No. 800,648. PATENTED OCT. 3, 1905.

E. E. HIGINBOTHAM.

PERMUTATION LOCK.

APPLICATION FILED JULY 23, 1904.

Fig. 1

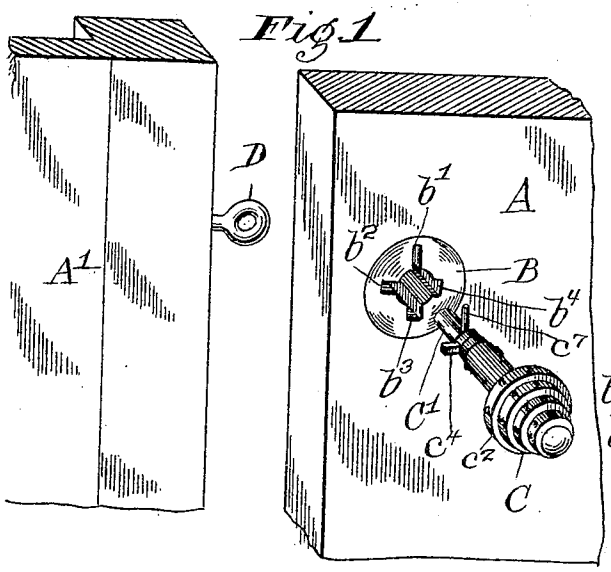
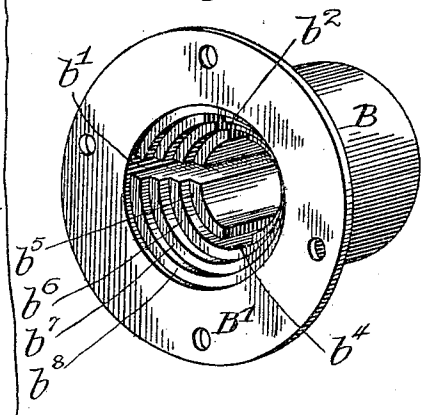



Fig. 2.



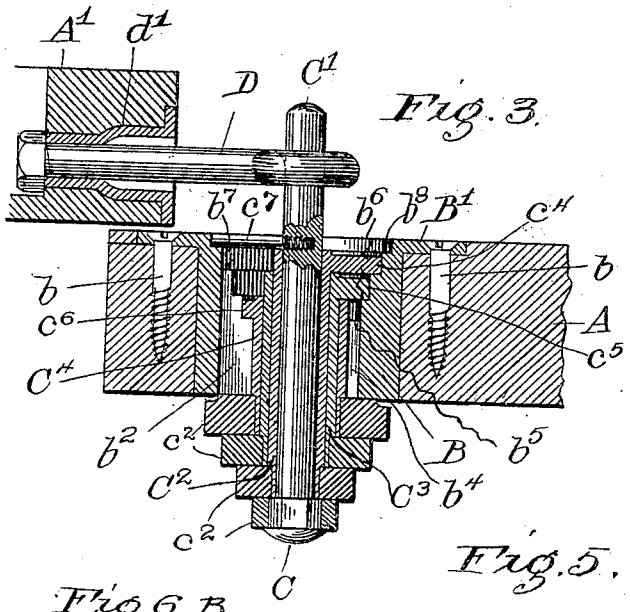




Fig. 3.

Fig. 4.

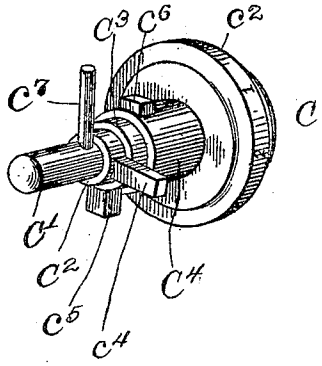



Fig. 5.

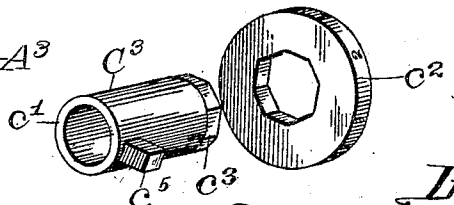
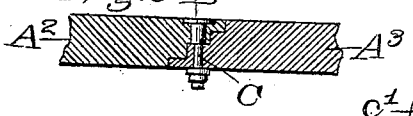



Fig. 6




Witnesses:
Chas. O. Sherway
Kathleen Connell

Inventor:
Elmer E. Higinbotham
by H. Bittner
Atty.

# UNITED STATES PATENT OFFICE.

ELMER E. HIGINBOTHAM, OF CHICAGO, ILLINOIS.

