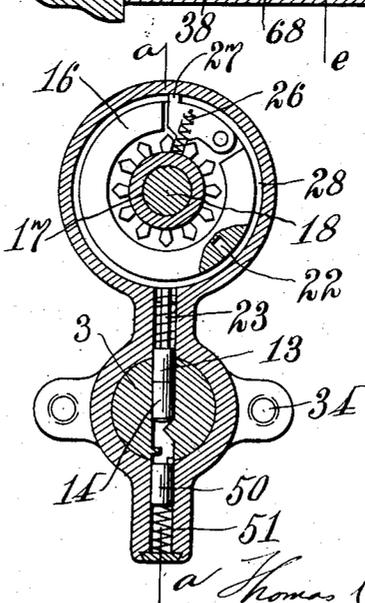
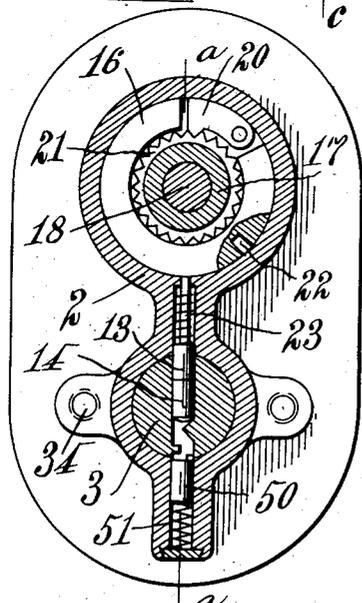
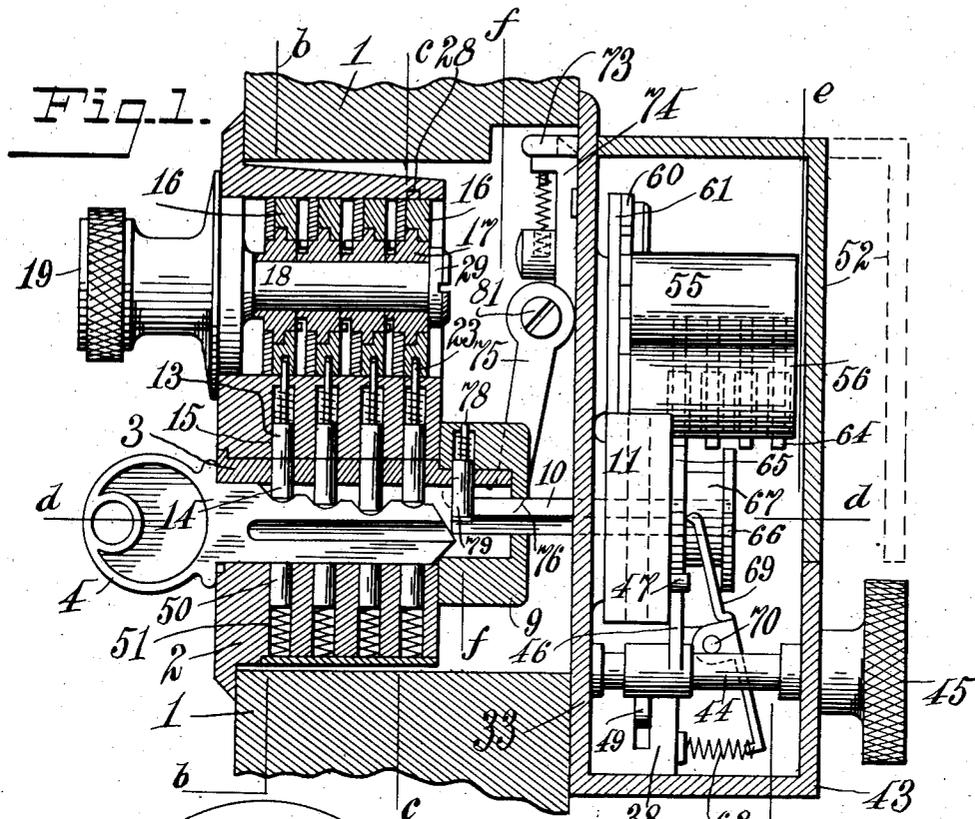


1,092,474.

Patented Apr. 7, 1914.

5 SHEETS—SHEET 1.



Witnesses
 M. Sibley
 M. Galloway

Fig. 2.

