is inserted into said keyway and rotated, said pin tumblers will permit said central cylinder to rotate relative to said middle cylinder but will interconnect said middle cylinder with said outer lock cylinder.

2. A two-key lock according to claim 1, wherein said pin tumblers in the tumbler bores of said outer lock cylinder are spring biased toward the central bore of said lock cylinder and the pin tumblers in one of said series of bores in the middle cylinder are spring biased toward the central bore of said middle cylinder.

3. A two-key lock according to claim 2, wherein said first cooperating interengaging stop means comprises a projection on one of said middle cylinder and outer lock cylinder and a pair of stop surfaces on the other of said cylinders, said stop surfaces being approximately 180° apart, one of said stop surfaces engaging said projection to prevent further rotation of said middle cylinder relative to said outer lock cylinder when said cylinders are in one of said positions and the other of said stop surfaces engages said projection to prevent further rotation of said middle cylinder relative to said outer lock cylinder when said cylinders are in the other of said positions; and wherein said second cooperating engaging stop means comprises a projection on one of said middle cylinder and central cylinder and a pair of stop surfaces on the other of said cylinders, said stop surfaces being approximately 180° apart, one of said stop surfaces engaging said projection to prevent further rotation of said central cylinder relative to said middle cylinder when said cylinders are in one of said positions, and the other of said stop surfaces engaging said projection to prevent further rotation of said central cylinder relative to said middle cylinder when said cylinders are in the other of said positions.

4. A two-key lock according to claim 3, including first resilient ball check means releasably preventing relative rotation between said middle cylinder and said outer lock cylinder in one of said positions and second resilient ball check means releasably preventing relative rotation between said middle cylinder and said central cylinder in one of said positions.

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U.S. Cl. X.R.

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