## PERMUTATION-LOCK.

No. 800,648. Specification of Letters Patent. Patented Oct. 3, 1905.

Application filed July 23, 1904. Serial No. 217,753.

*To all whom it may concern:*

Be it known that I, ELMER E. HIGINBOTHAM, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Permutation-Locks, of which the following is a specification.

My invention relates to certain new and useful improvements in permutation-locks, and the construction illustrated is designed, primarily, for use upon freight-car doors; but it can obviously be used upon other forms of doors, as well as upon boxes, trunks, and the like.

The object of the invention is to produce a lock in which the lock-bolt itself is removable and interchangeable with other locks of this kind, the bolt itself being of a peculiar construction containing a number of lugs or opposing pieces which must be brought into a certain predetermined arrangement before it can be removed to unlock the door.

To such end my invention consists in certain novel features of construction, a description whereof will be found in the following specification and illustrated in the accompanying drawings.

In the aforesaid drawings, Figure 1 is a fragmental perspective view of a car-door and jamb with my improved lock applied thereto, the bolt being shown in a position about to be inserted in the lock. Fig. 2 is a perspective view of the lock-casing. Fig. 3 is a horizontal section through the jamb, door, and lock, showing the parts in the locked position. Fig. 4 is a perspective view of the bolt. Fig. 5 is a similar view of one of the tumblers which comprise the bolt, and Fig. 6 is a horizontal section showing the manner of applying the lock to swinging doors.

In the figures, A represents a car-door, and A′ a jamb, the door in this case sliding from the open to the closed position, and vice versa. Near the edge the door is bored to receive the casing B of the lock, which is preferably cylindrical in form and secured in place in any suitable manner, here shown as by means of screws $b$, passing through a flange B′ on the casing. The bore of the casing has a number of radial grooves $b'$ $b^2$ $b^3$ $b^4$ of different depths extending radially from it, these grooves being also of different widths, the deepest groove being the narrowest one, and so on. Near its inner face the casing is formed with a number of concentric shoulders $b^5$ $b^6$ $b^7$ $b^8$, increasing in diameter from the bore outward, as shown in Fig. 2, the number of shoulders being the same as the number of grooves. It should be noted that the shallowest groove terminates at the shoulder of least diameter and that the deeper grooves terminate likewise in succession.

The bolt C consists, essentially, of an arbor or spindle C′ and a number of tumblers $C^2$ $C^3$ $C^4$, concentrically mounted upon said spindle and capable of being arranged in the proper manner to permit of the insertion and removal of the bolt. The spindle projects far enough beyond the inner face of the door to engage with the keeper, here shown as an eyebolt D, which is slidingly secured in the jamb A′, as shown in Fig. 3. The eyebolt is preferably mounted in a casing $d'$, and when the door is opened said bolt may be pushed back into the casing, so as to leave no parts projecting beyond the jamb. The construction of this eyebolt is not material to my invention, as any suitable keeper may be employed. Each of the tumblers consists in a tubular portion $c'$ (see Fig. 5) and a head $c^2$, the tubular portion being formed with an octagonal end $c^3$, upon which the head is seated, the head itself being formed with a similarly-shaped opening fitting on the tumbler. The heads of the tumbler are provided with characters which when arranged in a certain predetermined order will permit of the insertion and withdrawal of the bolt. Upon the other ends of the tubular portions of the tumbler are lugs $c^4$ $c^5$ $c^6$ of different lengths and widths, each one corresponding with one of the grooves in the casing, so that the one which is shortest and widest will freely enter the corresponding groove in the casing, but no other, the other lugs also being capable of entering their respective grooves. The spindle has a head removably secured thereon in like manner and is provided with a pin $c^7$, screwed into it, so as to be readily removable. It should be noted that the tubular portions of the tumblers are of such length that the lugs upon them will when in place engage the respective shoulders upon the casing, each lug also abutting against the adjacent tubular portion of the bolt, so that when the pin $c^7$ is in place in the spindle all of the tumblers will be confined between the head of the spindle and the pin $c^7$. In this way no longitudinal movement of any of the tumblers is permissible upon the other, whereby any unau-

thorized person might tamper with the lock and learn the proper arrangement of the tumblers to open the same. In the preferred form here shown the heads $c^2$ are of decreasing diameters, beginning with the head nearest the door, thus affording a convenient knob by which the bolt may be handled.

In the modification illustrated in Fig. 6 the lock is applied to swinging doors, such as are used in refrigerator-cars. The keeper in this case is the casing B itself, it being secured in the door $A^2$, which is closed first. A hole is provided in the door $A^3$, through which the bolt is inserted.