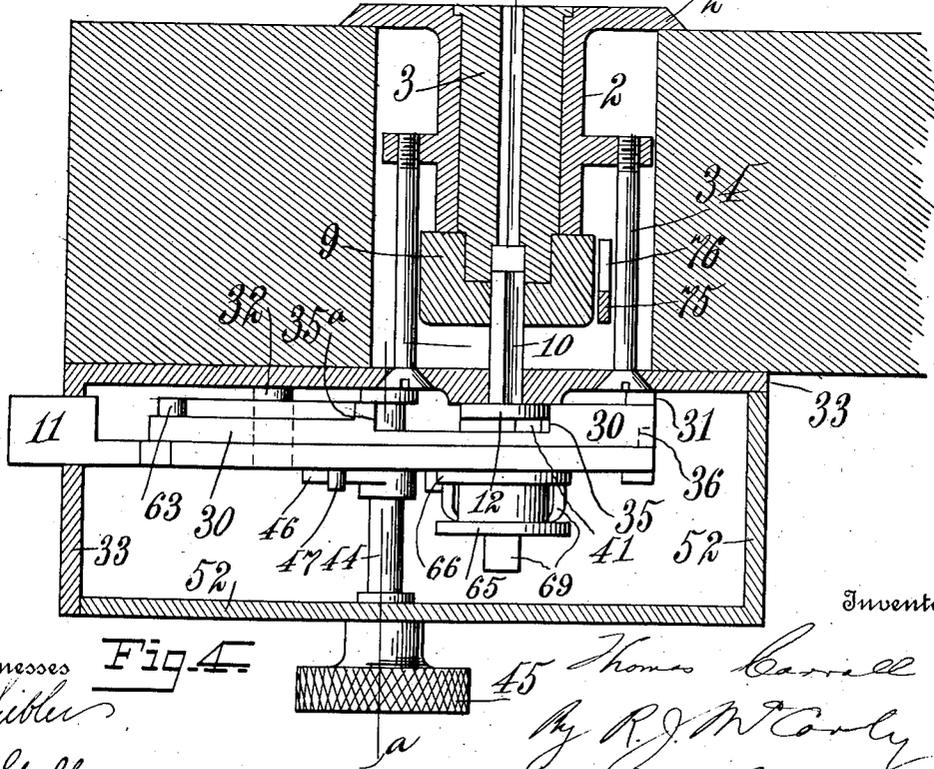
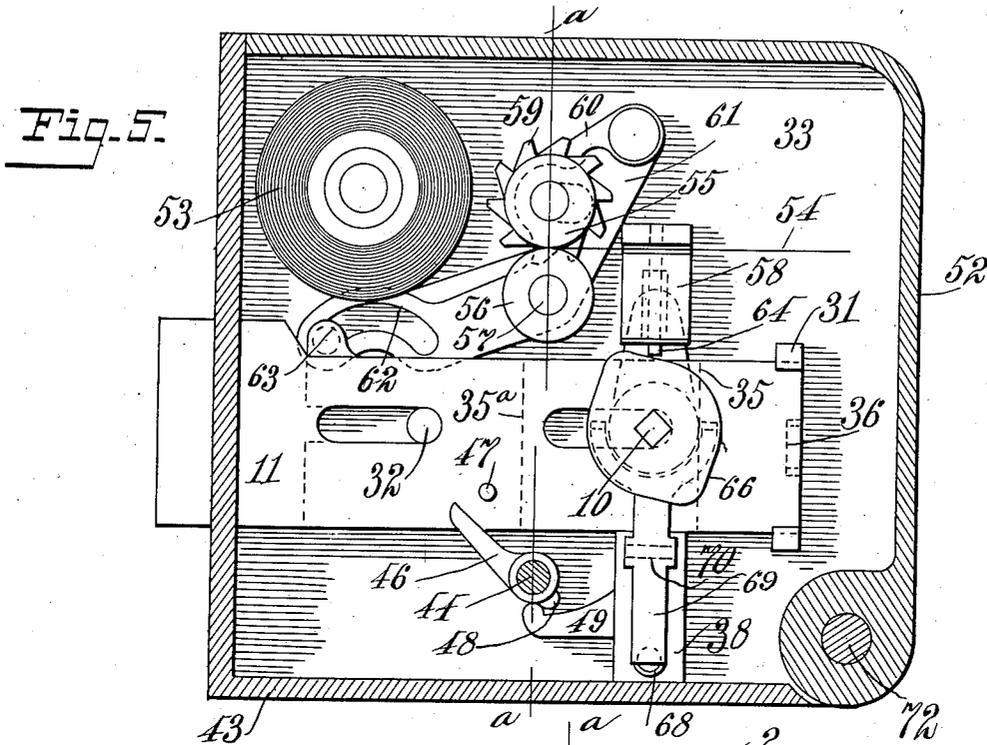
Inventor
 T. Carroll
 By R. J. K. Carty
 Attorney

Fig. 3.

1,092,474.

Patented Apr. 7, 1914.

6 SHEETS—SHEET 2.



Inventor

Witnesses
M. Sibley
M. Galloway

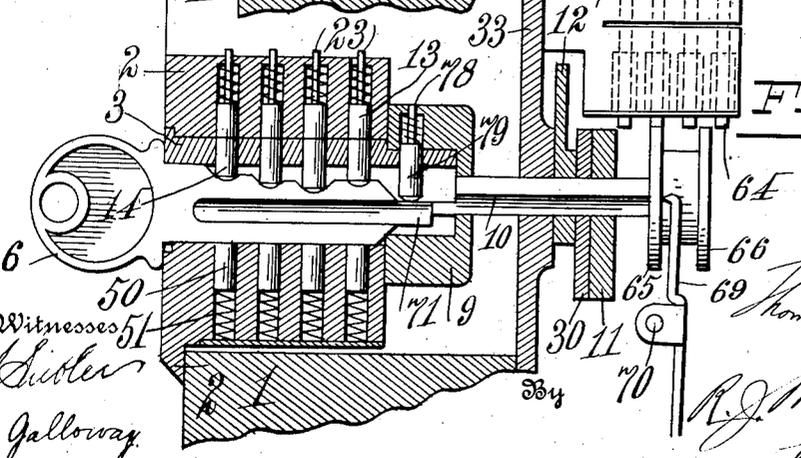
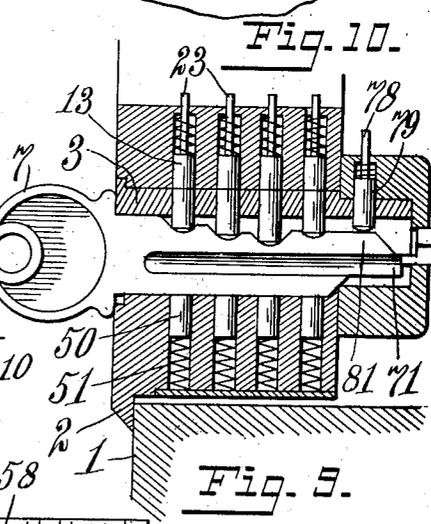
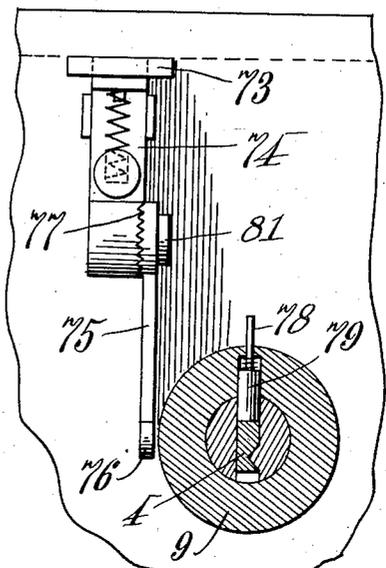
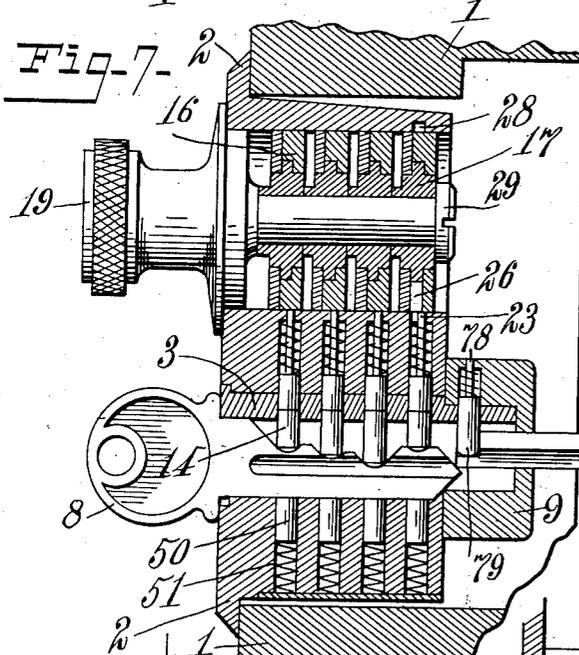
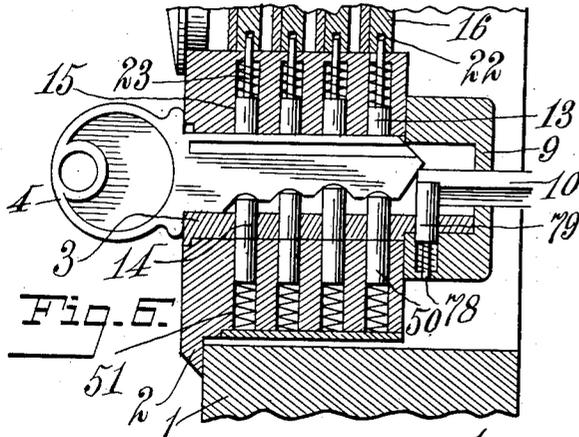
Thomas Carroll
 by *R. J. McAuley*
 his Attorney

T. CARROLL.
 PERMUTATION LOCK.
 APPLICATION FILED DEC. 6, 1912.

1,092,474.

Patented Apr. 7, 1914.