In operating the lock the tumblers are first arranged so that the lugs will be in position to enter their corresponding grooves in the casing and the indicating characters forming the combination noted. The bolt is then thrust into the casing, the end of the spindle entering the keeper upon the jamb and the tumbler turned to bring the lugs into engagement with the shoulders upon the casing. To open the door, the tumblers must again be arranged by means of the indicating characters so that all of the lugs will be in alinement with their respective grooves, when the bolt may be withdrawn.

In using this lock upon freight-car doors any number of these bolts may be had on hand, inasmuch as each will fit all the locks, and the clerk attending to the locking of the door may select any one of the bolts and after noting the combination of the indicating character can lock the door with it and indicate the combination upon the bill or invoice, so that the person receiving said bill or invoice at its destination will be the only person able to unlock the door. When it is desired to change the combination of any one of the bolts, the pin $c^7$ is unscrewed and either one or all of the heads turned with respect to the tumblers and the pin replaced. A new combination is thus very quickly obtained. The advantages of a lock of this kind are many. The bolt itself being removable prevents unauthorized persons from obtaining knowledge of the proper combination while the car is standing on the track and not in use. It also prevents mischievous persons from locking the doors, thereby making them very difficult to open. The interchangeability of the bolts and locks, as well as the interchangeability of the permutation of the bolts, is exceedingly advantageous in a structure of this kind.

I realize that considerable variation is possible in the details of this construction without departing from the spirit of the invention, and I therefore do not intend to limit myself to the specific form herein shown and described.

I claim as new and desire to secure by Letters Patent—

1. In a permutation-lock, the combination with a casing, of a member adapted to be locked thereto, a removable lock-bolt adapted to engage said member to lock it to the casing, provided with tumblers adapted to engage the casing to lock the lock-bolt therein, but which when properly arranged with respect to the casing will permit of the unlocking of the lock and removal of the lock-bolt.

2. In a permutation-lock, the combination with a casing having a cylindrical bore and two or more radial grooves, of a removable lock-bolt provided with tumblers having means adapted to lock the bolt therein, which when properly arranged will pass out through said grooves when the bolt is withdrawn.

3. In a permutation-lock, the combination with a casing having a cylindrical bore and two or more radial grooves of different sizes, of a removable lock-bolt comprising tumblers, each of which is provided with a lug adapted to pass through one of the grooves, but not through the other, and adapted to engage the casing to prevent withdrawal of the bolt when at least one of said lugs is out of alinement with its respective groove.

4. In a permutation-lock, the combination with a casing having a cylindrical bore terminating in a series of concentric annular shoulders gradually increasing in diameter, and a series of radial grooves of different depths, of a series of tumblers each having a lug corresponding to the depths of one of the grooves in the casing, said tumblers preventing withdrawal of the bolt when at least one is in engagement with its corresponding shoulder.

5. In a permutation-lock, the combination with a casing having a cylindrical bore, terminating in a series of concentric annular shoulders gradually increasing in diameter and a plurality of radial grooves of different depths and widths in said bore terminating at the shoulder corresponding to its depth, of a removable lock-bolt comprising concentrically-arranged tumblers each having a lug of a depth and width corresponding to one of the grooves in the casing, said tumblers preventing withdrawal of the bolt when at least one of said lugs is out of alinement with its respective groove.

6. In a permutation-lock, a removable lock-bolt comprising a spindle, a series of tumblers concentrically arranged upon the spindle and having heads, the positions of which upon the respective body portions may be changed at will to alter the combination of the lock.

7. In a permutation-lock, the combination with a casing formed with a cylindrical bore, of a removable lock-bolt therefor, comprising a spindle, a series of tumblers provided with devices for engagement with the casing and having heads, the positions of which up on their respective body portions may

be changed at will to alter the combination of the lock.

8. In a permutation-lock, the combination with a casing and keeper, of a removable lock-bolt adapted to engage the keeper to lock it thereto, provided with tumblers adapted to engage the casing to lock the bolt therein and in the keeper, but which when properly arranged will permit of the unlocking of the bolt and its withdrawal from the keeper and casing.

9. In a permutation-lock, the combination with a casing and keeper, said casing having a cylindrical bore, and a plurality of radial grooves, of a removable lock-bolt provided with tumblers having means adapted to lock the bolt to the casing and keeper, which when properly arranged will pass out through the bore and grooves when the bolt is withdrawn.

In witness whereof I have signed the above application for Letters Patent, at Chicago, in the county of Cook and State of Illinois, this 13th day of July, A. D. 1904.

ELMER E. HIGINBOTHAM.

Witnesses:

CHAS. O. SHERVEY,

KATHLEEN CORNWALL.