5 SHEETS—SHEET 3.



Witnesses
 M. S. Miller
 W. Galloway

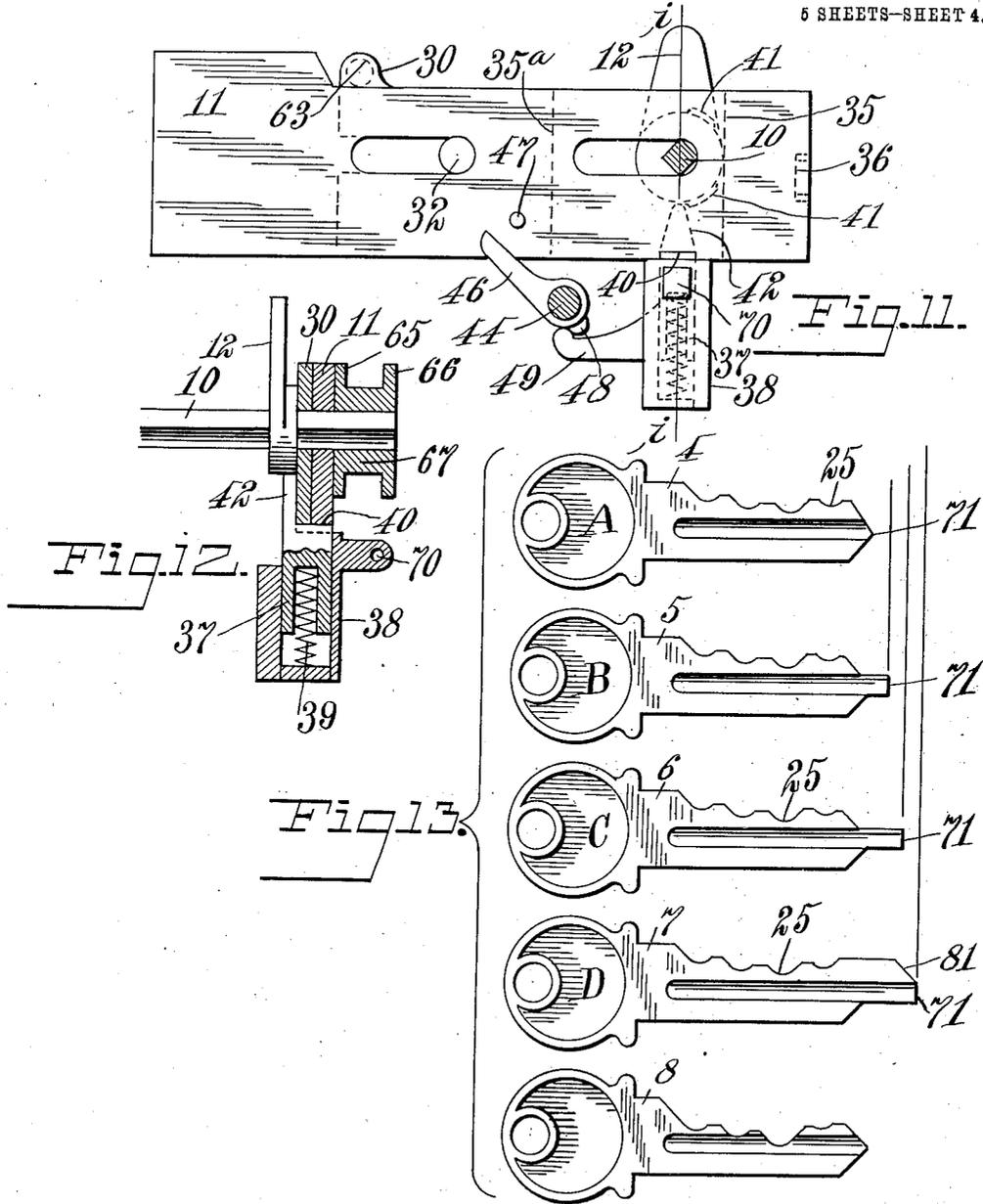
Inventor
 Thomas Carroll
 R. J. McCarty
 his Attorney

T. CARROLL.
 PERMUTATION LOCK.
 APPLICATION FILED DEC. 6, 1912.

1,092,474.

Patented Apr. 7, 1914.

5 SHEETS—SHEET 4.



Witnesses
M. Sibley
M. Galloway

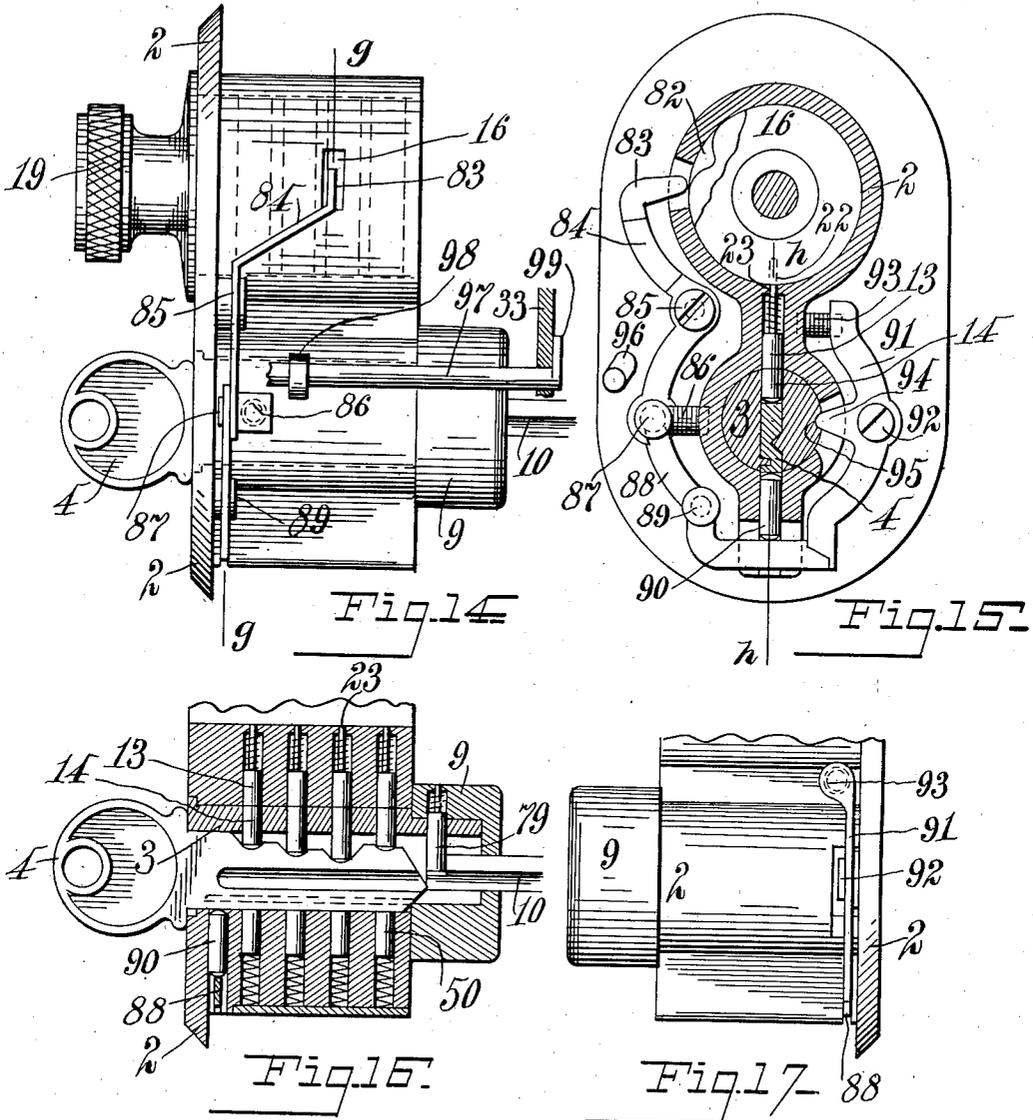
Inventor
Thomas Carroll
 By *R. J. M. Smith*
 his Attorney

T. CARROLL.
 PERMUTATION LOCK.
 APPLICATION FILED DEC. 6, 1912.

1,092,474.

Patented Apr. 7, 1914

6 SHEETS—SHEET 5.



Witnesses
M. Sibley
M. Galloway

Inventor
Thomas Carroll
 By *R. M. Carty*
 his Attorney

UNITED STATES PATENT OFFICE.

THOMAS CARROLL, OF DAYTON, OHIO.

PERMUTATION-LOCK.

1,092,474.

Specification of Letters Patent.

Patented Apr. 7, 1914.

Application filed December 6, 1912. Serial No. 735,205.

To all whom it may concern:

Be it known that I, THOMAS CARROLL, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Permutation-Locks; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in permutation locks.

The object of the invention is to provide a lock of the above type having the following novel and useful features. The insertion of a key is controlled by auxiliary permutation lock mechanism. In other words, the permutation lock mechanism must be first set before a key can be inserted. This precludes the possibility of the lock being opened by one who may obtain possession of a key, for example, a lost key. And further, the insertion of a special key is necessary before the removal of the permutation lock mechanism for the purpose of changing the combination, can be accomplished. This provision prevents any tampering with the combination mechanism, by unauthorized persons.

Referring in general terms to the accompanying drawings, Figure 1 is a vertical section of the lock mechanism on the lines $a-a$ of Figs. 2, 3, 4 and 5; Fig. 2 is a section of the same on the line $b-b$ of Fig. 1; Fig. 3 is a section of the same on the line $c-c$ of Fig. 1; Fig. 4 is a section of the same on the line $d-d$ of Fig. 1; Fig. 5 is a section on the line $e-e$ of Fig. 1; Fig. 6 is a view of the key cylinder with the key in a different position from that shown in Fig. 1; Fig. 7 is a view similar to Fig. 1 showing the manner in which the permutation tumblers or disks are removable; Fig. 8 is a partial view similar to Fig. 1, showing means for obtaining records indicating by what particular key the lock has been manipulated; Fig. 9 is a vertical sectional view of the key cylinder showing the means for unlocking the casing to permit of the insertion and removal of a record; Fig. 10 is a section on

the line $f-f$ of Fig. 1; Fig. 11 is a side elevation of the main locking bolt; Fig. 12 is a section on the line $i-i$ of Fig. 1; Fig. 13 is a plan view of the keys; Fig. 14 is a side elevation of the lock housing showing means whereby the combination is destroyed when a key is withdrawn; Fig. 15 is a section on the line $g-g$ of Fig. 14; Fig. 16 is a section on the line $h-h$ of Fig. 15; Fig. 17 is an elevation of the lower portion of the lock housing opposite that shown in Fig. 14.

Referring more specifically to the drawings, and particularly to Figs. 1, 2, and 3, 1 represents a door provided with a pocket or recess for the reception of the lock housing 2. Within said housing a key cylinder 3 is placed, the same being adapted to receive any one of a plurality of keys 4, 5, 6, 7 and 8. The said cylinder 3 is provided with a cap 9 which receives a slidable shaft 10. The cylinder 3 is adapted to actuate a bolt 11 through the shaft 10 and a cam 12, which will be hereinafter more fully described. When no key lies within said cylinder, or a wrong key is placed therein, the said cylinder cannot be rotated owing to the pins 13 and 14 which lie in pockets 15 in the housing 2 and cylinder 3. This expedient comprises a well known form of pin lock. The lower pins 14 are of varying lengths, and the keys are provided with cooperating recesses of varying depths. The arrangement is such, that, when the recesses of a proper key are in a position to receive the pins 14, the upper ends of said pins will coincide with the periphery of the key cylinder 3, thereby permitting the key cylinder to rotate and to actuate the main locking bolt 11. However, in the present case, means, consisting of a permutation lock mechanism is provided for controlling the insertion of a key by an unauthorized person, for example, one who has in some manner acquired possession of a key but is unacquainted with the combination of the permutation lock. The permutation lock mechanism comprises a series of tumblers 16 mounted on hubs 17 upon an arbor 18. The arbor 18 has a knob 19 by means of which the tumblers are rotated to set the combination. This permutation lock mechanism may be of any well known type in which the combination numbers may be selected by placing pawls 20 (Fig. 2) on the tumblers

in the desired notches of ratchets 21 attached to the hubs 17. The said tumblers 16 are provided with recesses 22 to receive projecting pins 23 of the upper series of pins 13. When there is no key within the cylinder 3, the pins 13 and 14 lie in depressed positions with the pins 23 out of the recesses 22, thus permitting the tumblers 16 to be rotated to a set position. When said tumblers are not set, and the insertion of the key within the cylinder 3 is attempted, the said key will be obstructed by the pins 14 owing to the pins 23 engaging the peripheries of said tumblers. When the tumblers are set, or the recesses 22 register with pins 23, a key may be inserted.

The permutation lock mechanism is held in, and is permitted to be withdrawn from the housing by the following means. (See Figs. 3 and 7). The innermost tumbler 16 is provided with a spring-controlled dog 26 having a projection 27 which normally rides in an annular groove 28 in the housing 2. The projection 27 maintains the permutation lock mechanism within the housing, owing to all of the tumblers being clustered upon the shaft 18 and held thereon by a screw 29. The groove 28 is so positioned that, when the innermost tumbler 16 is in a certain position, the projection 27 is adapted to be engaged by the innermost pin 23. When it is desired to remove the permutation lock, the innermost tumbler is rotated until the projection 27 is in alignment with the innermost pin 23. This position is indicated by a number of the combination which is known to the operator. A special key 8, shown in Figs. 7 and 13, is then inserted in the cylinder 3, and elevates the innermost pins 13, 14 and 23, sufficiently to remove the projection 27 from the groove 28. The remaining pins are not elevated high enough for the pins 23 to enter the recesses 22. When the latch 26 is elevated to move the projection 27 out of the groove 28, the entire cluster of tumblers may be removed from the housing 2. It will be noted that, when the special key 8 is inserted in the cylinder 3, the pins 13 and 14 are not elevated sufficiently to release the cylinder 3, therefore, the bolt 11 cannot be actuated owing to the impossibility of turning said cylinder. As before stated, the said bolt is actuated when the cylinder is permitted to turn. This mechanism, in detail, is as follows. (See Figs. 1, 4, 5, 11 and 12). A cam 12 actuates said bolt 11 indirectly through an auxiliary bolt 30 mounted in guides 31 and on a pin 32. The guides 31 and pin 32 extend from a plate 33 which forms the rear wall of the lock casing 52. The plate 33 is mounted on the inside of the door, and is connected with the housing 2 by screws 34. The cam 12 is adapted to engage a shoulder 35 on the auxiliary bolt 30

to move the bolt in and to engage a cam 35^a to move the bolt out. The main bolt 11 is actuated by said auxiliary bolt through a projection 36 on the end of said main bolt. The end of the auxiliary bolt engages said projection. The bolts 11 and 30 are normally held in a locked position by a locking member 37 slidingly mounted in a boss 38 and partially controlled by a spring 39. The upper end of the member 37 lies in recesses 40 in the bolts 11 and 30 and prevents said bolts being actuated from any unintended source, such as the manipulation of the bolt by an instrument inserted in the kerf between the door and the jamb. The bolts are released from engagement with the member 37 (see Fig. 12) when the cam 12 is actuated by cams 41 which latter cams are mounted on the hub of the cam 12. (See Fig. 11). The cams 41 are adapted to engage a projection 42 extending from the locking member 37, to depress said member. To actuate the main bolt 11 from the inside of the door, the following means is provided. Journaled in the plate 33 and the lower stationary portion 43 of the lock casing is a shaft 44 provided with a hand knob 45 which lies on the inner side of the door. The shaft 44 is provided with an arm 46 adapted to engage a pin 47 on said main bolt 11. The hub of the arm 46 is provided with a cam 48 (see Fig. 5) which is adapted to engage a projection 49 extending from the locking member 37. When the shaft 44 is oscillated by turning the knob 45, the cam 48 initially depresses the locking member 37, and the arm 46 subsequently actuates said bolt 11 independently of the auxiliary bolt 30. Whenever desired the lock may be used as an ordinary key lock. In thus utilizing said lock, the key and cylinder are turned to the position shown in Fig. 6, which, it will be observed, is the reverse of those shown in Fig. 7. In this position, the pins 14 cooperate with pins 50 which lie in pockets 51 in a manner similar to the cooperation with the pins 13 in releasing the key cylinder 3. The key may, therefore, be withdrawn and inserted in the cylinder 3 when said cylinder is in two positions, one position being that in which the permutation lock mechanism does not control the insertion of the key and the other being that in which it does. It is for this purpose that the hub of the cam 12 is provided with the two cams 41. It will be understood that when the key is in the reversed position as indicated above, the use of the permutation mechanism is eliminated.

Means are provided for obtaining a record of the persons operating the lock. (See Figs. 1 and 5). Within the lock casing, consisting of the plate 33, lower portion 43 and a movable portion 52, a paper roll 53 is

placed, the web or leading end 54 of which passes between feed rolls 55 and 56 mounted on studs 57 extending from the plate 33. The said web 54 also passes through a kerf in a punch housing 58 attached to and extending from the plate 33. The upper roll 55, which is the feeding roll, is provided with a ratchet 59 engaged by a pawl 60 mounted on a lever 61. The lever 61 is pivoted on one of the studs 57 and is provided with a cam slot 62 which receives a pin 63 on the auxiliary bolt 30. The paper web 54 is, therefore, fed by the rollers 55 and 56 each time the auxiliary bolt is actuated. Mounted in the punch-housing 58 is a series of punches 64 each of which is adapted to perforate the web 54. The two inner punches are adapted to be actuated by a cam 65 while the outer two are adapted to be actuated by a similar cam 66. The cams 65 and 66 are connected by a hub 67 and are mounted on the outer end of the slidable shaft 10. When one of the said cams is in an operative relation with one of its respective punches 64, the other, to-wit, cam 66, lies between two of the other punches. This expedient permits the cams to be shifted a shorter distance than the span of the punches. The said cams 65 and 66 are maintained in a normal position or that shown in Fig. 1, by a spring 68 and a lever 69 pivoted at 70, and are actuated against the tension of said spring to select one of the punches, by the keys 4, 5, 6 and 7, the ends 71 of which are of varying lengths as is shown in Fig. 13. Each of said keys is associated with a respective punch, and the ends 71 are adapted to place one of the cams 65 or 66 in operative relation with a respective punch. When one of said keys is inserted in the cylinder 3 and is then rotated, one of the cams 65 or 66 will actuate one of the punches, thereby making a record of the key thus inserted. The cams 65 and 66 are made double in order that a record of a key may be made either when said key is moved from its position shown in Fig. 1 or from the reversed position shown in Fig. 6. The portion 52 of the lock casing is removable to permit of the insertion and removal of the records and is slidably and pivotally mounted on a pin 72 extending from the plate 33. (See Figs. 1, 5 and 10). The said lock casing can only be opened by authorized persons in possession of a special key 7. The casing portion 52 is further provided with a projection 73, which extends through the plate 33 where it is engaged by a spring-controlled latch 74. The latch 74 carries an adjustable arm 75 provided with a hook extension 76. The said hook portion is shown in broken lines in Fig. 1. The said arm 75 is attached to the latch 74 by means of a screw 81, and both arm and latch are provided with serrations

77 which permit the arm 75 to be adjusted to different thicknesses of doors 1. The hook extension 76 is adapted to be engaged by a stem 78 extending from a pin 79 mounted in the cap 9. The pin 79 is adapted to be moved outwardly by a cam portion 81 on the key 7. (See Fig. 13). When said key is inserted in the cylinder 3 and the cylinder and key are turned, the hook extension 76 will lower the latch 74 and thereby permit the casing portion 52 to be moved horizontally and pivotally on the pin 72 and will thus allow access to be had to the interior of the lock casing.

In order that the combination may be destroyed after a key has been withdrawn from the position shown in Fig. 1, and to thereby prevent a person in possession of a key but not in possession of the combination from operating the lock, the following means is provided. (See Sheet 5 of the drawings). One of the tumblers 16 is provided with a cam recess 82 in operative relation with the upper end 83 of a lever 84 pivoted at 85 and partially controlled by a spring 86. When the recess 22 of that particular tumbler is in a position to receive its respective pin 23, the cam recess 82 of said tumbler is in a position to receive the end 83 of the lever 84 to cam said tumbler and to thus disorganize the combination, this being accomplished through the withdrawal of the key. The lever 84 is connected at 87 to a lever 88 pivoted at 89 on the plate 2. One arm of said lever 88 is in engagement with a pin 90 in operative relation with the key 4 and mounted in the housing 2. Said pin and arm are adapted to be actuated by the spring 86 when the key is withdrawn. The levers 84 and 88 are normally held in the position shown in Fig. 15 by a lever or detent 91 pivoted at 92 and the lower end of which is in operative relation with the free end of the lever 88. The said detent or lever 91 is partially controlled by a spring 93 and is provided with a projection 94 which is adapted to extend into a recess 95 in the key cylinder 3. When said cylinder 3 is rotated by the key, the detent 91 is released from engagement with the lever 88 thereby placing the levers 84 and 88 under the influence of the spring 86 and the key, when said key is returned to a normal position. When the key is subsequently withdrawn from the cylinder, the pin 90 will be permitted to move upwardly under the influence of the spring 86, and when the tumbler 16 is released by the pin 23, the spring 86 will actuate the levers 84 and 88 and the end 83 of lever 84 will engage the cam recess 82 of the tumbler to move the recess 22 of said tumbler out of the path of the pin 23 thereby destroying the combination.

In order to remove the tumblers from the influence of the combination-destroying mechanism above described, the following means is provided. The lever 84 is adapted to be engaged by a projection 96 on a rock shaft 97 journaled in a bearing 98 and in the plate 33. The shaft 97 is provided with a finger piece 99 accessible from within the lock casing 52, and by which said shaft is turned. When the said projection 96 is placed in engagement with the lever 84, the spring 86 is prevented from actuating said lever 84 and the tumblers are thus maintained in a set position when the key is withdrawn from the key cylinder 3.

It will of course be understood that changes more or less of a structural character may be made by those skilled in the art without affecting the functions or modes of operation of the various elements, therefore, I do not wish to be understood as limiting myself to these, but on the contrary, I desire to include within the scope of my invention all known equivalent means.

Having described my invention, I claim,

1. In a lock of the type specified, a key cylinder adapted to receive a key and to be actuated thereby, permutation lock mechanism, and means interposed between said key cylinder and said lock mechanism and actuated by the key, said means being adapted to prevent said cylinder being actuated when the combination of the lock mechanism is not set.

2. In a lock of the type specified, a cylinder adapted to receive a key, pins adapted to extend into apertures in said cylinder and into serrations in a key, a permutation lock mechanism controlling the positions of said pins whereby the said key is prevented from being inserted in the cylinder until the permutation lock mechanism is set.

3. In a lock of the type specified, a housing, permutation lock mechanism therein, a key cylinder the insertion of a key into which is controlled by said lock mechanism, means for retaining said lock mechanism in the housing, and means under the control of an inserted key whereby the said lock retaining means is controlled by said key.

4. In a lock of the type specified, a housing, a permutation lock mechanism mounted in said housing, means for retaining said lock mechanism in said housing, a key cylinder mounted in said housing, means interposed between said lock mechanism and said key cylinder for controlling the insertion of a key in said cylinder, and means interposed between said lock mechanism and said key cylinder, whereby the inserted key controls the removal of said lock mechanism from the housing.

5. In a lock of the type specified, a housing, a permutation lock mechanism mount-

ed in said housing, a detent for retaining said lock mechanism in said housing, a key cylinder mounted in said housing and adapted to receive a key, pins mounted in said housing and cylinder, and actuated by said key, one of said pins being also adapted to engage said detent to release said lock mechanism when said pins are actuated by said key.

6. In a lock of the type specified, a housing, a permutation lock mechanism mounted in said housing, a detent retaining said lock mechanism in said housing, a key cylinder mounted in said housing and adapted to receive a key, pins mounted in said housing and extending into said key cylinder in a position to be actuated by a key, said pins being under the control of said permutation lock mechanism, whereby a key is prevented from being inserted until said lock mechanism is set, one set of said pins being adapted to engage said detent when actuated by another key and to thereby release said lock mechanism and to permit it to be removed from the housing.

7. In a lock of the type specified, a housing, a key cylinder mounted in said housing, pins mounted in said housing and in said key cylinder and controlling the movement of the key cylinder, and permutation lock mechanism controlling said pins to prevent the insertion of a key in the cylinder until the permutation lock mechanism is set.

8. In a lock of the type specified, a key-receiving member adapted to be actuated by an inserted key, a permutation lock mechanism controlling the insertion of said key, and means for destroying the combination of said lock mechanism when the key is operated and withdrawn, said last named means being under the control of said key.

9. In a lock of the type specified, a key cylinder, a permutation lock mechanism controlling the insertion of said key, and means for destroying the combination of said lock mechanism when an inserted key is withdrawn, said means being under the control of the key cylinder and the inserted key.

10. In a lock of the type specified, a key-receiving member, a permutation lock mechanism controlling the insertion of said key in said member, a lever adapted to be operated to destroy the combination of said lock mechanism, said lever being under the control of said key-receiving member.

11. In a lock of the type specified, a key-receiving member, a permutation lock mechanism controlling the insertion of a key in said member, a lever adapted to destroy the combination of said lock mechanism, said lever being partially under the control of the inserted key, a detent partially controlling said lever, said detent being also under the control of said key-receiving member.

12. In a lock of the type specified, a key-receiving member, a permutation lock mechanism controlling the insertion of a key in said member, a lever adapted to destroy the combination of said lock mechanism by moving one of the disks thereof, a pin in operative relation with an inserted key and said lever, whereby said lever is partially controlled by said key, and a detent also par-

tially controlling said lever, said detent being under the control of said key-receiving member. 10

In testimony whereof I affix my signature, in presence of two witnesses.

THOMAS CARROLL.

Witnesses:

R. J. McCARTY.

MATTHEW SUBLER.